An evaluation of a patient safety culture tool in Saudi Arabia

Thesis by

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Summary

Background

Safety culture is considered to be an essential element of patient safety. Several tools are available to assess patient safety culture in hospitals. One of the most common methods of assessing safety culture is the use of safety climate questionnaires.

Research question

Is there an existing patient safety culture measure that can be demonstrated to be a valid and reliable tool for use with the workforce in hospitals in Saudi Arabia?

Aim and objectives

This study aims to identify whether there is an existing English language tool that would be suitable for assessing patient safety culture in Saudi context. The objectives of the study are:

1. To select an appropriate questionnaire to assess hospital patient safety culture.
2. To evaluate the face validity of the selected patient safety climate questionnaire.
3. To assess the psychometric properties of the selected patient safety climate questionnaire in hospitals in Saudi Arabia.
4. To develop the most appropriate measure for assessing patient safety culture for use in hospitals in Saudi Arabia.

Methods

Qualitative methods were used to evaluate face validity (n=12 hospital staff). Quantitative methods were used to assess psychometric properties (n=862 doctors and nurses in three hospitals in Saudi Arabia).

Findings

Evaluation of face validity identified a need for minor changes to the Hospital Survey on Patient Safety Culture (HSOPSC) questionnaire wording before it was used to collect data for psychometric assessment. The results of Confirmatory Factor Analysis (CFA) and reliability analysis showed an unsatisfactory fit for the factor structure of the original HSOPSC questionnaire to the Saudi data. Exploratory Factor Analysis (EFA) was used on one half of the Saudi dataset to produce an optimal model(s). This was followed by CFA of the resulting measurement model on the second (validation) half of the data to test the fit of the resulting optimal factor structure. The result of EFA showed that eight factors (23 safety climate items) is the optimal model to the Saudi data.

All factors consisted of two to four items. The items loading were between 0.43 and 0.97. The result of CFA confirmed the eight factors solution (CFA=0.94, RMSEA=0.045, SRMR=0.040, TLI=0.97). The results of EFA, CFA, correlation and reliability analysis (Cronbach's alpha) showed that the optimal model for the Saudi data consists of eight patient safety culture dimensions (23 safety climate items).

Conclusion

This is one of very few studies to provide an assessment of an American patient safety culture tool using data from Saudi Arabia. The results indicate the importance of appropriate validation of patient safety climate questionnaires prior to applying them to populations outside contexts in which they were developed. The validated Saudi English language version of the HSOPSC questionnaire is an appropriate patient safety climate questionnaire to assess patient safety culture in Saudi hospitals.

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Abbreviations

HSOPSC: Hospital Survey on Patient Safety Culture

MOH: Ministry of Health in Saudi Arabia

NHS: National Health Service

IOM: Institute Of Medicine

PHC: Primary Health Care

JCAHO: Joint Commission on Accreditation of Healthcare Organisation

HROs: High Reliability Organisations

WHO: World Health Organisation

NPSF: National Patient Safety Foundation

NPSA: National Patient Safety Agency

NSCPS: National Steering Committee on Patient Safety

ACSQHC: Australian Council for Safety and Quality in Health Care

CCHSA: Canadian Council on Health Services Accreditation

HSC: Health and Safety Commission

SLOAPS: Strategies for Leadership: An Organisational Approach to Patient Safety

PSCHO: Patient Safety Cultures in Healthcare Organisations

VHAPSCQ: Veterans Administration Patient Safety Culture Questionnaire

CSS: Culture of Safety Survey

SAQ: Safety Attitudes Questionnaire

SCS: Safety Climate Survey

MSSA: Medication Safety Self Assessment

HTSSCS: Hospital Transfusion Service Safety Culture Survey

HSCQ: Hospital Safety Culture Questionnaire

MORMAQ: Modified Operating Room Management Attitudes Questionnaire

SCS: Safety Climate Scale

AHRQ: Agency for Healthcare Research and Quality

FMASS: Flight Management Attitude Safety Survey

CFA: Confirmatory Factor Analysis

EFA: Exploratory Factor Analysis

χ^2**:** Chi-square

Df: Degree of freedom

CFI: Comparative Fit Index

NNFI: Non-Normed Fit Index

RMSEA: Root Mean Squared Error of Approximation

SRMSR: Standardised Root Mean Square Residual

TLI: Tucker–Lewis Index

α: Cronbach's coefficient alpha value

KMO: Kaiser-Meyer-Olkin

Glossary

Validity: refers to whether an instrument measures what it was designed to measure (Field, 2009).

Reliability: refers to the ability of a measure to produce similar results across different situations (Field, 2009).

Internal consistency of an instrument: is the most popular way for estimating reliability of an instrument and refers to how well the items in a particular dimension of a scale fit together (Pett et al, 2003). Within the validation literature this is commonly referred to as reliability but this differs from the use described above.

Cronbach's alpha (α): is widely used measure for assessing the internal consistency of a set of items (Pett et al, 2003).

Factor analysis can be used for theory and instrument development and assessing construct validity of an established instrument when administered to a specific population (Pett et al, 2003:3). Factor Analysis is a statistical technique widely used in psychology and social sciences. It is used for development and evaluation of instrument. There are two basic types of factor analysis: exploratory and confirmatory (Pallant, 2007).

Exploratory Factor Analysis (EFA): is used to identify how many factors (dimensions) are necessary to explain the interrelationships among a set of items (Pett et al, 2003).

Confirmatory Factor Analysis (CFA): is used to assess the extent to which the hypothesized structure of identified factors (dimensions) fits the data (Pett et al, 2003).

AMOS (Analysis of Moment Structures): is a popular statistical package for undertaking structural equation modelling. It is a more recent package, because of its user-friendly graphical (Arbuckle, 2005).

Goodness of fit tests determines if the theoretical model being tested should be accepted or rejected. These include:

Goodness-of-Fit Index (GFI) and Adjusted Goodness-of-Fit Index (AGFI): The goodness of fit index "is a measure of the relative amount of variances and covariances jointly accounted for by the model" (Joreskog & Sorbom, 1986: 41). The closer the GFI is to 1.00, the better is the fit of the model to the data.

Chi-square test statistic: A fundamental measure of fit used in the calculation of many other fit measures. Conceptually it is a function of the sample size and the difference between the observed covariance matrix and the model covariance matrix. In the case of the chi-square statistic, smaller rather than larger values indicate a good fit (Schumacker & Lomax, 2004).

Root Mean Residual (RMR): is the mean absolute value of the covariance residuals. Its lower bound is zero but there is no upper bound, which depends on the scale of the measured variables. The closer RMR is to 0, the better the model fit. One sees in the literature such rules of thumb as that RMR should be < .10, or .08, or .06, or .05, or even .04 for a well-fitting model (Hu & Bentler, 1998).

Standardized Root Mean Square Residual, Standardized RMR (SRMR): SRMR is the average difference between the predicted and observed variances and covariances in the model, based on standardized residuals. The smaller the SRMR, the better the model fit. SRMR = 0 indicates perfect fit. A value less than 0.05 is widely considered a good fit and below .08 adequate fit. In the literature one will find rules of thumb setting the cut-off at < .10, .09, .08, and even .05 (Schreiber et al, 2006).

Comparative Fit Index (CFI): Also known as the Bentler Comparative Fit Index. CFI compares the existing model fit with a null model which assumes the indicator variables (and hence also the latent variables) in the model are uncorrelated (the "independence model"). CFI should be equal to or greater than 0.90 to accept the model (Hu & Bentler, 1999).

Root mean square error of approximation (RMSEA): is also called RMS or RMSE or discrepancy per degree of freedom. There is good model fit if RMSEA is less than or equal to 0.05. There is adequate fit if RMSEA is less than or equal to 0.08. More recently, it has suggested RMSEA ≤0.06 as the cut off for a good model fit (Hu and Bentler, 1999).

Tucker-Lewis Index (TLI) or Non-Normed Fit Index (NNFI): a TLI close to 1 indicates a good fit. Some authors have used a cut-off as low as 0.80, while others suggested it should be greater than 0.9 for a good fit (Hu & Bentler, 1999).

Principle Axis Factoring: is "a method of identifying the relationship between these factors and the observed variables from the observed correlations between the variables" (Waterson et al, 2009:3).

Kaisers (eigenvalue >1) criterion: is "a method for deciding how many factors underlie the observed variables, based on extracting only factors that explain more variability than any single observed variable would" (Waterson et al, 2009:3).

Cattell's screen plot: is "a method for deciding how many factors underlie the observed variables, based on using a plot to identify at which point subsequent extracted factors explain only spurious extra variability, and hence should not be retained" (Waterson et al, 2009:3).

Oblique factor rotation: is used to aid interpretation of factors through rearranging the variance explained between them. It allows factors to be correlated when the expected underlying dimensions are probable to be related (Waterson et al, 2009:3).

Kaiser-Meyer-Olkin (KMO): measure of sampling adequacy ranges from 0 to 1, with 0.6 suggested as the minimum value for a good factor analysis (Tabachnick and Fidell, 2007).

Factor loadings: are the correlations of the variables with the factors (Kline, 1994).

Chapter one: Introduction

This thesis is concerned with investigating the measurement of patient safety culture and the aim of the research is to identify a suitable tool for assessing the patient safety culture in Saudi hospitals. This chapter provides an overview of the subject matter of the thesis and the current study. It outlines the study, including the background, research problem, research question, research aim and objectives and the significance of the study. It also offers insights into the Saudi healthcare system and patient safety in Saudi hospitals. The thesis structure is also outlined.

1.1 Background

Healthcare organisations are considered to be high-risk environments in terms of safety incidents (Colla et al., 2005). There are many interrelated factors that make healthcare a complex and risky process. These are organisational factors (e.g. policies and procedures), human factors (e.g. workforce and patients), and material factors (e.g. medical equipment). All of these factors might increase the probability of risk and errors which can cause significant harm to patients in this kind of environment. Therefore, patient safety is a very important issue in healthcare organisations as a means of preventing potential harm to patients that may result from healthcare delivery.

The Institute of Medicine report (2000), To Err Is Human, estimated that between 44,000 to 98,000 Americans die each year because of medical errors; this makes medical errors the eighth leading cause of death in the USA. In terms of cost, these medical errors translated into $29 billion annually in lost income, disability and health care costs. Since the publication of this report, patient safety has become an issue for discussion amongst healthcare providers. Healthcare organisations are generally showing a greater awareness of patient safety as a means of preventing the potential harm to the patients (Walshe and Boaden, 2006). Different interrelated factors influence patient safety improvement such as people (workforce), working conditions and the processes of the healthcare system. Most of these factors are related to safety culture as an important element of patient safety measurement and improvement.

Many researchers have discussed the importance of assessing safety culture as a tool to improve patient safety in healthcare organisations (Nieva and Sorra, 2003; Singer et al., 2003; 2007; Flin et al., 2006a). The UK Health and Safety Commission (1993) defined safety culture as:

> "*The product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management. Organisations with a positive safety culture are characterised by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures*" (HSC, 1993:23).

An annual assessment of safety culture is considered a priority within patient safety goals of the USA's Joint Commission for Accreditation of Health Care Organisations (JCAHO) (Pronovost and Sexton, 2005). This indicates the importance of measuring and understanding safety culture to enhance patient safety in healthcare. A patient safety culture involves shared attitudes, values and norms of staff related to patient safety. It is characterized by a number of positive features such as open communication about safety problems, effective teamwork and management commitment to patient safety as top a priority (World Health Organisation, 2008; Sorra and Dyer, 2010). It is widely agreed that patient safety culture can be assessed using patient safety climate questionnaire to assess workers' perceptions of patient safety climate in their healthcare organisations (Sexton et al., 2006; Fleming and Wentzell, 2008).

However, although the measurement of patient safety climate by researchers and healthcare professionals is increasing (Kirk et al., 2006), there is limited research on the understanding of the measurement of patient safety climate and the usefulness of using different patient safety climate questionnaires in different contexts. There is a lack of provision of complete data relating to psychometric properties (validity and reliability) of patient safety climate questionnaires when applied in different contexts beyond their origin, such as USA healthcare contexts (Waterson et al., 2009). Therefore, this study focuses on the psychometric properties of the American Hospital Survey on Patient Culture (HSOPSC) (Sorra and Nieva, 2004) and its suitability for use within the Saudi healthcare context.

1.2 Research problem

Patient safety problems are a major concern for healthcare organisations around the world in both rich and poor countries (Bodur and Filiz, 2010). Healthcare organisations aim to care for patients in a safe manner and have made patient safety a top priority in their healthcare processes. Patient safety culture is considered as important area in the field of patient safety. The Institute of Medicine (IOM, 2000) proposed that healthcare organisations should focus closely on improving their patient safety culture. A number of tools are available for assessing patient safety culture in hospitals, one of the most common of which is patient safety climate questionnaires.

Increasingly, there is an awareness of patient safety in Saudi Arabia; however, currently the problem is the lack of validated tools that are known to be suitable for assessing the patient safety culture in Saudi hospitals. Therefore this study is concerned with identifying a suitable tool for assessing patient safety culture in Saudi hospitals.

1.3 Research question

Is there an existing patient safety culture measure that can be demonstrated to be a valid and reliable tool for use with the workforce in hospitals in Saudi Arabia?

1.4 Research aim and objectives

This study aims to identify a suitable measure for assessing patient safety culture for use in hospitals in Saudi Arabia. The main objectives of the study are:

1. To select an appropriate questionnaire to assess hospital patient safety culture.
2. To evaluate the face validity of the selected patient safety climate questionnaire.
3. To assess the psychometric properties of the selected patient safety climate questionnaire in hospitals in Saudi Arabia.
4. To develop the most appropriate measure for assessing patient safety culture for use in hospitals in Saudi Arabia.

1.5 Significance of the study

Saudi hospitals, like all hospitals worldwide, need to prioritise patient safety as an important issue and work towards improving it. However, there is limited research on patient safety culture in Saudi hospitals. In addition, there is a lack of patient safety climate questionnaires validated for use in the Saudi hospital context. This study seeks to contribute to the knowledge base by assessing the validity and reliability of an appropriate patient safety climate questionnaire for use in hospitals in Saudi Arabia. It is hoped that the knowledge generated will contribute to the scientific literature on the measurement of the patient safety culture, in particular in Saudi Arabia, thereby supporting the creation of a safer environment for patients in hospitals. Furthermore, this thesis is also intended to promote a greater understanding of the use of different patient safety climate questionnaires in different contexts, bearing in mind that some patient safety culture tools such as the HSOPSC have been used in many counties outside their original context in which they were developed (Smits et al., 2008).

1.6 The Saudi health care system

Saudi healthcare services are provided through a number of government and private agencies. Healthcare services in Saudi Arabia, which started with limited resources and very small clinics, have been the subject of many development plans. The Saudi government has worked to improve the healthcare system by delivering healthcare services and developing polices and plans which aim to improve those services in the country. The healthcare system in Saudi Arabia can be described as a universal and comprehensive system which operates through many independent government and private health agencies that deliver primary, secondary and tertiary healthcare services (Roemer, 1991).

The ministry of health operates as a national health service by delivering primary, secondary and tertiary care to the entire population. It is considered to be the lead government agency responsible for all aspects of the health care system. These responsibilities include financing, effective management, directing, planning and regulating of the entire health care system. It also supervises the healthcare services that are provided by the private sector (Statistics Directorate, 2009).

1.6.1 Patient safety in hospitals in Saudi Arabia

Hospitals are considered to be the second line of treatment provision as they accept only referrals from primary care clinics or emergencies. Large numbers of hospitals are spread over the different parts of the country; more than 400 hospitals and a number of private clinics provide health care to around 26 million people (Statistics Directorate, 2009). These nationwide facilities employ around 500,000 people from more than 80 different countries (Alanazy, 2006).

Saudi Arabia has modern hospitals equipped with advanced medical technology, and qualified medical staff and many of these hospitals are operated to American and Western standards. Many Saudi hospitals have received accreditation by the Joint Commission on Accreditation of Healthcare Organisations (JCAHO), including the King Fahad Hospital National Guard in King Abdualsis Medical City, King Fasial Specialist Hospital and Research Centre and King Fahad Medical City. The Saudi hospitals are characterised by features such as:

1. The large size of the workforce.
2. The wide variety of employees from different countries.
3. The complexity of tasks that are performed especially advanced surgical procedures, for example open-heart surgery and organ transplant operations.
4. The increasing number of patients, which leads to an increased workload.

These factors may contribute to medical errors and, thus, threaten the safety of patients. Therefore, preventing medical error and keeping patients safe is a top priority in Saudi Arabia. Although the government of Saudi Arabia has not yet established a national patient safety organisation with responsibility for national patient safety policy, healthcare organisations are currently prioritising the provision of safe patient care (Alahmadi, 2010). On the whole, Saudi hospitals aim to provide safe and good quality healthcare. To this end, a number of patient safety and medical errors conferences have been held in various Saudi hospitals, for example, the Arab and Gulf Conference on Healthcare Quality and Safety 2009, under the slogan "Deep in the Challenges of Patient Safety"[1]. However, the research into patient safety, in particular patient safety culture is still in its early stages in the Saudi context.

[1] www.hcqs.eu

1.7 Thesis structure

This thesis comprises eight chapters and appendices. The current chapter has presented a background to the research and an overview of the current study. Chapter two provides a review of the literature related to safety in organisations, specifically patient safety in healthcare organisations, safety culture and safety climate, and measurement of patient safety climate. Chapter three describes the methodology employed in the study. Chapter four describes the process of choosing an appropriate patient safety climate questionnaire for use in the study. Chapter five describes the process of data collection by using the HSOPSC to collect the questionnaire data from the hospitals in Saudi Arabia. Chapter six reports the results of the psychometric properties of the HSOPSC questionnaire (Sorra and Nieva, 2004) in Saudi hospitals in Riyadh using Saudi data. Chapter seven discusses the research findings that emerged from this study whilst chapter eight presents an overall summary and the conclusion of the research.

1.8 Summary

Patient safety is an important aspect of healthcare. Patient safety culture assessment is a new field in the Saudi context and few studies have been published in Saudi Arabia on this critical component of patient safety. Therefore, the current study focuses on the assessment of patient safety culture in Saudi hospitals to identify a suitable questionnaire for measuring patient safety climate for use in hospitals in Saudi Arabia. In the next chapter, the relevant literature of patient safety culture assessment will be reviewed.

Chapter two: Literature review

2.1 Introduction

The aim of this chapter is to provide a comprehensive review of the literature associated with organisational safety, safety culture and the measurement of patient safety climate. This chapter reviews relevant literature in relation to a patient safety culture assessment based on the measurement of patient safety climate using a patient safety climate questionnaire. The chapter is composed of five sections. After presenting a brief introduction, section 2.2 discusses organisational safety in order to provide the background of safety in organisations, safety in healthcare organisations and patient safety in healthcare organisations.

Section 2.3 discusses safety culture and safety climate. This section aims to provide an overview of safety culture, to discuss the debate on safety culture versus safety climate, and the assessment of safety culture with a focus on the patient safety culture in healthcare. Section 2.4 is concerned with the measurement of the patient safety climate in healthcare organisations including a discussion of the development and validation of patient safety climate questionnaires, existing patient safety climate questionnaires and their characteristics and the selection of a suitable questionnaire for measuring patient safety climate. Section 2.5 concludes with a brief summary of the literature review.

2.2 Organisational safety

This section focuses on the review of safety in organisations including healthcare organisations and patient safety including the background to patient safety, the importance of patient safety and patient safety failure in healthcare organisations.

2.2.1 Safety in organisations

Safety cannot be viewed as just the total lack of mistakes and an absence of errors, but that safety has multiple dimensions and many possible outcomes. Reason (1990) defines error as the failure of planned action to achieve an aim without an unexpected event happening or the use of a wrong plan. This concept of error is a challenge for organisations (work environments) in terms of causality and consequence. Safety is a major concern for organisations and has attracted much attention across a wide range of industries, including the nuclear energy field, chemical processing, aviation and healthcare settings. The primary goal of safety within organisations is to prevent accidents and injuries. Safety is important to the welfare of the workers and customers of organisations and it is essential to a safe organisation (Dalling, 1997). Safety is an issue for organisations therefore, safety measures are particularly important to assess safety performance.

Considerable attention has been paid to the assessment of safety in high hazard industries such as aviation and nuclear energy. According to Weick et al. (1999) safety measures have moved from a focus on retrospective data of employee injuries and accidents to safety measures that focus on organizational, managerial and human factors rather than simply on technical failures that cause accidents in organisations. There are two main approaches to measuring safety performance: reactive (retrospective) and proactive (prospective). Reactive approaches are based on retrospective data (lagging indicators). In recent years there has been a movement away from relying on safety measures such as accident rate because it measures historical events of safety (past safety problems), towards proactive approaches that are based on the assessment of current safety culture (leading indicators) such as the measurement of safety climate (Flin et al., 2000; Choudhry et al., 2007). The proactive approach relies and focuses on current safety activities to determine system success rather than system failure (Cooper and Phillips, 2004). In this sense, the assessment of safety culture is categorized under the proactive approach of safety performance which relates to the measurement of safety climate. According to Cooper and Phillips (2004) both proactive and reactive approaches can help organisations to determine the effects of their safety activities.

There are two types of failure identified in the safety literature, active and latent failures. Active failures can be classified as unsafe acts by someone whose actions can have an immediate and serious effect, they include:

1. Slips or errors such as using the wrong tool.
2. Failures of a cognitive nature, such as lapses in memory, lack of concentration and mistakes through ignorance or in accurate assessment of situation.
3. Deviations from safe rules, operating practices, procedures, or standards.

A latent failure is seen as something that can remain inactive (invisible) for years before combining with an active failure to cause an accident. Many conditions lead to a latent failure, such as excessive workloads; lack of knowledge or experience; a stressful workplace; rapid change within an organisation; ineffective communication and poor leadership (Vincent et al., 1998).

Reason (1997, 1998) suggests that there are two kinds of accidents or errors that can happen in organisations: individual accidents and organisational accidents. There are two main approaches to investigate these accidents, the person approach and the system approach. The person approach places emphasis on blaming individuals for forgetfulness, loss of concentration, inattention, ethical weakness or other human attributes when they make errors. It concerns the actions of individual people when they do things wrongly. The system approach focuses on creating effective conditions under which individuals work and try to build defences in order to avoid errors or reduce their effects. In this approach, errors are viewed more as results of a problem rather than its causes. Moreover, this approach concerns not only the individual, but also the role of organisational factors (Reason, 2000).

In this sense, errors in organisations usually happen due to poorly designed systems rather than poorly functioning human beings (IOM, 2000). The system approach to error is widely used in organisations and is becoming increasingly used in healthcare (Currie and Watt, 2007). The best examples of the system approach are High Reliability Organisations (HROs). They expect the worst and prepare themselves to deal effectively with it throughout the organisation (Reason, 2000). HROs have professional team strategies to deal with problems when they arise in order to decrease the probability of error and manage unexpected events (Mckeon et al., 2006).

There has been a shift in focus within the safety literature away from individual level factors that might be responsible for accidents, such as error or non-compliance with safety procedures, towards organisational factors, such as safety climate (Reason, 1990). A literature review of safety identifies the factors that contribute to errors, such as lack of teamwork, communication, leadership and poor decision making (Flin and Yule, 2003; Yule et al., 2006). All these factors tend to be related to the organisational level rather than the individual level. A number of studies showed that the majority of errors are caused by organisational factors. For example, Vincent et al. (2000) reported that organisational problems such as deficiencies in training and supervision, and poor communication emerged as likely causal factors. Dean et al. (2002) identified organisational factors such as: work environment, workload, lack of knowledge and lack of team communication as contributory factors.

The safety literature also emphasises the influence of organisational factors on measures of system safety, such as accidents and near misses (Hofmann et al., 1995; Hofmann and Stetzer, 1998). Tomas et al. (1999) identified organisational factors such as organisational climate as a critical element involved in safety, training and education programmes, management attitude to safety as a top priority in organisation (work environment). All these factors seem to be important to the understanding accidents and play an important role in improving safety in the organisation of work. They (Tomas et al. 1999) argued that accidents in organisations are caused by unsafe actions by workers due to organisational factors (e.g. ineffective communication, weak leadership role, and unclear safety regulations) rather than human factors (e.g. lack of concentration, inattention and careless).

A number of studies have also discussed organisational factors, such as safety climate. For example, Hofmann and Stetzer (1996) argued that safety climate is an organisational factor and it is proposed to influence safety performance by influencing the context within which workers and teams work. Neal et al. (2000) examined the effects of general organisational climate on safety climate as organisational factor and safety performance. They concluded that general organisational climate can influence perceptions of safety climate, and that these perceptions of safety climate influence safety performance. Zohar (2002) argued that leadership style, concern for safety and safety priority as organisational factors influence safety performance of groups of workers in an organisation. Studies have highlighted the identification of organisational, managerial and environmental factors that influence accident causation (Oliver et al., 2002; Flin et al., 1996; Cheyne et al., 1998). Other factors identified as having an impact on error rates in work environment such as teamwork, communications, work environment workload and training (Helmriech, 2000; Mearns et al. 2001; Dean et al. 2002). From the above it is clear that the organisational factors are important factors influencing safety performance within organisations. In general, safety is a very important issue in organisations, especially a high risk organisation such as healthcare organisations, where significant hazards often occur that could harm patients (Colla et al., 2005).

2.2.2 Safety in healthcare organisations

Healthcare contains all the goods and services designed to promote health, including "*preventive, curative and palliative interventions, whether directed to individuals or to populations*" (World Health Organisation, 2000:6). Safety is a complex product consisting of the different integrated components of a system (people, job and organisation), particularly in complex environments such as healthcare organisations. Healthcare is concerned with preventing medical errors in order to provide safe and quality care for patients (Hudson, 2003). At the same time, healthcare is considered to be a high risk industry because it involves high risk of morbidity and mortality of patients (Colla et al., 2005).

Safety in healthcare differs from safety in other organisations in some aspects such as the nature of the services provided and the healthcare workers. Timely and effective use of healthcare services (preventive and treatment of illness) delivery can influence lives of patients. Healthcare workers are professionals who apply knowledge, adapt learned procedures, and use judgment at each step of the healthcare care process (Mary et al., 2005). The healthcare process focuses on a patient who is the recipient of healthcare services and is the person at the centred of most safety discussions in healthcare. Moreover, there are a number of factors such as workload (increasing number of patients), different specialities with different characteristics (e.g. surgery and intensive care) and complex technology which may lead to unsafe practice within healthcare organisations.

Incidents resulting from healthcare processes can harm both patients and staff, so safety in healthcare involves the safety of both healthcare workers (e.g. needle stick injuries, back injuries) and patients (safety events). Safety of staff and patients are very important in reducing the medical errors and injuries to both patients and workers (Flin, 2007). The IOM (2000) suggests that the healthcare system should be focused on patients in the right time, in an effective and fair way, with safety as the main aim. It suggests that organisations should creatively redesign their system to meet these aims. In particular, safety means that patients should not be injured by the healthcare they receive. It is thus necessary that healthcare providers should engage in patient safety. Patient safety outcomes are characterised by a decrease in medical errors and opportunities for risk, in other words, the result of minimizing medical errors and hazards (Flynn, 2004).

Unfortunately errors associated with healthcare cause significant harm to patients and increase the costs of healthcare (IOM, 2000). Consequently, patient safety is a very important issue and a goal for health care organisations in order to prevent harm happening to patients during the healthcare process. Patient safety will be examined in this study, in particular patient safety culture, and with a particular focus on the measurement of patient safety climate.

2.2.3 Patient safety in healthcare

Background

Patient safety is a cornerstone of quality in healthcare (James and Thrall, 2004). Keeping patients safe is the responsibility of healthcare providers. Patient safety in healthcare organisations has developed in stages. By the late 1980s, the concept of patient safety emerged in Australia in 1987 with the establishment of the Australian Patient Safety Foundation (Runciman, 2002). Through the 1990s, researchers published a number of studies (for example, Brennan et al., 1991 and Leape et al., 1991) that highlighted the significance of patient safety to prevent errors or decrease their effects. Nevertheless, healthcare organisations did not seem to pay much attention to patient safety until the IOM published the report, 'To Err is Human: Building a Safer Health System in 2000'. Since then, patient safety has gained importance and global awareness. The World Alliance for Patient Safety (2004) states that healthcare organisations should concentrate their efforts on preventing potential harm to patients which may result from unsafe healthcare practices.

Patient safety definition and medical errors

There are a number of definitions of the concept of patient safety. For example, the IOM (2000) defined patient safety as the condition of not having to receive an accidental injury due to medical care, or medical errors. The National Patient Safety Agency (2003) considered patient safety to be any incident which may cause harm to patients. These definitions or other definitions include some key terms such as medical errors, adverse events and a near miss. Medical error is described as the failure of planned action to be completed as intended or the use of incorrect plan to achieve an aim (IOM, 2000). Reason (1990) defines error as the failure of planned action to achieve an aim without an unexpected event happening or the use of a wrong plan.

An adverse event is any injury whereby a patient is harmed by their care or treatment and is not due to the patient's disease or condition (Mohr et al., 2004). Some adverse events are preventable, while others are not. Adverse events that can be prevented and result in harm are classified as errors (Regenstein, 2004). A near miss is described as any unforeseen incident which could have potentially harmed a patient but was recovered in sufficient time before it did (Currie and Watt, 2007).

Leape et al. (1993) have characterised the different kinds of medical errors as:

1. Diagnostic, such as error or delay in diagnosis or misinterpretation of results.
2. Treatment, such as incorrect procedure of an operation and error in the dose or drug.
3. Preventive, such as ineffective follow-up of treatment plan.
4. Other, such as lack of communication or equipment failure.

These errors can lead to adverse events for patients and a waste of resources. Inevitably, the quality of healthcare is reduced and presents barriers to healthcare organisations in providing safe patient care.

Importance of patient safety

There is considerable evidence to show that errors in the healthcare field can cause significant harm to patients. For instance, in the USA it is estimated between 44,000 and 98.000 hospitalised patients die annually due to medical error (IOM, 2000). In the UK, Vincent et al. (2001) examined the feasibility of detecting adverse events through record review in two British hospitals. They found 10.8% of patients experienced an adverse event. In Australia, the Quality in Australia Health Care Study in 1995 showed that 16.6% of all patients admitted to hospital had adverse events of which 51% could be preventable (Wilson et al., 1995). This percentage was reduced to 6.8% (Ehsani et al., 2006). This evidence highlighted that healthcare is a high risk environment and requires a focus on ensuring patient safety. Moreover, the significance of patient safety has now been recognised by healthcare organisations.

In global terms, patient safety has become an important issue in many countries across the world. Patient safety is a worldwide problem affecting both rich and poor countries (Pittet and Donaldson, 2006). Consequently, a number of countries have established national patient safety agencies, for example, the National Patient Safety Agency (NPSA) in the U.K, the National Steering Committee on Patient Safety (NSCPS) and the Canadian Patient Safety Institute in Canada, the Australian Council for Safety and Quality in Health Care (ACSQHC) in Australia, and the National Patient Safety Foundation (NPSF) in the USA (Arah and Klazinga, 2004).

Patient safety failure and medical errors

As mentioned earlier, there are two approaches to investigate safety failure. In terms of patient safety failure, the person approach focuses on the actions of the individual and tends to blame them when things go wrong. This approach is based on a belief that freedom from error is possible. On the other hand, a system approach focuses on the chain of events leading up to an error. This approach is based on a belief that people are fallible so errors are expected to occur (Reason, 1997).

Johnson (2004) reported that a number of organisational factors can play a significant role in patient safety failure such as a lack of communication or miscommunication, lack of attention to safety procedures, poor supervision, deficiency of care and concern, excessive workload, and shortage of staff for specified tasks. Patient safety research addresses a number of important issues that cause a threat to patient safety, such as breakdown in communication, leadership, teamwork, lack of awareness level, poor planning and decision-making (Flin and Yule, 2003; Yule et al., 2006). In addition, improvement of patient safety requires focus on a number of elements, such as teamwork and organisational learning in the delivery of healthcare and concentrating on systems not just on individuals (Firth-Cozens, 2001).

Threats to patient safety may arise from organisational factors (Amanda, 2006). The majority of these organisational factors relate to safety culture (Singer et al., 2003). Healthcare organisations have been focused on the importance of safety culture as a way of improving the safety of patient care. The usefulness of safety culture assessment as a tool for improving safety of patient in healthcare organisations generated much discussion and research (Nieva and Sorra, 2003; Singer et al., 2003; 2007; Pronovost and Sexton, 2005; Flin et al., 2006 a). It appears that these studies have stressed in the importance of safety culture as a tool for enhancing patient safety in healthcare organisations. Safety culture refers to the shared employees' attitudes, beliefs, perceptions, and values in relation to safety (Cox and Cox, 1991). This concept is discussed in detail in section 2.3.

It is widely accepted that safety culture is an important element in patient safety. The IOM report "To Err Is Human" concluded that "Health care organisations must develop a culture of safety" (IOM 2000: 14). This is reflected in the way that national patient safety organisations are developing. For example, in the UK, the NPSA identifies building a safety culture as the first step of its seven steps guide to improving patient safety. Similarly, the Canadian Council on Health Services Accreditation (CCHSA) identifies safety culture as the first of five goals on patient safety (Fleming, 2005).

Summary

Safety is a concept that has attracted much attention across a wide range of industries. Organisational factors play a critical role in the state of safety in organisations. Those organisations with good safety may reflect organisational characteristics, such as good communication, management commitment to safety and organisational learning from errors. Safety in healthcare involves the safety of both healthcare workers and patients. Patient safety is increasingly recognised as an important issue and there is growing awareness of the importance of safety culture in order to improve patient safety in healthcare organisations. The next section will examine safety culture.

2.3 Safety culture

The aim of this section is to provide an overview of safety culture, to discuss safety culture versus safety climate, and the assessment of safety culture. Lastly it focuses on patient safety culture in healthcare.

2.3.1 Overview of safety culture

The term safety culture originated from industrial engineering and has more recently been applied to healthcare. The concept of safety culture first appeared in 1986 following the Chernobyl nuclear power accident (Gadd and Collins, 2002). Since that time, it has received considerable attention in theoretical and research literature (e.g. Cox and Cox, 1991; Pidgeon, 1998; Lee et al.; 2000; Cooper, 2000; Guldenmund, 2000). The work of these studies and others are reviewed below.

The literature includes a number of definitions of safety culture. For example, Cox and Cox (1991) proposed that safety culture refers to the shared employees' attitudes, beliefs, perceptions, and values in relation to safety. Similarly, Pidgeon (1991) indicated that safety culture is the set of employees' beliefs, attitudes and practices that are concerned with handling risk and hazards in the workplace. Lee (1996) proposed that safety culture is related to the product of individual and group of values, attitudes and behaviours that determine the commitment to safety in an organisation. Mearns et al. (1998) indicated that safety culture refers to the attitudes, values, norms and beliefs that workers share with respect to risk and safety.

These definitions point to common elements of safety culture. These commonalities include the shared attitudes and beliefs among members of an organisation, which impact on how workers perceive and act at work. This interpretation is supported by number of studies that indicated to a link between attitudes and beliefs in the workplace. Guldenmund (2000) and Hale (2000) proposed that the attitudes, beliefs and perceptions shared by workers which determine how they act and react in relation to safety and risk issues in organisations.

Recently, Choudhry et al. (2007) review numerous definitions of safety culture and they conclude that these definitions tend to reflect the view that safety culture refers to the beliefs, attitudes and values of members of an organisation regarding safety. Furthermore, they claim that safety culture is something in an organisation (the beliefs, attitudes and values of workers with respect to safety) rather than something an organisation has (the structure, policies and practices to improve safety). The UK Health and Safety Commission (1993) produced the most widely accepted definition of safety culture as:

> "*The product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management. Organisations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures*"(HSC, 1993:23).

This definition is comprehensive and covers a number of issues. Firstly, it includes the common elements of safety culture that were mentioned in other definitions of safety culture which are workforce attitudes, perceptions and behaviours. Secondly, it highlights the characteristics of a positive safety culture (more details of the characteristics of a positive safety culture are discussed below). Most importantly, this definition can easily be adapted to the context of patient safety in healthcare and patient safety culture as it covers dimensions assessed by patient safety climate questionnaires (Nieva and Sorra, 2003).

It seems that the commonalities across most of definitions are to do with attitude and behaviour being important elements of safety culture in organisations. These common elements refer to the psychological aspect of safety culture in terms of how workers perceive and act towards safety and risk issues in organisation. This aspect refers to highly related concept known as safety climate. Safety climate is most commonly assessed by safety climate questionnaires to measure workforce attitudes and perceptions of safety (Gadd and Collins, 2002).

Although safety climate is a measurable aspect of safety culture, there are other aspects of safety culture. The literature focuses on the three aspects of safety culture as identified by Cooper (2000): situational, behavioural and psychological. A number of qualitative and quantitative tools are available for measuring these different aspects of safety culture. The situational aspect of safety culture focuses on the structure of organisations such as working policies and procedures, whilst the behavioural aspect can be evaluated through various measures, such as self-report measures, outcome measures and observations. Finally, the psychological aspect relates to people's norms, values, attitudes and perceptions of safety in their workplace, which is the aspect most commonly measured by safety climate questionnaires. Similarly, Lee and Harrison (2000) proposed that safety culture is expressed as the product of multiple interactions between people (psychological), functions (behavioural) and organisations (contextual). Fernandez-Muniz et al. (2007) indicated that safety culture can be viewed as a part of the organisational culture that refers to the individuals, jobs, and organisational characteristics that affect employees' health and safety in workplace.

In conclusion, it can be seen that safety culture is a comprehensive concept that reflects the interaction between workers and activities with regard to safety issues. It consists of common elements referring to the shared employees' attitudes, beliefs, behaviours, and perceptions towards safety issues in the workplace. These elements refer to the psychological aspect of safety culture in terms of how workers perceive and act towards the state of safety of an organisation which is called safety climate. The importance of safety culture in relation to improving safety in organisations is discussed below.

Importance of safety culture

Safety culture plays an important role in ensuring that the work environment is safe (Clarke, 2003). It can be regarded as a fundamental and important aspect of an organisation's ability to manage the safety of its operations (Cox and Flin, 1998; Cox and Cheyne, 2000). A series of major accidents such as the Chernobyl disaster, the King's Cross underground fire in London and the Piper Alpha oil platform explosion in the North Sea, highlighted the role of safety culture in improving workplace safety rather than concentrating on technical issues and individual human failures to prevent accidents. Poor safety culture was found to be a key contributory factor in all these accidents (Pidgeon, 1998).

A poor safety culture is characterised by a number of features, such as barriers to organisational learning from previous mistakes, absence of an incident reporting system and teamwork failure (e.g. lack of commitment and support from management to safety, breakdown in communication between workers and lack of coordination and communication at different levels of members of organisation) (Johnson, 2002). Helmreich (2000) pointed out that a breakdown in teamwork and communication has been identified as major factor in aviation accidents.

Mearns and Flin (1999) have identified important factors that contribute to accidents and near misses such as: employee experience; knowledge, skills and attitudes to safety; work environment and nature of tasks; safety culture and the safety management system. They also indicate that management commitment to safety has an effect on workers perceptions of safety issues. Cox and Flin (1998) argue that management's commitment to safety issues is essential to the overall state of safety in organisations.

The perceived importance of safety culture in preventing accidents and improving safety in complex and high-risk systems such as aviation, chemical and nuclear industries, and healthcare, has resulted in an increased numbers of studies examining safety culture (Cooper, 2000; Guldenmund, 2000). As a result, the World Health Organisation (2006) has emphasized the importance of safety culture in decreasing medical errors and keeping patients safe in healthcare organisations.

A number of industries have shown an interest in safety culture as a means of reducing accidents in the work environment (Fernandez-Muniz et al., 2007). Safety culture is a very important issue in relation to safety in the work environment at all levels of an organisation, individuals, teams and management. The commitment and actions of management in relation to safety issues are important aspects of safety culture and have an effect on the perceptions of workforce with regard to safety. Jointly, management and the workforce can minimise the number of accidents and improve the state of safety within an organisation. Thus, safety culture can be considered an important management tool in identifying workforce beliefs, attitudes, and behaviours towards safety in the workplace (Beck and Woolfson, 1999).

Safety culture can be good or poor depending on the way in which safety is managed and to what extent the safety culture dimensions are operating in the work environment (Pidgeon, 1998). Ostrom et al. (1993) argue that the safety culture of an organisation may be influenced by values and beliefs of its leaders. Moreover, in an organisation with a good safety culture, the management encourages workers to report errors, pay attention to safety issues and to minimise risk in the work environment, and supports safe work practices. Overall, safety culture influences safety practices in the work place. A poor safety culture is a significant risk factor that can threaten the state of safety in organisations. A good (positive) safety culture is a key factor that can improve safety in organisations. The characteristics of positive safety culture will be discussed in the next section.

Characteristics of positive safety culture

There is a large body of research evidence to suggest that a positive safety culture may help to enhance the state of safety of an organisation (Gadd and Collins, 2002). Vecchio-sudus and Griffiths (2004) argued that developing and maintaining a positive safety culture can be an effective tool for improving the state of safety in an organisation.

A positive safety culture is defined as:

> "A set of values, perceptions, attitudes and patterns of behaviour with regard to safety shared by members of the organisation; as well as a set of policies, practices and procedures relating to the reduction of employees' exposure to occupational risks,

implemented at every level of the organisation, and reflecting a high level of concern and commitment to the prevention of accidents and illnesses." (Fernandez-Muniz et al., 2007:628).

According to Ostrom et al. (1993) the aim of a positive safety culture is to create a climate, in which employees are aware and concerned about the risks and safety in their workplace in order to maintain the state of safety, avoid any unsafe actions, and to prevent accidents. Cox and Cox (1991) argue that the workforce's attitudes and perceptions of safety constitute the most important aspect of safety culture.

A number of earlier studies have discussed the characteristics of positive safety culture. For example, Zohar (1980) mentioned a number of characteristics of positive safety culture such as the priority given to safety by management and workers; the importance of the reporting of incidents and open lines of communication between management and employees as being related to good safety practices and performance. According to Pidgeon (1991), positive attitudes to safety among the workforce are a reflection of good safety culture in the work environment.

Reason (1997) argued that the characteristics of a positive safety culture are justice (no blame), flexibility (to adopt changes for safety), learning (learn from errors) and systematic (have a system to manage hazards). Dalling (1997) reported a number of characteristics of a positive safety culture such as: encouraging workers to anticipate and manage risks and threats to safety; improving working practices and continuing to improve safety; concern and commitment to safety as a top priority at all levels of workforce; learning from mistakes and open communication. Clarke (1998) proposed that the key characteristics of positive safety culture which improve safety in organisations are: management's commitment and support for safety, encouraging workers to report incidents (no blame culture), improving communication based on open and honest communication, enhancing levels of trust between workers.

Clarke (1999) argued that a positive safety culture is a result of a number of factors such as: good communication between staff and management, agreement across all levels of the organisation on the importance of safety and confidence amongst workers that safety measures are adequate.

Recently, a number of studies discussed the characteristics of positive safety culture. For example, Leape and Berwick (2000) stated that leadership, communication and preventive safety measures are positive characteristics of safety culture. Hale (2000) identified a number of characteristics for a positive safety culture, these include safety as a top priority, importance of safety, participation of workers at all levels, trust and cooperation among staff, communication openness and continues safety improvement. Sorensen (2002) identifies a positive safety culture as including good communication, organisational learning and management's commitment to safety. According to Pronovost et al. (2003) the characteristics of a positive safety culture include management commitment to discuss and learn from errors, encouraging teamwork, reporting and analysing errors, documenting and improving safety and encouraging employees to improve safety. Harvey et al. (2004) refer to the importance of managements' commitment to safety; leadership and communication are basic factors that constitute a positive safety culture. Kirk et al. (2006) identified a number of characteristics of a positive safety culture as follows:

1. The shared perceptions of workers regarding the importance of safety.
2. Good communication among workers based on mutual trust and openness.
3. The smooth flow of information within the team.
4. Leadership playing a role in giving direction for safe practice.
5. Effective preventive (safety) measures being applied.
6. Latent threats or causes that might lead to accidents being proactively identified.
7. Organisational learning.
8. Recognition that errors cannot always be avoided or stopped from happening.
9. The adoption of incident reporting and analysis instead of blame and a punitive culture.

Choudhry et al. (2007) noted that a positive safety culture compromises five characteristics which include management commitment to safety, management concerns for the workers, mutual trust between management and workers, workforce empowerment and continues improvement of safety in workplace. It is argued that an organisation's positive safety culture reflect a number of dimensions such as senior management commitment to safety, organisational learning (feedback and learning from mistakes), safety as a top priority and leadership (Pidgeon and O,leary, 2000).

In general, it seems that there is wide agreement across the majority of earlier and more recent studies regarding some of the common characteristics of positive safety culture. Review of these 13 studies (see footnote[2]) shows that there are some common characteristics:

1. Open and honest communication between workers (mentioned in ten studies).
2. Priority given to safety by management and workers of organisation (importance of safety in organisations) (mentioned in nine studies).
3. Management commitment to safety (mentioned in eight studies).
4. Importance of reporting incidents and analysing them and giving feedback (mentioned in six studies).
5. Organisational learning to learn from errors (mentioned in six studies).
6. Teamwork (trust and cooperation among staff) (mentioned in five studies).
7. No blame culture (mentioned in four studies).
8. Effective leadership role (mentioned in three studies).

The presence of these factors creates effective conditions which help workers to improve safety and avoid errors in work environment. In other words, all these characteristics create a positive safety culture that prevents accidents and maintains good safety within organisations (Clarke, 2003). It appears that a positive safety culture is characterised by organisational factors that play an important role in safety in organisations and most of these organisational factors have led to greater focus on safety climate as a related concept to the safety culture in organisations. Safety climate is an organisational factor that can influence safety performance (Hofmann and Stetzer, 1996; Flin et al., 2006a).

However, there is considerable debate in the literature regarding the relationship between safety culture and safety climate (Cox and Flin, 1998; Flin et al., 2000). A number of authors (e.g. Cox and Flin, 1998, Mearns and Flin, 1999) proposed that there is considerable overlap between the concepts, causing confusion for the reader, and this is evidenced by the fact that the two terms are highly related and often used interchangeably. According to Glendon and Stanton's (2000) argument that safety culture and safety climate are at an early development stage, it is appropriate to recognise the difference between the concepts of safety culture and

[2] Zohar, 1980; Pidgeon, 1991; Reason, 1997; Daling, 1997; Clarke, 1998; Clarke, 1999; Leape and Berwick, 2000; Hale, 2000; Sorensen, 2002; Pronovost, 2003; Harvey et al., 2004; Kirk et al., 2006; Choudhry et al., 2007.

safety climate, which have elements in common. The following section is concerned with the relationship between safety culture and safety climate.

2.3.2 Safety culture and safety climate

The concept of safety culture is derived from extensive research on organisational culture and climate. Therefore, terms such as culture, climate, organisational culture, and organisational climate play a role in defining and describing the relationship between safety culture and safety climate (Gonzalez-Roma et al., 1999). The following section discusses the distinction between the two concepts, culture and climate.

Culture versus climate

Although definitions of culture and climate tend to be similar, the term culture is generally seen as more comprehensive than climate. Culture can be seen as the set of values, beliefs and expectations that a group of people come to share (Van Maanen and Schein, 1979). Culture describes the shared corporate values within an organisation, which influence the attitudes and behaviours of its members. Safety culture is a part of the overall culture of the organisation and is seen as affecting the attitudes and beliefs of members in terms of health and safety performance (Cooper, 2000). Helmreich and Merritt (1998) describe culture as mixture of values and beliefs that guide the behaviours of members in an organisation. Pronovost and Sexton (2005:1) state that:

> "*Culture commonly refers to values, attitudes, norms, beliefs, practices and behaviours of personnel. In essence, culture is the way we do things around here, whereby the word here refers not to hospital, but rather to a particular work unit*".

On the other hand, climate can be defined as the sum of workers' perceptions about organisation (James et al., 1978). Climate refers to the shared perceptions of workers of an organisation at a discrete point in time (Cox and Cheyne, 1999). Denison (1996) debated the differences and similarities between culture and climate. He concluded that culture refers to deep structure based on the values, beliefs and assumptions of the members of an organisation, whilst climate refers to a state that links to the thoughts, feelings and perceptions of the members of an organisation. Denison (1996) further claimed that culture must be measured using qualitative approaches, whereas climate can be measured using quantitative methods such as questionnaires. Cooke and Rousseau (1998) reviewed a number of definitions of culture and climate and concluded that most of the culture definitions are concerned with values, beliefs and attitudes that members come to share. In contrast, climate definitions tend to take into consideration the perceptions of members regarding the organisation in which they work. According to Gonzales et al. (1999) culture contains values, beliefs and underlying assumptions, while climate refers to a descriptive measure reflecting the workforce's perceptions of the organisational atmosphere. Clarke (2003) argued that culture refers to the deeper values and norms that influence thinking and action, whereas climate is more superficial and concerned with perceptions of the work setting.

It appears that culture and climate are not clearly distinct and the terms are used interchangeably by a number of studies (Glendon and Stanton, 2000). Culture refers to the deep values and beliefs (deep structure of organisations) while climate refers to the employees' perceptions and norms and a measurable aspect of the work environment of organisations (policies, procedures and practices). The culture and climate of an organisation influence the practice of members in that organisation (Denison, 1996; Zohar, 2003). The relationship between organisational culture and organisational climate has also been debated. This is addressed in the following section.

Organisational culture and organisational climate

A number of studies have discussed the relationship between organisational culture and organisational climate. For example, Moran and Volkwein (1992) examined the distinctions between the two concepts and they conclude that organisational climate links to organisational culture as an element of organisational culture that is present when the members of an organisation act together when dealing with situations that may arise.

Guldenmund (2000) notes that organisational climate refers to member's attitudes, perceptions and behaviour of organisational features, whereas organisational culture has been defined as the values, beliefs, and assumptions shared by members of an organisation and which is more encompassing than organisational climate. Organisational culture is assessed through qualitative tools, such as observations and interviews, whereas organisational climate can be measured by using self-administered questionnaires. According to Glendon and Stanton (2000) organisational climate is usually regarded as being more superficial than organisational culture in that it addresses the current state of an organisation.

According to Neal et al. (2000:100):

> *"Safety climate is a specific form of organisational climate, which describes individual perceptions of the value of safety in the work environment"*

It appears that organisational climate can influence perceptions of safety climate and these perceptions can influence safety performance. Arezes and Miguel (2003) argued that safety culture is deeply related to organisational culture. In general, organisational culture and organisational climate are considered to be closely related concepts and safety culture and safety climate are elements of these two integrated concepts. As mentioned earlier, there is considerable debate regarding the relationship between safety culture and safety climate in the relevant literature and the relationship between them is unclear.

Several researchers have pointed out that safety culture is used together with safety climate. For example, Cox and Flin (1998) argued that safety climate is often used together with safety culture, without making a clear distinction between the two concepts. They argued that there is a need to create a clear understanding of the relationship between two terms. Mearns and Flin (1999) argued that although the two terms are often interchangeable and related, they are not exactly the same and this should be considered therefore they should be used with caution. According to Fleming (2005) it is accepted that the two concepts are closely related and the safety climate consists of the surface elements of the safety culture and can be measured by using safety climate questionnaire.

It seems that the relationship between safety culture and safety climate is unclear because the two terms are highly related. However, it would appear that it is possible to distinguish between the two terms through reviewing their definitions, dimensions and assessment. The following subsections outline how safety culture and safety climate have been defined and what the dimensions of each concept are in the safety literature.

Safety culture definitions and dimensions

As mentioned earlier several definitions of safety culture can be found within the literature. Most of the safety culture definitions indicate that safety culture is part of organisational culture and that it concerns the shared values, beliefs and attitudes of members of an organisation to safety issues (Cox and Cox, 1991). It is argued that a positive safety culture is one in which all staff, from top level management to individual workers, are committed to work safely and to contribute positively to their own safety and that of others within an organisation (Dalling, 1997). The dimensions of safety culture are addressed in the following section.

Safety culture dimensions

The dimensions of safety culture have been described in a number of studies (e.g. Brown and Holmes, 1986; Cooper and Philips, 2004). The dimensions relate to the perceived significance of safety to job behaviour, perceived management commitment towards safety, perceived commitment of workers to safety, and importance of safety training. Sorensen (2002) appears to agree that the dimensions of safety culture include management's commitment to safety, good communications, organisational learning and effective leadership role. Singer and colleagues (2003) identified the following safety culture dimensions:

1 A high level of organisation's commitment to safety, this commitment is translated into shared values and beliefs amongst all members of organisation.
2 Availability of resources to support a commitment to safety.
3 Safety as a top priority: priority of safety versus production.
4 Communication between employees and across different levels and units of organisation.
5 Openness about problems and errors: reporting errors.
6 Frequency of unsafe practice is rare.
7 Organisational learning: learning from errors.

A number of studies indicates that safety culture is a multi dimensional concept for example, the importance of management commitment to safety, the actions to improve safety performance, the importance of communication between workers and management, good reporting system including reporting and analysing incidents, the policies and procedures of work and the importance of the participation of the workforce in safety (workers involvement in safety) (Parker et al., 2006; Fernandez-Muniz et al., 2007).

Safety climate definitions

Several definitions of safety climate can be found within the relevant literature. Zohar (1980:96) defines safety climate as:

"*A summary of perceptions that employees share about their work environments*"

According to Cooper and Philips (1994) safety climate refers to the shared perceptions and beliefs of the workers regarding the state of safety in their work environment. According to Mearns and Flin (1999) safety climate refers to the perceptions, attitudes and beliefs of workers related to hazards and safety issues in organisation. Safety climate refers to employee perceptions regarding their organisation's commitment to safety issue in order to maintain safe work practices (Robyn et al., 2000). Safety climate is a snapshot of the state of safety that can be viewed as an accurate indicator of the organisation's safety culture as perceived by workers (Flin et al., 2000).

It seems that there is a degree of overlap between the definitions of safety culture and safety climate (Mearns and Flin, 1999) and the two terms are highly related. Most definitions of safety culture present a view of shared attitudes and behaviours of employees about safety issues in an organisation. Jointly, most definitions of safety climate present a view of shared attitudes and perceptions of employees about safety issues in an organisation.

Safety culture is a part of the overall culture of the organisation and is seen as attitudes and behaviours of workers in terms of safety performance (Cooper, 2000). Safety climate is a part of the overall climate of the organisation and is seen as attitudes and perceptions of workers in terms of safety performance (Neal et al., 2000). Safety climate is considered as a measurable aspect of safety culture. It is argued that safety climate is related to the current surface features of safety culture which are determined by the employees' attitudes and perceptions at given point of time (Flin et al., 2000; Cox and Cheyne, 2000). These perceptions are derived from interactions with staff and different levels of management such as supervisors and top management level, policies and procedures and work practices (Mary et al., 2005).

In conclusion safety climate is a snapshot of the state of safety providing a clear picture of underlying safety culture of workplace (Mearns and Flin, 1999; Flin et al., 2000). Cox and Flin (1998) proposed that safety climate is the preferred term when using psychometric questionnaire studies as the measurement tool. Similarly Mearns et al. (1998) suggested that a safety climate questionnaire is appropriate for assessing workforces' perceptions regarding the surface features of safety culture at a given point in time as a snapshot of safety culture. Sexton et al. (2006) indicated that safety climate is a measurable aspect of safety culture and can be assessed by safety climate questionnaire to assess frontline workers perceptions toward safety issues in organisations. Safety climate questionnaire can be used to assess workforce perceptions of procedures and behaviours in their work environment that indicate the priority given to safety relative to other organisational goals. Safety climate questionnaire can assesses a range of different dimensions (Zohar, 1980; Flin et al., 2006b).

Safety climate dimensions

The dimensions of safety climate have been examined in a number of studies. For example, Brown and Holmes (1986) found that management commitment to safety and safety activities are key dimensions of safety climate. Similarly, Dedobbeleer (1991) found management commitment to safety and workers involvement as a key dimension of safety climate across ten safety climate instruments. Flin et al. (2000) found that the most commonly assessed dimensions across 18 safety climate questionnaires concerned management commitment to safety, the safety system in relation to procedures and practices, probability of risk, work stress and professionalism of workers (workers' knowledge and skills). Robyn et al. (2000) identified a number of safety climate dimensions such as senior management support for safety, good communication among staff members, feedback and preventing barriers to safe work practices. Cheyne et al. (2002) identified that communication, safety rules and goals, workers involvement and physical work environment should be considered as safety climate dimensions.

Flin et al. (2006b) reviewed 12 studies of safety climate in healthcare and found common safety climate dimensions such as management support and commitment to safety, communication and feedback, reporting incidents, teamwork, rules and procedures of work, risk perception and safety attitudes of workers, organisational factors and safety system. It is worth noting that the safety climate dimensions emphasise the dimensions at a system level rather than an individual level. These include the importance of management support to safety, communication among employees and different units in workplace, feedback about errors, organisational learning, communication openness and reporting errors.

From the examples of safety climate definitions and dimensions above, safety climate refers to the shared perceptions of work members to improve safety and it may be regarded as a key indicator and measurable aspect of safety culture that arise from employees' perceptions of organisations. The concept of safety climate includes all levels of organisation: management, team and individual.

The most notable dimensions of safety climate are management commitment to safety, workers involvement, reporting system, organisational learning; communication openness, and feedback about error, and teamwork across different units in work environment. In short, safety climate dimensions enhance the state of safety in the work environment when most of these dimensions work in effective way (Mearns et al., 1998). Each dimension has a specific function and aim impacting on safety climate and safety performance.

There is a large body of research describing safety climate dimensions. For example, management commitment to safety is described as the perceptions of management commitment to safety issues in organisations (Abdullah et al., 2009). Management commitment to safety has been described as a management support and positive actions in order to enhance safety in organisation (Health and Safety Executive, 2007). Havold and Nesset (2008) described communication as interaction and an effective information exchange between management and workforce about safety and risk in the work environment. Open communication means exchanging information between units of organisation honestly and smoothly (Hsu et al., 2007). Reporting system describes the willingness of workers to give details about safety issues and those workers must be given feedback about errors for learning purposes (Health and Safety Executive, 2005).

Employee involvement refers to how employees in all levels participate in improving safety (Fernands-Muniz, 2007), while organisational learning is related to getting feedback and learning from errors that happened in organisation. Teamwork means workers look out for each other and trust each other and it consists of attitudes, knowledge and skills of workers towards safety and concerns (Kaissi et al., 2003). Non punitive culture means whether are workers willing to report errors without fear of punishment for making mistakes (Weingart et al., 2004). However, it is known that poor performance in relation to safety climate dimensions such as lack of communication, lack of attention to safety procedures, workload and breaks in continuity of care leads to increased errors in organisation (Yassi and Hancock, 2005).

In summary, safety climate may be regarded as a clear picture, a current surface picture and a measurable aspect of safety culture. It appears that using a safety climate questionnaire is a useful measurement of an organisation's safety climate to provide a clear picture of the current state of safety. The assessment of safety culture is addressed in the following section.

The assessment of safety culture

As mentioned earlier, safety culture consists of three components: psychological, situational and behavioural. It is important to mention that methods such as peer reviews, performance indicators and audit can be used to assess safety culture in a comprehensive way (Lee and Harrison, 2000). The psychological aspects of safety culture are concerned with workers' perceptions and actions toward safety issues in organisations (Kirk et al., 2006). This aspect of safety culture is a measurable aspect which is related to safety climate.. In reality safety culture assessment tools that assess the psychological aspect of safety culture are measuring safety climate.

Zohar, (1980) suggested that safety climate questionnaires produce a clear picture of an individual's safety climate at a group or organisational level. Safety climate questionnaires assess surface features of safety culture to produce a clear picture of safety culture in terms of what the workforce do regarding safety, while the deeper layer of safety culture requires qualitative methods such as observations and in-depth interviewing to investigate deep features in relation to workforces' safety practices (Cooper, 2000). Cox and Cheyne (2000:114) proposed that:

"*Assessment of safety climate is used as an indicator of overall of safety culture*".

Flin et al. (2006b) argue that safety climate can be regarded as the surface (external) features of the underlying safety culture and it can be used to assess workforce perceptions of procedures and behaviours in their workplace that indicate the priority given to safety in relation to other organisational goals. Thus, an evaluation of safety culture can be based on measuring safety climate primarily through the use of questionnaire surveys.

Evidence from numerous studies demonstrates that questionnaires are a useful tool for measuring safety climate to provide a clear picture of the state of safety in organisations through assessing the perceptions of the workforce at a particular time (Mearns et al., 2003; Flin et al., 2006b; Guldenmund 2007). It is widely accepted that safety culture assessment is based on measuring safety climate by using safety climate questionnaire to assess workers' perceptions of safety climate in their organisations (Flin, 2007).

A number of studies identify benefits of using a safety climate questionnaire for assessing safety culture. For example, Baily and Petersen (1989) concluded that safety climate questionnaires are useful because measuring safety culture by traditional methods such as safety review and audits is not enough and not effective. Safety climate questionnaire is effective method to assess employee perceptions, to identify weakness and strengths areas of safety culture and by using the data of safety climate questionnaire can effectively identify improvements of safety culture.

Similarly, Ostrom et al. (1993) agreed with the conclusion of Baily and Petersen that the safety climate questionnaire is a valuable tool to assess safety culture. According to Kho et al. (2005) the self-administered questionnaire can help in understanding institutional perceptions of safety culture as an efficient way to ask standardized questions of all respondents concurrently and anonymously. Guldenmund (2007) agreed that the use of safety climate questionnaires is an effective approach in safety culture assessment in terms of assessing workforce perceptions towards safety issues in organisation. Safety climate questionnaires are used to assess safety culture in different organisations such as aviation, nuclear power, petrochemicals and Medicine (Helmreich and Merritt, 1998).

It is widely accepted that, the relationship between safety climate and safety culture is closely related and they are integrated concepts. After reviewing the relevant literature on safety culture and safety climate table 2-1 is presented to summarize some of the differences and similarities between safety culture and safety climate.

Table 2-1 Differences and similarities between safety culture and safety climate

Differences and similarities	Safety culture	Safety climate
Background	Has been discussed since Chernobyl disaster in 1986 (Cox and Flin, 1998).	Introduced in 1980 (Zohar, 1980).
Definition	Safety culture refers to the shared employees' attitudes, beliefs, perceptions, and values towards safety (Cox and Cox, 1991).	Is a snapshot of the surface features of state of safety resulting from the workforce's perceptions attitudes and beliefs about risk and safety issues (Mearns and Flin, 1999).
Components	Psychological (relates to people's norms, values, attitudes and perceptions), situational (relates to policies and procedures), and behavioural (qualification, knowledge and pattern of behaviour) components (Cooper, 2000).	Safety climate refers to workforces' perceptions of practices, policies and procedures relating to safety within organisation (Neal and Griffin, 2002).
Dimensions (the most common dimensions)	Such as: 1 Importance of safety 2 Management commitment to safety 3 Communication between workers and across organisational levels. 4 Reporting system 5 Organisational learning.	Such as: 1 Management commitment to safety 2 Workers involvement 3 Communication and feedback about error 4 Teamwork 5 Organisational learning 6 Reporting system
Assessment	It could be assessed by measure safety climate. Safety culture is usually measured in industry by workforce questionnaire survey to assess what is called safety climate (Flin et al., 2006 b).	Measured by workforce questionnaire to give a snapshot of the current state of safety (Mearns and Flin, 1999).
Other considered points	Safety culture is a part of organisational culture. Attitudes are corner stone of culture (Mearns and Flin, 1999). Safety culture is more stable than safety climate and resistant to change (Mearns et al., 1998). Psychological aspect of safety culture is related to safety climate. Organisational safety culture is a measure of common thoughts, behaviours, and beliefs. Safety culture highlights deep features (Cox and Flin, 1998). Positive safety culture characterised by communication founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures (HSC,1993:23).	Safety climate is a part of organisational climate. Perceptions are basis of climate (Mearns and Flin, 1999). Safety climate is a measure of individual perceptions or feelings about organisation. Safety climate is a measurable aspect of safety culture (Wiegmann et al., 2002). Safety climate measurement is based on workforce perceptions. Safety climate highlights surface features of safety culture (Cox and Flin, 1998). Positive safety climate characterised by a shared commitment of care and concern towards safety (Cooper and Philips, 2004).

In summary, safety culture reflects the deep values, attitudes and beliefs of members of organisation regarding safety and risk issues. It widely agreed that safety culture is normally assessed by workforce questionnaire to measure safety climate. Safety climate reflects members' perceptions of safety and risk issues in their organisation. Safety climate is usually measured by questionnaire and providing a picture of safety culture in terms of assessing workforce perceptions towards risk and safety issues at that point in time in an organisation.

Safety culture assessment is increasingly recognised as an important factor to improve patient safety in healthcare organisation (Pronovost et al., 2003; Pronovost and Sexton, 2005). Therefore, the current study focuses on patient safety culture assessment and its role in improving patient safety. The following section discusses patient safety culture in healthcare organisations.

2.3.3 Patient safety culture

In healthcare organisations safety culture assessment is increasingly a critical element for improving patient safety (Nieva and Sorra, 2003). The significance of safety culture in preventing medical errors and improving patient safety has led to an increasing number of studies that discuss and assess safety culture in complex organisations such as healthcare and, in particular, in hospitals (Fleming and Wentzell, 2008). Healthcare organisations are increasingly aware of the importance of patient safety culture in order to enhance patient safety through the measurement of patient safety climate. Measuring patient safety climate in healthcare helps to diagnose the underlying patient safety culture of an organisation or work unit (Flin et al., 2006b). It is widely agreed that probably one of commonest ways to assess patient safety culture is based on using patient safety climate questionnaire to assess workers' perceptions of patient safety climate in their healthcare organisations (Sexton et al., 2006b; Fleming and Wentzell, 2008).

The importance of safety culture in healthcare is widely recognised. For example, Nieva and Sorra (2003) argue that the positive safety culture supports patient safety and a poor safety culture is considered as a significant risk factor that can affect patient safety negatively. Similarly, Parker et al. (2006) argue that safety culture is affected by organisational changes, such as the systems, processes and practices of the organisation. For example, an organisation with a poor safety culture often has limited safety systems, while an organisation with a positive safety culture has many safety systems, processes and practices to promote patient safety. This argument suggests that it should be possible to assess the extent to which systems and processes promote a positive patient safety culture by evaluating organizational practices that influence the patient safety culture. Therefore, patient safety culture assessment tools were developed to assess a number of important organisational practices that may influence patient safety culture (Fleming and Wentzell, 2008).

Flin (2007) has argued that organisational factors of a positive safety culture influence patient safety culture and patient safety outcomes. Pronovost et al. (2003) argued that positive patient safety culture is characterized by clear commitment of leadership to discuss issues that threaten patient safety, learning from medical errors, continuous patient safety improvement, encouraging teamwork, using reporting systems to analyse adverse events and no blame culture.

A positive safety culture in healthcare can be seen as an environment that supports reporting, ends blame culture, effective leadership and focuses on systems. A poor safety culture contributes to medical errors, unsafe therapies and unintended injuries (Institute of Medicine, 2000). Poor safety culture includes barriers to organisational learning from previous incidents (Johnson, 2002). This argument is supported by Nieva and Sorra (2003) who agreed that a positive safety culture supports patient safety while a poor culture is a significant risk factor that can threaten patient safety. Similarly, Fleming and Wentzell (2008) suggested that a poor patient safety culture is a significant risk factor that can threaten patient safety.

The Institute of Medicine (2000) suggest that changing the patient safety culture from blaming culture in which healthcare workers are blamed for errors to an organisational learning culture in which people learn from errors to improve healthcare and prevent harm is the biggest challenge for moving towards patient safety. Similarly, the Institute for Healthcare Improvement (2005) suggests that a patient safety culture is characterised by an environment of mutual trust between staff members to allow them to talk and discuss freely about patient safety problems and work to solve them without fear of blame and punishment. Patient safety culture concerns how healthcare workers' values, attitudes and perceptions regarding their organisation's commitment to patient safety in order to maintain safe work practices in healthcare organisation (Handler et al., 2006).

A patient safety culture involves shared attitudes, values and norms of staff related to patient safety. It is characterized by a number of positive features such as open communication about safety problems, effective teamwork and management supports patient safety to make it a top priority (World Health Organisation, 2008). Sorra and Dyer (2010) argued that patient safety culture is an aspect of organisational culture. It refers to management and staff values, beliefs and norms about important issues in healthcare organisation, behaviour of members, acceptable and unacceptable actions and attitudes, and what process and procedures are in place with regard to patient safety.

All these definitions indicate that patient safety culture is characterised by number of dimensions. The healthcare literature mentioned a number of patient safety culture dimensions. Table 2-2 presents a number of patient safety culture dimensions.

Table 2- 2 Patient safety culture dimensions

Study		Patient safety culture dimensions
Kirk et al. (2007)	1	Overall commitment to quality: The policies and procedures of organisation should be aimed to provide safe and quality healthcare services.
	2	Priority given to patient safety: The issue of patient safety should be taken in consideration at all levels of staff and management.
	3	Communication about safety issues: Communication should be open to discuss patient safety issues.
	4	Staff education and training about safety issue: Availability and usefulness of education and training programs.
	5	Team working around safety issues: Managing and developing teamwork based on effective cooperation and communication between staff.
	6	Organisational learning following patient safety incidents: Learning from patient safety incidents to improve patient safety.
	7	Perceptions of the causes of patient safety incidents and their identification: The mechanisms of reporting incidents.
	8	Investigating patient safety incidents: How the incidents are investigated?
	9	Personnel management and safety issues: Managing safety issues in work environment.

Table 2-2 (continued)		
IOM (2004)	1	Healthcare workers share the view that healthcare is a high-risk environment.
	2	Management commitment to exposing and analysing mistakes (events) that might harm patients.
	3	A balance between the need for reporting of events and the need to take action to improve patient safety.
Weingart et al. (2004)	1	Leadership (patient safety is high priority to senior leaders)
	2	Salience (responsibility to patient safety)
	3	A non punitive environment (afraid of punishment)
	4	Reporting and communication (reporting errors and getting feedback about errors for learning from mistakes).
Handler et al. (2006)	1	Non punitive response to error.
	2	Teamwork within units.
	3	Communication openness.
	4	Feedback and communication about error.
	5	Organisational learning.
Amanda et al. (2007)	1	Communication,
	2	leadership
	3	Tendency of staff to report errors and teamwork.
Sammer et al. (2010)	1	Leadership role to assure patients are safe from medical errors in healthcare as a high-risk environment.
	2	Teamwork in terms of the relationships among staff should be based on cooperation and open communication.
	3	Evidence-based which means patient care practices should based on evidence and standardised to provide safe and high quality care to patients.
	4	Communication in terms of an environment that helps staff to speak up when something is harm patients.
	5	Organisational learning, staff learns from mistakes for performance improvement.
	6	Just: medical errors happen due to system failures rather than individual failures.
	7	Patient-centred: Patient care is at the centred of healthcare process.

It seems that it is not possible to include all these dimensions of patient safety culture at the same time in one patient safety climate questionnaire but some questionnaires such as the HSOPSC questionnaire (Sorra and Nieva, 2004) includes many of these common dimensions.

In summary, it appears that patient safety culture is concerned with shared values, attitudes and perceptions that determine how staff perceive and act upon patient safety within their healthcare organisations. Review of the studies in this section (2.3.3) (see footnote3) shows there are some common patient safety culture dimensions: management commitment to improve patient safety, communication among staff, teamwork, feedback communication about error, event reporting and organisational learning.

A large number of quantitative tools (e.g. Safety Climate Survey) and qualitative tools (e.g. Manchester Patient Safety Assessment Framework) have been developed to assess patient safety culture in healthcare organisations (Kirk et al., 2006). It is widely accepted that assessing patient safety culture in healthcare can be conducted by measuring patient safety climate through using patient safety climate questionnaire (Pronovost et al., 2003; Nieva and Sorra, 2003; Sorra and Nieva, 2004; Colla et al., 2005; Flin, 2007; Singla et al., 2006; Fleming and Wentzell, 2008). Measurement of patient safety climate seeks to explore the shared perceptions of healthcare workers regarding to safe performance in relation to patient care. The perceptions include key issues such as open and honest communication among staff, teamwork, organisational learning, management commitment of safety, feedback about errors and event reporting and analysing (Mary et al., 2005).

Summary

In summary, it can be seen that safety culture is a comprehensive concept that reflects the interaction between workers and processes in terms of the state of safety of the organisation. Safety culture refers to employees' shared attitudes, beliefs and perceptions towards safety issues in the workplace. The importance of safety culture in preventing accidents and improving safety in workplace is widely perceived. The characteristics of a positive safety culture are considered as important factors contributing to improve safety of organisations.

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[3] Kirk et al, 2007; Institute of Medicine, 2004; Wingart et al, 2005; Handler et al., 2006; Amanda et al, 2007; Sammer et al, 2010

Safety climate may be regarded as a clear picture, a current surface and measurable aspect of safety culture and it is most often assessed by workforce questionnaire to measure safety climate. Healthcare organisations are increasingly aware of the importance of patient safety culture in order to enhance patient safety, through measuring patient safety climate using patient safety climate questionnaires. There are a number of patient safety climate questionnaires available to assess patient safety culture. The next section discusses the measurement of patient safety climate and provides the details of patient safety climate questionnaires.

2.4 Measurement of patient safety climate

This section is concerned with the measurement of the patient safety climate in healthcare organisations. It examines the existing patient safety climate questionnaires and their characteristics. In addition, the development and validation of patient safety climate questionnaires and the selection of a suitable questionnaire for measuring patient safety climate are discussed in this section.

Patient safety culture can be assessed based on patient safety climate measurement using a patient safety climate questionnaire. The evaluation of patient safety climate generally refers to a measurable component of patient safety culture that is assessed by measuring the perceptions of healthcare staff toward patient safety through the use of patient safety climate questionnaires (Colla et al., 2005; Flin et al., 2006b). It is widely accepted that measuring perceptions of healthcare staff regarding patient safety issues assesses patient safety climate (Sexton et al., 2006b). Therefore, it is possible to measure healthcare professionals' perceptions of patient safety across a range of dimensions by using patient safety climate questionnaires (Fleming and Wentzell, 2008).

The current study aims to identify and validate a patient safety climate questionnaire for use in hospitals in Saudi Arabia. Initially, it is important to review the various patient safety climate questionnaires and their characteristics to select the most appropriate one. Section 2.4.1 identifies existing patient safety climate questionnaires. General characteristics, dimensions and psychometric properties of patient safety climate questionnaires are also discussed in this section.

Section 2.4.2 discusses the development and validation of patient safety climate questionnaires and their psychometric analysis and properties. Section 2.4.3 discusses selecting a suitable questionnaire for measuring patient safety climate. Psychometric testing entails the use of established psychometric assessment techniques to assess psychometric properties of questionnaires, such as exploratory factor analysis, confirmatory factor analysis and reliability analysis. These terms are provided and explained in a glossary (page number XIV).

2.4.1 Existing patient safety climate questionnaires

There are a number of patient safety climate questionnaires available that are used to assess patient safety climate in healthcare. A search strategy was developed to identify existing patient safety climate questionnaires. A literature search was conducted utilising manual searching and electronic databases such as the Medline, Science direct and Pub med Central. The key words included patient safety climate, questionnaires, patient safety culture questionnaires/survey, safety climate questionnaires, measuring patient safety climate and healthcare. A combination of the key words, such as patient safety climate questionnaire in healthcare, and patient safety culture questionnaire in healthcare were used. No restriction on date or study type was used. However, the search was restricted to the English language publications. Websites relevant to patient safety were also used, and these included the website of the Agency for Healthcare Research and Quality (AHRQ), the National Patient Safety Agency (NPSA) and the Institute for Healthcare Improvement (IHI). A review of references from relevant studies was also conducted. The searches were originally conducted in December 2007.

The criteria used for identifying existing patient safety climate questionnaires were:

1 Use of questionnaire for measuring patient safety climate.
2 Use in healthcare settings.
3 Use for assessing the perceptions of healthcare staff.
4 Questionnaires are published in English.

The above strategy produced 18 patient safety climate questionnaires as follows:

1. Strategies for Leadership: An Organizational Approach to Patient Safety (SLOAPS) (Voluntary Hospital of America, 2000).
2. Veterans Administration Patient Safety Culture Questionnaire (VHA PSCQ) (Burr et al., 2002).
3. Hospital Survey on Patient Safety Culture (HSOPSC) (Sorra and Nieva, 2004).
4. Safety Attitudes Questionnaire (SAQ) (Sexton et al., 2004).
5. Safety Climate Survey (Sexton et al., 2000, 2003).
6. Hospital Transfusion Service Safety Culture Survey (Sorra and Nieva, 2002).
7. Medication Safety Self-Assessment (MSSA) (Institute for Safe Medication Practices, 2000).
8. Culture of Safety Survey (CSS) (Weingart et al., 2004).
9. Teamwork and Patient Safety Attitudes Questionnaire (Kaissi et al., 2003).
10. Operating Room Management Attitudes Questionnaire (ORMAQ) (Helmriech et al., 1997).
11. Modified Operating Room Management Attitudes Questionnaire (MORMAQ) (Flin et al., 2003).
12. Safety Climate Scale (SCS) (Pronovost et al., 2003; Kho., 2005).
13. Stanford University Patient Safety Climate in Health Care Organisation Questionnaire (Singer et al., 2003).
14. Patient Safety Culture in Health Care Organisation (Modified Stanford instrument) (Singer et al., 2007).
15. An employee questionnaire for assessing patient safety (Carayon et al., 2005).
16. Team Work and Safety Climate Survey (Sexton et al., 2004).
17. Leiden Operating Theatre and Intensive Care Safety Scale (Beuzekom, 2007).
18. Patient Safety Culture Improvement Tool (Fleming and Wentzell, 2008).

A number of review papers concluded that the patient safety climate questionnaires varied according to the general characteristics, dimensions covered and psychometrics properties (e.g. Colla et al., 2005; Fleming, 2005; Flin et al., 2006b; Singla et al., 2006). Further details and examples of these characteristics are presented below in order to clarify this variation among patient safety climate questionnaires.

General characteristics of patient safety climate questionnaires

This section focuses on the general characteristics of patient safety climate questionnaires such as source, aim, settings suitable for use, respondents (who are supposed to complete a questionnaire), length of questionnaires and response scale.

A number of questionnaires have been adapted for healthcare from other industries such as aviation and nuclear because most of safety climate questionnaire were first developed in these industries (Helmreich and Merritt, 1998). For example, the SAQ (Sexton et al., 2004) was adapted from the Flight Management Attitude Questionnaire. The Modified Operating Room Management Attitudes Questionnaire (MORMAQ) was adapted from the Cockpit Management Attitudes questionnaire (Flin et al., 2003). Recently, a number of patient safety climate questionnaires have been developed specifically for healthcare such as the Hospital Survey on Patient Safety Culture (HSOPSC) (Sorra and Nieva, 2004). The majority of patient safety climate questionnaires originate from the USA (Colla et al., 2005). For example, the Agency for Healthcare Research and Quality (AHRQ) in USA developed the HSOPSC (Sorra and Nieva, 2004). The SAQ (Sexton et al., 2004) was developed at the University of Texas, Centre of Excellence for Patient Research and Practice.

In terms of the aims of patient safety climate questionnaires, each questionnaire has a specified aim. Most questionnaires are designed to measure attitudes and perceptions of staff about various aspects of patient safety. For example, the SAQ (Sexton et al., 2004) claims to measure attitudes of healthcare staff towards safety. The HSOPSC questionnaire (Sorra and Nieva, 2004) was developed to assess staff perspectives on patient safety culture (Handler et al., 2006). The SCS (Pronovost et al., 2003) was developed to assess perceptions of healthcare staff regarding the commitment to patient safety as a positive culture (Pronovost et al., 2003). In contrast, some questionnaires, such as the SLOAPS (Voluntary Hospital of America, 2000) and the MSSA (Institute for Safe Medication Practices, 2000) were developed to measure the extent to which patient safety improvement activities and concerns have been implemented (Colla, 2005). The SLOAPS (Voluntary Hospitals of America, 2000) aims to assess the extent to which safety is a strategic priority for a healthcare organisation. In other words, it is designed to assess attitudes of leadership towards patient safety (Pronovost et al., 2003).

Nieva and Sorra (2003) state that some questionnaires assess staff perspectives that focus on daily activities within organisation and their impact on patient safety. An example of a questionnaire that focuses on staff perceptions is the HSOPSC questionnaire (Sorra and Nieva, 2004). Some questionnaires assess managerial perspectives that focus on management assessment of patient safety policies and practices in healthcare organisations. An example of a self-assessment questionnaire designed for use by managers is the SLOAPS (Voluntary Hospital of America, 2000). However, the majority of patient safety climate questionnaires focus on the perceptions of healthcare staff while a minority of questionnaires are used at management level. Some questionnaires are designed to be completed as a team together such as the MSSA (Institute for Safe Medication Practices, 2000).

In short, patient safety climate questionnaires measure either staff or managerial perspectives, or combine perspectives of both. The questionnaires' respondents are healthcare staff including, senior managers, clinicians (front line staff such as physicians and nurses) and non clinicians (Nieva and Sorra, 2003). According to Singla et al. (2006) most patient safety climate questionnaires were designed to be completed by hospital staff including physicians, nurses, pharmacists and other caregivers.

The majority of patient safety climate questionnaires are appropriate for general use (general evaluation of patient safety climate in healthcare settings) such as the HSOPSC (Sorra and Nieva, 2004) and the Teamwork and Safety Climate Survey (Sexton et al., 2004). In contrast, others are designed for specific departments, for example the MSSA (Institute for Safe Medication Practices, 2000) for use in pharmacy. The Hospital Transfusion Service Safety Culture Survey (Sorra and Nieva, 2002) is used for transfusion services. Colla et al. (2005) reviewed nine patient safety climate questionnaires designed to measure patient safety climate. They found five of these questionnaires were used for general evaluation of patient safety climate across healthcare settings.

Flin et al. (2006b) reviewed 12 patient safety climate questionnaires designed to measure safety climate and diagnose the underlying safety culture of healthcare organisations. They found five of these questionnaires for general evaluation of patient safety climate in healthcare settings. Singla et al. (2006) reviewed 13 patient safety climate questionnaires. They found 9 questionnaires were designed for general use, for example the SAQ (Sexton et al., 2004) and the HSOPSC questionnaire (Sorra and Nieva, 2004). Four questionnaires were designed for specific use, for example the Modified Operating Room Management Attitudes Questionnaire (MORMAQ) (Flin et al., 2003). It seems that the majority of the patient safety climate questionnaires are designed for general use.

The majority of patient safety climate questionnaires are designed to be self-administered (Singla et al., 2006). The majority of questionnaires use the 5 point Likert scale such as the HSOPSC questionnaire (Sorra and Nieva, 2004). Some questionnaires use the 6 point Likert scale, for example the Teamwork and Safety Climate Survey (Sexton et al., 2004). The majority of patient safety climate questionnaires use the five-point scale reflecting the level of agreement with statement about patient safety: from 'strongly disagree' (1) to 'strongly agree' (5), with a neutral category 'neither' (3). Other items can be answered using a five-point frequency scale from 'never' (1) to 'always'(5) (Colla et al., 2005).

The number of items to be completed ranges from 10 items in the Safety Climate Scale (Sexton et al., 2000, 2003) to 194 items in the MSSA (Institute for Safe Medication Practices, 2000) (Colla et al., 2005). The demographic information in most patient safety climate questionnaires includes data on gender, years of experience and job title.

Dimensions of patient safety climate questionnaires

Patient safety climate questionnaires differ from one another in the dimensions covered. These dimensions range from four dimensions, such as the Safety Climate Scale (Kho et al., 2005), while others include 12 dimensions, for example, the HSOPSC questionnaire (Sorra and Nieva, 2004). A number of studies reviewed patient safety climate questionnaires. Table 2-3 presents dimensions of patient safety climate questionnaires in these studies.

Table 2- 3 Dimensions of patient safety climate questionnaires

Study	Dimensions of Patient safety climate questionnaires
Colla et al. (2005)	1 Leadership 2 Policies and procedures 3 Staffing, 4 Communication 5 Reporting incidents.
Fleming (2005)	1 Management commitment to support patient safety. 2 Importance of safety. 3 Non punitive culture (no blame and shame response). 4 Handoffs and transitions. 5 Stress recognition. 6 Staffing. 7 Working condition relevant to patient safety. 8 Reporting system. 9 Teamwork (teamwork within units, teamwork across units). 10 Communication openness. 11 Organisational learning. 12 Feedback and communication. 13 Job satisfaction. 14 Overall perception of safety. 15 Supervisors' expectations and actions. 16 Organisation/department.
Flin et al. (2006b)	1 Management support and commitment to safety. 2 Supervisors' role. 3 Communication and feedback. 4 Reporting incidents. 5 Teamwork. 6 Rules and procedures of work. 7 Personal resources. 8 Job demands. 9 Risk perception and safety attitudes of workers. 10 Organisational factors. 11 Safety systems.

Table 2-3 (continued)

Singla et al. (2006)	1	Management commitment to safety.
	2	Non punitive culture (no blame and shame response).
	3	Handoffs and transitions.
	4	Working condition relevant to patient safety.
	5	Stress recognition.
	6	Risk taking (hazard detection).
	7	Frequency of event reporting.
	8	Teamwork.
	9	Staffing.
	10	Communication openness.
	11	Organisational learning.
	12	Feedback and communication about error.
	13	Beliefs about causes of errors such as human factors (e.g. fatigue and stress on patient safety).
	14	Job satisfaction.
	15	Overall perception of safety.

In general, it seems that patient safety climate questionnaires vary in the dimensions addressed. However, it appears that most of patient safety climate questionnaires cover a number of common dimensions of patient safety climate. A comparison of dimensions was conducted across number of review papers (e.g. Fleming, 2005; Colla et al., 2005; Flin et al., 2006b; Singla et al., 2006). These review papers include dimensions that related to patient safety climate in most of patient safety climate questionnaires that widely used and available in the literature. These dimensions are mentioned as common dimensions in most of these key review papers. Table 2-2 compares the 12 common patient safety climate dimensions that are mentioned in the four review papers.

Table 2-4 A comparison of the common patient safety climate dimensions that are mentioned in four review papers

Patient safety climate dimensions	Colla et al., (2005) Nine questionnaires	Fleming, (2005) four questionnaires	Flin et al., (2006) 12 questionnaires	Singla et al., (2006) 13 questionnaires
Overall perceptions of patient safety (Priority given to patient safety (patient safety is coming first and/safety system)		√	√	
Feedback and communication	√	√	√	
Incident reporting	√	√	√	
Staffing	√	√		
Leadership/supervisors role	√	√	√	
Policies and procedures of work/working condition relevant to patient safety	√	√	√	
Organisational learning (Learning from patient safety incidents)		√	√	
Management commitment to support patient safety		√	√	√
Teamwork		√	√	√
Communication openness		√		√
Perception and understanding of the causes of patient safety incidents				√
Non punitive responses to error		√		

These questionnaires in table 2-4 are included in the list of existing patient safety climate questionnaires in section 2.3.1 as the most widely used questionnaires that are representative of the patient safety climate questionnaires currently available in the literature.

From table 2-2 it seems that management commitment to support patient safety, feedback and communication, incident reporting, leadership/supervisors role, teamwork, and policies and procedures of work/working condition relevant to patient safety are common dimensions across three of the review papers. The dimensions for priority given to patient safety, staffing, organisational learning, and communication openness are common across two of the review papers. The dimensions for perception and understanding of the causes of patient safety incidents and non punitive responses to error are mentioned in one of the review papers. These dimensions were discussed in the section of safety culture and safety climate (2.3.2) in the current chapter.

It is important that a patient safety climate questionnaire should be a valid and reliable tool and it should measure the common dimensions of patient safety culture (Nieva and Sorra, 2003). Although the reviewed literature revealed that in recent years there has been increasing attention towards measuring patient safety climate, it has been reported that there is a lack of information reporting related psychometric properties of patient safety climate questionnaires (Flin et al., 2006b). The psychometric properties of patient safety climate questionnaires are discussed below.

Psychometric properties of patient safety climate questionnaires

The term psychometric can be described as the science of the measurement of mental functions, theoretically, when a concept does not lend itself to being measured directly, a set of questions which explore various aspects of the same concept can be asked and then tested for their reliability and validity (Bowling, 2005). Psychometric analysis is concerned with statistical techniques that help to assess the validity and reliability of the items of patient safety climate questionnaires (Singla et al., 2006). The validity and reliability of instruments are very important aspects of psychometric measurement. Instrument validity refers to what extent a measurement instrument measures what it is intended to measure, while reliability is based on the measuring tool which yields the same results on repeated occasions (Carmines and Zeller, 1979).

Reliability is also referred to as consistency. The more common way of estimating reliability is by assessing internal reliability which means to what extent a group of items relates to a specific dimension of instrument (Pett et al., 2003). It can be assessed by using a statistical test called Cronbach's alpha (Cronbach, 1951).

A number of statistical analyses are used to assess the psychometric properties of questionnaires. For example, item analysis is used to provide descriptive item responses. Factor analysis is the most frequently used statistical technique and is employed to assess the psychometric properties of survey instruments (Colla et al., 2005; Flin et al., 2006b). It can be used to define a number of basic dimensions, each of which contains items which can be grouped together in a consistent and structured way (Bowling, 2005). The more popular choice for estimating reliability is internal consistency (Etchegaray and Fischer, 2006).

Although there is agreement about the importance of assessing psychometric properties (validity and reliability) of patient safety climate questionnaires, there is a lack of reporting the data of the psychometric properties of questionnaires. The psychometric properties of patient safety climate questionnaires are not always provided in published studies, for instance, the Stanford University Patient Safety Climate in Health Care Organisation (Pronovost et al., 2003; Fleming, 2005). Colla et al. (2005) examined the psychometric properties of nine patient safety climate questionnaires using a number of psychometric tests as review criteria, including item analysis, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Cronbach's alpha, correlation across dimensions, test/retest reliability and analysis of variance to test for variance between groups of a sample. They found the psychometric testing varied considerably across nine patient safety climate questionnaires and there was a limitation on reporting psychometric data from most patient safety climate questionnaires. For example, while psychometric properties were reported for three questionnaires: the HSOPSC (Sorra and Nieva, 2004), Hospital Transfusion Service Safety Culture Survey (HTSCS) (Sorra and Nieva, 2002) and the SAQ (Sexton et al., 2004), other questionnaires had a lack of reporting of their psychometric properties.

Flin et al. (2006b) reviewed the psychometric properties of 12 patient safety climate questionnaires including: construct validity which refers to the factor (dimension) structure of a questionnaire and content validity which refers to the degree to which elements of a measure are relevant to a construct. Content validity of patient safety climate questionnaire refers to the degree to which items of a patient safety climate questionnaire are relevant to patient safety culture (items related to dimensions). Internal consistency is assessed by Cronbach's alpha. Finally, factor structure is assessed by factor analysis (Pallant, 2007). In this review (Flin et al., 2006b) only six studies were found to report the results of factor analysis and Cronbach's alpha. Furthermore, only one study provided a comprehensive report of scale development and psychometric properties, relating to the HSOPSC questionnaire (Sorra and Nieva, 2004).

Flin et al. (2006b) found there was a lack of clear theoretical reinforcement for most questionnaires and psychometric properties of some questionnaires were not reported where this information was available. Also, they concluded that there was a lack of standard psychometric analysis in several studies. It seems that the main limitation of Flin et als' review was the lack of reporting psychometric data of patient safety questionnaires.

Similarly, Singla et al. (2006) examined the psychometric properties of 13 patient safety climate questionnaires. Psychometric testing was reported for two questionnaires, the SAQ (Sexton et al., 2004) and the HSOPSC questionnaire (Sorra and Nieva, 2004). Some psychometric testing was reported for three questionnaires. No psychometric was reported for eight of the questionnaires.

In general, the authors of these review papers agreed that there is a lack of information reporting psychometric properties of a number of patient safety climate questionnaires. Moreover, it was noted that most of the above studies used general words such as adequate psychometric properties and good psychometric properties in relation to the psychometric evaluation of patient safety climate questionnaires. Unfortunately, this could increase the ambiguity of psychometric literature. Therefore, it is recommended that more consideration should be given to psychometric properties in the design of healthcare safety climate instruments and health services researchers need to assess the validity and reliability of their measures correctly (Flin et al., 2006; Etchegaray and Fischer, 2006).

Psychometric data should be reported in a clear way by using standardised psychometric tests. For example, as a minimum psychometric analysis should include EFA, CFA and reliability analysis and the correlations between questionnaire dimensions (factors) to ensure a rigorous scientific approach (Flin et al., 2006b). Factor analysis is commonly used as a measure of the construct validity of a questionnaire by using EFA to test factor structure (grouping a number of items together into one extracted factor) and CFA to test the proposed factor structure of the questionnaire (Hutchinson et al., 2006). In terms of reliability, internal consistency is used to assess questionnaire reliability by calculating the Cronbach's alpha (α) coefficient alpha value for each factor of a questionnaire. It is generally agreed that questionnaire validity is good when items load strongly to one factor (item loading >0.4) and reliability being good when coefficient alpha value >0.7 under these conditions, all items of a questionnaire are assumed to be correlated (Wet et al., 2010).

To conclude, it is seen that patient safety climate questionnaires vary in a number of ways, such as general characteristics, content (dimensions) and psychometric properties (validity and reliability). Although there are differences between the questionnaires most of them have important similarities. For instance, they are designed to be used in particular settings such as hospitals and they are mainly intended for front line respondents (e.g. physicians, nurses). Furthermore, there are common dimensions across a number of patient safety climate questionnaires and psychometric analysis includes factor analysis and reliability analysis.

In general, a patient safety climate questionnaire should be a valid and reliable questionnaire and it should measure the common dimensions of patient safety culture (Nieva and Sorra, 2003). The following section aims to discuss the development and validation of patient safety climate questionnaires including their psychometric analysis and properties.

2.4.2 Development and validation of patient safety climate questionnaires

The development of patient safety climate questionnaires is increasingly recognised as an important tool for assessing and improving patient safety culture in healthcare organisations (Nieva and Sorra, 2003; Colla et al., 2005; Prononvost and Sexton, 2005). Recent studies have focused on developing patient safety climate questionnaires either by adapting a questionnaire from other industries or by developing new questionnaires for healthcare organisations to measure patient safety climate in order to assess and improve patient safety culture. A number of questionnaires that were either adapted or developed have been validated in a number of countries (either original country of questionnaire or outside its country) (e.g. Sexton et al., 2000, 2003, 2004; Sorra and Nieva, 2004; Singer et al., 2003, 2007).

The first development approach has been to adapt patient safety climate questionnaires from other industries (adapting approach). A number of questionnaires were adapted for healthcare from other industries such as aviation as early stage of developing patient safety climate questionnaires. For example, the Safety Attitude Questionnaire (SAQ) (Sexton et al., 2004) was adapted from the Flight Management Attitude Questionnaire (FMAQ). The Safety Climate Scale (SCS) (Kho et al., 2005) was adapted from a widely used questionnaire in aviation called the Flight Management Attitudes and Safety Survey which is designed to measure attitudes toward stress, status hierarchies, leadership and interpersonal interaction. The SCS questionnaire is used to assess safety culture among staff (Pronovost et al., 2003). Helmreich et al. (1997) extended their work with the aviation industry to examine the attitudes of hospital operating rooms staff to teamwork and safety. They adapted the Cockpit and Flight Management Attitudes Questionnaires (CMAQ) to produce the Operating Room Management Attitudes Questionnaire (ORMAQ) (Helmreich et al., 1997). The Teamwork and Safety Climate Survey was adapted for use in healthcare settings (Sexton et al., 2004).

A number of patient safety climate questionnaires originated from the USA (Colla et al., 2005). Therefore, most of them were validated in the USA healthcare settings. For example, the SAQ was developed at the University of Texas, Centre of Excellence for Patient Research and Practice by Sexton et al. in 2004 with new items generated by a focus group of healthcare providers, review of the literature and consultations with safety experts. The items were then evaluated through pilot testing. The SAQ contains 60 items and covers six dimensions, which were identified in psychometric testing: teamwork, safety climate, perceptions of management, job satisfaction, stress recognition and work condition. Internal consistency by Cronbach's alpha coefficient ranged from 0.74 to 0.93. It demonstrated good psychometric properties. There are several different versions with slight modifications of its items based on different departments (e.g. emergency, pharmacy, intensive care unit, operating rooms and laboratory) (Sexton et al., 2006).

In addition, some adapted questionnaires have been applied and empirically evaluated in different countries. For example, the SAQ (Sexton et al., 2004) was translated into Norwegian and validated in Norway (Norwegian university hospital) (Deilkas and Hofoss, 2008), 1306 staff members completed and return the questionnaire (68% response rate). Reliability analysis and confirmatory factor analysis were performed. The factor structure was tested by confirmatory factor analysis and this identified 36 items representing seven dimensions: teamwork, safety climate, perceptions of hospital management, perception of unit management, job satisfaction, stress recognition and work condition. They used goodness of fit indices: the Adjusted Goodness of-Fit Index (AGFI), and the Root Mean Square Error of Approximation (RMSEA). CFA showed acceptable goodness of fit values. The reliability analysis was acceptable for the seven dimensions (Cronbach's alpha coefficient ranged from 0.68 to 0.85). The SAQ Norwegian version showed satisfactory psychometric properties (Deilkas and Hofoss, 2008).

Norden-Hagg et al. (2010) conducted a validation study of the SAQ (Sexton et al., 2004) for use in Swedish pharmacies. The SAQ data from 828 community pharmacies in Sweden, including 6,683 eligible pharmacists were received. The psychometric properties of the translated questionnaire of the SAQ (Sexton et al., 2004) were analysed using Cronbach alpha and inter correlations among the scales. CFA was conducted. The coefficient alpha value for each of the SAQ scales ranged from 0.72 to 0.89. The confirmatory factor analysis results, demonstrate that the Swedish translation of the SAQ has acceptable, to good, psychometric properties. Perceptions of the pharmacy (teamwork climate, job satisfaction, perceptions of management, safety climate, and working conditions) were moderately to highly correlated with one another whereas attitudes about stress (stress recognition) had only low correlations with other factors. Norden-Hagg et al. (2010) conclude that the Swedish translation of the SAQ demonstrates acceptable construct validity, for assessing the frontline perspective of safety culture in community pharmacy staff.

The three examples above of using the SAQ showed that the psychometric results are consistent. In other words, using the SAQ (Sexton et al., 2004) in different healthcare settings and other languages showed that the SAQ was valid and reliable. The development and characteristics of SAQ is provided in section 4.2 of chapter four.

A number of patient safety climate questionnaires have been validated in different countries. For example, the Modified Operating Room Management Attitudes Questionnaire (MORMAQ) was adapted by Flin et al. (2003) to use in hospitals in the United Kingdom. The MORMAQ was adapted from the Cockpit Management Attitudes questionnaire. It contains 60 items and covers seven dimensions. The proposed factor structure measures attitudes of staff to leadership, communication, teamwork, stress and fatigue, work values, human error and organisational climate. The questionnaire was completed by 222 anaesthetists. A reliability analysis of the proposed structure based on Cronbach's alpha scores for each of the proposed factors showed low values (α = 0.18–0.54) for internal consistency (Flin et al., 2003).

Hutchinson et al. (2006) examined the factor structure, reliability and potential usefulness of the 27 item Teamwork and Safety Climate Survey (Sexton et al., 2004) for use in the UK healthcare, based on a sample of n=897. Factor analysis and reliability analysis were carried out. EFA was carried out on a random 50% sample of respondents (the "construction" half of the data) using principal components extraction. Table 2-3 shows the psychometric information of Hutchinson et al's study (2006).

Table 2- 5 Psychometric properties of Hutchinson et al's study (2006)

Psychometric analysis performed	Psychometric properties
Exploratory factor analysis to identify optimal model	Five factors were identified
Confirmatory factor analysis on 11 factors	CFA indicated adequate fit. The CFI and RMSEA took values of 0.93 and 0.08 for teamwork, and 0.94 and 0.07 for safety climate
Reliability analysis on five factors	Internal consistency reliabilities were satisfactory to good, with Cronbach's alpha 0.69 or above in all five factors
Optimal model	five factors and 22 items

Table 2-3 shows that five factors and 22 items were identified. CFA on the remaining 50% (the "validation half") of the dataset indicated an almost adequate fit of the model to the data under the widely applied fit indices criteria. The CFI and RMSEA values were: 0.93 and 0.08 for teamwork, and 0.94 and 0.07 for safety climate. Internal consistency reliabilities were satisfactory to good, with Cronbach's alpha (α) 0.69 or above in all five factors.

To summarise, it appears that the early stage of the measurement of patient safety climate in healthcare was an immature stage of development as compared to other industries such as aviation. Therefore, adapting commonly used questionnaires from other industries was the common approach as healthcare organisations started to work with patient safety culture and with the measurement patient safety climate. Therefore, learning from other industries experiences such as aviation was helpful in understanding the concepts and how they were measured (Helmreich, 2000; Sexton et al., 2000). Although, validation studies in healthcare (e.g. Hutchinson et al., 2006; Norden-Hagg et al. 2010) showed that some questionnaires such as the SAQ (Sexton et al., 2004) and the Teamwork and Safety Climate Survey (Sexton et al., 2004) had acceptable psychometric properties across different countries, there was a lack of psychometric data for early questionnaires, for example, psychometric properties and analysis of the SCS had not been reported (Pronovost et al., 2003).

The reason for not reporting psychometric data in some studies might be because they were concerned with developing new item questionnaires to use in healthcare rather than evaluating psychometric properties. In addition, there was a little experience in healthcare of safety culture assessment but currently there are now a number of questionnaires for assessing safety culture in healthcare (Fleming, 2005).

The situation of measuring patient safety climate has changed to an approach in which a number of questionnaires have been developed specifically for healthcare organisations (Nieva and Sorra, 2003). For example, the SLOAPS was developed by the Volunteer Hospital Association (2000) to assess the extent to which safety is a strategic priority for healthcare leaders (Pronovost et al., 2003), 23 clinical and administrative leaders completed the SLOAPS. No psychometric testing has been reported. The Teamwork and Patient Safety Attitudes Questionnaire consists of 24 items across 4 dimensions. The questionnaire was completed by 261 staff members. Psychometric analysis was performed and revealed four dimensions: perceived of teamwork, support for team communication and decision making, teamwork in department and leadership role. Internal consistency results were reported for each dimension (Kaissi et al., 2003).

Singer et al. (2003) developed a patient safety climate questionnaire based on a review of existing patient safety climate questionnaires. They identified a list of key dimensions. A draft questionnaire consisting of 122 items was tested in pilot study to get feedback and to modify the questionnaire. The questionnaire was completed by 21,496 (response rate 51%). The principle factor analysis was conducted on the responses of 82 questions and this identified five factors: organisation, department, production, reporting/seeking help and shame/self-awareness. The initial psychometric properties and analysis were not reported (Fleming, 2005). After that the revised version consisting of 38 items was used to collect data. Analysis of the psychometric properties of the questionnaire was performed by splitting the sample into derivation sample and validation sample, and then assessed by using exploratory factor analysis to responses in derivation sample. They identified nine factors (dimensions) and 38 items, Cronbach's alpha coefficients ranged from 0.50 to 0.89 (Singer et al., 2007).

Fleming and Wentzell (2008) developed the Patient Safety Culture Improvement Tool (PSCIT) to assess patient safety culture in healthcare organisations. The early development stage of the PSCIT involved reviewing the literature on patient safety culture assessment and patient safety culture instruments. Five interviews with patient safety experts across Canada were conducted to assess the content and face validity of the original version of the PSCIT questionnaire. This questionnaire covers five patient safety culture dimensions such as leadership, risk analysis, workload management, sharing and learning and resource management. However, Fleming and Wentzell (2008) conclude that this questionnaire should be used with caution because the psychometric properties (validity and reliability) have not been determined.

It seems that although some patient safety climate questionnaires were developed to assess patient safety culture in healthcare organisations, there is limited reporting of psychometric data for some questionnaires (e.g. SLOAPS (Volunatry Hospital of America, 2000); Teamwork and Patient Safety Attitudes Questionnaire (Kaissi et al., 2003); Patient Safety Culture Improvement Tool (Fleming and Wentzell, 2008). More recently, patient safety climate questionnaires have been developed specifically for healthcare such as the HSOPSC questionnaire (Sorra and Nieva, 2004) (Flin et al., 2006b).

For example, the Agency for Health Care Quality and Research (AHQR) developed the HSOPSC questionnaire. The original items were validated by the Agency for Healthcare Research and Quality (AHRQ) for the USA hospital settings (Sorra and Nieva, 2004). The HSOPC questionnaire is based on a set of pilot studies carried out in 21 different hospitals involving 1461 hospital staff across the USA. The HSOPSC questionnaire (Sorra and Nieva, 2004) is considered valid, reliable, and the most efficient questionnaire for assessing patient safety culture (Colla et al., 2005; Flin et al., 2006b). The HSOPSC questionnaire (Sorra and Nieva, 2004) was also modified to assess patient safety culture in the nursing home setting. The internal consistency of the individual dimensions was generally similar to that of the original HSOPSC questionnaire (Sorra and Nieva, 2004). Cronbach's alpha values ranged from 0.50 for staffing to 0.84 for teamwork across units (Handler et al., 2006). Table 2-6 shows the original analysis of the HSOPSC questionnaire (Sorra and Nieva, 2004).

Table 2- 6 The original analysis of the HSOPSC (Sorra and Nieva, 2004)

Sorra and Nieva's original analysis	
1	Cognitive interviews were conducted to assess the face validity of the questionnaire
2	Pilot study is conducted.
3	4983 questionnaires were administered across 21 hospitals in USA, with 1437 responses received (29%response rate)
4	The psychometric analysis consisted of analytical techniques:
•	Reliability analysis: Cronbach's alpha values ranged from 0.63 to 0.84.
•	Item analysis
•	Content analysis
•	Exploratory factor analysis.
•	Confirmatory factor analysis.
•	Correlation analysis.
•	Analysis of variance.

The HSOPSC questionnaire (Sorra and Nieva, 2004) is used increasingly in different countries such as the UK, Netherland, Turkey and Germany. This might indicate that this questionnaire reflects stable psychometric properties when used in different contexts. A number of studies have validated the HSOPSC questionnaire (Sorra and Nieva, 2004) to measure patient safety culture in different health care settings across different countries. Some illustrative examples of recent validation studies in healthcare in different countries are provided below.

Waterson et al. (2009) report on the assessment of the psychometric properties and suitability of the American HSOPSC questionnaire (Sorra and Nieva, 2004) for use within the UK. The questionnaire was completed by 1437 staff members. EFA, CFA and reliability analyses were carried out to assess the psychometric performance of this questionnaire. The results of reliability analysis of the items within each original scale showed that more than half the scales failed to achieve satisfactory internal consistency (Cronbach's alpha <0.7). Furthermore, a CFA carried out on the UK data set achieved a poor fit when compared with the original American model. An optimal measurement model was then constructed via exploratory and confirmatory factor analyses with split half sample validation and consisted of nine dimensions. The sample was split randomly into two halves; on one "construction" half, EFA was used to construct a measurement model for the items; the other "validation" half of the data was then used to test this model via CFA.

The results of a reliability analysis on the original dimensions (12 groupings of items) showed that seven dimensions (overall perceptions of safety, supervisor/manager expectations, organisational learning—continuous improvement, communication openness, non-punitive responses to error, staffing, hospital management support) fell short of an adequate level of internal consistency (Cronbach's alpha <0.70), with staffing exhibiting an extremely poor level of reliability (α=0.58). Only two of the dimensions achieved alpha values >0.80 (frequency of error reporting, and feedback and communication about error). A CFA of the original model was then run (χ^2 =1907, df =674); the full range of fit indices suggested a level of fit with minor adequacy; specifically Comparative Fit Index (CFI) =0.91, Non-Normed Fit Index (NNFI) =0.89, RMSEA=0.04, Standardised Root Mean Square Residual (SRMSR) =0.05.

Waterson et al. (2009) performed an EFA, using principal axis factoring as the extraction method and assessing the number of factors to be extracted by a combination of Kaiser's criterion and Cattell's screen plot method. An oblique rotation was carried out to aid interpretation of the resulting factors. Having examined a series of possible models, and gradually removing 13 items that were either severely cross-loaded or had very low loadings and communalities, the evidence pointed most strongly towards a nine-factor model for the remaining 27 items. Then, they tested the fit of this model to the other "validation" half of the data set using CFA (χ^2 =588, df =288). The fit indices suggested an adequate fit to the data, with CFI =0.95, Tucker–Lewis Index (TLI) =0.93, RMSEA=0.04, SRMSR=0.04.

Finally, using the whole sample, reliability analyses were performed for each of the groups of items defined by this factor structure. This indicated suitable internal consistency, with Cronbach's alpha >0.7 for seven of the nine dimensions. Only two dimensions fell below this level. Table 2-4 summarises the Psychometric analysis performed and psychometric properties provided of this validation study (Waterson et al., 2009).

Table 2- 7 Psychometric properties of Waterson et al's study (2009)

Psychometric analysis performed	Psychometric properties
Reliability analysis on the original HSOPSC model	More than half failed to achieve satisfactory internal consistency (Cronbach's a<0.7)
Confirmatory factor analysis on the original HSOPSC model	A poor fit (CFI=0.91, NNFI=0.89, RMSEA=0.04, SRMSR=0.05)
Exploratory factor analysis to identify optimal model	Nine factors were identified
Confirmatory factor analysis on nine factors	An adequate fit CFI=0.95, TLI =0.93, RMSEA=0.04, SRMSR =0.04
Reliability analysis on nine factors	Suitable internal consistency, with Cronbach's α> 0.7 for seven of the nine dimensions. Two dimensions < 0.7
optimal model	Nine factors and 27 items

Another example of validation studies is provided by Bodur and Filiz (2010). They translated the HSOPSC questionnaire (Sorra and Nieva, 2004) to assess patient safety culture in Turkish hospitals. The aim of the study was to assess the validity and reliability of the translated form of the questionnaire. The questionnaire was completed by 309 staff members. The data analysis strategy was summarized as percentages, means, and standard deviation values.

Factor analysis, correlation coefficient, Cronbach's alpha (α), analysis of variance (ANOVA), and t-tests were employed in statistical analyses. Items on patient safety were categorized into 10 factors. Factor loadings and internal consistencies of dimension items were high. They (Bodur and Filiz, 2010) concluded that the Turkish version of HSOPSC questionnaire was sufficiently valid and reliable to assess patient safety culture. The internal consistency of the Turkish items was lower for each factor than the original items in the AHRQ study except for frequency of events reported (α =0.86) and teamwork within units (α =0.83). The internal consistency of two factors was poor: staffing (α =0.19) and non-punitive response to error (α =0.31). The CFA results for the original showed a poor fit (fit indices not provided).

The EFA identified 10 factors. Factor loadings were between 0.36 and 0.87. The factors jointly explained 62.1% of the variance in the responses. The internal consistency of the 10 factors was calculated with Cronbach's alpha coefficient was between 0.57and 0.86, except in two dimensions. Internal consistency reliability for all items was high (α =0.88). Construct validity for each of the 10 factors, were calculated by obtaining the mean of the item scores within one factor for every respondent and correlations between the scale scores were calculated. The scale scores showed there was correlation between factors. Table 2-5 summarises the psychometric properties of Bodur and Filiz's study (2010).

Table 2- 8 Psychometric properties of Bodur and Filiz's study (2010)

Psychometric analysis performed	Psychometric properties (details)
Reliability analysis on the original HSOPSC model	Internal consistency: 8 factors lower than original model. One factor α =0.86. Two factors were poor (α =0.19-0.31).
Confirmatory factor analysis on the original HSOPSC model	A poor fit (fit indices not provided).
Exploratory factor analysis to identify optimal model	Ten factors were identified
Confirmatory factor analysis on ten factors	Not performed
Reliability analysis on nine factors	Internal consistency: Cronbach's alpha coefficient was between 0.57and 0.86, except in two dimensions.
Construct validity	There was correlation between 10 factors
Optimal model	10 factors and 42 items

Smits et al. (2008) examined the psychometric properties of the HSOPSC questionnaire (Sorra and Nieva, 2004) in Dutch hospitals. The aim of this study was to examine the underlying dimensions and psychometric properties of the questionnaire in Dutch hospital settings, and to compare these results with the original questionnaire used in American hospital settings. The questionnaire was completed by 583 staff members. CFA was performed to examine the applicability of the factor structure of the American questionnaire to the Dutch data. EFA was performed to examine whether another composition of items and factors would fit the data better. Supplementary psychometric analyses were performed, including internal consistency and construct validity.

The result of the CFA (principal component analysis with Varimax rotation) showed that the factor structure of the original American questionnaire was a poor fit to Dutch data. Exploratory factor analysis identified 11 factors (factor loadings >0.40). Two items were removed from the questionnaire. Smits et al. (2008) concluded that the Dutch translation of the HSOPSC consists of 11 factors with acceptable reliability and good construct validity. It is similar to the original HSOPSC factor structure (Sorra and Nieva, 2004). The construct validity was studied by calculating scale scores for every factor and subsequently calculating Pearson correlation coefficients between the scale scores. The construct validity of each factor is reflected in scale scores that are moderately related. The construct validity was satisfactory for all factors; the moderate correlations of the factors show that there are no two factors measuring the same construct. For each factor, the internal consistency of the Dutch items was lower than the original HSOPSC items in the AHRQ study, except for communication openness, which was the same. The internal consistency of three factors was poor or even unacceptable: organisational learning and continuous improvement ($\alpha = 0.57$), staffing ($\alpha = 0.49$) and teamwork across hospital units ($\alpha = 0.59$). The internal consistency of 11 factors was acceptable ($0.64 < \alpha < 0.79$), except for factor 10, adequate staffing was doubtful (0.58). Table 2-6 shows the psychometric properties of Smits et al's study (2008).

Table 2- 9 Psychometric properties of Smits et al's (2008) study

Psychometric analysis performed	Psychometric properties
Reliability analysis on the original HSOPSC model	Internal consistency was lower than the original HSOPSC items in the AHRQ study. One factor was the same. Three factors was poor or even unacceptable (0.57-0.49-0.59)
Confirmatory factor analysis on the original HSOPSC model	A poor fit (fit indices not provided).
Exploratory factor analysis to identify optimal model	11factors were identified
Confirmatory factor analysis on 11 factors	Not performed
Reliability analysis on 11 factors	The internal consistency of 11 factors was acceptable ($0.64 < \alpha < 0.79$), but factor 10, Adequate staffing was doubtful (0.58)
Construct validity	There was correlation between 11 factors. The construct validity was satisfactory for all factors
Optimal model	11 factors and 40 items

A more recent example is provided in the literature of the development and validation of a new version of patient safety climate questionnaire. Pfeiffer and Manser (2010) developed the German version the HSOPSC. The original HSOPSC version (Sorra and Nieva, 2004) was translated into German. They assessed the dimensionality and psychometric properties of the questionnaire. Two new dimensions (unit management support and unit handoffs and transitions) were added to the questionnaire (six items more and the total items of the HSOPSC became 50 items). The questionnaire was completed by 568 staff members. Confirmatory and exploratory factor analyses (CFA, EFA) and Reliability analysis were applied. This strategy of analysis revealed eight factors instead of twelve factors for the original HSOPSC model. The CFA results indicated that the fit is not sufficiently good to confirm the original factor structure proposed by Sorra and Nieva (2004). The EFA results indicated eight underlying factors explained 59.8% of the variance of the items. Overall, the scales (eight factors) showed satisfactory to good internal consistency. Table 2-7 shows the psychometric properties of Pfeiffer and Manser's study (2010).

Table 2- 10 Psychometric properties of Pfeiffer and Masner's study (2010)

Psychometric analysis performed	**Psychometric properties (details)**
Reliability analysis on the original HSOPSC model	Internal consistency was lower than the original HSOPSC items in the AHRQ study
Confirmatory factor analysis on the original HSOPSC model	The overall fit was not consistently satisfactory: three criteria indicate an adequate fit (RMSEA = .047, PCLOSE = .91,CMIN/df = 2.271). While GFI = .878, NFI = .859, and TLI = .901
Exploratory factor analysis to identify optimal model	8factors were identified
Confirmatory factor analysis on 8 factors	Not performed
Reliability analysis on 11 factors	The internal consistency of 8 factors was satisfactory to good internal consistency (alpha was ranged from 0.61 to 0.88) Seven out of twelve scales showed a lower internal consistency than was reported for the HSOPSC
Construct validity	There was correlation between 8 factors. The construct validity was satisfactory for all factors (correlation coefficient)
Optimal model	Eight factors

On the whole, the results of validation studies (e.g. Hutchinson et al., 2006; Smits et al., 2008, Waterson et al., 2009; Bodur and Filiz, 2010; Pfeiffer and Manser's study, 2010) are similar in using agreed fit indices and identifying optimal models and they are different in the values for internal consistency (Cronbach's alpha coefficient) and the number of factors in each optimal model.

In summary, it seems that the early stage of development of patient safety climate questionnaires which had been adapted provided little data about their psychometric properties. After that a number of questionnaires were specifically developed for healthcare but they provided limited data about the psychometric properties of the questionnaires. More recent validation studies provide comprehensive data about the psychometric properties of questionnaires. However, it seems that there is still a need for studies to assess the psychometric properties of patient safety climate questionnaires when used in new contexts. Therefore, the current study aims to provide detailed information on psychometric analysis and properties of the questionnaire used in this investigation.

Although, the development and validation of patient safety climate questionnaires has been carried out in a wide range of countries, there was no validated questionnaire for use in Saudi Arabia. There are very few studies of patient safety culture in Saudi Arabia, in particular, there are no validation studies and consequently no valid and reliable questionnaire for measuring patient safety climate. For example, Alahmadi, Talal (2009) assessed patient safety culture in Saudi hospitals by using the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) without examining the reliability and validity of the questionnaire in the Saudi context. Similarly, a study by another author (Alahmadi, Hanan, 2010) used the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) to assess patient safety culture in a number of Saudi hospitals without performing a detailed assessment of the validity and reliability of the questionnaire before its application in the Saudi context.

These two examples of Saudi studies (e.g. Alahmadi, Talal 2009; Alahmadi, Hanan 2010) used the HSOPSC questionnaire to assess patient safety culture without validation of the questionnaire. They did not assess the validity and reliability of the questionnaire before applying it in a new context as recommended by Smits et al. (2008). These recent studies (Alahmadi, Talal, 2009; Alahmadi, Hanan, 2010) in Saudi hospitals were published after the current study began. However, both studies adopted a different approach to assessing patient safety culture than the current study. They aimed to assess patient safety culture in Saudi hospitals by using the original HSOPSC questionnaire without prior validation of the questionnaire. Whereas the current study using Saudi data performed extensive validation in order to identify a suitable measure for assessing patient safety culture in Saudi hospitals. Therefore, the current study aims to address an important gap in the literature.

In general, more recent validation studies since 2004 have reported psychometric properties of validated patient safety climate questionnaires (e.g. Sorra and Nieva, 2004; Hutchinson et al., 2006; Smits et al., 2008, Waterson et al., 2009). This may be because these studies followed similar recommended practice in terms of assessing psychometric properties of patient safety climate questionnaires and publishing information regarding psychometric analysis including factor analysis and reliability analysis.

2.4.3 Selecting a suitable questionnaire for measuring patient safety climate

A large and growing body of literature addresses ways of measuring patient safety climate either by developing or selecting an established a suitable tool. It is recommended that using a valid and reliable questionnaire may be better than developing a new questionnaire (Pett et al. (2003). Indeed, Nieva and Sorra (2003:6) recommended that:

> *"Healthcare organisations should first examine the suitability of existing tools to their needs before embarking on an effort to develop a new tool".*

The selection of a suitable patient safety climate questionnaire depends on the purpose and the needs of the study. In addition, the choice of questionnaire depends on the intended use, the target population, reliability and validity of the tool and dimensions. Colla et al. (2005) mentioned that selecting a suitable patient safety climate questionnaire depends on its purpose. Singla et al. (2006) argued that choice of patient safety climate questionnaire depends on a number of issues such as the intended use, the target population, psychometric properties including validity and reliability.

A number of studies used selection criteria to find a suitable patient safety culture assessment tool. For example, Hutchinson et al. (2006) used criteria for the selection of an instrument that included: the instrument measured safety climate and was short enough for busy healthcare professionals. Nieva and Sorra (2003) proposed the following criteria: (1) the dimensions of patient safety culture that are evaluated; (2) the staff members who will complete the tool; (3) the settings for which the tool was developed; and (4) the availability of reliability and validity evidence about the tool. Flin et al. (2006b) used criteria such as: use of questionnaire to measure safety climate in healthcare setting, availability of details of the questionnaire, questionnaires tested on sample of over 50 respondents and finally, English language questionnaire. A valid and reliable patient safety climate questionnaire is the most important criteria beside the patient safety culture dimensions that are covered in a questionnaire (Fleming, 2005; Pronovost and Sexton, 2006).

However, it is important to note that the selection of an appropriate patient safety climate questionnaire does not mean that one survey questionnaire is better than others but it depends on the purpose of study, taking into account some very important issues related to psychometric properties and dimensions of the questionnaire.

In conclusion, this study needs a patient safety climate questionnaire that covers a comprehensive range of patient safety culture dimensions, and is a valid and reliable tool to assess patient safety culture in Saudi hospitals. Therefore, there are many questionnaires for specific aims and use that are not suitable for this study such as the Modified Operating Room Management Attitudes Questionnaire (Flin et al., 2003) and the Teamwork and Patient Safety Attitudes Questionnaire (Kaissi et al., 2003). Further details of the selection of an appropriate patient safety climate questionnaire for use in the current study are provided in section 4.2 of chapter four.

Summary

There are a number of patient safety climate questionnaires available to assess patient safety culture in healthcare. They are varied in terms of the general characteristics; the dimensions of patient safety culture covered in the questionnaires and psychometric properties. The development of patient safety climate questionnaires is increasingly recognised as an important tool for assessing and improving patient safety culture in healthcare organisations. The selection of the patient safety climate questionnaire depends on the purpose and the needs of the study, reliability and validity of the questionnaire and dimensions that are addressed in a questionnaire.

2.5 Overall summary of chapter two

The literature review for this study focuses on the key elements of safety in organisations, patient safety, and the assessment of patient safety culture in healthcare. Safety is a concept that has attracted much attention across a wide range of industries, particularly high risk settings such as nuclear energy field, chemical processing, aviation, and healthcare. Organisations with good safety may reflect specific characteristics such as good communication, management commitment to safety and organisational learning from errors. Safety is a particularly important issue in high-risk organisations such as healthcare, where significant hazards are present.

Safety in healthcare involves the safety of both healthcare workers and patients. The Institute of Medicine (2000) defines patient safety as freedom from accidental injury due to medical care or medical errors. It is widely accepted that safety culture is an important element in patient safety improvement. Safety culture refers to the shared attitudes, beliefs, and values of employees of an organisation in relation to safety issues. It is normally assessed by means of workforce questionnaire surveys to measure safety climate. Safety climate can be seen as clear picture, a current surface and measurable aspect of safety culture, which is recognized, from the employee's perceptions (Flin et al., 2000).

It is widely agreed that safety climate questionnaires are used to assess safety culture. The common approach for identifying safety culture dimensions is through analysing the psychometric properties of highly structured questionnaires (Cox and Flin, 1998). For that reason, patient safety climate measurement studies should focus on the psychometric properties of patient safety culture questionnaires that measure patient safety climate. The real test of the safety climate questionnaire is validation, in terms of its power to expose safety climate dimensions (Flin et al., 2000).

Assessing patient safety culture in healthcare is based on measuring patient safety climate through the use of a patient safety climate questionnaire. A number of patient safety climate questionnaires with differing characteristics have been developed to assess patient safety culture in healthcare organisations. These questionnaires are varied in terms of the general characteristics, psychometric properties and the dimensions of patient safety culture that are addressed by the questionnaires.

It is also very important to take into account that a patient safety climate questionnaire should be a valid and reliable tool and it should measure the common dimensions of patient safety culture (Nieva and Sorra, 2003).

It seems that few studies have provided a full report of the development of measurement scales and their psychometric properties at an early stage of development of the patient safety climate questionnaires. In addition, there was no agreement about how to assess the validity and reliability of patient safety climate questionnaires. Most studies at that early stage adapted questionnaires from other industries or reviewed a number of questionnaires to develop new questionnaires. However, the development and validation studies are varied in terms of how they develop and validate the patient safety climate questionnaires and how they assess psychometric properties. The validation of the patient safety culture questionnaire construct has been performed by using factor analysis to uncover the latent structures of the safety culture dimensions and Cronbach's alpha for internal consistency as an accepted method for assessing reliability. Importantly, that more recent validation studies have provided a clearer view of psychometric analysis and psychometric properties of patient safety climate questionnaires (e.g. Sorra and Nieva, 2004; Hutchinson et al., 2006; Waterson et al., 2009).

Selecting a suitable patient safety climate questionnaire depends on its intended use, the target population, length of questionnaire, dimensions of patient safety culture, and reliability and validity of questionnaire. However, it is important to review the various questionnaires to select the most appropriate one. The process of selecting an appropriate questionnaire involves establishing methodological criteria which can be employed as guidelines in this process.

The reviewed literature revealed a number of gaps. Firstly, is in relation to a lack of reporting the psychometric properties of patient safety climate questionnaires provided in relevant literature. Although the reviewed literature revealed that in recent years there has been increasing attention to measuring patient safety climate, there remains a lack of reported information on the psychometric properties of patient safety climate questionnaires (Flin et al., 2006b).

Most importantly for this current study is the lack of a suitable tool for assessing patient safety culture in Saudi hospitals. This topic is still at an early stage of development in Saudi Arabia. Although much patient safety research has been published, in particular in patient safety culture assessment, the patient safety climate measurement in non-Western countries such as Saudi Arabia is less advanced. There is no paper that provides a unique measurement of patient safety climate in healthcare organisations in Saudi Arabia (Walston et al., 2010). This means there is a little known about patient safety culture in Saudi hospitals (Alahmadi, 2010). However, it is clear that research on patient safety culture in the Saudi healthcare setting is needed. This in turn, increased the need for appropriate tools to measure patient safety climate in Saudi Arabia. Therefore, the current study aims to identify a suitable measure for assessing patient safety culture in hospitals in Saudi Arabia. In the next chapter, the research methodology used to address the aim of the current study is presented.

Chapter Three: Methodology

3.1 Introduction

This chapter outlines the methodological procedures that were followed in addressing the aim of the present study. This study employed qualitative and quantitative approaches to identify a suitable patient safety climate questionnaire for use in hospitals in Saudi Arabia. Details of the research ethics process are presented in this chapter.

3.2 Research aim and objectives

This study aims to identify a suitable measure for assessing patient safety culture for use in hospitals in Saudi Arabia. The current study investigates whether there is an existing patient safety climate questionnaire that would be suitable for assessing patient safety culture in hospitals in Saudi Arabia. In this investigation four main objectives need to be met in order to achieve the aim of the study.

The main objectives of the study are:

1. To select an appropriate questionnaire to assess hospital patient safety culture.
2. To evaluate the face validity of the selected patient safety climate questionnaire.
3. To assess the psychometric properties of the selected questionnaire in hospitals in Saudi Arabia.
4. To develop the most appropriate measure for assessing patient safety culture for use in hospitals in Saudi Arabia.

3.3 Study design

The present study is focused on the validation and development of an appropriate patient safety climate questionnaire for use in Saudi hospitals. The selected patient safety climate questionnaire was identified to use in this investigation. Then the face validity of the selected questionnaire was established. The selected questionnaire was used to collect data to assess its psychometric properties (validity and reliability) and to develop an optimal model for assessing patient safety culture in Saudi hospitals. The settings for the study were three hospitals in Riyadh, Saudi Arabia.

The study comprised four main methods to address the study objectives:

1. Literature review process to select appropriate quantitative tools for assessing patient safety culture.

This stage of research aimed to select appropriate patient safety culture tools for assessing the perceptions of the workforce towards patient safety culture in hospitals for use in the investigation. A comprehensive literature search was conducted in this stage. This stage consisted of four steps and a number of selection criteria at each step. This stage identified two questionnaires, the HSOPSC questionnaire (Sorra and Nieva, 2004) and the Teamwork and Safety Climate questionnaire (Sexton et al., 2004). Further details of the approach taken can be found in chapter four, section 4.2.

2. Qualitative interviews to assess face validity of the selected patient safety climate questionnaires.

This stage aimed to establish the face validity of the HSOPSC questionnaire (Sorra and Nieva, 2004) and the Teamwork and Safety Climate questionnaire (Sexton et al., 2004) and compared them in order to select the more appropriate patient safety climate questionnaire for the study. Semi-structured interviews were conducted with 12 medical and nursing staff to explore the face validity of each questionnaire. At the end of this stage the HSOPSC questionnaire (Sorra and Nieva, 2004) was identified as the most appropriate questionnaire to use in this investigation. The wording of the selected patient safety climate questionnaire (HSOPSC questionnaire) was modified to suit the Saudi settings. This method and its results are provided in detail in chapter four, section 4.3.

3. Data collection using the HSOPSC questionnaire in hospitals in Saudi Arabia.

In this stage of the study the HSOPSC questionnaire was applied in order to provide the data for psychometric assessment. This stage was concerned with the distribution and collection of the HSOPSC questionnaires. This method is described in detail in chapter five. The data management process is also provided in chapter five.

4. Data analysis to assess the psychometric properties of the HSOPSC questionnaire in hospitals in Saudi Arabia.

The main aim of the analytical strategy is to assess the psychometric properties (validity and reliability) of the HSOPSC questionnaire in hospitals in Saudi Arabia. Validity is defined as the extent to which any instrument measures what it is intended to measure. Reliability concerns the extent to which an experiment, test, or any measuring procedure yields the same results in repeated trials (Carmines and Zeller, 1979). To achieve this aim a number of analytical techniques were used such as factor analysis, correlation and reliability analysis.

Factor analysis is a technique for examining the interrelationships among the items of the HSOPSC questionnaire in order to determine the structure (important underlying patient safety culture dimensions) in the Saudi data. Factor analysis aims to assess construct validity of an established instrument when administered to a specific population (Pett et al., 2003). Correlation refers to the association between two factors (dimensions) using a correlation coefficient ranging from -1 to +1. A positive correlation means both factors increase, while a negative correlation means one factor increases as the other decreases (Campbell et al., 2007). Reliability refers to the ability of the measure to produce similar results across different situations, Cronbach's alpha (α) is the most common measure of internal consistency (Field, 2009). Internal consistency of instrument is the most popular way for estimating how well the items of a particular dimension are related to each other (Pett et al., 2003).

In the current study, the analytical strategy of assessing the psychometric properties of the original HSOPSC questionnaire is as follows:

1. Confirmatory Factor Analysis (CFA) to test the fit of the original model (original HSOPSC questionnaire) to the whole data. If the original model fits satisfactorily this means the HSOPSC questionnaire is valid.

2. Reliability analysis is carried out to assess internal consistency of each dimension of the original HSOPSC questionnaire.

The second probable result is if the original HSOPSC questionnaire data does not fit satisfactorily, in this situation:

1. The data was split randomly into two halves.
2. Exploratory Factor Analysis (EFA) was used on one half to derive optimal model.
3. Confirmatory Factor Analysis (CFA) was used on the other half of the data to test the fit of the optimal model.
4. Correlation of factors of the optimal model was performed to assess construct validity (to ensure the factors of the optimal model are related to each other).
5. Reliability analysis was used on the whole data to assess the internal consistency of the optimal model in hospitals in Saudi Arabia by calculating the Cronbach alpha coefficients for the items in each dimension emerging from the factor analysis (EFA and CFA).

There are a number of issues that should be considered in performing CFA and EFA:
Firstly, CFA was used to test the original model fit to the data. Amos software was used to do CFA (Arbuckle, 2005). The guidelines for adequacy of fit in CFA suggests a comparative fit index (CFI) value at least 0.95. The adequacy of the model fit was determined by multiple fit indices. This includes the chi-square test statistic, which is the most commonly used fit statistic. Root-mean-square error of approximation (RMSEA) and incremental fit index (IFI) are also considered. The Normed fit index (NFI) is a rescaled chi-square value (0 = no fit, 1.0 = perfect fit) that is based on a comparison of the proposed model with a model that contains no relations, or a null model (Raykov and Marcoulides, 2000). Several authors (e.g. Bone, et al., 1989; Hair et al., 1998; Joreskog and Sorbom, 1993; Schumacker and Lomax, 2004; Nusair and Hua, 2010) agreed that the overall model fit is evaluated using goodness-of-fit indices including x/df ratio, CFI, NFI, PNFI, RFI, IFI and RMSEA. Table 6-15 in page 174 provides the general agreed fit indices (parameters).

Secondly, Exploratory Factor Analysis (EFA) is an important and useful tool for refining measures and evaluating construct validity. In other words, EFA is used for creating and refining the instrument's scales (Conway and Allen, 2003). In EFA the aim is to discover the main constructs or dimensions (Kline, 1994).

A number of studies (e.g. Ford et al., 1986; Floyd and Widaman, 1995; Gorsuch, 1997; Fabrigar et al., 1999) suggested that there are three important decisions should be taken in consideration before using EFA as follows:

(a) The factor extraction model used.

(b) The number of factors retained.

(c) The method used to rotate factors (assuming more than one factor is retained).

Selection of the factor extraction model:

A variety of factor extraction models are available, most can be categorized as either a common factor model or a components model (Gorsuch, 1983). The most popular components model is Principle Component Analysis (PCA). Among common factor models, maximum likelihood and principal axis factoring with estimated communalities are popular. The main difference between the two models is in their purposes. The purpose of common factor models is to understand unobserved (latent) factors that account for relationships among measured variables (items). The goal of PCA is simply to reduce the number of variables by creating linear combinations that retain as much of the original measures' variance as possible (without interpretation in terms of constructs). The results of two models may very closely resemble common factor results in some cases (Conway and Allen, 2003).

In other words, if a study's purpose is to understand the latent structure of a set of variables and interpret results then the use of a common factor model such as principal axis factoring represents the best decision. If a study's purpose is to be purely reduction of variables without interpreting the resulting variables in terms of latent constructs, then use of PCA represents the best decision (Conway and Allen, 2003). Snook and Gorsuch (1989) pointed out that common factor analysis tends to produce more sensible and accurate results than PCA.

Generally, the selection of the factor extraction model is based on the purpose of the study. The current study aims to identify a suitable measure for assessing patient safety culture for use in hospitals in Saudi Arabia. That means exploring and understanding the patient safety culture dimensions (factors) that could be used in Saudi hospitals for assessing patient safety culture. Therefore, the aim here is not just purely reducing the variables but the aim is to understand and interpret the resulting factors in terms of the structure of the patient safety culture tool. Generally, the purpose of the current study involves latent constructs (important underlying patient safety culture dimensions) in order to determine the structure of patient safety culture tool in the Saudi data. Therefore, Principle Axis Factoring was selected to use as the extraction method of EFA.

The number of factors retained:

The second important decision is the criterion for the number of factors to retain. A number of studies (e.g. Zwick and Velicer, 1986; Fabrigar et al., 1999; Conway and Allen, 2003) clearly show that different criteria often lead to different numbers of factors being retained such as "Eigenvalues greater than one" rule, the Scree test and parallel analysis. Research shows that the Eigenvalues greater than 1 rule is commonly used but tends to produce too many factors. Therefore, in general there is wide agreement that using multiple techniques such as Eigenvalues and Scree plot have become more common that gives the most interpretable solution (Zwick and Velicer, 1986; Gorsuch, 1997; Fabrigar et al., 1999). Eigenvalue is the sum of the squared of all items of each factor of extracted factors. Eigen value represents the amount of variation contributed by the factor. The Scree plot is used to identify a number of extracted factors (Pallent, 2007). Therefore, in order to achieve the most interpretable solution in terms of a number of factors retained the combination of techniques of Eigenvalues greater than 1 rule and Scree plot were used in the current study.

The method used to rotate factors (assuming more than one factor is retained):

Rotation of factors usually aims to find a more interpretable solution, given a number of factors greater than one, (Conway and Allen, 2003). Fabrigar et al. (1999) described simple structure of rotation factors in that each factor has a subset of variables (items) with high loadings, and the rest with low loadings, and that each variable has high loadings on only some of the factors and low loadings on the rest. Factor loadings are the correlations of items with factors. The factors deduced by their loadings (Kline, 1994).

There are two type of analytical rotations can be used to get a more interpretable solution. The first type is called orthogonal rotation, such as varimax. The second type is called oblique rotation, such as direct oblimin. Orthogonal rotation decreases the number of factors and uses uncorrelated factors that mean this rotation gives some high loadings and some low loadings for each factor. Oblique rotation is allowing correlated factors and gives one high loading and other loadings near zero for each factor (Conway and Allen, 2003).

In this type of rotation the covariance between elements on factors is minimized (Kim and Mueller, 1978). Oblique rotation provides a more interpretable solution than orthogonal rotations therefore; an oblique rotation is preferred (Ford et al., 1986; Gorsuch, 1997; Fabrigar et al., 1999). In this study varimax was used at the initial solution (first step of EFA) to produce the initial idea of factor loadings and to examine the clarity of the initial solution. After that, the oblique rotation was used to force factors of patient safety culture to be correlated. In summary the following criteria are used in EFA:

1. Principle Axis Factoring was selected to use as the extraction method of EFA.
2. The combination technique of eigenvaluesgreater-than-1 rule and scree plot were used.
3. Varimax then oblique rotation (direct oblimin) were used.

The data in this study was analysed according to the above strategy to assess the psychometric properties of the HSOPSC questionnaire in Saudi hospitals. More details of the method and the results are presented in chapter six.

3.4 Study setting and sample

The location of the study was in Riyadh, Saudi Arabia. The HSOPSC questionnaire was administered at three hospitals in Riyadh from June to mid of September 2009. The study sample was selected from all doctors and nurses in the three selected hospitals. Details of study settings and sample are provided in chapter five.

3.5 Research Ethics Review

Research ethics review was required from the School of Health and Related Research at the University of Sheffield. Thereafter, ethics review and agreements were sought from the three hospitals in Riyadh in Saudi Arabia. The first stage involved ethical approval from the University of Sheffield. The current study received approval from the ethics committee in the School of Heath and Related Research at the University of Sheffield (see copies of ethics approval in appendix 5 and 6).

The second stage of ethics review was the hospitals' approval to conduct the study. Communication was established with the research centres in the three hospitals in Riyadh for ethics application forms and regulations (instructions) for research requirements to obtain their agreement to undertake the study.

1. Institutional Review Board Committee of the Research Centre, King Fahad Hospital (submitted in April 2009).
2. Office of research affairs in King Faisal Specialist Hospital and Research Centre (submitted in April 2009).
3. Institutional Review Board of the King Fahad Medical City (submitted in June 2009).

The proposal of the current study and relevant forms were submitted to the three research centres above in hospitals in Riyadh in Saudi Arabia. The proposal was approved by the Chairman of the Research Committee in the King Fahad Hospital (see appendix 8 for the copy of the approval letter from Institutional Review Board of King Abdullah International Medical & Health Sciences Research Centre in King Fahad Hospital). The proposal of the study was reviewed and approved by two committees, Research Ethics Committee (REC) and Clinical Research Committee (CRC) in the King Faisal Specialist Hospital and Research Centre. After that the proposal was approved by the Research Advisory Council (see appendices 13 and 14 for the copies of the approval letter from the Research Advisory Council, King Faisal Specialist Hospital and Research Centre). The proposal was reviewed by the External Research Review Committee after that the proposal was approved by the Institutional Review Board in the third hospital (see appendix 11 for the copy of the approval letter from Institutional Review Board of the King Fahad Medical City). This research ethics review process is described in detail in appendix 7.

3.6 The fieldwork and plan

The fieldwork commenced in early 2009 for a period of six months in Riyadh in Saudi Arabia. Firstly, there were interviews with a number of participants. The approximate duration of the interview process including obtaining agreements of the hospitals was two and a half months. Secondly, the questionnaires were distributed in the three hospitals. The approximate duration of data collection process including distributing and collecting the questionnaires in the three hospitals was three months.

This period of time was particularly convenient because there were no holidays within this period of time that might have interrupted the field work. Table 3-1 shows the timetable of the fieldwork in Saudi Arabia.

Table 3- 1 Fieldwork timetable

Stage	Start	End
Interviews	10-4-2009	25-6-2009
Questionnaires	28-6-2009	1-10-2009

3.7 Summary

In summary, the methodology used for undertaking the research was based on the aim and objectives of the research. In the current study, both quantitative and qualitative methods were used to identify patient safety climate questionnaire that would be a suitable for assessing patient safety culture in hospitals in Saudi Arabia. The next chapter provides the details of choosing an appropriate patient safety climate questionnaire for use in Saudi hospitals. The details of the data collection process can be found in chapter five. The results of the psychometric analysis of the HSOPSC questionnaire properties (Sorra and Nieva, 2004) in Saudi hospitals using Saudi data can be found in chapter six of this thesis.

Chapter 4: Choosing an appropriate patient safety climate questionnaire for use in Saudi hospitals

4.1 Introduction

The current chapter aims to describe the process of choosing an appropriate patient safety climate questionnaire for use in the study. This chapter is divided into four sections. Following this introduction, section 4.2 describes the selection of appropriate questionnaires for assessing the perceptions of the workforce towards patient safety culture in hospitals. Section 4.3 describes the face validity testing of the two patient safety climate questionnaires and reports the findings. Section 4.4 provides the overall summary of the chapter.

4.2 Selection of appropriate patient safety climate questionnaires

This stage seeks to select appropriate patient safety climate questionnaires for assessing the perceptions of the workforce towards patient safety culture in hospitals for use in the investigation. This stage consists of four steps. Table 4-1 describes the criteria used in each step of the selection of appropriate patient safety climate questionnaires for assessing patient safety culture.

Table 4- 1 Steps of selecting appropriate patient safety climate questionnaires

Step	Criteria
Step 1: Identifying existing patient safety climate questionnaires	1. Quantitative instruments 2. Use for healthcare organisations 3. Patient safety culture /climate questionnaire
Step 2: Assessment of psychometric properties and dimensionality of questionnaires	1. A valid and reliable questionnaire 2. A questionnaire that encompasses the important patient safety culture dimensions
Step 3: Assessment of general characteristics of questionnaires	1. For assessing perceptions of hospital staff 2. Self- reported questionnaires 3. A questionnaire is short enough for use by health professionals who are busy 4. Availability of versions of questionnaires
Step 4: Selection of appropriate patient safety climate questionnaires	The selected questionnaires should be fitted with all criteria above

4.2.1 Step1: Identifying existing patient safety culture questionnaires

This step was based on the following criteria:

1. Patient safety culture /climate measures.
2. Use for healthcare organisations.
3. Quantitative instruments.

Search strategy

An extensive and comprehensive literature search was conducted utilising hand (library) searching and electronic databases such as the Medline, Science direct, Pubmed Central and the Psycho review of the published literature from 1966 to July 2008, Psycho from 1985 to July 2008. Using the search terms "healthcare organisation", "safety culture", "safety climate", "patient safety culture"," patient safety climate", "survey", "questionnaire" and "measuring". A combination of the key words, such as patient safety climate questionnaire in healthcare, and patient safety culture questionnaire in healthcare were used. No restriction on date or study type was used. However, the search was restricted to the English language. Websites relevant to patient safety were also used, and these included the website of the Agency for Healthcare Research and Quality (AHRQ), the National Patient Safety Agency (NPSA) and the Institute for Healthcare Improvement (IHI). Moreover, bibliographic references were also searched. The searches were conducted in 2007.

The above strategy and criteria yielded 14 questionnaires that are used to measure patient safety culture /climate in healthcare organisations as follows:

1. Hospital Survey on Patient Safety Culture (Sorra and Nieva, 2004).
2. Safety Climate Survey (Sexton et al., 2000, 2003).
3. Team Work and Safety Climate Survey (Sexton et al., 2004).
4. Safety Attitudes Questionnaire (Sexton et al., 2004).
5. Safety Climate Scale (Pronovost et al., 2003; Kho et al., 2005).
6. Leiden Operating Theatre and Intensive Care Safety scale (Beuzekom, 2007).
7. Veterans Administration Patient Safety Culture Questionnaire. (Burr et al., 2002).
8. Strategies for Leadership: An Organisational Approach to Patient Safety (Voluntary Hospital of America, 2000).
9. Hospital Transfusion Service Safety Culture Survey (Sorra and Nieva, 2003).
10. Patient Safety Culture in Health Care Organisation (Singer et al., 2007).
11. Medication Safety Self-Assessment (Institute for Safe Medication Practices, 2000).
12. Culture of Safety Survey (CSS) (Weingart et al., 2004).
13. Stanford University Patient Safety Climate in Health Care Organisation Questionnaire (Singer et al., 2003).
14. An employee questionnaire for assessing patient safety (Carayon et al., 2005).

4.2.2 Step 2: Assessment of psychometric properties (validity and reliability) and dimensionality of patient safety climate questionnaires

This step was related to reviewing the validity and reliability of questionnaires, an important step in selection process (Pronovost and Sexton, 2005). The dimensionality of the questionnaires was also considered. This step addressed the following criteria:

1. A valid and reliable patient safety climate questionnaire.
2. A questionnaire that encompasses the important patient safety culture dimensions.

These criteria were applied to the list of 14 questionnaires; four questionnaires were excluded. Table 4-2 shows the excluded patient safety climate questionnaires in this step.

Table 4- 2 Excluded patient safety climate questionnaires in step2

Patient safety climate questionnaire	Reason for exclusion
Stanford University Patient Safety Climate in Health Care Organisation (Singer et al., 2003)	Reliability not mentioned (Fleming, 2005)
Strategies for Leadership: An Organisational Approach to Patient Safety(Voluntary Hospital of America, 2000)	Cronbach's alpha not mentioned (Colla et al., 2005)
Safety Climate Scale (Pronovost et al., 2003; Kho et al., 2005)	Small number of dimensions
Culture of Safety Survey (CSS) (Weingart et al., 2004)	Cronbach's alpha (internal consistency scores) were poor

The remaining ten patient safety climate questionnaires as follows:

1. Hospital Survey on Patient Safety Culture (Sorra and Nieva, 2004).
2. Safety Climate Survey (Sexton et al., 2000, 2003).
3. Team Work and Safety Climate Survey (Sexton et al., 2004).
4. Safety Attitudes Questionnaire (Sexton et al., 2004).
5. Leiden Operating Theatre and Intensive Care Safety scale (Beuzekom, 2007).
6. Veterans Administration Patient Safety Culture Questionnaire (Burr et al., 2000).
7. Hospital Transfusion Service Safety Culture Survey (Sorra and Nieva, 2003).
8. Patient Safety Culture in Health Care Organisation (Singer et al., 2007)

9. Medication Safety Self-Assessment (Institute for Safe Medication Practices, 2000)
10. An employee questionnaire for assessing patient safety (Carayon et al., 2005)

4.2.3 Step 3: Assessment of general characteristics of patient safety climate questionnaires

The third step in the process of selecting appropriate patient safety climate questionnaires for assessing patient safety culture was based on the following criteria:

1. An instrument that can be utilised to assess the perceptions of patient safety culture of doctors and nurses in hospitals.
2. Self-reporting questionnaires that staff could complete themselves without any assistance.
3. Instrument short enough for use health workers who are busy such as doctors and nurses (Hutchinson et al., 2006) as time to complete questionnaire is an important consideration.
4. The availability of the questionnaires. Full copies of questionnaires giving descriptions, such as number of questions (items), type of questions, scale used the intended sample population and the setting where it has been used.

These criteria above were applied to the list of 10 questionnaires, five questionnaires were excluded. Table 4-3 shows the excluded patient safety climate questionnaires in this step.

Table 4- 3 Excluded patient safety climate questionnaires in step 3

Patient safety climate questionnaire	Reason for exclusion
Leiden Operating Theatre and Intensive Care Safety scale (Beuzekom, 2007)	It contains 99 items. It is used for assessing system failure in operating room and intensive care
Medication Safety Self-Assessment (Institute for Safe Medication Practices, 2000)	Too long questionnaire contains 194 items
Hospital Transfusion Service Safety Culture Survey(Sorra and Nieva, 2003)	Use for transfusion service. In addition the version of questionnaire is not available
Veterans Administration Patient Safety Culture Questionnaire (Burr et al., 2000)	Relatively long, it contains 71 items. In addition the version of questionnaire is not available
An employee questionnaire for assessing patient safety (Carayon et al., 2005	The version questionnaire is not available

The remaining five patient safety climate questionnaires were:

1 Hospital Survey on Patient Safety Culture (HSOPSC) (Sorra and Neiva, 2004).

2 Safety Climate Survey (SCS) (Sexton et al., 2000, 2003).

3 Team Work and Safety Climate Survey (Sexton et al., 2004).

4 Safety Attitudes Questionnaire (SAQ) (Sexton et al., 2004).

5 Patient Safety Culture Survey in Health Care (PSCSHC) (Singer et al., 2007).

4.2.4 Step 4: Select appropriate patient safety climate questionnaires

The five patient safety climate questionnaires mentioned above were further reviewed in detail for their general characteristics, dimensions covered and psychometric properties of each questionnaire (Colla et al., 2004; Singla ., 2006).

Hospital Survey on Patient Safety Culture (HSOPSC)

Sorra and Neiva developed this tool in 2004 funded by the Agency for Health Care Quality and Research (AHRQ). This survey aims to enable hospitals to assess their patient safety culture. It was developed by reviewing the literature and existing safety culture surveys followed by interviews with hospital staff. The resulting questionnaire was piloted and the data analysed using factor analysis to identify which scales and items to retain. It contains 44 items on a 5-point Likert Scale, and it is appropriate for general use by healthcare staff. The HSOPSC questionnaire is considered as a valid and reliable tool when tested in the USA to assess the perceptions of the workforce towards the patient safety culture in hospitals. It covers 12 dimensions of safety culture, which are:

1 Good channels of communication openness.
2 Supervisor/manager actions promoting patient safety.
3 No punitive response to error.
4 Staffing.
5 Hospital management support for patient safety.
6 Teamwork within units.
7 Teamwork across hospital units.
8 Effective processing of organisational learning.
9 Regular feedback and communication about errors.
10 Hospital handover and transitions (information handover, exchange of information).
11 Overall perceptions of safety.
12 Frequency of event reporting.

There are four outcomes, which include overall perceptions of safety, frequency of events reported, number of events reported and overall patient safety grade. This patient safety climate questionnaire shows good psychometric properties (Sorra and Neiva, 2004). Table 4-4 shows the characteristics of the original HSOPSC questionnaire.

Table 4- 4 Characteristics of the original Hospital Survey on Patient Safety Culture

Characteristics	Hospital Survey on Patient Safety Culture
Authors and development date	Sorra and Nieva (2004)
Country	U.S.A
Aim	To enable hospitals to assess their patient safety culture.
Number of items	44
Scale	On a 5-point Likert Scale
Setting	Hospital
Staff	Health care staff
Dimensions	1. Communication openness 2. Supervisor/manager actions promoting patient safety 3. No punitive response to error 4. Staffing 5. Hospital management support for patient safety 6. Teamwork within units 7. Teamwork across hospital units 8. Organisational learning processing 9. Feedback and communication about error 10. Hospital handover and transitions (information handover, exchange of information) 11. Overall perceptions of safety 12. Frequency of event reporting
Psychometric assessment	1 Good psychometric properties 2 Cronbach's alpha range from 0.63-0.84 3 Tested on large sample Statistical analysis such as item analysis, exploratory factor analysis, confirmatory factor analysis and correlated composite scores across dimensions performed to assess psychometric properties. It has a strong content validity and has been validated at all levels (Sorra and Nieva, 2004; Colla et al., 2004).

The version of the questionnaire can be found on www.ahrq.gov/qual/hospculture

As mentioned in section (2.4) in chapter two, the HSOPSC questionnaire is very widely used in different countries, for example, the study in Belgium by Hellings and colleagues (2007) selected the HSOPSC questionnaire for their survey because they found it met more of their psychometric criteria than the other instruments they reviewed (Hellings et al., 2007). Overall, the questionnaire examines patient safety culture from a hospital staff perspective. The HSOPSC questionnaire measures a number of important dimensions and includes a number of outcomes of patient safety culture. It is a reliable and a valid questionnaire in measuring patient safety climate.

Safety Climate Survey (SCS)

Sexton and colleagues (2000, 2003) developed the Safety Climate Survey (SCS). It aims to allow an organisation to be able to assess staff perceptions of safety culture and to monitor the success of the patient safety initiatives. It is derived from the Flight Management and Attitudes Safety Survey (FMASS). The Safety Climate Survey contains 19 items covering seven safety culture dimensions, which are:

1. Communication.
2. Priority given to patient safety.
3. Perception and understanding of the cause of patient safety incidents.
4. Learning from patient safety incidents.
5. Incident reporting.
6. Leadership.
7. Error management.

It has been reported that this tool has a good test–retest reliability and internal consistency and that it is predictive of performance and accident rates (Sexton et al., 2000; Pronovost et al., 2003). Table 4-5 shows the characteristics of the SCS.

Table 4- 5 Characteristics of Safety Climate Survey

Characteristics	Safety Climate Survey
Authors and development date	Sexton et al. (2000,2003)
Country	U.S.A
Aim	To allow organisations to be able to assess staff perceptions of safety culture and to monitor the success of the patient safety initiatives
Number of items	19
Scale	On a 5-point Likert Scale
Setting	Acute hospital settings
Staff	Health care staff
Dimensions	1. Communication 2. Priority given to patient safety 3. Perception of the cause of patient safety incidents 4. Learning from patient safety incidents 5. Incident reporting 6. Leadership 7. Error management
Psychometric assessment	Cronbach's alpha is good. Partial item analysis, partial confirmatory factor analysis, partial test /retest reliability and analysis of variance across services performed (Colla et al., 2005)

Teamwork and Safety Climate Survey

Sexton et al. (2004) developed this questionnaire. It contains 27 items covered in two sections teamwork and safety climate. Table 4-6 shows the characteristics of the Teamwork and Safety Climate Survey.

Table 4- 6 Characteristics of Teamwork and safety climate survey

Characteristics	Teamwork and safety climate survey
Authors and development date	Sexton et al (2004)
Country	U.S.A
Aim	To measure teamwork and safety climate in healthcare organisations
Number of items	27
Scale	6-point Likert scale
Setting	General primary and secondary health care settings
Staff	Hospital and primary care staff
Dimensions	1. Safety climate domain Attitudes to safety within own team, capacity to learn from errors, overall confidence in safety organisation and perception of management attitudes 2.Team work domain Communication and collaboration with other staff, information handover (exchange of information)
Psychometric assessment	Psychometric analysis: 1 Cronbach's alpha range from 0.69-0.84 2 Face validity is good Factor analysis and reliability analysis performed

Safety Attitudes Questionnaire (SAQ)

The Safety Attitudes Questionnaire (SAQ) is a refinement of the Intensive Care Unit Management Attitude Questionnaire (ICUMAQ), which has been taken from a questionnaire widely used in commercial aviation, the Flight Management Attitudes Questionnaire (Sexton et al., 2004). This questionnaire was developed by Sexton et al. (2004) to measure caregiver attitudes about the following dimensions: teamwork, safety climate, job satisfaction, stress recognition, perception of management and working condition. It contains 60 items and demographic information such as sex, age, nationality and experience. It uses a Likert scale and some items are negatively worded. It is used for multiple units in an organisation. The SAQ was designed to take a snapshot of culture in clinical areas. The SAQ is used for assessing the attitudes of front-line healthcare providers across a number of dimensions of patient safety. This questionnaire has shown adequate psychometric properties and was tested on a large sample. Cronbach's alpha ranged from 0.65-0.83 (Sexton et al., 2006). Table 4-7 shows the characteristics of the SAQ.

Table 4- 7 Characteristics of Safety Attitude Questionnaire

Characteristics	**Safety Attitude Questionnaire**
Authors and development date	Sexton et al. (2004)
Country	U.S.A
Aim	To measure the attitudes of front-line healthcare providers about six patient safety-related domains
Number of items	60
Scale	On a 5-point Likert scale
Setting	Multiple units
Staff	Health care staff
Dimensions	1. Teamwork 2. Safety climate 3. Job satisfaction 4. Stress recognition. 5. Perception of management 6. Working conditions
Psychometric assessment	Adequate psychometric properties. Tested on large sample Cronbach's alpha range from 0.65 - 0.83. Exploratory factor analysis, confirmatory factor analysis, correlated composite scores across dimensions and test /retest reliability (Colla et al., 2005)

Note: Questionnaires (Safety Attitudes Questionnaire, Safety Climate Survey and Team Work and Safety Climate) are available at the University Of Texas Centre Of Excellence for Patient Safety Research and Practice website: http://www.uth.tmc.edu/schools/med/imed/patientsafety/survey&tools.htm.

Patient Safety Culture Survey in HealthCare (PSCSHC)

Singer and colleagues developed the Patient Safety Culture Survey (Stanford instrument) in 2003. It was adapted from five questionnaires in aviation and health care to assess safety culture. It contains 82 items and covers 16 topics but reliability statistics have not been published and it is relatively long. It was modified into 38 items, which is now the Patient Safety Culture Survey (modified Stanford instrument) and it is used to measure workforce perception of hospital safety culture. Cronbach's alpha ranged from 0.50-0.89 (Singer et al., 2007). Table 4-8 shows the characteristics of the PSCSHC.

Table 4- 8 Characteristics of Patient Safety Culture Survey on Health Care Organisations

Characteristics	Patient Safety Culture Survey on Health Care Organisations
Authors and Development date	Singer et al. (2007)
Country	U.S.A
Aim	To assess workforce perception of hospital safety culture
Number of items	38
Scale	Likert scale
Setting	General
Staff	Healthcare staff
Dimensions	1. Senior manager's engagement 2. Organisational resources for safety 3. Overall emphasis on safety 4. Unit safety norms 5. Unit recognition and support for safety effort 6. Fear of shame. 7. Provision of safety care 8. Learning 9. Fear of blame
Psychometric assessment	1. Pilot tested 2. Alpha's range from 0.50 - 0.89 3. It is a valid and reliable tool that is used to measure features of hospital safety climate 4. Exploratory factor analysis performed

To sum up the process of selecting appropriate patient safety climate questionnaires, the decision was made to include the HSOPSC questionnaire (Sorra and Nieva, 2004) as an appropriate questionnaire to be used in the present study because of the following reasons:

1. The tool is developed for hospitals.
2. It is used internationally such as in the USA and Europe.
3. It is a valid and reliable instrument when it was tested in USA hospitals.
4. It examines patient safety culture from a hospital staff perspective.
5. It is new tool, based on the review of many instruments.
6. It is a comprehensive tool; that encompasses 12 dimensions of patient safety culture.
7. The HSOPSC questionnaire freely available. It has no copyright restriction, this is considered as a good point especially as time is limited in the present study.

The second appropriate questionnaire selected was the Teamwork and Safety Climate Survey because of the following reasons:

1. It is a valid and reliable instrument when it was tested in USA hospitals.
2. It examines patient safety culture from a hospital staff perspective.
3. It is relatively short questionnaire (27 items).
4. It is used internationally such as in the USA and Europe.
5. The copy of the questionnaire freely available. It has no copyright restriction, this is considered as a good point especially as time is limited in the present study.

Table 4-9 shows the steps of selecting appropriate patient safety climate questionnaires for assessing patient safety culture that were used in this study.

Table 4- 9 Steps of selection of an appropriate questionnaire for assessing patient safety culture

Step	Description	Outcomes
1. Identifying an existing patient safety climate questionnaire	An extensive and comprehensive literature search	14 questionnaires
2. Assessment of psychometric properties (validity and reliability) and dimensionality of the questionnaires	Review the psychometric properties and dimensions of the tools	10 questionnaires
3. Assessment of general characteristics of the questionnaires	Review the general characteristics	Five questionnaires
4. Select appropriate patient safety climate questionnaires	A more detailed review and compares general characteristics, dimensions covered and the psychometric assessment of each questionnaire	Two questionnaires

The next section discusses the comparison of the two questionnaires.

4.2.5 Comparison of the two questionnaires

The aim of the comparison of the two questionnaires is to select the most appropriate one of them to use in the study. The first suitable patient safety climate questionnaire for this study was the HSOPSC questionnaire (Sorra and Nieva, 2004) and the second suitable questionnaire was the Teamwork and Safety Climate Survey (Sexton et al., 2004). Therefore, in order to confirm that the final selected questionnaire was an appropriate instrument for the study, it was useful to make a comparison between the two questionnaires. In addition this comparison might provide important data for the study based on the answers of the participants.

Theoretically it is important to consider the characteristics of patient safety climate questionnaires to compare and select an appropriate patient safety climate questionnaire. Therefore, the methodology of the current study started with comparing the patient safety climate questionnaires based on their characteristics as an important step to select appropriate patient safety climate questionnaires to use in this study. In terms of practicality the comparison of all questionnaires does not work because it is not feasible to the participants to ask them to compare between more than two questionnaires, this would take a long time and consume their time especially they are not experts in the measurement of patient safety climate to make a decision for which questionnaire is suitable for this study. Moreover, most of the other questionnaires are too long or too short or for specific settings such as pharmacy or operation rooms and not for the whole hospital. The section on selecting an appropriate questionnaire in this chapter has provided more details related to the comparison of the patient safety climate questionnaires therefore there was no point in comparison of the questionnaires in the interviews unless to confirm that the patient safety climate questionnaire that has been selected is the most appropriate questionnaire for the current study.

A number of doctors and nurses from one hospital were selected to ask them to read the two tools and compare them to select the most clearly and understandable patient safety culture questionnaire. The comparison was between the following patient safety culture questionnaires:

1. The HSOPSC questionnaire [44 items] (Sorra and Neiva, 2004).
2. Teamwork and Safety Climate Survey [27 items] (Sexton et al., 2004).

The next section provides more details of the face validity interviews.

4.3 Face validity testing of two patient safety climate questionnaires

4.3.1 Introduction

This step was concerned with establishing and comparing the face validity of the HSOPSC questionnaire and the Teamwork and Safety Climate questionnaire in order to select the more appropriate patient safety climate questionnaire for the study. The main aim was to ensure that the selected questionnaire was understandable and easy to complete by the respondents without any difficulties in the language and wording of questionnaire. Fink (1995: 51) points out that" Face validity is concerned with how a measure appears". To achieve this aim a maximum of 12 semi-structured interviews on a one-to-one basis were conducted to investigate perceptions of doctors and nurses towards the HSOPSC questionnaire and the Teamwork and Safety Climate questionnaire.

The cognitive interviewing technique was used in the face validity testing of the survey instrument to learn how the respondents understand the questionnaires and to identify the problems that might have arisen regarding the language and wording of the questionnaire. The cognitive interview is an interviewing technique based on memory retrieval for testing and improving the wording of questions in questionnaires. Therefore, the goal of cognitive interviewing is to make questionnaire items clear and understandable for respondents (Collins, 2003). There are two types of cognitive interview: concurrent and retrospective. Concurrent encourages the respondents to give a verbal account of their thinking. Retrospective involves a respondent answering a draft questionnaire (Drennan, 2003). Therefore the participants in the interviews were asked to give their verbal and written responses of their thinking in answering the HSOPSC questionnaire and the Teamwork and Safety Climate questionnaire.

The interviews aimed to investigate the perceptions of the interviewee, both doctors and nurses, towards both questionnaires. The process lasted from 11/4/2009 to 25/6/2009. It was concerned with conducting the interviews in one selected hospital because the data from one hospital would be sufficient to identify the potential changes related to the wording of the questionnaire, making it unnecessary to conduct the interviews in a second hospital. The interviews were conducted in hospital where the first ethics approval was obtained.

Twelve physician and nurse volunteers (Saudi and non Saudi) were recruited from one targeted hospital to participate in the interviews. The language of the questionnaires used in the interviews was English, for both Saudi and non Saudi physicians and nurses.

4.3.2 Objectives of interviews

The interviews aimed to:

1. To establish the face validity of the HSOPSC questionnaire.
2. To establish the face validity of the Teamwork and Safety Climate questionnaire.
3. To compare the two questionnaires.
4. To select the most appropriate patient safety climate questionnaire for the study.

4.3.3 Setting of interviews

The interviews were conducted in the hospital that gave ethical approval and agreement first, because there is no big difference in terms of bed capacity and workforce. Also, the three hospitals are considered as tertiary hospitals and they are accredited by the Joint Commission of American Hospital Organisation (JCAHO), and thus the views of staff in one hospital were expected to be represented of the views of staff in other two hospitals in terms of the clarity and ease of understanding the language of the questionnaires. The first hospital providing an approval letter and agreeing to conduct the study was King Fahad National Guard Hospital in Riyadh Saudi Arabia on 1/5/2009.

4.3.4 Sample of interviews

The participants in the interviews were selected based on convenience sampling technique. 12 doctors and nurses volunteers (Saudi and non-Saudi) were recruited from one targeted hospital to participate in the interviews.

4.3.5 Recruitment (interview process)

The workforce of the three hospitals consists of Saudi and non-Saudi staff. Therefore, the interviews were conducted with Saudi and non-Saudi doctors and nurses.

1 Identification: six physicians and six nurses to be interviewed were approached from the different categories of physicians and nurses (resident, specialist, consultant

physicians, head nurse and nurse), Saudi and non Saudi, in King Fahad National Guard hospital. In addition letters from medical and nursing directors were sent to the physicians and nurses in medical and nursing departments in the hospital indicating that the research was being undertaken and that staff who would like to participate may do so (see appendices 9 and 10 for the copies of letters from Associate Executive Director of Nursing Services and from Chairman of Surgery department in King Fahad National Guard Hospital). These letters were very helpful and motivated the staff to participate in the study.

2 Approach: the researcher sent an invitation letter with participant information sheet to 12 doctors and 12 nurses to invite them to participate in the interviews. The participant information sheet explains important points such as the purpose of this study and the confidentiality of data (see appendix 2). A period of 5-7 days was given to read the information sheet and to decide whether or he/she wishes to participate. Invitees who expressed their willingness to participate in the study were recruited until the target number of participants was reached, which was six physicians and six nurses. Each doctor/nurse who decided to participate was asked to sign a consent form and choose a suitable time for conducting the interview. If the invitees refused to take part in the study other participants were identified for recruitment. Any invitee was free to decline to participate at any point.

3 Recruitment: the doctors and nurses that agreed to participate; were asked by the researcher to sign a consent form (see appendix 1). Then the researcher organised an interviews schedule. Those who took part in the interviews were not asked to take part in completing the questionnaires.

In brief, the participants received the invitation letter to participate in the interviews and information sheet about the study. Approximately one week later, the researcher contacted the invited doctors and nurses to ensure their willingness to participate and to arrange a convenient time and place for the interviews. Participation in the study involved no harm or discomfort to participants. The participants received no direct benefit from participating in this study, but they were informed that the data they provided would contribute to the knowledge base by investigating the suitability of an appropriate patient safety climate questionnaire for use in hospitals in Saudi Arabia.

4.3.6 The structure of the interview

The purpose of the interviews was to make sure that the respondents had no difficulties in the language and wording of the selected patient safety culture questionnaire when administered in the selected hospitals. The language of the interviews was English because the common language of work in Saudi hospitals is English. The content of the interviews helped to identify the difficulties in understanding the language and wording of the HSOPSC questionnaire (see appendix 3) and the Teamwork and Safety Climate questionnaire (see appendix 4). Therefore, it was important to create a structure for the interview, which helped to achieve this. The structure of the interview, from the opening words to the final thanking of the respondents is as follows:

1- The first contact between the researcher and the participants involved greetings, welcoming, and thanking the participant in advance, for his/her participation. Then, the researcher told the participant about the purpose of interview, the content of the interview and how the confidentiality of the information will be protected. The interview lasted 50 to 60 minutes. The content of the interview was recorded on the interview record sheet.

2- The HSOPSC questionnaire and Teamwork and Safety Climate questionnaire with a cover sheet including the title and the aim of the study were provided to the participant.

3- The researcher asked the participant to read and complete the two questionnaires carefully regarding to the clarity of the language, understanding the meaning of the words and understanding of the instructions and items in each section of the questionnaires.

4- The following three questions were asked for each item of the two questionnaires:

   Q1: Is the wording of the item number (A1) clear for you?

   Answer: 1 -YES 2 -NO

   This question aims to ensure the item is clear to the participants.

   Q2: What does item number (A1) mean to you?

   This question aims to ensure that the participants understand the meaning of the items straight away without getting confused by different possible meanings coming in their minds. In other words direct to the point.

Q3: Do you find the item number (A1), easy or difficult to understand?

Comments:

....

This question aims to make sure that the participants understand and answer the items easily, without any difficulty.

5- The researcher discussed the comments of the participant regarding the clarity of the language and understanding the meaning of the words, terminology used for each item in the questionnaires.

6- An interview record sheet was completed for each interview to save the content of each interview and for analysing the data of the interviews.

7- The interview record sheet consists of four parts, firstly participant information such as name, job, nationality, department and hospital. Secondly, Part A: HSOPSC questionnaire. Thirdly, Part B: Teamwork and Safety Climate questionnaire. Finally, General comments.

8- In closing the interview, the researcher checked that the questions and comments in the interview record sheet are completed and thanked the respondent for his/her interest and effort.

In summary, 12 semi-structured interviews on a one-to-one basis were employed to investigate perceptions of doctors and nurses towards the HSOPSC questionnaire and the Teamwork and Safety Climate. The interviews started at different times during the hospital working hours and in different places of the hospital according to the participants' convenience. The participants were asked to carefully read and complete the two questionnaires, with focus on the clarity of the language and understanding of the items of the questionnaires. Therefore the participants in the interviews were asked to give verbal and written responses of their thinking in answering the two questionnaires.

Generally, the same procedure was followed for both questionnaires, however, to avoid potential bias associated with the order of presenting the questionnaires, six interviews started with the HSOPSC questionnaire and the other six interviews started with the Teamwork and Safety Climate Survey. As mentioned earlier the answers of these three questions were recorded in the interview record sheet for each interview. These sheets were analysed. The next section provides the interview data analysis.

4.3.7 Analysis of interviews data

The main aim of the interviews was to establish the face validity of the selected questionnaires (HSOPSC and Teamwork and Safety Climate Survey) in order to ensure that the final selected questionnaire was understandable and easy for the respondents to complete, with no language and wording difficulties. The language of the two questionnaires was English. The interviews focused on investigating the wording and language of the questionnaires to ascertain which one of them was the most appropriate tool to use in the study in terms of the clarity and ease of understanding. The 12 interviewees provided a number of comments related to the meaning of the words, the clarity of the language, the structure of the sentence and the scale used in the questionnaire and the overall understanding of the language of each questionnaire. Generally, the interviews focused on the respondents' perceptions toward the clarity of the language and understanding the items in the two questionnaires. A number of points and issues were observed during the interviews in relation to the respondents' perceptions of the HSOPSC and Teamwork and Safety Climate Survey. This section reports the interview findings of the 12 semi-structured interviews. It begins with demographic information then the results of the HSOPSC questionnaire, followed by the results of the Teamwork and Safety Climate, after that, comparison of the tools, followed by the decision and changes for a choice of questionnaire. Finally, the summary of the interviews is provided.

4.3.8 Characteristics of participants

Table 4-10 shows the characteristics of the participants of the interviews.

Table 4- 10 Demographic information of participants (n=12)

Interview No	Job title	Department	Gender	Nationality	Duration of interview (hours/minutes)
1	Doctor	Paediatrics	Male	Saudi	1:20
2	Nurse	Outpatient clinics	Male	Philippine	1:25
3	Nurse	Cardiology	Female	British	1:13:
4	Nurse	Nursing	Male	Dutch	1:15
5	Nurse	Surgery	Female	Saudi	1:05
6	Nurse	inpatient wards	Female	South Africa	1:00
7	Doctor	Rehabilitation	Male	Saudi	1:00
8	Nurse	Inpatient wards	Male	Philippine	1:00
9	Doctor	Medicine	Male	Saudi	00:55
10	Doctor	Surgery	Male	Saudi	00:53
11	Doctor	Paediatrics	Female	Saudi	00:50
12	Doctor	Medicine	Female	Saudi	00:50

Table 4-10 shows that the interviews included nurses and doctors of both genders across a variety of departments and nationalities. The duration of the interviews ranged from 50 minutes to 80 minutes. The next section reports the interview findings of the face validity testing of the HSOPSC questionnaire.

4.3.9 Results of the face validity testing of the Hospital Survey on Patient Safety Culture (HSOPSC)

Instructions and definitions:

The instructions, definitions and the structure of the questionnaire were regarded as considered to be clear and organised, as the following participants commented:

"I think it is fine and well organised and structured" (Interview 1)

"The instructions and definitions are very clear to me" (Interview 5)

"The first page is organised with clear instructions and definitions are provided" (Interview 10).

The majority of the participants suggested using square brackets instead of circles in all the instructions in order to be consistent. (Mark one answer by filling in the brackets). Under section F only one respondent suggested adding "SECTION F": Your hospital (continued) and using the same scale of answering to avoid confusion on page six. However, the instruction under each section of the questionnaire was very clear and easy to understand. The definitions used in the questionnaire were clear and the respondents were familiar with them. Thus it was concluded that, the instructions and definitions used in the questionnaire were clear and there was no need to change them.

First question:

The respondents to the study were doctors and nurses working in medical and nursing departments only. Therefore, pharmacy, laboratory and radiology were removed as there was no staff from those departments in the hospital. The first question in the questionnaire was changed (see a copy of the HSOPSC questionnaire in appendix 3).

The wording of the questionnaire and the clarity of the items:

The total number of items in the HSOPSC questionnaire is 54 including background items. Table 4-11 shows how clear and easily understood items of the HSOPSC were, based on the participants' answers.

Table 4- 11 Clarity and understanding of the HSOPSC

Interview No	Clarity of terms		Understanding of items		Unclear items
	Number of Yes answers	Number of No answers (%)	Number of easy items	Number of difficult items (%)	
1	52	2 (3.7%)	52	2 (3.7%)	A5-A7
2	54	0	54	0	-
3	52	2 (3.7%)	52	2 (3.7%)	A5-B4
4	53	1 (1.9%)	53	1 (1.9%)	A5
5	50	4 (7.4%)	50	4 (7.4%)	A5-A7-A14-F3
6	52	2 (3.7%)	52	2 (3.7%)	A15-F3
7	47	7 (13.0%)	47	7 (13.0%)	A5-A7-B4-F3-F11-H1-H8
8	54	0	54	0	-
9	52	2 (3.7%)	52	2 (3.7%)	A5-A7
10	50	4 (7.4%)	50	4 (7.4%)	A5-A7-B4-H1
11	54	0	54	0	-
12	51	3 (5.6%)	51	3 (5.6%)	A5-A7

Three respondents perceived that the HSOPSC was very clear. Nine respondents agreed that nine items of the HSOPSC were not clear and were difficult to understand. The words identified as difficult to understand are underlined. Table 4-12 shows these items and the number of participants who found them unclear and difficult.

Table 4- 12 Number of participants identifying unclear items

Items	Number of participants
A5: Staff in this unit work longer hours than is best for patient care	8
A7: We use more agency/temporary staff than is best for patient care	6
A14: We work in "crisis mode" trying to do too much, too quickly	1
A15: Patient safety is never sacrificed to get more work done	1
B4: My supervisor/manager overlooks patient safety problems that happen over and over	3
F3: : Things "fall between the cracks" when transferring patients from one unit to another	2
F11: Shift changes are problematic for patients in this hospital.	1
H1: What is your staff position in this hospital? Mark ONE answer that best describes your staff position.	3
H8: In your staff position, do you typically have direct interaction or contact with patients?	2

Table 4-12 shows that the participants agreed that items A5-A7-A14-A15-B4-F3-F11-H1-H8 were unclear and difficult to understand. In particular A5 and A7 appear most problematic.

It was observed that the majority of the items of the HSOPSC were clear and easy to understand except a few items, as the following participants indicated:

> "In general it is clear, the language is simple and clear just two phrases (crisis mode and fall between the cracks) so it is important to check those with other staff. The meaning of the items is clear, so it is easy to understand the key word of each item quickly and easily. Most terms used related to patient safety, medical errors and incident reports. Reading one time enough to understand and get the meaning of the items. I think time of completion this is fair and reasonable (around 10 minutes)." (Interview 6)

> "Terms of the questionnaire are more related to patient care. A5 and A7 are not clear in good way because of (than is best)." (Interview 1)

> "The majority of the items of the HSOPSC are simple and short. Generally, it is clear and all the items are understandable." (Interview 2)

> "Generally the HSPOPSC was very clear although, the item number A5 was simple but complex in same time." (Interview 3)

> "The language of the questionnaire is clear and easy to understand except A5 is very ambiguous question." (Interview 4)

> "Most of items were clear and self explanatory. There are few confusing items that might carry more than one meaning such as A5-A7-B4-F3-F11. Open question at the end is good and it is considered as advantage." (Interview 7)

> "It is very clear questionnaire and easy to understand so I do not have comments about all the items." (Interview 8)

> "It is written in clear and excellent language except A5 and A7." (Interview 9)

"It is very clear and easy to complete. The language of items is simple except A5 and A7." (Interview 10)

"The language of the questionnaire is excellent and clear item." (Interview 11)

Although, the above examples showed that the majority of the items were clear it was observed that a number of items were not clear enough such as A5-A7-A14-A15-B4-F3-F11, as the following comments indicated:

Item A5: Staff in this unit work longer hours than is best for patient care. The participant commented:

"It seems difficult to understand because (than is best) confuses me, do you mean good or it is not good for patient care." (Interview 5)

"Generally the questionnaire was very clear and the items were easy to understand except item A5 sort of complexity." (Interview 3)

"It is not clear because of (than is)." (Interview 7)

Similarly, other participants stated:

"I do not know the meaning exactly because of (than is) so it is difficult I read it 3 times." (Interview 9)
"It is not clear item because of (than is)." (Interview 10)

Item A7: We use more agency/temporary staff than is best for patient care. Similarly, the participants commented:

"Also this item was not clear enough because of (agency and than is best), these words make the question difficult to understand, here we just use temporary staff I do not know what do you mean by agency."(Interview 5)

"It is not clear and difficult to understand because of (than is) and we do not use agency here" (Interview 7).

"Also than is not clear it is difficult." (Interview 9)

"It is not clear because of (than is)." (Interview 10)

Item A14: We work in "crisis mode" trying to do too much, too quickly. The respondent stated:

"Do you mean doing many things quickly, to be onset it is difficult to understand because of (crisis mode)." (Interview five)

Item A15: Patient safety is never sacrificed to get more work done. The participants stated:

"I think this item is clear in general but I would wonder about the word sacrificed? So maybe it needs change." (Interview 6)

"It is difficult to understand the item because of (sacrificed)" (Interview 12).

Item B4: My supervisor/manager overlooks patient safety problems that happen over and over. The participants commented:

"I do not know the meaning of (overlook) here exactly, do you mean ignore." (Interview 10)

"No comments. But it is better to change overlook (ignore)." (Interview 3)

"Overlook carry two meaning, it should be changed." (Interview 7)

Item F3: Things "fall between the cracks" when transferring patients from one unit to another. The participants stated:

"It is easy but the (fall between the cracks) I do not know, if is it easy to understand to the staff or not so it should be checked." (Interview 6)

"I do not understand the meaning of fall between the cracks so it was no meaning." (Interview 5)

Item F11: Shift changes are problematic for patients in this hospital. The participant stated:

"It needs more clarification because of problematic." (Interview 7)

Item H1: What is your staff position? The participants commented:

"If you mean my current position so it should be changed to what is your current position? This is easy and direct question because your staff position could be meant my colleague position." (Interview 7)

"Your staff position means the staff work with you, it is difficult to understand so I think it should be your current position." (Interview 9)

"Use current position instead of staff position." (Interview 10)

Similarly, item H8: In your staff position, do you typically have direct contact with patients? The participant stated:

"What do you mean by staff position? Is it my position or my colleague position?" (Interview 7)

Thus it was decided that, items number A5-A7-A14-A15-B4-F3-F11-H1-H8 should be reworded to make them clearer and easier to understand.

Some inconsistencies in the wording of the questionnaire were highlighted, for example, item A1 and A4 use the term people while other items use such as A8, A16 and C6 the term staff. Participants agreed that it would be better to use one term instead of two terms, as the following participants stated:

"Use staff instead of people." (Interview 1)

"Staff instead of people in terms of consistency." (Interview 4)

"Use one term for consistency staff instead of people." (Interview 7)

As a result of this, it was decided to change the word people to staff in items A1 and A4.

Scale:

An important issue highlighted by the participants was the scale used in the questionnaire. The 5-point Likert scale that reads: (Strongly disagree -Disagree -Neither- Agree- Strongly agree-). The perception of most participants was that the scale of the questionnaire was good, as the following examples indicated:

> "It is clear and I can select my answer." (Interview 4)
>
> "The scale used in this questionnaire was good." (Interview 10)

In general, it was observed that the most of the respondents had no difficulty linking their answer with this scale. Furthermore, it was observed that most of the respondents read the items of the HSOPSC questionnaire only one time before linking their answers with the scale. This indicates the clarity of the items and the scale was easy to use.

Positive and negative items:

It is worth noting that several respondents understood the negative items and could differentiate between the positive and negative items, as the following examples indicated:

Item B1: My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures.

> "I think the meaning of this item is positive and good attitude of the supervisors, really it is good to feel satisfy and somebody has recognised good job." (Interview 3)

Item B2: My supervisor/manager seriously considers staff suggestions for improving patient safety.

> "This item means take suggestion of staff in positive way." (Interview 3)

On the other hand, in the case of the negative items, for example:

Item B3: Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts

> "This indicate to negative things because they do not care, just ask me to shortcut to do a job." (Interview three)

Item B4: My supervisor/manager overlooks patient safety problems that happen over and over

> "We aware there is a problem but they do not mange it in satisfactory way to avoid happening a problem. It is clear that means they pay no attention to problems that happen. This affects patient safety negatively." (Interview 3)

Item A5: Staff in this unit work longer hours than is best for patient care. The participant commented:

> "It is not good for patient safety because it means we work more than regular hours which affect patient safety negatively." (Interview 8)

It was clear that the negative items were recognised by the respondents without any difficulty. Therefore, it was decided that there was no need to direct participants' attention towards negative items by using a mark such as underlining. In general, the participants distinguished between positive and negative items.

General comments on the Hospital Survey on Patient Safety Culture:

Table 4-13 shows the general comments of the respondents about the HSOPSC questionnaire.

Table 4- 13 General comments of the respondents about HSOPSC

Interview No	General comments
1	The questionnaire is clear and easy to understand except items A5 and A7. Use 'staff' instead of 'people'. Use same term either 'mistakes' or 'errors'.
2	The majority of the items are simple and short. Generally it is clear and all the items are understandable.
3	The questionnaire is very clear. Item number A5 is complex in terms of clarity and understanding. Generally, all items are easy to understand.
4	The questionnaire is clear but a few items are ambiguous should be changed. Use what is your position instead of what is your staff position?. The scale of the questionnaire is good.
5	Some items were not clear. The majority of the items were easy to understand.
6	It is clear. Most of the terms used were related to patient safety, medical errors and reporting. Time for completion is fair. It is easy to understand the key word of each item therefore; you can get the idea of each item quickly.
7	Most of the items were clear and self explanatory. There were few confusing items that might carry more than one meaning such as A5, A7, F11, and B4. Use one term for consistency such as staff or people. Use that instead of like in item number A8. Use current position instead of staff position.
8	It is very clear and easy to understand.
9	It is clear and excellent language except A5-A7.
10	It is very clear and easy to complete. The language of items is simple except two (A-A7). Use current position instead of staff position. The scale of the questionnaire is good.
11	The language of the questionnaire is excellent. Easy format. Clear items.
12	In general it is clear. Use one style of instruction in all sections. Clarity of language is good.

In summary, the language of the HSOPSC questionnaire was found to be simple and understandable. The meaning of the words was found to be clear and direct and the structure of the sentences simple. The items were easy to understand. However, A5-A7-A14-A15-B4-F3-F11-H1-H8 needed rewording and more clarification. The participants found the scale in the questionnaire easy to use. The positive and negative items were clear and the participants were able to distinguish between them. Generally, the HSOPSC is clear and easy to understand and complete. The next section reports the interview findings of the Teamwork and Safety Climate Survey.

4.3.10 Results of the face validity testing of the Teamwork and Safety Climate Survey

Instructions:

It was observed that the participants found the instructions in the questionnaire were not clear enough, as the following participants commented:

> "Instructions were not clear on the first page because using (with respect to your specific unit or clinical units), I am working in many different units not in specific unit. This cause confused." (Interview 11)

> "I think the instructions of the questionnaire were very short and it needs more clarification but still acceptable." (Interview 12)

The wording of the questionnaire and the clarity of the items:

The total number of items in the Teamwork and Safety Climate Survey is 35 including background items. Table 4-14 shows how clear and easily understood the items in the Teamwork and Safety Climate Survey were.

Table 4- 14 Clarity and understanding of Teamwork and Safety Climate Survey

Interview No.	Clarity of items		Understanding of items		Items
	Number of Yes answers.	Number of No answers.	Number of easy items	Number of difficult items.	
1	30	5 (14.3%)	30	5 (14.3%)	5-11-12-24-25
2	31	4 (11.4%)	31	4 (11.4%)	11-18-24-25
3	32	3 (8.6%)	32	3 (8.6%)	1-15-25
4	32	3 (8.6%)	32	3 (8.6%)	1-5-25
5	29	6 (17.1%)	29	6 (17.1%)	5-11-12-18-24-25
6	34	1 (2.9%)	34	1 (2.9%)	11
7	33	2 (5.7%)	33	2 (5.7%)	11-15
8	35	0	35	0	-
9	32	3 (8.6%)	32	3 (8.6%)	11-15-24
10	34	1 (2.9%)	34	1 (2.9%)	24
11	35	0	35	0	-
12	33	2 (5.7%)	33	2 (5.7%)	1-11-15

The participants agreed that eight items were not clear and were difficult to understand. There was a wide range of views from the respondents as to which items were ambiguous and difficult to understand, which makes the decision to make changes extremely difficult.

The number of items that were not clear was eight of 27 items which means large number of the items of Teamwork and Safety Climate were somewhat ambiguous as far as the participants were concerned. Table 4-15 shows these items and how many respondents found them unclear and difficult.

Table 4- 15 Number of participants identifying unclear items

Item No	Number of participants
1: Nurse input is well received in this clinical area	3
5: Disagreement in this clinical area resolved appropriately (i.e. not who is right, but what is best for the patient)	3
11: Briefings personnel before the start of a shift (i.e. to plan for possible contingencies) is important for patient safety	7
12: Briefings are common in this clinical area	2
15: The levels of staffing in this clinical area are sufficient to handle the number of patients	4
18: Personnel frequently disregard rules or guidelines (e.g. hand wash, treatment protocols/clinical pathways, sterile field, etc) that are established for this clinical area	2
24: Hospital management does not knowingly compromise the safety of patients	5
25: This situation is doing more for patient safety now, than it did one year ago	5

There was agreement that items number 1, 5, 11, 12, 15, 18, 24, and 25 are ambiguous and difficult to understand. It was observed that the participants found some of the items of the questionnaire clear and easy to understand while they found others ambiguous and difficult to understand, as the following participants indicated:

"Generally it is ok but there is some editing will assist future respondents to answer the questions more accurately such as using words with specified meaning rather than using comprehensive words such as input in item 1, levels of staffing in item 15 and institution in item 25, also there are number of long sentences so I read most of items more than once because of these comprehensive words." (Interview 3)

"It is clear and easy to understand but some items need to read more than one time to understand." (Interview 8)

"Some items were not to clear to me and also there are too long items so it is not clear such as item 11-18-24-25." (Interview 2)

"Items 24 it is difficult to understand because (knowingly compromise). The word (institution) in item 25, this word more general should be used healthcare organisation or hospital. The word briefings in items 11 and 12, it was not specified because we use endorsement instead of briefings. Using i.e. in items 11-5 makes these items unclear such as the word (contingencies) in item 11 it was not clear to me." (Interview 1)

Similarly, some items used abbreviation such as (i.e.) were not easy to understand, as the participants stated:

"Items with i.e.in brackets are not easy to understand such as item 5. It is difficult to understand item 11 because (i.e.to plan for possible contingences)" (Interview 5)

"I.e. makes some items not clear, I get confused because of i.e." (Interview 7)

Some participants found words that have wider more general meaning which confusing and other words are ambiguous, as the following examples indicated:

"I think you have to write organisation or hospital instead of institution in item 25. Endorsement instead of briefings because briefings could be carried for many meanings, in general, some words were too comprehensive in meaning such as nurses input in item1, levels of staff in item 15, institution in item 25." (Interview 5)

"What do you mean by levels of staffing in item 15? I think this could be mean number of staff." (Interview 5)

"Knowingly compromise makes item 24 not clear and difficult to understand the meaning of this item so I am unable to answer it." (Interview 5)

"I do not understand item 24 and what the purpose of this item is." (Interview 10)

"It is difficult to understand item 24, I think this item need reworded because of (Knowingly compromise)." (Interview 9)

"Some items were too long such as 5-11-18 this make understanding too difficult. Some items included ambiguous words such as input, contingences, briefings and knowingly compromise." (Interview 5)

"The word contingences were not clear in item 11." (Interview 7)

"The item 11 is clear but the word contingences was not clear and it is difficult to understand its meaning exactly." (Interview 9)
"I have to read most of the questions twice to be clear." (Interview 4)

"Some items are little long, the content of the most items is more comprehensive, most of items need reading twice to understand and to connect with suitable answer in the scale. Several items are not clear without i.e. and examples." (Interview 6)

Scale:

As mentioned earlier the scale used in the questionnaire was an important issue. The questionnaire used a 6-point Likert scale (Disagree Strongly-Disagree Slightly-Neutral-Agree Slightly-Agree Strongly-Not Applicable). The participants experienced significant difficulty linking their answers to this scale, as the following comments indicated:

> "I am not comfortable with that scale, because more chances (six answers), need more concentration and focus, do I have disagreement or do I have agreement, so this scale put you off balance in answering the questions, so I need go back to read the question again which takes long time to read and understand the questions. What is the difference between disagree and slightly disagree, if I am just disagree what can I select, this scale confused me so the chance of just disagree is lost." (Interview 6)
>
> "The scale used is not easy to use and not comfortable and not clear to express your agreement." (Interview 10)
>
> "It is clear and appropriate length but the scale is not good." (Interview 11)

Similarly, another participant noted that the scale was not appropriate:

> "The scale is not appropriate use the previous one because I want just agree, which one should I select, in this questionnaire it is difficult to answer many questions because many ambiguous questions in this questionnaire and because of the scale." (Interview 4)

A major concern was related to understanding their preferences between 5-point and 6-point Likert scales. It was very clear that the respondents did not express a preference for the 6-point Likert scale. A reason for this because strongly and slightly to agree prevented the participants from expressing their feeling correctly, hence they spent more reading the items of the Teamwork and Safety Climate Survey and debating over their responses. Also there was no option to simply agree or disagree. Furthermore, because of the addition of a sixth possibility the participant may not have understood under what circumstances not applicable should be used.

It was noted that many items carrying different meanings and could be interpreted in different ways for example:

> "What do you mean by institution in items 25." (Interview 4)

> "It was quite difficult to understand some items because of the wording of the questionnaire such as the words contingencies in item11 and levels in item 15. It is short questionnaire." (Interview 7)

> "It is clear and short questionnaire. Ambiguous words such as contingencies in item 11."(Interview 9)

General comments of the Teamwork and Safety Climate Survey:

Table 4-16 shows the general comments of the respondents about the Teamwork and Safety Climate Survey.

Table 4- 16 General comments of the respondents about Teamwork and Safety Climate Survey

Interview No	General comments
1	The questionnaire is clear except some items. Some items needed further explanation, hence the use of i.e.in brackets. Some items were not direct to the point.
2	Generally the questionnaire is clear.
3	Generally, the questionnaire is ok but some editing would assist future respondents to answer the questions more accurately. Some words were too comprehensive in meaning such as situation (item 25), levels of staffing (item 15), nurses input (item 1).
4	The scale used is not appropriate so the questions were difficult to answer. Ambiguous items because of difficult word used such as contingencies, knowingly compromise.
5	Some items were too long, this makes understanding too difficult. Some items included ambiguous words such as levels of staff, contingences and briefing. Items with i.e. in brackets are not easy to understand.
6	You need to think more before answering the questions. The items themselves were more comprehensive. The two items use i.e.in bracket that means is not easy to understand then need more concentration and focus and therefore, reading many times. The scale used is less user friendly as it is likely to make respondent confused.
7	Generally, it was clear except some items. It is short questionnaire.
8	It is clear questionnaire but some items need to be read many times to be understood.
9	It is clear and short questionnaire.
10	It is clear to some extent. Scale used is not comfortable and not clear to express your agreement. Current position instead of staff position.
11	It is very clear and easy to understanding. Appropriate length. Instructions were not clear on the first page. Scale was different (duration) in item 31 and 32.
12	It is clear. Duration was different in items 31 and 32 need for consistency.

In summary, it was clear that the participants found the language in the Teamwork and Safety Climate Survey more complex at times than the HSOPSC, such as in items 1-5-11-12-15-18-24-25, in which non-specific words, for example "institution"', ambiguous words, for example "contingencies"; and words with different meanings, for example, "input" were used. Therefore, the wording of the questionnaire needs clarification to be clear and easy for participants to understand. Participants found the scale used in the questionnaire difficult to apply. All these points are considered as disadvantage of this questionnaire especially in multi-cultural settings such as Saudi hospitals that contains staff from Saudi and other different nationalities. Therefore, simplifying the language of a questionnaire is an important consideration.

4.3.11 Results of the comparison of the two patient safety climate questionnaires

In this comparison, it is not just the number of clear and easy to understand answers that will be taken into consideration but also the degree of clarity and difficulty of items based on the participants' comments above. Table 4-17 show the comparison of the questionnaires.

Table 4- 17 Comparison of the questionnaires (12 interviews)

Patient safety climate questionnaires	Clarity of items		
	Number of clear and easy to understand items.	Number of not clear and difficult to understand items	Total of the items
The first interview			
HSOPSC	52	2 [A5-A7]	54
Teamwork and Safety Climate Survey	30	5 [5-11-12-24-25]	35
The second interview			
HSOPSC	54	0	54
Teamwork and Safety Climate Survey	31	4 [11-18-24-25]	35
The third interview			
HSOPSC	52	2 [A5-B4]	54
Teamwork and Safety Climate Survey	32	3 [1-15-25]	35
The fourth interview			
HSOPSC	53	1.[A5]	54
Teamwork and Safety Climate Survey	32	3 [1-5-25]	35
The fifth interview			
HSOPSC	50	4 [A5-A7-A14-F3]	54
Teamwork and Safety Climate Survey	29	6 [5-11-12-18-24-25]	35
The sixth interview			
HSOPSC	52	2 [A15-F3]	54
Teamwork and Safety Climate Survey	34	1 [11]	35
The seventh interview			
HSOPSC	48	6 [A5-A7-B4-F11-H1-H8]	54
Teamwork and Safety Climate Survey	33	2 [11-15]	35

The eighth interview			
HSOPSC	54	0	54
Teamwork and Safety Climate Survey	35	0	35
The ninth interview			
HSOPSC	52	2 [A5-A7]	54
Teamwork and Safety Climate Survey	32	3 [11-15-24]	35
The tenth interview			
HSOPSC	50	4 [A5-A7-B4-H1]	54
Teamwork and Safety Climate Survey	34	1 [24]	35
The eleventh interview			
HSOPSC	54	0	54
Teamwork and Safety Climate Survey	35	0	35
The twelfth interview			
HSOPSC	52	2 [A5-A7-]	54
Teamwork and Safety Climate Survey	32	3 [1-11-15]	35

Table 4-18 shows the comparison of the questionnaires in terms of clarity of items based on number of no answers (unclear and difficult to understand).

Table 4- 18 Comparison of the questionnaires in terms of clarity (n=12)

Interview No	Number of NO answers(unclear and difficult to understand)		Result (based on questionnaire with lowest number of NO answers).
	HSOPSC	Teamwork and Safety Climate	
1	2	5	HSOPSC
2	0	4	HSOPSC
3	2	3	HSOPSC
4	1	3	HSOPSC
5	4	6	HSOPSC
6	2	1	Teamwork and Safety Climate
7	6	2	Teamwork and Safety Climate
8	0	0	Both
9	2	3	HSOPSC
10	4	1	Teamwork and Safety Climate
11	0	0	Both.
12	2	3	HSOPSC

Seven out of twelve respondents agreed that the HSOPSC questionnaire was clearer than the Teamwork and Safety Climate questionnaire, while only three respondents agreed that the Teamwork and Safety Climate was clearer. Two respondents agreed that the both tools were clear. It was observed that the majority of the respondents read and completed the HSOPSC questionnaire easily and smoothly whilst the majority of the participants had to read Teamwork and Safety Climate questionnaire many times before completing the items. Table 4-19 summarises the advantages and disadvantages of the HSOPSC questionnaire and the Teamwork and Safety Climate questionnaire in terms of the clarity of language.

Table 4- 19 Advantages and disadvantages of questionnaires

Questionnaire	Advantages	Disadvantages
HSOPSC	1. Clear instructions 2. Good scale of answer 3. Clear language 4. Short items 5. Straight forward items 6. Easy to understand 7. Items consistency 8. It has open question 9. Easy format.	1. Language of some items was difficult to understand such as items number A5, A7. 2. It used different terms such as people, staff, mistakes and errors. 3. Use short forms like don't. All these could be solved without changing the meaning.
Teamwork and Safety Climate	1. Language clear to some extent 2. Short questionnaire	1. Less friendly user scale. 2. Use of comprehensive words. 3. Use of ambiguous words. 4. Long sentences 5. Need more focus and concentration. 6. Has to be read many times to be clear and understood 7. Complex structure of sentences (not direct)

4.3.12 Decision and changes (making a choice of questionnaire and changes to questionnaire's language and structure)

Two main decisions needed to be made regarding which questionnaire should be selected to use in the study and which items should be changed in the selected questionnaire. The decision was made to use the HSOPSC questionnaire as the most appropriate questionnaire for the study because its language is clear and easy to understand, straightforward items and the scale is easy to use.

In terms of changes to be made, it became apparent that were three possibilities in relation to the items of the HSOPSC questionnaire, could remain unchanged, be revised or be omitted. It is important to mention that the proposed changes were based on the comments and suggestions of participants. These changes were checked with supervisors of the research. Moreover, the changes were checked with one of the authors of the original HSOPSC questionnaire to confirm that the changes would not alter the meaning of the items. The decision was based on the clarity of the items to all participants. Table 4-20 shows the changes made to the number of items of the HSOPSC questionnaire.

Table 4- 20 Changes made on the HSOPSC questionnaire

Item number	Before change	After change
A1	People support one another in this unit	Staff support one another in this unit
A4	In this unit, people treat each other with respect	In this unit, staff treat each other with respect
A5	Staff in this unit work longer hours than is best for patient care	Staff in this unit work longer hours than they should which is not good for patient care.
A7	We use more agency/temporary staff than is best for patient care	We use more temporary staff than we should which is not good for patient care
A14	We work in "crisis mode" trying to do too much, too quickly	We work in a hurry, trying to do too much, too quickly
A15	Patient safety is never sacrificed to get more work done	Patient safety never takes second place to get more work done
F3	Things fall between cracks when transferring patient from one unit to another	Some things do not happen or get missed when transferring patients from one unit to another
B4	My supervisor/manger overlooks patient safety problems that happen over and over	My supervisor/manger ignores patient safety problems that happen over and over
F11	Shift changes are problematic for patients in this hospital.	Shift changes cause problems for patients in this hospital
H1	What is your staff position in this hospital? Mark ONE answer that best describes your staff position	What is your current position in this hospital? Mark ONE answer that best describes your staff position
H8	In your staff position, do you typically have direct interaction or contact with patients?	In your current position, do you typically have direct interaction or contact with patients?

In conclusion, the HSOPSC questionnaire has been selected for use in the study. This questionnaire includes 12 dimensions of patient safety culture divided into nine sections and including a background information section. The questionnaire consists of five pages in addition to the covering letter. There were many changes in section H (background information) which included as follows: three questions (question number two, three and four) about gender (Male or Female), nationality (Saudi or non Saudi) and educational levels of respondents were added to this section. These questions are important to describe the characteristics of respondents in the study. In question number one, the other staff positions were omitted, except doctor and nurse positions, because the target population of the study was doctors and nurses. The changes were made to the HSOPSC items that were mentioned in table 4-20 (see appendix 22 for a copy of the Hospital Survey on Patient Safety Culture questionnaire). The workforce of the three hospitals consists of Saudi and non-Saudi staff. The common language in the three hospitals is English. Therefore, the language of the HSOPSC questionnaire is English. Table 4-21 provides the patient safety culture dimensions of the HSOPSC questionnaire.

Table 4- 21 Patient safety culture dimensions of the HSOPSC questionnaire

Patient safety culture dimension [items]	Definition	Number of items
Communication openness [C2-C4-C6]	Staff will freely speak up if they see something that may negatively affect patient care, and feel free to question those with more authority	3
Feedback and communication about error[C1-C3-C5]	Staff are informed about errors that happen, given feedback about changes put into place based on event reports, and discuss ways to prevent errors	3
Frequency of events reported [D1-D2-D3]	Mistakes of the following types are reported: 1) mistakes caught and corrected before affecting the patient, 2) mistakes with no potential to harm the patient, 3) and 3) mistakes that could harm the patient, but do not	3
Handoffs & transitions [F3-F5-F7-F11]	Important patient care information is transferred across hospital units and during shift changes	4
Management support for patient safety [F1-F8-F9]	Hospital management provides a work climate that promotes patient safety and shows that patient safety is a top priority	3
No punitive response to error [A8-A12-A16]	Staff feel that their mistakes are not held against them, and mistakes are not kept in their personnel file	3
Organizational learning-Continuous improvement [A6-A9-A13]	Mistakes have led to positive changes and changes are evaluated for their effectiveness	3
Overall perceptions of patient safety [A15-A18-A10-A17]	Procedures and systems are good at preventing errors and there is a lack of patient safety problems	4
Staffing [A2-A5-A7-A14]	There are enough staff to handle the workload and work hours are appropriate to provide the best care for patients	4
Supervisor/manager expectations and actions promoting safety [B1-B2-B3-B4]	Supervisors/managers consider staff suggestions for improving patient safety, praise staff for following patient safety procedures, and do not overlook patient safety problems	4
Teamwork across units [F2-F4-F6-F10]	Hospital units cooperate and coordinate with one another to provide the best care for patients	4
Teamwork within units [A1-A3-A4-A11]	Staff support one another, treat each other with respect, and work together as a team	4

Summary

The participants understanding of the patient safety climate questionnaires were varied because of the way that they were written. Some participants understood the items in a certain way while others did not understand them at all. Therefore, an initial assessment is very important before full application of any patient safety culture tool is used in different contexts because of language and cultural variations.

The interviews revealed variation of English language skills amongst participants. Therefore, it is very important to ensure using clear language, simple and clear words, simple structure of the sentences and simple and clear scale. The simple and clear items could be answered by all participants regardless of their level of English. Therefore, changes should be made to make all the items easy for all participants to understand.

In terms of the language of the two questionnaires, the participants perceived that the language and wording of the HSOPSC questionnaire was clearer than the Teamwork and Safety Climate questionnaire. The respondents indicated that they understood the HSOPSC questionnaire better than the Teamwork and Safety Climate Survey because the language of the HSOPSC is simpler and the sentences are shorter and more straightforward than those of the Teamwork and Safety Climate Survey. The HSOPSC questionnaire is the most appropriate patient safety climate questionnaire to use for the study.

4.4 Overall summary

The first stage of the process of choosing an appropriate patient safety culture questionnaire for use in the study identified two questionnaires (the HSOPSC and the Safety Climate Survey). The next stage entailed an assessment of the face validity of the two questionnaires. The results of the comparison between these two questionnaires showed that the HSOPSC questionnaire (Sorra and Nieva, 2004) was the most suitable patient safety climate questionnaire for the current study. In the next chapter, the process of data collection by using the HSOPSC questionnaire will be described.

Chapter Five: Data collection: Using the Hospital Survey on Patient Safety Culture questionnaire

5.1 Introduction

In this part of study the amended HSOPSC questionnaire was used to obtain the data for further validity assessment. The current chapter aims to describe the process of data collection using the HSOPSC to collect the questionnaire data from three hospitals in Saudi Arabia. This chapter is divided into seven sections. In section 5.2 describes the study settings. Section 5.3 concerns the study population. Section 5.4 addresses the sample size of the study. Section 5.5 describes the distribution and collection of the HSOPSC questionnaires. Section 5.6 describes the data management process and section 5.7 provides the summary of the chapter.

5.2 Study setting

The location of the study was in Riyadh, Saudi Arabia. The HSOPSC questionnaire was administered at three hospitals in Riyadh from June to October 2009. Three separate hospitals in Riyadh city, which has the largest number of hospitals in Saudi Arabia, have been selected for the purpose of this study:

1. King Fahad National Guard Hospital (KFNGH) at King Abdul-Aziz Medical City
2. King Fahad Medical City (KFMC)
3. King Faisal Specialist Hospital and Research Centre (KFSH&RC)

These hospitals represent different types of the government providers in the Saudi health care system. These hospitals have been chosen for this study because they are the largest and most modern hospitals. Bed capacity is large with a large number of staff especially physicians and nurses, therefore, the three hospitals would provide sufficient potential respondents for the present study.

In addition, those hospitals have expertise and experiences in communicating with international healthcare organisations. Moreover, the three hospitals are accredited by the Joint Commission on Accreditation of Healthcare Organisations (JCAHO).

5.3 Population of study

The population of the study consists of physicians and nurses from the three hospitals. The staff in these hospitals are Saudi and non Saudi from a wide range of different nationalities. The common language is English. The study sample was selected from all doctors and nurses in the three selected hospitals.

5.4 Sample size

The HSOPSC questionnaires were distributed to a sample of the doctors and nurses (Saudi and non Saudi) in the three hospitals. The ideal sample would be derived from random sampling, as this technique is relatively simple to apply and to represent the target population of the study but this technique takes a long time to obtain the required number of questionnaires. Therefore, the alternative sample entailed convenience sampling of physicians and nurses at all levels within the three hospitals to achieve the target number of completed questionnaires. This technique is a practical way to increase the return rate in a short time because it depends on readily available physicians and nurses in the three selected hospitals (Fink, 2003). There are several factors to take into consideration to estimate sample size of the study in order to determine the number of questionnaires should be distributed. The first factor is the minimum number of completed questionnaires required to obtain enough participants to perform the strategic plan of data analysis.

In general a major concern was to obtain enough participants to perform factor analysis. Therefore, the required number of questionnaires is a minimum of 300 completed questionnaires to satisfactorily undertake factor analysis. It has been argued that a minimum sample size is at least 300 for factor analysis (Guadagnoli and Velicer, 1988). Secondly, anticipated return rate, the expected return rate of this study was 20%. Thirdly, the cost (printing cost of questionnaires) and available resources were taken into account.

The workforce of doctors and nurses in the three selected hospitals is approximately 4630 (Statistics Directorate, 2009) with a target response rate is a minimum 300 completed questionnaires and the expected return rate was 20%. Also, according to Sorra and Nieva (2004) the sample size should be at least double the number of responses that are required. The number of questionnaires distributed was 1700 in the three hospitals.

5.5 Data collection

The data collection process was concerned with the distribution and collection of the HSOPSC questionnaires from three hospitals in Riyadh in Saudi Arabia. The data collection process aimed to collect at least 300 completed questionnaires (target data) for analysis. The study utilized primary data that was collected from doctors and nurses in the three hospitals in order to provide the data for assessment. The data collection was done during daily working hours in the three hospitals to avoid any physical or emotional harm to the patients and the staff.

After getting the final approval and permission from the University of Sheffield (see the copy in appendices 5 and 6), 1700 HSOPSC questionnaires and cover letter as one document were printed in Saudi Arabia. The appearance of the questionnaires contributes to stimulating the respondents to complete them. Therefore, the questionnaires were printed on good quality paper with quality envelopes to motivate the staff to reply. Envelopes were used for maintaining respondents' confidentiality as an important factor for increasing response rate (Bourque and Fielder, 1995).

The printing process took approximately one week. The principal aim of the distribution process was to ensure getting the target number of questionnaires returned. The data collection process was based on distributing as many questionnaires as possible to maximize the return rate in the limited time available in this very important stage of the study. The process was supervised and followed up carefully from the beginning to ensure the flow of distribution and collection of questionnaires was smooth and flexible without any difficulties.

The proposed strategy was based on posters and signs posted in the nurses' stations and doctors' meeting rooms throughout the hospitals to inform them of the survey. The questionnaires were distributed by the researcher in wards and other specialist areas such as out-patient departments during staff breaks. The questionnaires were returned to the boxes located within the hospital or to a designated hospital contact person (primary contact person through the internal mail system in each hospital).

In fact, this method was not effective because it did not work in terms of practicality and nobody had time to track the questionnaires. Moreover, with this strategy it was taking too long to get the data because during the first two weeks just 10 doctors and 25 nurses returned completed questionnaires. Consequently, at that point in time it was considered that there was a need to find a more effective method. Therefore, the questionnaires were distributed in the three hospitals by establishing a data collection plan for each hospital to capture the target data by using different range of methods based on the current situation of each hospital such as the response of hospital management towards the study, the number of staff available, workload, awareness of patient safety and time limitations such as holidays. All these issues were taken into consideration in devising the best data collection plan for each hospital.

5.5.1 King Fahad National Guard hospital at King Abdul-Aziz Medical City

The first hospital to give the ethics approval letter was King Fahad National Guard Hospital (see copy in appendix 8). Once the approval letter was obtained from the hospital's research committee, the planning of distributing the questionnaires was started immediately in order to save time. The new proposed strategy commenced with an introductory week in the hospital in order to gain good support for the data collection and to inform the staff about the research. The introductory week included the meeting with the chairman of research centre of King Abdullah International Medical Research Centre (KARC). The advice was given to submit the proposal and the ethical approval and discuss it with hospital management and medical and nursing directors to seek their help and support for the study by encouraging the staff to complete the questionnaires.

A number of appointments with several medical directors in the hospital such as the director of surgery, medicine and paediatric department were made. In these meetings they read the proposal and ethical approval. The protocol of the study was presented and the outlines of the study were discussed. All of them were interested and very keen to help and support this research because they believe the research was important and useful for the patients and staff and for healthcare as well. Generally, they were interested in this project because they are concerned about patient safety in their departments and wish to improve it. In fact, these meetings were very helpful and they provided generous offers to distribute and collect the questionnaires through sending memos and they asked their secretaries to distribute the questionnaires in the doctors' mail boxes and the head nurses were requested to distribute and collect the questionnaires from their nursing staff during daily shift.

This strong support demonstrates the interest of the hospital management, the medical directors and the nursing directors in looking after patient safety as a very important issue in healthcare. Patient safety is clearly considered to be top priority. Further, this support is recognised as the most important factor for maximizing the return rate of doctors' and nurses' contributions (see appendices 9 and 10 for the copies of their support letters). Consequently, all of them sent internal memos to the staff to ask them to contribute to the study as much as they can. A number of anonymous questionnaires were distributed through medical secretaries in each medical department based on the number of doctors available at that time.

Two weeks were given for doctors to get their responses. The first reminder was issued after two weeks and the final reminder was issued after another two weeks because they are very busy staff and also owing to holidays. It is important to mention that three important strategies were used to improve data collection process.

There was a meeting with the Associate Executive Director of the nursing department related to approaching the nursing staff in the hospital. In this meeting the proposal and ethical approval were provided and the protocol of the study was presented and discussed. The researcher accepted the generous suggestion of the Executive Director of the nursing department of the hospital to distribute the questionnaires to the rest of the departments in the hospital through the head nurses. This support from the director of nursing was helpful in increasing the return rate in this period of time (summer holidays) because during the summer there is a shortage of staff because of holidays. In addition the nurses are very busy in their clinical areas which hinder the communication between the researcher and the nursing staff. The follow up process of distributing and collecting the questionnaires through administrative assistant of nursing services started, approximately one week after the first meeting with director to get the responses of nursing staff in patient areas and clinical areas such as wards and clinics of the hospital (see appendix 9 for the copy of the letter of the Associate Executive Director of the nursing department). Ten days was given for nurses to get their responses. The first reminder was issued after the ten days and the final reminder was issued after two weeks because they are very busy staff.

To ensure the smooth flow of the data collection regular visits were made to doctors' meeting rooms; head nurses offices and medical secretaries in order to remind them about the survey. The main purpose of the follow up process was to emphasise the importance of their response and purpose of the study. A tracking record was used for distributing the questionnaires and handling the returned questionnaires from the medical secretaries and head nurse. The follow up process was continued every day and this tracking also is recognised as an important factor for maximizing the return rate of nurses' contribution. This process lasted more than one month (45 days) to complete. Table 5-1 shows the number of these questionnaires distributed to the medical and nursing staff of the hospital.

Table 5- 1 data collection of KFNGH

Staff	Questionnaires distributed	Questionnaires returned	Return rate
Medical	250	107	42.8%
Nursing	650	440	67%
First reminder	Two weeks for doctors	Ten days for nurses	
Final reminder	Two weeks for doctors	Two weeks	
Duration of time	45 days		
Total	900	547	60%

King Faisal Specialist Hospital and Research Centre (KFSH&RC) was intended to be the second hospital. However, there was a delay in getting the ethical approval because of the establishment of a new research committee there. Therefore, the second hospital was King Fahad Medical City (KFMC) instead of KFHRC.

5.5.2 King Fahad Medical City

The proposal and relevant forms were submitted to the External Research Review Committee, a subcommittee of Institutional Review Board for consideration and approval. The proposal was reviewed by the External Research Review Committee after that the principal investigator (the researcher) was informed that the proposal has approved by the Institutional Review Board of King Fahad Medical City (see the copy in appendix 11). Once the hospital's permission was obtained the introductory week was started immediately. The introductory week included meetings at management level of the hospital in order to gain support in the data collection. First meeting was done with Executive Director of Medical Affairs and Medical Consultant Council of the hospital. The protocol of the study and the ethical approval were presented and the main outlines of the study were discussed. As a result of this meeting internal memo was sent to all medical directors to encourage the doctors to participate in completing the attached questionnaire (see the copy of this letter in appendix 12), which reflects the keenness of the hospital administration to support patient safety and their conviction in this research.

In addition, meetings were conducted with medical directors such as paediatrics and medicine department to seek their support and make this study successful. The overall outcome of these meetings was positive and effective in terms of cooperation and participation in the study.

A further meeting was conducted with the nursing director of the hospital. The protocol of the study and the ethical approval were presented and the main outlines of the study were discussed. There was agreement for help and support to encourage nursing staff to participate in this study. The advice was given that to present the study would be useful for seeking nursing cooperation for conducting this study. Therefore, the main outlines of the study were presented for the target audiences head nurses in the King Fahad Medical City. At workforce level a number of meetings were done with a number of doctors and nurses in the hospital in order to inform the medical and nursing staff of the survey. In each meeting the proposal and ethical approval were provided.

After that, 400 questionnaires were distributed for both doctors and nurses in the hospital based on the discussion with the medical directors and head nurses that this number was reasonable as first distributing to their available staff at that time because of holidays. Two weeks were given for doctors to get their responses. The first reminder was issued after two weeks and the final reminder was issued after another two weeks because they are very busy staff and also owing to holidays. Ten days was given for nurses to get their responses. The first reminder was done through head nurses after ten days and the final reminder after two weeks because they are very busy staff. Table 5-2 shows the number of these questionnaires distributed to the medical and nursing staff of the hospital.

Table 5- 2 Data collection of KFMC

Staff	**Questionnaires distributed**	**Questionnaires returned**	**Return rate**
Medical	150	46	30%
Nursing	250	164	65.6%
First reminder	Two weeks for doctors	Ten days for nurses	
Final reminder	Two weeks for doctors	Two weeks	
Total	400	210	52.5%

At this point in time (three weeks before the start of the holiday there), the proposal of the study had been approved by the new research committee of KFHRC. There were two options either to stay in the second hospital or work in parallel and start the data collection in the third hospital. The decision was made to include the third hospital in the study. Therefore, the data collection was started in the third hospital before the holiday. In this strategy (decision) time was saved to start in the third hospital before the holiday. Moreover, it was aiming to increase the probability of getting large number of respondents from the two hospitals rather than one hospital especially to increase the return rate of doctors responses because they are usually very difficult to recruit them to this type of questionnaire survey. Lastly, that it was worthwhile going to the third hospital (KFSH&RC) because three hospitals improve and enhance the value of the results of the study. According to this strategy 800 questionnaires were distributed in the second (KFMC) and the third hospital, 400 questionnaires for each hospital.

5.5.3 King Faisal Specialist Hospital and Research Centre

The King Faisal Specialist Hospital and Research Centre (KFSH&RC) was the third hospital of this study. According to the KFSH&RC guidelines and instructions for submission of research proposals, the researcher must have successfully completed the National Institute of Health (NIH) Web based training course "Protecting Human Research Participants" which was done on 22/3/2009. Then the principal investigator was identified. Subsequently, the research proposal format and the application form were completed. The principal investigator submitted the proposal with all relevant forms to the Office of Research Affairs (ORA). This office screened the proposal for compliance with submission guidelines, then forwarded it for peer review and sent it to the appropriate research committee for evaluation. The final decision was the study has approved by Research Advisory Council (RAC) (see the copy of ethical approval in appendices 13 and 14).

The introductory week was started by making appointments with the principle investigator in the hospital and the Deputy Executive Director of Nursing Affairs of the hospital. In that week the proposal and ethical approval were provided to the directors of medical departments such as surgery, medicine and paediatric to give them chance to read it before the meetings. All of them were interested and very keen to help and support the research because they believe the research was important and useful for patients. The principal investigator coordinated the process of data collection in Family Medicine and Polyclinic, Surgery, Medicine and Paediatrics. A number of questionnaires were distributed in each department based on available number of doctors working in each department.

There was a meeting with the Deputy Executive Director of Nursing Affairs of the hospital. In this meeting the proposal and ethical approval were provided and the protocol of the study was presented and discussed. As a result of this meeting internal memo was send to all head nurses to encourage the nurses to contribute in completing the questionnaire as important study for patient safety as much as they can(see the copy of this letter in appendix 15). Also there was a meeting with the Senior Clinical Research Coordinator of King Faisal Heart Institute. There was support for data collection by sending covering letter with the questionnaires to encourage doctors to participate in the study. In this way 400 questionnaires were distributed in different medical departments and clinical areas and patient areas such as wards and clinics. To ensure the smooth flow of the data collection regular visits were made with the principal investigator; head nurses and Senior Clinical Research Coordinator in order to remind them about the survey.

Two weeks were given for doctors to get their responses. The first reminder was issued after two weeks and the final reminder was issued after another two weeks through the communication between principal investigator and medical secretaries. Ten days was allowed for nurses to get their responses. The first reminder was done through head nurses after ten days and the final reminder after another two weeks because they are very busy staff. All returned data collected from the medical secretaries, head nurse and the Senior Clinical Research Coordinator. The time required to complete data collection was approximately (six months). Therefore, at that point of time in the beginning of October 2009 this process was completed. Table 5-3 shows the number of these questionnaires was distributed to medical and nursing staff of the hospital.

Table 5- 3 Data collection of the KFSH&RC

KFSH&RC			
Staff	Distributed questionnaires	Returned questionnaires	Return rate
Medical	150	40	26%
Nursing	250	116	46%
First reminder	Two weeks for doctors	Ten days for nurses	
Final reminder	Two weeks for doctors	Two weeks	
Total	400	156	39%

In summary, 1700 questionnaires and cover letter were distributed as one document. Different methods were used in each hospital to approach potential respondents and these methods produced 913 returned questionnaires from the three hospitals in Riyadh in Saudi Arabia which was very successful data collection as a good number of the questionnaires for data analysis. The data collection process was based on the following main principles:

1. The data collection started by submitting the study proposal and hospital's requirements for getting the ethical approval.
2. Making a data collection plan for each hospital in order to save time.
3. Using different methods of gathering the data to achieve the minimum target data for each hospital.
4. Approximately two weeks were given for doctors and nurses to return questionnaires because staff differ in terms of time they need to complete the questionnaires which might be completed at one sittings or over two sittings or may they completed at home because they are busy staff with patients (Bourque and Fielder, 1995).
5. Follow up and assessment of the progress of the data collection.
6. There was no need to redistribute the questionnaires because a large number of questionnaires were returned.
7. At the end of the data collection process all the people who provided support to get this data were thanked for their helps and support, such as medical and nursing directors, principal investigator, head nurses and medical secretaries in all three hospitals.

The data collection included the following activities to maximize return rate:

1. An introductory week was done in each hospital before distributing the questionnaires included a number of meetings at both management level and workforce level, this week was very helpful and supportive in terms of informing the medical and nursing staff of survey and to make plan for data collection.
2. The meetings were held with medical director and nursing directors in each hospital to seek support and facilitate the data collection process.
3. A number of presentations were given in order to inform staff of the outlines of the study.
4. A number of meetings with doctors and nurses in nurses' stations and doctors meeting rooms at each hospital were held to inform them of the survey.
5. The questionnaires were returned to the head nurses and medical secretaries in wards, clinics and other specialist areas such as medical centres in the hospitals. The questionnaire and cover letter were handed to the participants to be completed. The cover letter explained the purpose of this study. The cover letter also assured the participants that the questionnaires were totally anonymous. In addition how to return the questionnaires was also stated in the cover letter clearly.
6. Working every day in the hospital and following up the progress by regularly visiting the doctors and head nurses in order to motivate them to reply is considered very important factor in increasing the response rate (Bourque and Fielder, 1995).
7. The strategy of data collection was changed many times and depends on the situation in each hospital.
8. Doctors and nurses were motivated to complete the questionnaires because patient safety is an important issue and one of the main responsibilities of their job and because they believe that they are responsible for the safety of patients in their hospitals therefore they were very keen to contribute and complete the questionnaire.
9. Handling the return questionnaires was based on collecting the returned questionnaires from the head nurses and the medical secretaries in all three hospitals as a reception point for the returned questionnaires.

In short, all these activities helped to approach potential participants for the study. There were number of factors that increased the response rate. Firstly, there were factors related to the subject of the study, because assessment of patient safety culture is a very important element for improving patient safety in hospitals.

Furthermore, the study protocol was carried out carefully to achieve this good data return. Secondly, factors related to the questionnaire, included the simple and clear language of the questionnaire and easy questionnaire formats and structures to make it easy for respondents to complete. Finally, factors related to the practicality of the gathering the data such as using different effective methods of data collection. All returned questionnaires (913) were kept in a secure location for confidentiality during all stages of the data collection in Saudi Arabia as well as in the university. The returned questionnaires were brought to the UK to start data management and cleaning before performing data analysis.

5.6 Data management

5.6.1 Introduction

Reviewing and cleaning of the data was conducted to make it ready for entry into SPSS for analysis. In this stage of the research each questionnaire was examined for completeness, to make sure that the respondents had completed the questionnaires properly prior to coding and entering the data into an electronic data file using statistical software (SPSS).

The data management process is concerned with preparing, entering and editing the questionnaire responses from the returned questionnaires. The data management aims to prepare a clean data file for analysis. The process started with revision, checking and cleaning of the returned questionnaires to make them ready for entry into the data file in order to perform the analysis. The statistical packages SPSS version 16.0 and STATA V.8 were used for data processing and analysis. At this stage identifying complete and incomplete questionnaires is very important in calculating the return rate of the study.

5.6.2 Data Preparation

Data management was started with sorting the returned questionnaires in terms of completed and incomplete questionnaires. Thus each questionnaire was thoroughly reviewed to check whether it was completed or not. Among 1700 questionnaires that were administered at three hospitals, there were 862 completed questionnaires with a return rate of 50.7% and 51 incomplete questionnaires. At this level the completed questionnaires (862) were sufficient to perform the analysis according to the statistical requirements (Guadagnoli and Velicer, 1988) and therefore the incomplete questionnaires were excluded from the data entry in this stage. The incomplete questionnaires were examined later in order to know which items were not completed and the reasons for incompleteness. The completed questionnaires were provided with serial numbers, started from number 1 to number 862. This numbering helped in data entry and also facilitated tracking and queries during different stages of data management; it was also useful for the questionnaires' archiving and sorting. Each questionnaire was addressed by the name of the hospital where it was completed, work area and the current position of the respondent in order to enable the researcher to identify participants by this information during data entry.

5.6.3 Data entry

The variables of the HSOPSC questionnaire were clearly numbered and defined in the SPSS data file before entering the data. This stage consisted of two steps. The first step was coding and defining the variables' numeric values in the "Variable view" in SPSS. The second step was entering data into SPSS. The data entry step was started with variables definition by identifying the variables of the HSOPSC questionnaire which includes the number of the variable, variable label, type and measurement. The variables were classified into background variables (11 variables) and patient safety culture variables (44 variables). The first set of variables provides information about the respondents' identity and background characteristics (Demographic items include: A-H1-H2-H3-H4-H5-H6-H7-H8-H9-H10). The second set of variables includes the variables of patient safety culture (44 variables) (Non demographic items include A1-A2-A3-A4-A5-A6-A7-A8-A9-A10-A11-A12-A13-A14-A15-A16-A17-A18-B1-B2-B3-B4-C1-C2-C3-C4-C5-C6-D1-D2-D3-E-F1-F2-F3-F4-F5-F6-F7-F8-F9-F10-F11-G). The total coding of the variables is 55 data variables plus the ID of questionnaire (see appendices 17 and 18).

The second step in this stage was entering data into SPSS (through data view). With the variables defined, data entry started according to the serial number sequence of the questionnaires from number one to number 862. During the data entry each questionnaire was subject to double check and matching with its value label in order to ensure the precision of the data entry and to minimize the probability of data entry errors. This process was continued up to the end of the data entry. The data entry record was used to write comments during data entry e.g. record of latest entry every day, poor handwriting, etc. It is worth to mentioning that the data was entered in reasonable blocks of time (approximately 20 questionnaires each time) to minimize data entry mistakes due to fatigue and tiredness rather than entering it in one large period of time.

5.6.4 Data editing (validation and checking)

This stage was intended to check and validate the data by carefully reviewing and screening the entered data in order to identify duplicate cases, to check missing values, and to identify implausible (unlikely) values outside the range. In this stage the following strategy was used:

1. **Identify duplicate cases**

The option of identifying duplicate cases (questionnaires) in SPSS was used to check if there was any duplicate case (sorting cases by serial number). This step identified five duplicate cases. These cases were 166, 334, 600, 674 and 675. Each case was reviewed carefully. Initial data entry error with code for 196 was being wrongly input as 166. Number 334 was entered wrongly with number 344 as 334. Number 600 was entered twice. Number 674 was entered in place of 574. Number 675 was entered instead of number 575. All duplicate cases were sorted out or deleted. Table 5-4 shows the duplicate cases and the action taken to these cases.

Table 5- 4 Duplicate cases

ID	Reason	Action taken
166	196 wrongly input as 166	ID changed to 196
334	344 wrongly input as 334	ID changed to 344
600	Same questionnaire input twice	The second entry was removed
674	Number 674 was entered in place of 574	ID (674) changed to 574
675	Number 675 was entered instead of number 575	ID (675) changed to 575

2. Identify Missing values

The option of identifying missing values in SPSS was used to check if there was any missing value. The frequencies tables show blank records in 34 questionnaires. All these questionnaires were reviewed carefully to double check the data entry of these questionnaires. All were found to be due to errors in the data entry. Therefore all these blank records were completed using the responses from the questionnaires. All the items of each questionnaire above were reviewed and not only specific items. After that the data was checked again and the frequencies tables showed no missing values.

3. Identify implausible values outside the range:

The frequencies tables show number of implausible values outside the range as follows:

Table 5- 5 Outliers

Number of questionnaire	Number of item	Action taken
601	H4	H4 was changed from 6 to 4
606	G-H2-H3	Corrected G=4, H2=2, H3=2
608	H2	H2 was changed from 5to 1
686	A5	A5 was changed from 45to 4
710	A17	A17 was Changed from 15to 4

All the above questionnaires were checked and all the outliers were corrected. Generally, in this stage 39 questionnaires were reviewed carefully in order to clean the data continuously. Errors could happen at any stage of entering the data from the HSOSPC questionnaires into SPSS, therefore ensuring the accuracy of data entry is very important to achieve the best quality of data to obtain a realistic analysis. Double entry of data is recommended as a method for validating the accuracy of the data entry and an effective method for reducing data entry errors (Day, 1998).

5.6.5 Double entry

In order to have complete confidence in the final data set, 15% double random check entry was done as follows:

1. 15% of the cases were randomly selected (130 cases) entitled DF1A1 (original file)
2. The new file was created including 130 cases entitled DF1A2 (re entering data)
3. Re entering the same 130 cases into DF1A2
4. STATA V.8 was used to compare the two files to check entry data errors (see the result of the comparison
5. The values of the two files were compared with the values in the questionnaires to detect the place of error (see the comparison table in appendix 19).

In summary, the comparisons showed that there were 55 data items (ignoring the ID) and 130 cases (55×130), which make 7150 records. There were 51 errors (the number of errors found in the re-entering file (DF1A2) was 33 errors; while in the original file (DF1A2) was 18 errors) in 23 questionnaires in total which is an error proportion of 0.7%. Therefore, double entry was made for the rest (732 questionnaires).

Double entry was done as follows:

1. First data entry file was created containing 732 cases
2. The new file was created including 732 cases entitled double entry data file (DF1A2)
3. Re entering the same 732 cases into DF1A2
4. STATA V.8 was used to compare the two files to check entry data errors.
5. The values of the two files were compared with the values in the questionnaires to detect the place of error (see appendix 20).

In summary, the comparisons showed that there were 55 data variables (ignoring the ID) and 732 cases (questionnaires) (55×732), which make 40260 records. There were 320 mismatches (errors) in 118 questionnaires in total which is an error proportion of 0.8%. The comparison was performed between these errors which showed that the number of errors found in double data entry file was 183 errors; while in the first data entry (original file) was 137 errors in 66 questionnaires. This means, an error proportion of the first data entry original file is 0.34%, less than one per variable. In fact the output of the double data checking from STATA that shows for each variable there is a mismatch is a good example of the value of double entry that was made in the study. This is a good return in terms of accuracy of data entering. All entry data errors that found in first data file entry were corrected in the original file. All the questionnaires were reviewed and checked carefully as a final stage of cleaning data to detect any errors of the data in order to resolve them before starting data analysis.

5.6.6 Incomplete questionnaires

The incomplete questionnaires were checked to clarify whether the respondents faced difficulty with completion in common items or sections or whether it was due to other reasons. Also, the incomplete questionnaires were examined to know whether the demographic information or non demographic information was incomplete. The number of incomplete questionnaires were returned from the three hospitals was 51 (25 from KFNGH, 14 from KFMC and 12 from KFSH&RC). The questionnaires were provided with serial numbers, started from number 1 to number 51 and entered into SPSS. Frequencies tables were used to examine these incomplete questionnaires. These tables showed incomplete item or section in each questionnaire (see appendix 16). Table 5-6 summarises these incomplete questionnaires in five groups.

Table 5- 6 Incomplete questionnaire (n=51)

In complete section or items	Number of returned questionnaires	%
1. Demographic items	16	31.4
2. More than half of demographic items	9	17.6
3. Section B	5	9.8
4. Different sections (D-C-E-F-G)	14	27.5
5. Different items (A3-A4-A7-A17-D2-D3-F6 F7-H4-H5-H8)	7	13.7
Total	51	100%

From the above table the demographic items were incomplete in 16 questionnaires and more than half of demographic items were incomplete in nine questionnaires. Section B was incomplete in five questionnaires. Different sections such as D, C, E, F and G were incomplete in 14 questionnaires. Different items such as A3, A4, A7, A17, D2, D3, F6, F7, H4, H5, and H8 were incomplete in seven different questionnaires. As mentioned earlier incomplete questionnaires were examined to clarify whether the respondents faced difficulty with completion in common items or sections and to identify if there is any trend or interest issues in these questionnaires.

There are several interpretation of these findings: for example as a few respondents may have felt that the questionnaire was too long so they left many sections blank, or they did not have time to complete it. For section B it could be that respondents do not like to use the word supervisor or manager in section B or were unsure which was more appropriate word, thus section B was left incomplete in five questionnaires.

Generally, the aim of analysing incomplete questionnaires was to examine whether the incomplete questionnaires were valid to be included in data analysis or not. Due to incomplete demographic information and the fact that considerable numbers of sections in these questionnaires were missing and moreover, given the availability of the large number of completed questionnaires (862). Hence, it was felt that it was better to use just the completed data set rather than including missing data as well as, because of the uncertainty of the seriousness of the respondents of incomplete questionnaires. Therefore the decision was made that the incomplete questionnaires were excluded from data analyses. At the end of the data management process the clean data file was ready for the next stage, data analysis.

5.7 Summary

The HSOPSC questionnaire was used to collect data, and 1700 questionnaires were administered at three hospitals in Saudi Arabia to collect the questionnaire data. In terms of return rate 913 questionnaires was returned. The data was cleaned and prepared for data analysis, 862 fully completed questionnaires were returned from three hospitals with a return rate of 50.7%. In the next chapter the data analysis will be presented.

Chapter 6: Assessing the psychometric properties of the Hospital Survey on Patient Safety Culture

6.1 Introduction

This chapter reports the results of the psychometric properties of the HSOPSC questionnaire (Sorra and Nieva, 2004) in Saudi hospitals in Riyadh in Saudi Arabia using Saudi data (862 completed questionnaires). The chapter is composed of seven sections. Section 6.2 presents descriptive analysis including the sample characteristics and the item responses (item analysis). Section 6.3 concerns assessing the psychometric properties of the HSOPSC questionnaire (Sorra and Nieva, 2004). This section presents the results of the assessment of the suitability of the Saudi data for factor analysis. Section 6.4 provides the results of testing the original HSOPSC questionnaire (Sorra and Nieva, 2004) using Saudi data including CFA and reliability analysis (internal consistency). Section 6.5 reports the results of identifying the optimal model, including EFA, CFA and reliability analysis. Section 6.6 provides the proposed optimal model of the study. Finally, section 6.7 presents a brief summary of the chapter.

6.2 Descriptive Analysis

This section provides the demographic characteristics of the study respondents. It also presents an analysis of the responses to individual items of the HSOPSC questionnaire. Frequency tables are used to show the responses and the percentages of the respondents to safety climate items of the questionnaire.

6.2.1 Demographic information

This section reports the characteristics of the sample. Table 6-1 shows work area of respondents (doctors and nurses).

Table 6- 1 Work area of respondents (n=862)

Work area unit	Number (%)
Surgery	164 (19.0)
Other	164 (19.0)
Intensive care unit (any type)	148 (17.2)
Medicine	117 (13.6)
Paediatrics	106 (12.3)
Obstetrics	69 (8.0)
Emergency	43 (5.0)
Rehabilitation	26 (3.0)
Many different areas	16 (1.9)
Anaesthesiology	6 (0.7)
Psychiatric/mental health	3 (0.3)

Table 6-1 shows that the variety of work areas of the respondents. Among the total respondents (862) the highest proportion of respondents worked in surgery (19.0%) and other departments (19.0%) followed by intensive care units (17.2%), medicine (13.6%), and paediatrics (12.3%). The detail of other departments is provided in table 6-2. The lowest percentage of respondents worked in obstetrics (8%), followed by emergency (5%), rehabilitation (3%), many different hospital units (1.9%), anaesthesiology (0.7%) and psychiatry /mental health (0.3%). It was important to identify other work areas because it was the highest percentage. Table 6-2 shows the other departments.

Table 6- 2 Other work areas of respondents (n=164)

Work area unit	Number (%)
Cardiac	30 (18.3)
In patient wards	28 (17.0)
Endoscopy	23 (14.0)
Operation room	20 (12.2)
Oncology	15 (9.0)
Ophthalmology	13 (8.0)
Neonate	10 (6.0)
Quality and safety	9 (5.5)
Orthopaedic	6 (4.0)
Nephrology	5 (3.0)
Endocrinology	5 (3.0)

The demographic variables of the sample included: current position; gender; nationality; highest educational level; training outside Saudi Arabia; years of work in this hospital; years of work in current hospital work area/unit; years of work in current speciality or profession; hours of work per week; and direct contact with patients. Table 6-3 provides the sample characteristics of the study.

Table 6- 3 Sample characteristics of the study (n=862)

N	Variable		Number in each unit (%)	
1	Current position	Nurse	661	(76.7)
		Doctor	201	(23.3)
2	Gender	Female	632	(73.3)
		Male	230	(26.7)
3	Nationality	Non Saudi	700	(81.2)
		Saudi	162	(18.8)
4	Highest qualification	PhD	129	(15.0)
		Master	34	(3.9)
		Bachelor	525	(60.9)
		Diploma	160	(18.6)
		Other	14	(1.6)
5	Training outside S.A	Yes	668	(77.5)
		No	194	(22.5)
6	Years of working in this hospital	Less than 1year	123	(14.3)
		1 to 5 years	464	(53.8)
		6 to 10 years	181	(21)
		11 to 15 years	48	(5.6)
		16 to 20 years	26	(3.0)
		21 years or more	20	(2.3)
7	Years of working in current hospital work area/unit	Less than 1year	119	(13.8)
		1 to 5 years	499	(57.9)
		6 to 10 years	161	(18.7)
		11 to 15 year	45	(5.2)
		16 to 20 years	23	(2.7)
		21 years or more	15	(1.7)
8	Years of working in your current speciality or profession	Less than 1year	42	(4.9)
		1 to 5 years	235	(27.3)
		6 to 10 years	220	(25.5)
		11 to 15 yea	162	(18.8)
		16 to 20 years	99	(11.5)
		1 years or more	104	(12.0)
9	Working hours per week	Less than 20 hours per week	9	(1.0)
		20 to 39 hours per week	46	(5.3)
		40 to 59 hours per week	661	(76.7)
		60 to 79 hours per week	105	(12.2)
		80 to 99 hours per week	37	(4.3)
		100 hours per week or more	4	(0.5)
10	Direct interaction or contact with patients	Yes	850	(98.6)
		No	12	(1.4)

The sample of the study consisted of 201 doctors (23%) and 661 nurses (77%). The majority of respondents were female (73.3%). Most of respondents were non Saudi staff (81.2%) from 24 different nationalities. These nationalities were: British, Australian, Canadian, American, South African, Philippine, Pakistani, Indian, French, Egyptian, Netherlands, Jordanian, Norwegian, Finland, Yemeni, Kuwaiti, Chinese, Scottish, New Zealand, Malaysian, Sudan, Syria, Ireland, and Bahraini.

The majority of staff (60.9%) have a bachelor's degree and 18.9% of staff have postgraduate qualifications (PhD, master's degree). Over 18.6% have a diploma degree. The majority of staff had training outside Saudi Arabia (77.5%) in many countries such as UK, USA, Australia, and Canada. The majority of the respondents (53.8%) worked from one to five years in their hospital and 57.9% worked from one to five years in their specific hospital unit or work area. The majority of the respondents (52.8%) have experience from one to ten years in their current speciality or profession. The most common category of work hours per week (76.7%) was 40 to 59 hours. Almost all respondents (98.6%) had direct contact with patients.

6.2.2 Items analysis

The HSOPSC questionnaire consists of 42 items (24 positively worded items and 18 negatively worded items) plus two items on an overall patient safety grade (E) and number of events reported (G). These 42 items measure 12 dimensions of patient safety culture. Table 6-4 shows the responses of the positively worded safety climate items.

Table 6- 4 Responses of the 24 positively worded safety climate items (n=862)

Item	Strongly Disagree %	Disagree %	Neither %	Agree %	Strongly Agree %
A1	1.3	6.7	8.4	62.9	20.8
A2	8.4	25.4	14.4	42.3	9.5
A3	0.7	7.5	11.0	58.7	22.0
A4	2.0	8.2	15.2	55.7	18.9
A6	0.5	1.4	4.6	57.0	36.5
A9	2.9	10.3	21.7	54.4	10.7
A11	4.1	18.3	13.0	51.4	13.2
A13	1.2	5.2	9.5	65.5	18.6
A15	4.9	15.7	13.0	46.8	19.7
A18	2.0	9.5	16.1	60.2	12.2
B1	4.1	7.0	12.9	56.4	19.7
B2	3.4	8.4	13.6	57.1	17.6
C1	2.0	9.3	34.5	36.0	18.3
C2	1.2	8.8	31.0	38.5	20.5
C3	1.6	7.7	23.3	37.4	30.0
C4	9.6	23.1	32.9	25.3	9.0
C5	1.3	5.8	16.5	43.3	33.2
D1	3.5	18.1	24.7	31.8	21.9
D2	4.1	16.0	25.4	33.8	20.8
D3	3.1	10.0	20.3	36.5	30.0
F1	1.3	6.7	11.3	64.2	16.6
F4	1.4	12.9	22.6	55.9	7.2
F8	2.2	4.2	9.0	49.1	35.5
F10	0.9	7.2	13.9	55.3	22.6

Table 6-4 shows that the highest percentage of all positive safety climate items is between the responses agree and strongly agree. The response of neither ranges from 4.6% to 34.5%. The lowest percentage is between disagree and strongly disagree. This means the majority of the respondents tended to agree and strongly agree with these positive items. Table 6-5 shows the responses of the negative safety climate items.

Table 6- 5 Responses of the 18 negatively worded safety climate items (n=862)

Item	Strongly Disagree %	Disagree %	Neither %	Agree %	Strongly agree %
A5 ®	6.1	35.2	18.3	26.6	13.8
A7 ®	21.0	48.1	14.8	11.1	4.9
A8 ®	4.8	26.2	22.3	35.7	11.0
A10 ®	9.3	35.8	18.7	31.6	4.6
A12 ®	4.3	26.7	20.5	37.4	11.1
A14 ®	5.9	34.2	18.6	30.3	11.0
A16 ®	1.9	10.0	17.3	50.9	20.0
A17 ®	8.4	37.1	19.4	29.7	5.5
B3 ®	12.9	57.0	19.6	8.6	2.0
B4 ®	33.4	56.4	6.0	2.91	1.3
C6 ®	15.9	26.0	40.5	13.2	4.4
F2 ®	7.2	46.5	21.2	21.3	3.7
F3 ®	2.6	30.9	24.9	39.0	2.7
F5 ®	11.4	53.9	18.9	14.3	1.5
F6 ®	6.4	45.9	26.7	17.4	3.6
F7 ®	2.9	34.2	30.4	29.4	3.1
F9 ®	10.9	47.7	15.2	20.6	5.6
F11 ®	11.3	52.3	22.7	11.9	1.7

R indicates negatively worded items

The above table shows the responses for the 18 negatively worded safety climate items. The highest percentage of all items is between disagree and strongly disagree except items A16 and F3. The response of neither ranges from 6% to 40.5%. The smallest percent is between agree and strongly agree. The responses of disagree and strongly disagree of negatively worded items count as positive response because negative response of negative items means positive response. This means the majority of the respondents disagreed and strongly disagreed with these negative items. Table 6-6 provides the responses to the question of an overall grade on patient safety of 862 respondents.

Table 6- 6 Responses to the question of an overall grade on patient safety (n=862)

Item	Excellent %	Very good %	Acceptable %	Poor %	Failing %
E	14.0	48.1	35.7	1.9	0.3

Among the 862 respondents 48.1% perceived that the grade of patient safety was very good and 14% perceived that the grade of patient safety was excellent. A sizable proportion of the respondents 35.7% indicated that patient safety was acceptable. Few respondents (1.93%) perceived that patient safety was poor and failing.

Table 6-7 provides the responses to the question on the number of events reported in the past 12 months for all respondents.

Table 6- 7 Responses to the question on the number of events reported in the past 12 months (n=862)

Item	No event reports %	1 to 2 event reports %	3 to 5 event reports %	6 to 10 event reports %	11 to 20 event reports %	21 event reports or more %
G	40.8	38.9	12.1	5.5	1.6	1.2

The highest percentage of respondents (40.8%) did not report events followed by one to two event reports. Over 12 % reported three to five event reports. Five and half percent (5.5%) reported six to ten event reports. Around 1.6% reported 11 to 20 event reports. The lowest percent was 1.2% reported more than 21 event reports.

It was useful to determine if those reporting poor/failing were the same individuals who reported lots of events. Table 6-8 shows the comparison between an overall grade of patient safety and number of event reports in the past 12 months.

Table 6- 8 Comparison between an overall grade on patient safety and number of event reports in the past 12 months (n=862)

Item		**G: Number of event report in the past 12 months**			
		No event reports and 1 to 2 event reports	**3 to 5 event reports and 6 to 10 event reports**	**11 to 20 event reports and 21 event reports or more**	**Total**
E: An overall grade of patient safety	Very good and Excellent	433 (80.7%)	88 (16.4%)	15 (2.7%)	536
	Acceptable	242 (78.6%)	58 (18.8%)	8 (2.5%)	308
	Poor and Failing	12 (66.7%)	5 (27.8%)	1 (5.5%)	18
	Total	687	151	24	862

Table 6-8 shows for those reporting poor/failing the higher proportion (66.7%) reported no event reports, while the lowest proportion (5.5%) reported 11 to 20 event reports. This means those reporting poor/failing were not the same individuals who reported lots of events. Table 6-9 shows the descriptive analysis of the positively worded safety climate items.

Table 6- 9 Descriptive analysis of the 24 positively worded safety climate items (n=862)

Item	Mean (Sd)	Median (IQR)
A1: Staff support one another in this unit	3.9 (0.8)	4.0 (1-5)
A2: We have enough staff to handle the workload	3.1 (1.2)	4.0 (1-5)
A3: When a lot of work needs to be done quickly, we work together as a team to get the work done	3.9 (0.8)	4.0 (1-5)
A4: In this unit, people treat each other with respect	3.8 (0.9)	4.0 (1-5)
A6: We are actively doing things to improve patient care	4.2 (0.6)	4.0 (1-5)
A9: Mistakes have led to positive changes here	3.6 (0.9)	4.0 (1-5)
A11: When one area in this unit gets really busy, others help out	3.5 (1.1)	4.0 (1-5)
A13: After we make changes to improve patient safety, we evaluate their effectiveness	3.9 (0.8)	4.0 (1-5)
A15: Patient safety never takes second place to get more work done	3.6 (1.1)	4.0 (1-5)
A18: Our procedures and systems are good at preventing errors from happening	3.7 (0.9)	4.0 (1-5)
B1: My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	3.8 (0.9)	4.0 (1-5)
B2: My supervisor/manager seriously considers staff suggestions for improving patient safety	3.7 (0.9)	4.0 (1-5)
C1: We are given feedback about changes put into place based on event reports	3.5 (0.9)	4.0 (1-5)
C2: Staff will freely speak up if they see something that may negatively affect patient care	3.6 (0.9)	4.0 (1-5)
C3: We are informed about errors that happen in this unit	3.8 (0.9)	4.0 (1-5)
C4: Staff feel free to question the decisions or actions of those with more authority	3.0 (1.1)	3.0 (1-5)
C5: In this unit, we discuss ways to prevent errors from happening again	4.0 (0.9)	4.0 (1-5)
D1: When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?	3.5 (1.1)	4.0 (1-5)
D2: When a mistake is made, but has no potential to harm the patient, how often is this reported?	3.5(1.1)	4.0 (1-5)
D3: When a mistake is made that could harm the patient, but does not, how often is this reported?	3.8(1.1)	4.0 (1-5)
F1: Hospital management provides a work climate that promotes patient safety	3.8(0.8)	4.0 (1-5)
F4: There is good cooperation among hospital units that need to work together	3.5(0.8)	4.0 (1-5)
F8: The actions of hospital management show that patient safety is a top priority	4.1(0.9)	4.0 (1-5)
F10: Hospital units work well together to provide the best care for patients	3.9 (0.8)	4.0 (1-5)

Table 6-9 shows that the mean scores of positive items were divided into three groups, the first group was between 3.0 and 3.5. The second group was between 3.6 and 3.9. The third group was between 4.0 and 4.2. The median score of all items was 4.0 except item number C4 was 3.0. Table 6-10 shows the descriptive analysis of the negative safety climate items.

Table 6- 10 Descriptive analysis of the 18 negatively worded safety climate items (n=862)

Item	Mean (S d)	Median (IQR)
A5: Staff in this unit work longer hours than they should, which is not good for patient care	3.0 (1.2)	3.0 (1-5)
A7: We use more temporary staff than we should, which is not good for patient care	2.3 (1.1)	2.0 (1-5)
A8: Staff feel like their mistakes are held against them	3.2 (1.1)	3.0 (1-5)
A10: It is just by chance that more serious mistakes are held against them	2.8 (1.1)	3.0 (1-5)
A12: When an event is reported, it feels like the person is being written up, not the problem	3.2 (1.1)	3.0 (1-5)
A14: We work in a hurry, trying to do too much, too quickly	3.0 (1.1)	3.0 (1-5)
A16: Staff worry that mistakes they make are kept in their personnel file	3.7 (0.9)	4.0 (1-5)
A17: We have patient safety problems in this unit	2.8 (1.1)	3.0 (1-5)
B3: Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	2.3 (0.9)	2.0 (1-5)
B4: My supervisor/manager ignores patient safety problems that happen over and over	1.8 (0.8)	2.0 (1-5)
C6: Staff are afraid to ask questions when something does not seem right	2.6 (1.0)	3.0 (1-5)
F2: Hospital units do not coordinate well with each other	2.6 (1.0)	2.0 (1-5)
F3: Some things do not happen or get missed when transferring patients from one unit to another	3.0 (0.9)	3.0 (1-5)
F5: Important patient care information is often lost during shift changes	2.4 (0.9)	2.0 (1-5)
F6: It is often unpleasant to work with staff from other hospital units	2.6 (0.9)	2.0 (1-5)
F7: Problems often occur in the exchange of information across hospital units	2.9 (0.9)	3.0 (1-5)
F9: Hospital management seems interested in patient safety only after an adverse event happens	2.6 (1.1)	2.0 (1-5)
F11: Shift changes cause problems for patients in this hospital	2.4 (0.9)	2.0 (1-5)

Table 6-10 shows that the mean scores of negative items were divided into three groups. The first group was between 1.8 and 2.6. The second group was between 2.8 and 3.2. The third group was 3.7. The median scores of all items were also divided into three groups. The first group scored 2. The second group scored 3. The third group scored 4. Table 6-11 shows the descriptive analysis of an overall grade on patient safety and number of event reports in the past 12 months.

Table 6- 11 Descriptive analysis of an overall grade on patient safety item and number of event reports in the past 12 months (n=862)

Item	Mean (S d)	Median (IQR)
E: An overall grade on patient safety	3.7 (0.7)	4.0 (1-5)
G: Number of event reports in the past 12 months	1.9 (1.0)	2.0 (1-5)

Table 6-11 shows that the mean score of item (E) was 3.7 and its median score was 4. The mean score of item (G) was 1.9 and its median score was 2. The HSOPSC questionnaire consists of 42 items grouped by 12 dimensions. Table 6-12 shows the responses of the HSOPSC questionnaire items grouped by dimensions.

Table 6- 12 Responses of the HSOPSC items grouped by dimensions (n=862)

Item N	Dimensions	Strongly disagree %	Disagree %	Neither %	Agree %	Strongly agree %
	1. Teamwork within units (4 items)					
A1	Staff support one another in this unit	1.3	6.7	8.4	62.9	20.8
A3	When a lot of work needs to be done quickly, we work together as a team to get the work done	0.7	7.5	11.0	58.7	22.0
A4	In this unit, people treat each other with respect	2.0	8.2	15.2	55.7	18.9
A11	When one area in this unit gets really busy, others help out	4.1	18.3	13.0	51.4	13.2
	2. Supervisor/Manager expectation and action promoting patient safety (4 items)					
B1	My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	4.1	7.0	12.9	56.4	19.7
B2	My supervisor/manager seriously considers staff suggestions for improving patient safety	3.4	8.4	13.6	57.1	17.6
B3 ®	Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	12.9	57.0	19.6	8.6	2.0
B4 ®	My supervisor/manager ignores patient safety problems that happen over and over	33.4	56.4	6.0	2.91	1.3
	3. Management support for patient safety (3 items)					
F1	Hospital management provides a work climate that promotes patient safety	1.3	6.7	11.3	64.2	16.6
F8	The actions of hospital management show that patient safety is a top priority	2.2	4.2	9.0	49.1	35.5
F9 ®	Hospital management seems interested in patient safety only after an adverse event happens	10.9	47.7	15.2	20.6	5.6
	4. Organizational learning-continuous improvement (3 items)					
A6	We are actively doing things to improve patient care	0.5	1.4	4.6	57	36.5
A9	Mistakes have led to positive changes here	2.9	10.3	21.7	54.4	10.7

A13	After we make changes to improve patient safety, we evaluate their effectiveness	1.2	5.2	9.5	65.5	18.6
	5. Overall perceptions of patient safety (4 items)					
A15	Patient safety never takes second place to get more work done	4.9	15.7	13.0	46.8	19.7
A18	Our procedures and systems are good at preventing errors from happening	2.0	9.5	16.1	60.2	12.2
A10 ®	It is just by chance that more serious mistakes do not happen around here	9.3	35.8	18.7	31.6	4.6
A17 ®	We work in a hurry, trying to do too much, too quickly	8.4	37.1	19.4	29.7	5.5
	6. Feedback and communication about error (3 items)					
C1	We are given feedback about changes put into place based on event reports	2.0	9.3	34.5	36	18.3
C3	We are informed about errors that happen in this unit	1.6	7.7	23.3	37.4	30.0
C5	In this unit, we discuss ways to prevent errors from happening again	1.3	5.8	16.5	43.3	33.2
	7. Communication openness (3 items)					
C2	Staff will freely speak up if they see something that may negatively affect patient care	1.2	8.8	31.0	38.5	20.5
C4	Staff feel free to question the decisions or actions of those with more authority	9.6	23.1	32.9	25.3	9.0
C6 ®	Staff are afraid to ask questions when something does not seem right	15.9	26.0	40.5	13.2	4.4
	8. Frequency of event reported (3 items)					
D1	When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?	3.5	18.1	24.7	31.8	21.9
D2	When a mistake is made, but has no potential to harm the patient, how often is this reported?	4.1	16.0	25.4	33.8	20.8
D3	When a mistake is made that could harm the patient, but does not, how often is this reported?	3.1	10.0	20.3	36.5	30.0

	9. Teamwork across units (4 items)					
F4	There is good cooperation among hospital units that need to work together	1.4	12.9	22.6	55.9	7.2
F10	Hospital units work well together to provide the best care for patients	0.9	7.2	13.9	55.3	22.6
F2 ®	Hospital units do not coordinate well with each other	7.2	46.5	21.2	21.3	3.7
F6 ®	It is often unpleasant to work with staff from other hospital units	6.4	45.9	26.7	17.4	3.6
	10. Staffing (4 items)					
A2	We have enough staff to handle the workload	8.4	25.4	14.4	42.3	9.5
A5 ®	Staff in this unit work longer hours than they should, which is not good for patient care	6.1	35.2	18.3	26.6	13.8
A7®	We use more temporary staff than we should, which is not good for patient care	21.0	48.1	14.8	11.1	4.9
A14 ®	We work in a hurry, trying to do too much, too quickly	5.9	34.2	18.6	30.3	11.0
	11. Handoffs and transitions (4 items)					
F3 ®	Some things do not happen or get missed when transferring patients from one unit to another	2.6	30.9	24.9	39.0	2.7
F5 ®	Important patient care information is often lost during shift changes	11.4	53.9	18.9	14.3	1.5
F7 ®	Problems often occur in the exchange of information across hospital units	2.9	34.2	30.4	29.4	3.1
F11 ®	Shift changes cause problems for patients in this hospital	11.3	52.3	22.7	11.9	1.7
	12. No punitive response to error (3 items)					
A8 ®	Staff feel like their mistakes are held against them	4.8	26.2	22.3	35.7	11.0
A12 ®	When an event is reported, it feels like the person is being written up, not the problem	4.3	26.7	20.5	37.4	11.1
A16 ®	Staff worry that mistakes they make are kept in their personnel file	1.9	10.0	17.3	50.9	20.0

Table 6-12 shows the responses tending to positive response (strongly agree and agree) toward positively worded safety climate items and dimensions, while they tend towards negative response (strongly disagree and disagree) toward negatively worded items and dimensions. The next section will report the results of the psychometric analysis of the HSOPSC questionnaire in Saudi hospitals.

6.3 Psychometric Analysis of the Hospital Survey on Patient Safety Culture

6.3.1 Introduction

This study aims to examine the underlying dimensions and the psychometric properties of the selected patient safety climate questionnaire in hospitals in Saudi Arabia. This stage was concerned with assessing the psychometric properties (validity and reliability) of the HSOPSC questionnaire using the Saudi data and comparing this with the original HSOPSC model (Sorra and Neiva, 2004). Factor analysis is a method for examining the interrelationships amongst the items of the HSOPSC questionnaire in order to determine the structure (important underlying patient safety culture dimensions) in the questionnaire data. Furthermore, factor analysis can be used to assess the construct validity of an established instrument when administered to a specific population (Pett et al., 2003).

Therefore, it is important to examine the suitability of the data for factor analysis and to check the inter-item correlations of the HSOPSC questionnaire before performing factor analysis in order to ensure that the data is sufficient to be used for factor analysis (Smits et al., 2008). The following section presents the assessment of the suitability of the data for factor analysis.

6.3.2 Assessment of the suitability of the data for factor analysis

This step aimed to assess the suitability of the Saudi data for factor analysis. There are two main issues when considering whether a particular data set is suitable for factor analysis. The first issue is sample size (adequacy of sample). The second issue is the strength of the inter-correlation amongst the items (correlation between the items) (Pallant, 2007).

Sample size is considered as an important requirement for factor analysis (Field, 2009). Therefore, before measuring the adequacy of the sample for factor analysis, it is important to report sample requirements such as the sample size of the study, the ratio of the sample size to the number of variables, the ratio of the number of variables to the number of factors in order to assess whether the sample size is sufficient to satisfactorily undertake factor analysis (Ford et al., 1986; Tinsley and Tinsley, 1987). Table 6-13 shows the sample size requirements.

Table 6- 13 Sample size requirements of factor analysis

	Number
Sample size of the study	862
Number of variables	42
Ratio of sample size to number of variables:	Greater than 20:1
Ratio of number of variables to number of factors:	3:1
	4:1

The sample size of the data (862) is large and more than enough to conduct factor analysis with greater than 20 observations to each variable according to Coakes and Steed (2003). Comrey and Lee (1992) suggest that 300 cases are good, 500 cases are very good and 1000 cases or more are excellent because the large sample is useful and support the high confidence in the results. Also they report that normality is not necessary, because although normally distributed variables make the solution stronger, this is not necessary with a large data set. It is recognised that the assumption of normality may not be fully met (Helen, 2010). It is important to mention that the factor analysis assumed that the 5-point response scale for the HSOPSC items was a continuous response scale (Pett et al., (2003).

The ratio of sample size to number of variables is greater than 20:1, which is sufficiently large according to Everitt (1975). Costello and Osborne (2005) empirically tested the effect of sample size on the results of factor analysis and reported that larger samples tend to produce more accurate solutions. Moreover, 70% of the samples with the largest ratio (20:1) produced correct solutions. They also report that the number of misclassified items was also significantly affected by the size of a sample. MacCallum et al. (1999) suggest that increasing the sample size is one means of overcoming these problems. They argue that, as the sample size increases, sampling error is reduced, factor analysis solutions become more stable and more reliably produce the factorial structure of the population (MacCallum et al. 1999). It is clear that a large data set is very useful in factor analysis in terms of producing a robust factor solution. From these results we can conclude that the sample of the study is sufficient for undertaking the factor analysis.

In terms of correlation between the items, looking at the inter-correlation between items is also an important requirement when conducting factor analysis. There are two potential problems, firstly, correlations that are not high enough (below 0.3) and secondly, correlations that are too high (greater than 0.8) (Field, 2009). Tabachnick and Fidell (2007) recommend an inspection of the correlation matrix for evidence of coefficients greater than 0.3.

Two statistical measures help to assess the suitability of the data for factor analysis: Bartlett's test of sphericity (Bartlett, 1954) and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. Bartlett's test of sphericity should be significant ($P<.05$) for the factor analysis to be considered appropriate and the KMO should be greater than 0.6 as the minimum value for a good factor analysis (Tabachnick and Fidell, 2007). Therefore KMO and Bartlett's test were used to assess factorability of anti image to correlate (items to correlate as factors). Table 6-14 shows the results of KMO and Bartlett's test.

Table 6- 14 KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.905
Bartlett's Test of Sphericity	Approx. Chi-Square	6606.872
	df	861
	Sig.	.000

If KMO >0.6 that means the correlation matrix is valid (acceptable) for factor analysis. Pett et al. (2003) report that a KMO above 0.90 is very good. In this data set KMO=0.905, which means that the degree of homogeneity of the sample that was obtained was sufficient and the sample is adequate for factor analysis.

The Bartlett's test was applied to determine the presence of the relationship with variables (items) of the HSOPSC questionnaire. The Bartlett's test was highly significant ($P<0.001$) for the data set which is considered appropriate and factor analysis is applicable according to Coakes and Steed (2003) and Field (2009).

It is important to mention that if Bartlett's test is significant ($P<0.05$) that means the correlation matrix is not an identity matrix (Coakes and Steed, 2003; Pett et al., 2003).

> "*Identity matrix is a matrix which 1s appear on the diagonal and 0s on the off-diagonal. An example of such an identity matrix would be a correlation matrix in which all items on the off-diagonal are completely uncorrelated. A correlation matrix that is an identity matrix is not a welcome sight in factor analysis because its presence would imply that there are no interrelationships among the items*" (Pett et al., 2003:63).

Moreover, according to Field (2009), the Bartlett's test examines whether the correlation matrix resembles an identity matrix (i.e. off-diagonal components are zero). Therefore, if Bartlett's test is significant that means the correlations between items are significantly different from zero. This means good news for conducting factor analysis because there are correlations between the items. If Bartlett's test is not significant that means the correlation matrix resembles an identity matrix. This means items correlate very badly with all other items (i.e. all correlation coefficients are close to zero) (Field, 2009). If the correlation is greater than 0.3 this means factor loading is greater than 0.3, which is good for the data.

In summary both the KMO test statistic and Bartlett's test of Sphericity indicate that the Saudi data is suitable to be subjected to factor analysis.

6.3.3 Psychometric Data Analysis Strategy

The psychometric data analysis strategy used in this stage was based on three main steps:

Step 1:

The first step aimed to investigate whether the factor structure of the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) can be used with the Saudi data, in which both Confirmatory Factor Analysis (CFA[4]) and reliability analysis used. This step is described in section 6.4.

Step 2:

The second step aimed to examine whether an alternative structure of factors and items would fit the Saudi data better. In the other words, the objective is to check whether the items of the HSOPSC questionnaire formed different factors in the Saudi data, using exploratory factor analysis in order to develop the optimal model that can be used for assessing patient safety culture in Saudi hospitals. This step is described in section 6.5.1.

Step 3:

This step of psychometric analysis was concerned with undertaking the CFA and reliability analysis (internal consistency). It was concerned with testing the fit of the model that emerged from the Exploratory Factor Analysis (EFA[5]) using CFA and reliability analysis (section 6.5.2). In this step, the comparison between the CFA output of resulting models and the CFA output of USA (Sorra and Nieva, 2004) and UK (Waterson et al., 2009) studies was presented. Factor correlations of the optimal mode were performed (section 6.5.3). Finally, the reliability analysis (internal consistency) was performed to assess how well the items within each dimension relate to each other of the optimal model of the study (section 6.5.4). Each step is presented below:

[4] For full definition of CFA, see glossary
[5] For full definition of EFA, see glossary

6.4 Testing the original USA HSOPSC model

This step aimed to test the fit of the original USA HSOPSC model (Sorra and Nieva, 2004) to the Saudi data. This step of analysis is concerned with undertaking the CFA and Reliability Analysis.

6.4.1 Confirmatory Factor Analysis

This step aimed to test the fit of the original USA HSOPSC model (Sorra and Nieva, 2004) to the Saudi data using CFA which is the best procedure for investigating the factor structures of questionnaire (Hoyle, 1995). CFA[6] was performed in order to examine the applicability of the factor structure of the original USA HSOPSC questionnaire to the Saudi data. AMOS software was used to undertake CFA (Arbuckle, 2005). Various measures of fit (fit indices[7]) examine whether the model provides a satisfactory fit to the data. This analysis includes the chi-square test statistic (χ^2), which is the most commonly used fit statistic, and the degree of freedom (df) ratio. Comparative Fit Index (CFI) value, Root-Mean-Square Error of Approximation (RMSEA), Incremental Fit Index (IFI), Root mean square residuals (RMR), Standardised Root Mean Square Residual (SRMR) and Tucker-Lewis Index (TLI) are also considered (Hu and Bentler, 1999). There is wide agreement that the overall model fit is evaluated using goodness of fit indices such as CFI-RMSEA-RMR-SRMR-TLI (March and Balla, 1994; Sanislow et al., 2002; Lievens and Anseel, 2004; Kline, 2005).

Hu and Bentler (1999) examine a range of cut-offs for many of these measures under different conditions (different sample size and model structure) and suggest using a combination of fit indices such as CFI and SRMR and RMSEA. They also suggest the CFI is used, with a value >0.90 indicating a good model. SRMR is used, with a value <0.08 indicating a good model. RMSEA is used, with a value ≤0.06 indicating a good model. Use of more fit indices been worthwhile such as χ^2/df, RMR, and TLI. Therefore, χ^2/df, CFI, RMSEA, RMR, SRMR and TLI were also used to evaluate the adequacy of the model fit. Table 6-15 shows the general agreed fit indices (parameters).

[6] For full definition of CFA, see glossary

[7] For more detail of fit indices and cut offs for fit indices, see glossary

Table 6- 15 Generally agreed fit indices (parameters)

Fit index(parameter)	**Cut off level (value)**
Chi square (χ^2) AMOS lists chi-square as CMIN/DF	CMIN/DF should be 2 or less reflects good fit. In the case of the chi-square statistic, smaller rather than larger values indicate a good fit.
Degree of freedom (df)	Should be small
Comparative Fit Index (CFI)	CFI should be equal to or greater than 0.90 to accept the model.
Root-Mean-Square Error of Approximation (RMSEA)	RMSEA $\leq$0.06 as the cut-off for a good model fit
Root mean square residuals (RMR)	RMR should be < .10, or .08, or .06, or .05, or even .04, for a well-fitting model
Standardized root mean square residual (SRMR)	A value less than 0.05 is widely considered good fit and below 0.08 adequate fit.
Tucker-Lewis index (TLI)	It should be greater than 0.9 for a good fit

Note: The usual words that are used in assessing model fit are: good model fit (for good model), adequate model fit (when the values of fit indices are at borderline), not satisfactory (when the values of fit indices are outside the generally agreed parameters).

Practical steps in the CFA process:

The following steps describe the process of CFA:

1 AMOS Graphics was used to open up a blank diagram window.

2 Opening the data (the whole data was used, 862 questionnaires).

3 Building the model (drawing the 12 factors by using model drawing area in step one).

4 Adding the variable names to the model.

5 Running the model and using the output window.

Table 6-16 shows the fit indices of CFA when applying the original USA model to the Saudi data compared with USA data (Sorra and Nieva, 2004).

Table 6- 16 Fit indices of CFA of USA 12 factors model (Sorra and Nieva, 2004)

Model	Chi-square	df	CMIN/DF	CFI	RMSEA	RMR	SRMR	TLI
USA data	2064	746	-	0.94	0.040	-	-	-
Saudi data	4995	805	6.2	0.64	0.067	0.178	0.193	0.617

The fit indices from CFA indicated a weak fit to the Saudi data, while the values of fit indices in USA indicated a good fit to the USA data. For example the CFI in the Saudi data was less than 0.9 while in the USA data it was 0.94 (good model > 0.90). RMSEA in the Saudi data was 0.067 while in the USA data it was 0.040 (good model < 0.06). CMIN/DF in Saudi data was greater than 2 (good model ≤2). Overall, the values of the fit indices of the Saudi data (12 factors) are outside the general agreed parameters in table 6-15. Therefore, this model fit was not satisfactory.

6.4.2 Reliability Analysis of the original USA HSOPSC model

The internal consistency of the dimensions of the original USA HSOPSC model (Sorra and Nieva, 2004) to the Saudi data was calculated with Cronbach's alpha (α). When different items are supposed to measure the same dimension (concept), it is recommended that internal consistency should be greater than or equal to 0.6 (Field, 2000). Since the HSOPSC questionnaire contains both positively worded items (n=24) and negatively worded items (n=18), the negatively formulated items were first recoded to make sure that a higher score always means a more positive response (Pallant, 2007). The internal consistency was calculated for every factor according to the original dimensions and items were then compared with the internal consistency found in the American study (Sorra and Nieva, 2004). The results of the reliability analysis for USA and Saudi data are presented in table 6-17.

Table 6- 17 Results of reliability analysis for USA data and Saudi data

HSOPSC dimension	Cronbach's alpha (α)	
	American data	Saudi data
Overall perceptions of safety	0.74	0.31
Frequency of error reporting	0.84	0.83
Supervisor/manager expectations and actions promoting patient safety	0.75	0.75
Organisational learning-continues improvement	0.76	0.63
Teamwork within units	0.83	0.75
Communication openness	0.72	0.67
Feedback and communication about error	0.78	0.74
Non punitive response to error	0.79	0.72
Staffing	0.63	0.57
Hospital management support for patient safety	0.83	0.65
Teamwork across hospital units	0.80	0.69
Hospital handoffs and transitions	0.80	0.59

The internal consistency of the Saudi data (n=862) for each dimension was greater than 0.6 except for three dimensions that were poor or unacceptable with values less than 0.6: overall perceptions of safety ($\alpha = 0.31$), staffing ($\alpha = 0.57$) and hospital handoffs and transitions ($\alpha = 0.59$). The internal consistency of the Saudi data was lower for each dimension than the American data except dimension of supervisor/manager expectations and actions promoting patient safety.

Thus the results of the confirmatory factor analysis and reliability analysis showed that when applying the original USA HSOPSC model (Sorra and Nieva, 2004) to the Saudi data, the fit indices from CFA and internal consistency result indicated that this model fit was not satisfactory. This prompted an exploratory factor analysis in order to investigate if there is a factor structure that better fits the Saudi data.

6.5 Identifying an optimal model

This step aimed to construct an optimal model for assessing patient safety culture in Saudi hospitals. Exploratory factor analysis (EFA) is an important and useful tool for refining measures and evaluating construct validity. It is used for creating and refining the instrument's scales (Conway and Allen, 2003) and to explore the field and to discover the main constructs or dimensions (Kline, 1994). The analysis strategy in this step was based on validating the HSOPSC questionnaire construct by using EFA to uncover the latent structures of the safety culture dimensions (factors) and Cronbach's alpha for internal consistency, using the Saudi data set.

The Saudi data set was split randomly into two halves. Two files for each split half includes 431 cases, the first one called the exploratory data file (EFA) and the second one called the Confirmatory data file (CFA). EFA was used on one half to produce optimal model followed by CFA of resulting measurement model on validation half of data to test the fit of the resulting optimal factor structure. In other words, the first random half of the Saudi data set was used for model construction by exploring a number of factors (patient safety climate dimensions). The second random half of the Saudi data set was used for model validation by confirming a number of factors resulting from model construction.

The output of the first and final step EFA including tables of communalities, total variance explained and rotated Factor matrix and pattern matrix are presented in this section. The rest of the output of the other steps (from 2 to 10) of EFA are provided in the appendices as they are large tables and many that are difficult to present in this chapter because of space. Section 6.5.1 is concerned with a step by step strategy of EFA and reports its outputs.

6.5.1 Exploratory Factor Analysis (EFA)

Step by step strategy and output of Exploratory Factor Analysis (EFA) is as follows:

EFA consists of two basic stages. The first stage, extraction, is concerned with how many factors should be extracted to represent the HSOPSC (safety climate items). The second stage is concerned with interpreting the meaning of the extracted factors and representing them in terms of theoretical structures of the patient safety climate dimensions. The strategy was based on running an initial EFA, using Principle Axis Factoring and Varimax rotation, as well as both Kaiser's criterion and the Scree plot, to assess how many factors should be extracted. This strategy produced a number of solutions. All these solutions were then examined by extracting the number of factors and changing the rotations to enable interpretation of the factors.

Each possible solution was examined in order to determine the number of extracted factors. A number of points were taken into consideration for each of the possible solutions included identifying items with no loading, low loading, low communalities, items which cross-load and the theoretical structure of items. The theoretical structure refers to the extracted factors (related items grouped in one factor) that are expected to be theoretically related. This process was continued until a satisfactory solution was reached.

Generally, each solution was examined and analysed carefully in relation to all these points before making a decision to either accept or reject it. Factor analysis is used as a data exploration technique and therefore, in order to achieve a satisfactory solution, the interpretation and the guidelines used are up to researcher judgement, rather than any hard and fast statistical rules (Pallant, 2007).

Step 1: EFA on all safety climate items of HSOPSC (42 items)

In order to run an initial EFA, Principal Axis Factoring was the chosen extraction method. Varimax was the chosen rotation method to provide an initial idea of items loading on each factor of the initial solution, thus providing a view about the underlying factors (latent structure). Eigenvalues greater than one (Eigenvalues > 1), and Scree plot were used to determine the number of factors to be extracted.

Output of the initial solution (11 factor solution):

As mentioned earlier, factor analysis depends on correlation between variables. Therefore, examining the correlations between the safety climate items (42 items) is considered to be a good idea in order to examine the correlations between the items before starting exploratory factor analysis. The correlation matrix shows the blocks of larger correlations running roughly diagonally down the matrix, indicating that the patient safety climate items are indeed closely related and that factor analysis is applicable. In order to examine the clarity of this solution the communalities, total variance explained, and rotated factors were investigated. Table 6-18 shows the communalities of the initial solution.

Table 6- 18 Communalities of the initial solution (n=431)

Safety climate items	Initial	Extraction
A1 Staff support one another in this unit	.52	.57
A2 We have enough staff to handle the workload	.25	.26
A3 When a lot of work needs to be done quickly, we work together as a team to get	.50	.59
A4 In this unit, people treat each other with respect	.50	.69
A5 Staff in this unit work longer hours than they should, which is not good for patient	.25	.28
A6 We are actively doing things to improve patient care	.41	.47
A7 We use more temporary staff than we should, which is not good for patient care	.25	.31
A8 Staff feel like their mistakes are held against them	.46	.66
A9 Mistakes have led to positive changes here	.35	.39
A10 It is just by chance that more serious mistakes do not happen around here	.13	.09
A11 When one area in this unit gets really busy, others help out	.38	.40
A12 When an event is reported, it feels like the person is being written up, not the	.44	.53
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.47	.53
A14 We work in a hurry, trying to do too much, too quickly	.36	.37
A15 Patient safety never takes second place to get more work done	.20	.19
A16 Staff worry that mistakes they make are kept in their personnel file	.31	.35
A17 We have patient safety problems in this unit	.18	.20
A18 Our procedures and systems are good at preventing errors from happening	.42	.42
B1 My supervisor/manager says a good word when he/she sees a job done according	.60	.77
B2 My supervisor/manager seriously considers staff suggestions for improving	.63	.71
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster,	.38	.46
B4 My supervisor/manager ignores patient safety problems that happen over and over	.42	.60
C1 We are given feedback about changes put into place based on event reports	.42	.44
C2 Staff will freely speak up if they see something that may negatively affect patient	.46	.52
C3 We are informed about errors that happen in this unit	.44	.48
C4 Staff feel free to question the decisions or actions of those with more authority	.41	.56
C5 In this unit, we discuss ways to prevent errors from happening again	.56	.57
C6 Staff are afraid to ask questions when something does not seem right	.28	.34
D1 When a mistake is made, but is caught and corrected before affecting the patient,	.54	.58
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?	.66	.88

Table 6-18 (continued)		
D3 When a mistake is made that could harm the patient, but does not, how often is	.54	.55
F1 Hospital management provides a work climate that promotes patient	.41	.41
F2 Hospital units do not coordinate well with each other	.45	.46
F3 Some things do not happen or get missed when transferring patients from one unit	.15	.14
F4 There is good cooperation among hospital units that need to work together	.47	.56
F5 Important patient care information is often lost during shift changes	.39	.46
F6 It is often unpleasant to work with staff from other hospital units	.37	.39
F7 Problems often occur in the exchange of information across hospital units	.42	.48
F8 The actions of hospital management show that patient safety is a top priority	.45	.47
F9 Hospital management seems interested in patient safety only after an adverse event	.36	.36
F10 Hospital units work well together to provide the best care for patients	.53	.61
F11 Shift changes cause problems for patients in this hospital	.34	.37

Extraction Method: Principal Axis Factoring.

The extraction column of the communalities table (6-18) above shows the proportion of variance of each variable explained by the initial solution. Five items, specifically A2, A10, A15, A17, and F3 are very poorly explained (very poor communalities, less than 0.3). A5 (2.84) was close to 0.3. This item (A5) was retained initially, but it was a candidate for removal later. Table 6-19 shows the total variance explained by the initial solution.

Table 6- 19 Total variance explained by the initial solution (n=431)

Total Variance Explained									
Factor	Initial Eigenvalues			Extraction Sums of Squared			Rotation Sums of Squared		
	Total	% of Variance	Cumulative %	Total	% of Varianc	Cumulative %	Total	% of Varianc	Cumulative %
1	9.78	23.9	23.9	9.3	22.7	22.7	2.20	5.4	5.4
2	2.32	5.7	29.5	1.8	4.5	27.1	2.18	5.1	10.4
3	2.19	5.3	34.9	1.7	4.2	31.4	2.10	5.0	15.5
4	1.73	4.2	39.1	1.2	3.0	34.4	1.20	4.9	20.3
5	1.62	3.9	43.1	1.2	2.9	37.3	1.20	4.7	25.0
6	1.50	3.7	46.8	1.0	2.5	39.8	1.92	4.5	29.6
7	1.26	3.1	49.8	.8	1.8	41.6	1.85	4.4	33.9
8	1.18	2.8	52.7	.6	1.5	43.2	1.55	3.7	37.7
9	1.08	2.6	55.4	.6	1.5	44.7	1.42	3.4	41.1
10	1.07	2.6	58.0	.4	1.1	45.8	1.40	3.3	44.5
11	**1.00**	**2.5**	**60.5**	**.4**	**1.0**	**46.8**	**0.95**	**2.3**	**46.8**
12	.96	2.3	62.9						
13	.90	2.1	65.1						
14	.84	2.0	67.1						
15	.77	1.8	69.0						
16	.76	1.8	70.9						
17	.73	1.7	72.6						
18	.72	1.7	74.4						
19	.68	1.6	76.1						
20	.65	1.5	77.7						
21	.63	1.5	79.2						
22	.61	1.5	80.7						
23	.60	1.4	82.2						
24	.58	1.4	83.6						
25	.56	1.3	85.0						
26	.53	1.2	86.3						
27	.51	1.2	87.6						
28	.47	1.1	88.7						
29	.46	1.1	89.8						
30	.43	1.0	90.9						
31	.43	1.0	92.0						
32	.41	1.0	93.0						

Table 6-19 (continued)									
33	.39	.9	93.9						
34	.37	.9	94.9						
35	.36	.9	95.8						
36	.34	.8	96.6						
37	.34	.8	97.4						
38	.30	.7	98.2						
39	.27	.6	98.9						
40	.25	.6	99.5						
41	.19	.4	100						

Extraction Method: Principal Axis Factoring.

The three columns above show the Eigenvalues and respective cumulative percentages of variance accounted of all possible extracted factors. The next three columns indicate how many factors have been extracted determined by Kaiser's Eigenvalues > 1 criterion. The final three columns represent the percentages of variance explained by each factor after rotation. The total variance explained by this initial solution shows that 11 factors account for 46.8% of total variance. This number of factors was determined by Kaiser's Eigenvalues >1 criterion. Table 6-20 shows the rotated factor matrix of the initial solution.

Table 6- 20 Rotated Factor Matrix of the initial solution (n=431)

Safety climate items	Factor										
	1	2	3	4	5	6	7	8	9	10	11
F7 Problems often occur in the exchange of information across hospital units	.65										
F5 Important patient care information is often lost during shift changes	.57										
F6 It is often unpleasant to work with staff from other hospital units	.55										
F11 Shift changes cause problems for patients in this hospital	.50										
F9 Hospital management seems interested in patient safety only after an adverse event happens	.31										
F3 Some things do not happen or get missed when transferring patients from one unit to another	.30										
A17 We have patient safety problems in this unit											
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?		.91									
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?		.70									
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		.69									
A4 In this unit, people treat each other with respect			.75								
A1 Staff support one another in this unit			.68								
A3 When a lot of work needs to be done quickly, we work together as a team to get the work			.60								
A6 We are actively doing things to improve patient care				.55							
A9 Mistakes have led to positive changes here				.52							
A18 Our procedures and systems are good at preventing errors from happening				.38			.32				
F1 Hospital management provides a work climate that promotes patient safety	-.30			.36			.30				
A15 Patient safety never takes second place to get more work done											
C3 We are informed about errors that happen in this unit					.54						
C1 We are given feedback about changes put into place based on event reports					.52						
A13 After we make changes to improve patient safety, we evaluate their effectiveness				.44	.46						
C5 In this unit, we discuss ways to prevent errors from happening again					.46					.30	
A8 Staff feel like their mistakes are held against them						.77					
A12 When an event is reported, it feels like the person is being written up, not the problem						.64					
A16 Staff worry that mistakes they make are kept in their personnel file						.51					
F10 Hospital units work well together to provide the best care for patients							.63				
F4 There is good cooperation among hospital units that need to work together							.58				
F8 The actions of hospital management show that patient safety is a top priority				.36			.45				

Table 6-20 (continued)

F2 Hospital units do not coordinate well with each other	.41						-.42				
B1 My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures								.77			
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety								.66			
A5 Staff in this unit work longer hours than they should, which is not good for patient care									.48		
A7 We use more temporary staff than we should, which is not good for patient care									.44		
A14 We work in a hurry, trying to do too much, too quickly						.38			.38		
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts					-.30				.38		.32
A2 We have enough staff to handle the workload									-.36		
A11 When one area in this unit gets really busy, others help out			.32						-.36		
C4 Staff feel free to question the decisions or actions of those with more authority										.63	
C2 Staff will freely speak up if they see something that may negatively affect patient care					.34					.50	
C6 Staff are afraid to ask questions when something does not seem right										-.45	
B4 My supervisor/manager ignores patient safety problems that happen over and over								-.32			.56
A10 It is just by chance that more serious mistakes do not happen around here											

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 17 iterations.

The rotated factor matrix shows the loadings of the initial solution (11 factors) with multiple items loading on each factor. Items A10, A15, A17 did not load upon any factor. Item cross loadings were: A11, A13, A14, A18, B3, B4, C2, C5, F1, F2, and F8. A11 cross loaded on factors three and nine. A13 cross loaded on factors four and five. A14 cross loaded on factors six and nine. A18 cross loaded on factors four and seven. B3 cross loaded on factors five and nine and eleven. B4 cross loaded on factors eight and 11. C2 cross loaded on factors five and ten. C5 cross loaded on factors five and ten. F1 cross loaded on factors one and four and seven. F2 cross loaded on factors one and seven. F8 cross loaded on factors four and seven. Table 6-21 shows the summary of the 11 factor solution and the factor loadings.

Table 6- 21 Structure of the initial solution (11 factors) and its loading

Factor number	Items	loading (<.4)	Strongly loading(>.4)
1	F1-F2-F3-F5-F6-F7-F9-F11	F1-F3-F9	F5-F2-F6-F7-F11
2	D1-D2-D3		D1-D2-D3
3	A1-A3-A4-A11	A11	A1-A3-A4
4	A6-A9-A13-A18-F1-F8	A18-F1-F8	A6-A9-A13
5	A13-B3-C1-C2-C3-C5	A13-B3-C2	C1-C3-C5-
6	A8-A12-A14-A16	A14	A8- A12 -A16
7	A18-F1-F2-F4-F8-F10	A18-F1	F2-F4-F8-F10
8	B1-B2-B4	B4	B1-B2
9	A2-A5-A7-A11-A14-B3	A2-A11-A14-B3	A5-A7
10	C2-C4-C5-C6	C5	C2-C4-C6
11	B3-B4	B3	B4

The 11 factor solution contained several items with loading less than 0.4. These items were F1-F3-F9-A11-A18-A14-A2-B3. Some items cross loaded (had loading < 0.4 on one factor but loadings > 0.4 on another factor such as A13-C2-C5-F8-B4). Factor number 11 has only one item loading heavily (which might mean too many factors were extracted). In summary this solution provides ten clear factors with quite strong multiple items loading (> 0.4) on each factor (Pallant, 2007). It is usual to regard factor loadings as high if they are greater than 0.6 (the positive or negative sign is irrelevant) and moderately high if they are above 0.3. Other loading can be ignored (Kline, 1994).

In summary, the initial solution was unclear because of cross loadings of many items. In addition, several items had loading less than 0.4, factor number 11 has only one item loading heavily, two factors (factor one and seven) were not theoretically related and the 11 factors solution accounts for 46.8% of total variance. Because of these findings and the lack of clarity of this initial solution, EFA on 42 items with 11 factors and oblique rotation was undertaken to aid interpretation of the items in each factor of the solution. The following pattern matrix shows the structure and loadings of the 11 factor solution.

Table 6- 22 Pattern matrix of the initial solution (11 factors) (n=431)

Safety climate items	Factor										
	1	2	3	4	5	6	7	8	9	10	11
C3 We are informed about errors that happen in this unit	.45										
C1 We are given feedback about changes put into place based on event reports	.42										
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.41										
A8 Staff feel like their mistakes are held against them		.79									
A12 When an event is reported, it feels like the person is being written up, not the problem		.65									
A16 Staff worry that mistakes they make are kept in their personnel file		.49									
A14 We work in a hurry, trying to do too much, too quickly		.34						-.31			
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?			-.97								
D3 When a mistake is made that could harm the patient, but does not, how often is this			-.74								
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?			-.73								
F7 Problems often occur in the exchange of information across hospital units				.64							
F5 Important patient care information is often lost during shift changes				.57							
F6 It is often unpleasant to work with staff from other hospital units				.52							
F11 Shift changes cause problems for patients in this hospital				.46							
F3 Some things do not happen or get missed when transferring patients from one unit to another											
A17 We have patient safety problems in this unit											
A4 In this unit, people treat each other with respect					.77						
A1 Staff support one another in this unit					.67						
A3 When a lot of work needs to be done quickly, we work together as a team to get the work					.57						
C4 Staff feel free to question the decisions or actions of those with more authority						.69					
C2 Staff will freely speak up if they see something that may negatively affect patient care						.55					
C6 Staff are afraid to ask questions when something does not seem right						-.41					
C5 In this unit, we discuss ways to prevent errors from happening again	.30					.32					
B1 My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures							-.87				
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety							-.73				
A5 Staff in this unit work longer hours than they should, which is not good for patient care								-.48			
A7 We use more temporary staff than we should, which is not good for patient care								-.46			

Table 6-22 (continued)											
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts								-.33			
A2 We have enough staff to handle the workload								.32			
A11 When one area in this unit gets really busy, others help out								.30			
B4 My supervisor/manager ignores patient safety problems that happen over and over							.33		.56		
A10 It is just by chance that more serious mistakes do not happen around here											
F10 Hospital units work well together to provide the best care for patients										-.69	
F4 There is good cooperation among hospital units that need to work together										-.63	
F8 The actions of hospital management show that patient safety is a top priority										-.49	
F2 Hospital units do not coordinate well with each other										.43	
A18 Our procedures and systems are good at preventing errors from happening										-.31	
F1 Hospital management provides a work climate that promotes patient safety											
A6 We are actively doing things to improve patient care											-.48
A9 Mistakes have led to positive changes here											-.46
F9 Hospital managemnet seems interested in patient safety only after an adverse event happens											
A15 Patient safety never takes second place to get more work done											

Extraction Method: Principal Axis Factoring.
Rotation Method: Oblimin with Kaiser Normalization
Rotation converged in 20 iterations

The pattern matrix above indicated that items A10-A15-A17-F3-F1-F9 did not load upon any factor. Items A11-A14-A18-A2-B3-C5 had low loadings. The next step excluded A10-A15-A17-F3-F1-F9 because they did not load upon any factor.

Step 2: EFA was then run excluding items A10-A15-A17-F3-F1-F9, with 11 factors and oblique rotation to aid interpretation of the items in each factor of the solution (Waterson et al., 2009).

The extraction column of the communalities table (see appendix 24) shows that item A2 was very poorly explained (0.243), while item A5 was now above 0.3. The table of the Total Variance Explained of the initial solution shows that the 11 factors account for 50.8% of total variance (see appendix 25). The pattern matrix of the initial solution in this step indicated that items A2-A11 did not load upon any factor. Items number A14-A18-C5 had low loadings (see appendix 26). The next step excluded A2-A11-A14-A18-C5.

Step 3: After excluding items A10-A15-A17-F3-F1-F9-A2-A11-A14-A18-C5 EFA was then run again with 11 factors and an oblique rotation was carried out to aid interpretation of the items in each factor of the solution.

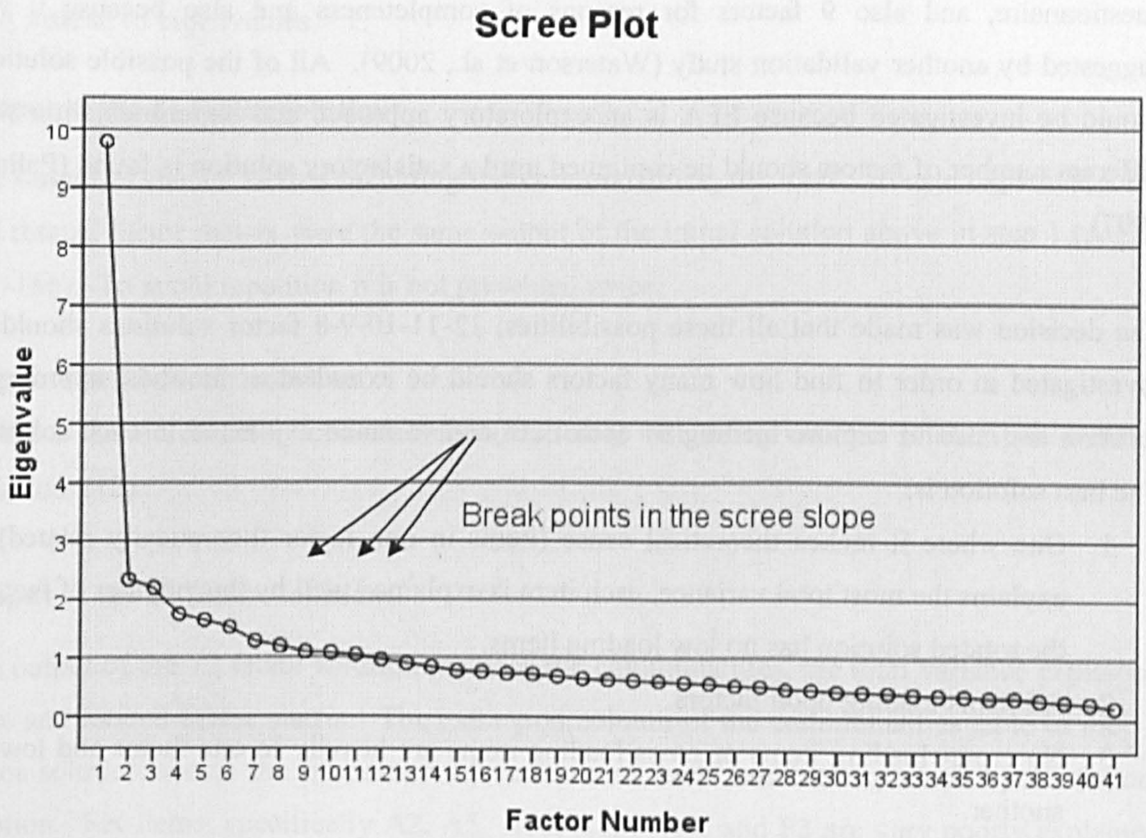
The communalities table shows that all the 31 safety climate items had high communalities (see appendix 27). Item A7 was close to 0.3 (0.285). The total variance explained by this step shows that the 11 factors account for 52.9 % of total variance (see appendix 28). The pattern matrix of the initial solution shows that this solution included 31 safety climate items in 11 factors while 11 items were excluded (A2-A10-A11-A14-A15-A17-A18-C5-F1-F3-F9). Item loadings were between 0.37 and 0.97. There were only small shifts among items across factors. For instance, A13 moved to 'Feedback and communication about error', F6 moved to 'Handoffs and transitions', and F8 moved to 'Teamwork across units'. All dimensions consisted of two to four safety climate items (see appendix 29). Table 6-23 shows the final structure of the initial solution.

Table 6- 23 Final structure of the initial solution (11 factors)

Factor number	Factor	Items loading(0.37-0.97)	Number of items
1	Feedback and communication about error	C1-C3-A13	3
2	Frequency of event reported	D1-D2-D3	3
3	No punitive response to error	A8-A12-A16	3
4	Handoffs and transitions	F5-F6-F7-F11	4
5	Teamwork within units	A1-A3-A4	3
6	Communication openness	C2-C4-C6	3
7	Supervisor expectation and action promoting patient safety	B1-B2	2
8	Staffing	A5-A7	2
9	Teamwork across units	F2-F4-F10-F8	4
10	Organisational learning- continuous improvement	A6-A9-	2
11	Supervisor expectation and action promoting patient safety negatively attitude	B3-B4	2

The composition of the factors of the initial solution was very similar to that of the USA HSOPSC questionnaire (Sorra and Nieva, 2004) because the main part of the factor structure was unchanged. Although the initial solution was clear and appropriate, use of a combination of Kaiser's criterion and Cattell's screen plot (Scree plot) method was also required to assess the number of factors to be extracted (Conway et al., 2003). Thus, the Scree plot was examined in order to identify the optimal number of factors that should be extracted, to explore potential improvements by examining a series of possible solutions and to identify common factor structure across different solutions of the exploring approach. Figure 6-3 shows the Scree plot of the initial solution.

Figure 6- 1 Scree plot of the initial solution



Cattell (1966) recommended retaining all factors above the elbow or break in the plot, as these factors contribute the most to the explanation of the variance in the data set. The breaks in the Scree plot suggest three break points. Only factors to the left of the point of the break should be retained (Field, 2009). The first break point corresponds to factor number 12. Counting back one factor means that the actual break point was 12, so the 11 factor solution should be tested. The second break point corresponds to factor number 11. Counting back one factor means that the actual break point was 11 then a 10 factor solution should be tested. The third break point corresponds to factor number 9. Counting back one factor means that the actual break point was 9, and then a 8 factor solution should be also tested.

In fact, the Scree plot in figure 6-3 was not very clear because there was more than one obvious break and it seems just a gradual curve. Therefore it was very important to examine all possible realistic solutions such as, 12 factors because it is the original structure of the questionnaire, and also 9 factors for reasons of completeness and also because it was suggested by another validation study (Waterson et al., 2009). All of the possible solutions should be investigated because EFA is an exploratory approach and experimentation with different number of factors should be continued until a satisfactory solution is found (Pallant, 2007).

The decision was made that all these possibilities; 12-11-10-9-8 factor solutions should be investigated in order to find how many factors should be extracted as the most appropriate solution and also to explore loading of each item and variance explained in each solution. The best solution is:

1 One where it makes theoretical sense (items in one factor theoretically related), it explains the most total variance, each item is explained well by this number of factors , the rotated solution has no low loading items.
2 All items loading upon factors.
3 No cross- loading items or cross loading items are heavily in one factor and low on another.
4 No free- standing items (one item in one factor).
5 The most items loading should be quite strongly (close or above 0.4) in the final model.
6 Three items and above load up on each factor is the best but two items are acceptable especially if they are very high loadings items (above 0.5) and theoretically related.

All these possible (11-12-10-9-8) factor solutions were investigated. Each solution is presented below: Step 4 investigated the 11 factor solution, step 5 investigated the 12 factor solution, step 6 investigated the 10 factor solution, step 7 investigated the 9 factor solution and step 8 investigated the 8 factor solution.

Step 4: The 11 factor solution

EFA was run on all safety climate items of HSOPSC (42 items), Principal Axis Factoring was the chosen extraction method. Varimax was the chosen rotation method and 11 factors were used instead of eigenvalues > 1.

Output of the 11 factor solution:

The output of the 11 factors including the communalities, the total variance explained table and rotated factor matrix were the same output of the initial solution above in step 1 (pages: 181-186). To avoid repetition it is not presented twice.

Step 5: The 12 factor solution

EFA was run on all safety climate items (42 items) with using varimax rotation and number of factors (12).

Output of the 12 factor solution:

The output of the 12 factor solution includes the communalities, the total variance explained table and rotated factor matrix. The extraction column of the communalities table of the 12 factor solution shows the proportion of variance of each variable explained by 12 factors solution. Six items, specifically A2, A5, A10, A15, A17, and F3 are very poorly explained (very poor communalities, < 0.3) (see appendix 30). The total variance explained table shows that 12 factor solution accounts for 48% of total variance (see appendix 31).

The rotated factor matrix of the 12 factor solution shows the loadings of 12 factors with multiple items on each factor. Items A17 and F3 did not load upon any factor. Items cross loadings were A2, A11, A13, A14, A18, B4, C2, F1, F2, F8, and F9. A2 cross load on factor four and factor nine. A11 cross load on factors four, nine and 11. A13 cross loaded on factors three and seven. A14 cross loaded on factors six and nine. A18 cross loaded on factors five and seven. B4 cross loaded on factors eight, 11 and 12. C2 cross loaded on factors three and ten. F1 cross loaded on factors five and seven. F2 cross loaded on factors one and five. F8 cross loaded on factors five and seven. F9 cross loaded on factors one and seven (see appendix 32). Table 6-24 shows the structure of the 12 factor solution and item loadings.

Table 6- 24 Structure of the 12 factors solution and item loadings

Factor number	Items	loading (<0.4)	Heavily loading(>0.4)
1	F2-F5-F6-F7-F9-F11	F2-F9	F5-F6-F7-F11
2	D1-D2-D3		D1-D2-D3
3	C1-c2-C3-C5-A13	C2	C1-C3-C5-A13
4	A1–A2-A3-A4-A11	A2-A11	A1-A3-A4
5	F1- F2-F4-F8 -F10-A18	F1-A18	F2-F4-F8-F10
6	A8- A12 –A14-A16	A14	A8- A12 -A16
7	A6-A9-A13-A15-A18-F1-F8-F9	A15-A18-F1-F8-F9	A6-A9-A13
8	B1-B2-B4	B4	B1-B2
9	A5-A7-A14-B3-A11-A2-	A2-A11-A14	A5-A7-B3
10	C2-C4-C6		C2-C4-C6
11	A10-A11-B4	A10-A11-B4	
12	B4	B4	

The 12 factor solution contained several items with loading less than 0.4. These items were F1-F9-A2-A10-A11-A14-A15-A18-B4. Factors number 11 and 12 had no items loading >0.4, which means there are too many factors in this solution. In summary, this solution provided ten clear factors with multiple items loading heavily on each factor.

Step 6: The 10 factor solution

EFA was run on all safety climate items (42 items) using varimax rotation and number of factors (10).

Output of the 10 factor solution:

The output of the 10 factors including the communalities; the total variance explained table and rotated factor matrix are provided in appendix. The extraction column of the communalities table of the 10 factor solution shows the proportion of variance of each variable explained by the 10 factors solution. Seven items, specifically A2, A5, A7, A10, A15, A17, and F3 are very poorly explained (very poor communalities, <0.3) (see appendix 33).

The total variance explained table shows the 10 factors solution accounts for 45.5% of total variance (see appendix 34). The rotated factor matrix shows the loadings of the 10 factors with multiple items on each factor. Items A10, A15, A17 and F3 did not load upon any factor. Items cross loadings were A3, A11, A13, A14, B3, C2, C3, C5, F2 and F10.

A3 cross loaded on factor one and factor four. A11 cross loaded on factors four and seven. A13 cross loaded on factors one and eight. A14 cross loaded on factors five and seven. B3 cross loaded on factors seven and ten. C2 cross loaded on factors eight and nine. C3 cross loaded on factors one and eight. C5 cross loaded on factors one and eight. F2 cross loaded on factors one and factor two. F10 cross loaded on factors one and factor two (see appendix 35). Table 6-25 shows the structure of the 10 factor solution and item loadings.

Table 6- 25 Structure of the 10 factor solution and its loading

Factor number	Items	loading (<0.4)	Heavily loading(>0.4)
1	A6-A13-A18-F8-F10-F1-F4-A9-C5-A3-C3-F2-F9	A3-C3-F2-F9	A6-A13-A18-F8-F10-F1-F4-A9-C5
2	F2-F5-F6-F7-F11-F10	F10	F2-F5-F6-F7-F11
3	D1-D2-D3		D1-D2-D3
4	A1-A3-A4-A11	A11	A1-A3-A4
5	A8- A12 –A14-A16	A14	A8- A12 -A16
6	B1-B2-		B1-B2
7	A5-A7-A14-B3-A11-A2-	A2-A11-A14-B3	A5-A7
8	C3-C1-C5-A13-C2	C2	C3-C1-C5-A13
9	C2-C4-C6		C2-C4-C6
10	B3-B4	B3	B4

The 10 factor solution contained several items with loading less than 0.4. These items were F9-A11-A14-A2-B3. Some items had loading <0.4 but loadings >0.4 on different factors such as A3-C3-F2-F10-C2. Factor number 10 had one item loading >0.4. In summary this solution provided nine clear factors with multiple items loading heavily on each factor. Factor number one included nine items that had loadings >0.4. This factor might be divided into two factors meaning this solution included 10 factors.

EFA was re run on all safety climate items (42 items) with using oblique rotation and number of factors (10). In this step the rotation was changed into oblique to make sure that factor number 10 was loading by one item. The result was given by oblique rotation indicated that the factor number 10 was loading heavily by one item. Therefore, this solution provides nine factors with multiple items loading heavily on each factor.

Step 7: The 9 factors solution

EFA was run on all safety climate items (42 items) using varimax rotation and number of factors (9).

Output of the 9 factor solution:

The output of the 9 factors includes the communalities, the total variance explained table and rotated factor matrix. The extraction column of the communalities of the 9 factors solution table shows the proportion of variance of each variable explained by 9 factors solution. Seven items, specifically A2, A5, A7, A10, A15, A17, C6, and F3 are very poorly explained (very poor communalities, < 0.3) (see appendix 36).

The Total variance explained table shows the 9 factor solution accounts for 44.2% of total variance (see appendix 37). The rotated factor matrix table of the 9 factor solution shows the loadings of 0 9 factors with multiple items on each factor. Items A10, A15, A17 and F3 did not load upon any factor. Items cross loadings were A3, A11, A14, B1, B2, B3, C2, C5, F1, F4, F9 and F10. A3 cross loaded on factors one and four. A11 cross loaded on factors one and six. A14 cross loaded on factors five and six. B1 cross loaded on factors one and eight. B2 cross loaded on factors one and eight. B3 cross loaded on factors six and nine. C2 cross loaded on factors one and seven. C5 cross loaded on factors one and seven. F1 cross loaded on factors one and two. F4 cross loaded on factors two and nine. F9 cross loaded on factors one and two. F10 cross loaded on factors one and two (see appendix 38). Table 6-26 shows the structure of the 9 factor solution and item loadings.

Table 6- 26 Structure of the 9 factors solution and its loading

Factor number	Items	loading (<0.4)	Heavily loading(>0.4)
1	A3-A6-A9-A11-A13-A18-B1-B2-B4-C1-C2-C3-C5-F1-F8-F9-F10	A3-A11-B1-B2-B4-C2-F1-F9	A6-A9-A13-A18-C1-C3-C5-F8-F10
2	F1-F2-F4-F5-F6-F7-F9-F10-F11	F1-F4-F9	F2-F5-F6-F7-F10-F11
3	D1-D2-D3		D1-D2-D3
4	A1-A3-A4		A1-A3-A4
5	A8-A12-A14-A16	A14	A8-A12-A16
6	A2-A5-A6-A7-A11-A14-B3	A2-A11-	A5-A7-A14-B3
7	C2-C4-C5-C6	C5	C2-C4-C6
8	B1-B2		B1-B2
9	B3-F4	B3	F4

The 9 factor solution contained several items with loading less than 0.4. These items were A2-A5-A11-B3-C5-F1-F9. Some items had loading <0.4 but loadings >0.4 on different factors such as A3-A14-F4-C2. Factor number 9 have one item loading >0.4. In summary this solution provided nine factors with multiple items loading heavily on each factor. Factors number one consists of nine items loading >0.4. This factor might be divided into two factors. Factors number two consists of six items loading >0.4. This factor might be divided into two factors.

EFA was re run on all safety climate items (42 items) using oblique rotation and number of factors (9) to check whether the number of extracted factors had changed or not. In this step the rotation was changed into oblique to make sure that factor number 9 was loading by one item. The result given by oblique rotation indicated that factor number 9 was still loading heavily by one item. However, this solution provided eight factors with multiple items loading heavily on each factor.

Step 8: The 8 factor solution

EFA was run on all safety climate items (42 items) using varimax rotation and number of factors (8).

Output of the 8 factor solution:

The output of the 8 factors solution includes the communalities, the total variance explained table and rotated factor matrix. The extraction column of the communalities table of the 8 factors solution shows the proportion of variance of each variable explained by 8 factors solution. Seven items, specifically A2, A5, A7, A10, A15, A17, C6, and F3 are very poorly explained (very poor communalities, < 0.3) (see appendix 39). The Total variance explained table of the 8 factors solution shows 8 factors solution accounts for 42.4% of total variance (see appendix 40).

The rotated factor matrix of the 8 factor solution shows the loadings of 8 factors with multiple items on each factor. Items A10, A15, A17 and F3 did not load upon any factor. Items cross loadings were: A3, A11, A14, B1, B2, B3, B4, C2, C5, F1, F2, F4, F9 and F10. A3 cross loaded on factors one and four. A11 cross loaded on factors one and four and seven. A14 cross loaded on factors five and seven. B1 cross loaded on factors one and eight. B2 cross loaded on factors one and eight. B3 cross loaded on factors seven and eight. B4 cross loaded on factors one and eight. C2 cross loaded on factors one and six. C5 cross loaded on factors one and six. F1 cross loaded on factors one and two. F2 cross loaded on factors one and two. F4 cross loaded on factors one and two and four. F9 cross loaded on factors one and two. F10 cross loaded on factors one and two (see appendix 41). Table 6-27 shows the structure of the 8 factor solution and its item loadings.

Table 6- 27 Structure of the 8 factor solution and its item loadings

Factor number	Items	loading (<.4)	Heavily loading(>.4)
1	A3-A6-A9-A11-A13-A18-B1-B2-B4-C1-C2-C3-C5-F1-F2-F4-F8-F9-F10	A3-A11-B2-B4-C2-F1-F2-F4-F9	A6-A9-A13-A18-B1-C1-C3-C5-F8-F10
2	F1-F2-F4-F5-F6-F7-F9-F10-F11	F1-F4-F9	F2-F5-F6-F7-F10-F11
3	D1-D2-D3		D1-D2-D3
4	A1-A3-A4-A11-F4	A11-A14	A1-A3-A4
5	A8-A12-A14-A16	A14	A8-A12-A16
6	C2-C4-C5-C6	C5-C6	C2-C4
7	A2-A5-A7-A11-A14-B3	A2-A11	A5-A7-A14-B3
8	B1-B2-B3-B4-		B1-B2-B3-B4

It is clear that the 8 factor solution contained several items with loading less than 0.4. These items were A2-A11-C5-C6-F1-F9. Some items had loading <.4 but loadings >0.4 on different factors such as A3-A14-B2-B4-C2. In summary this solution provided eight clear factors with multiple items loading heavily on each factor. Factor number one consisted of ten items loading > 0.4. This factor might be divided into two factors. Factor number two consists of six items loading > 0.4. This factor might be divided into two factors.

EFA was re run on all safety climate items (42 items) with using oblique rotation and number of factors (8) to check whether the number of extracted factors had changed or not. The result was given by oblique rotation indicated that the same number of extracted factors (8 factors). Therefore, this solution provided eight clear factors with multiple items loading heavily on each factor.

Conclusion from the different factor solutions (11-12-10-9-8)

The investigation of the five solutions in steps number 4-5-6-7-8 aimed to identify the number of factors that could be extracted. The 11 factors solution shows that the 11 factors seems the most logical fit to this set of items. The 12 factors solution shows that the 10 factors seems the most logical fit to this set of items. The 10 factors solution shows that the nine factors seems the most logical fit to this set of items. The 9 and 8 factor solutions show that the 8 factors seems the most logical fit to this set of items. Items number A10-A15-A17-F3 had no loading upon any factor. Table 6-28 shows the summary of the five solutions.

Table 6- 28 Summary of the five solutions

Steps of E.F.A	**Solution**	**Number of factors**	**Total variance explained %**	**Items not loading**
Step 4	11	11	46.8	A10-A15-A17
Step 5	12	10	48	A17-F3
Step 6	10	9	45.5	A10-A15-A17-F3
Step 7	9	8	44.2	A10-A15-A17-F3
Step 8	8	8	42.4	A10-A15-A17-F3

Table 6-29 shows the low communalities and loading items in each solution.

Table 6- 29 Low communalities and loading items in each solution

Steps of E.F.A	**Solution**	**Items with low communalities (< 0.3)**	**Items with low loading (< 0.4)**
Step 4	11	A2-A5-A10-A15-A17-F3	F1-F3-F9-A11-A18-A14-A2-B3
Step 5	12	A2-A5-A10-A15-A17-F3	F1-F9-A11-A10-A14-A15-A18-A2-B4
Step 6	10	A2-A5-A7-A10-A15-A17-F3	F9-A11-A14-A2-B3
Step 7	9	A2-A5-A10-A15-A17-F3-C6	A2-A5-A11-B3-C5-F1-F9
Step 8	8	A2-A5-A7-A10-A15-A17-C6-F3	A2-A11-C5-C6-F1-F9

The items that did not load upon any factor were A10-A15-A17-F3 across most of the proposed solutions and items A2-A5-A10-A15-A17-F3 had low communalities across most the proposed solutions. Items A2-A11-F1-F9 had low loading (< 0.4). It is important to notice that A10-A15-A17 were all from one dimension (overall perceptions of patient safety) while A2-A5 were from another dimension (staffing), F1-F9 were from another dimension (management support for patient safety) and F3 was from different dimension (handoffs and transitions).

It is important to mention that extra investigation (EFA and CFA) was performed in order to explore potential improvements and because exploratory factor analysis is based on exploration approach. Therefore, this investigation was performed by exploring the comparison between the 11-12-10-9-8 factors solutions that produced the common factor structure across these solutions. Although the eight factors seems the most appropriate number in terms of how many factors that should be extracted, it seems that the common factor structure which consists of 10 factors should be examined. However, the result of this extra investigation also confirmed that the eight factor solution is the optimal model of the current study (see appendix 47).

In conclusion the results of the comparison above between the five solutions suggested 10 or 9 or 8 factor solution. However, the 8 factors seems the most appropriate number in terms of how many factors that should be extracted because it was indicated in the Scree plot and it was recommended by the 9 factors solution and the 8 factors solution. Each solution has a number of cross loadings items; hence orthogonal rotation was used to produces more easily interpretable results (Costello and Osborne, 2005). However, rotation cannot improve the basic aspects of the analysis, such as the amount of variance extracted from the items (Costello and Osborne, 2005). Therefore, the 8 factors were investigated by using oblique rotation to obtain the optimal solution.

Step 9:

EFA was run on all safety climate items (42 items) with using an oblique rotation and number of factors (8).

Output:

As mentioned earlier the output of the 8 factors including the communalities, the total variance explained were the same output in step 8. The pattern matrix of the 8 factors solution shows the loadings of 8 factors with multiple items on each factor. Items A10, A15, A17, F3 and F4 did not load upon any factor (see appendix 42). The 8 factor solution contained several items with loading less than 0.4. These items were A2-A11-A14-A18-B3-B4-C1-C3-C6-F1-F9-F10. Therefore, these 17 items were excluded on the next step.

Step 10:

EFA was run excluding A10-A15-A17-F3-F4-A2-A11-A14-A18-B3-B4-C1-C3-C6-F1-F9-F10 by using oblique rotation and number of factors (8).

Output:

The output of the 8 factors included the communalities, the total variance explained table and pattern matrix. The extraction column of the communalities table of the 8 factors solution shows the proportion of variance of each variable explained by 8 factors solution. Item A7 was very poorly explained (very poor communalities, < 0.3) (see appendix 43). The total variance explained table of the 8 factors solution shows 8 factor solution accounts for 51.2% of total variance (see appendix 44).

The pattern matrix shows the loadings of the 8 factors with multiple items on each factor. Item number C5 cross loaded on factors one and six. Item number F2 had loading less than 0.4 (see appendix 45). Therefore, these two items (C5-F2) were excluded on the next step.

Step 11: The final 8 factor EFA solution

EFA was run excluding 19 items (A10-A15-A17-F3-F4-A2-A11-A14-A18-B3-B4-C1-C3-C5-C6-F1-F9-F10-F2) with using oblique rotation and number of factors (8).

Output of the final 8 factor EFA solution

The output of the final 8 factor EFA solution included the communalities, the total variance explained table, Scree plot and pattern matrix. Table 6-30 shows the communalities of the final 8 factor EFA solution.

Table 6- 30 Communalities of the final 8 factor EFA solution (n=431)

Safety climate items	Initial	Extraction
A1 Staff support one another in this unit	.48	.66
A3 When a lot of work needs to be done quickly, we work together as a	.41	.51
A4 In this unit, people treat each other with respect	.45	.60
A5 Staff in this unit work longer hours than they should, which is not good	.15	.28
A6 We are actively doing things to improve patient care	.37	.47
A7 We use more temporary staff than we should, which is not good for	.17	.24
A8 Staff feel like their mistakes are held against them	.41	.61
A9 Mistakes have led to positive changes here	.31	.34
A12 When an event is reported, it feels like the person is being written up,	.40	.54
A13 After we make changes to improve patient safety, we evaluate their	.38	.49
A16 Staff worry that mistakes they make are kept in their personnel file	.26	.35
B1 My supervisor/manager says a good word when he/she sees a job done	.57	.70
B2 My supervisor/manager seriously considers staff suggestions for	.60	.77
C2 Staff will freely speak up if they see something that may negatively	.40	.51
C4 Staff feel free to question the decisions or actions of those with more	.31	.60
D1 When a mistake is made, but is caught and corrected before affecting the	.52	.56
D2 When a mistake is made, but has no potential to harm the patient, how	.64	.89
D3 When a mistake is made that could harm the patient, but does not, how	.50	.52
F5 Important patient care information is often lost during shift changes	.34	.43
F6 It is often unpleasant to work with staff from other hospital units	.30	.37
F7 Problems often occur in the exchange of information across hospital	.36	.57
F8 The actions of hospital management show that patient safety is a top	.29	.34
F11 Shift changes cause problems for patients in this hospital	.31	.40

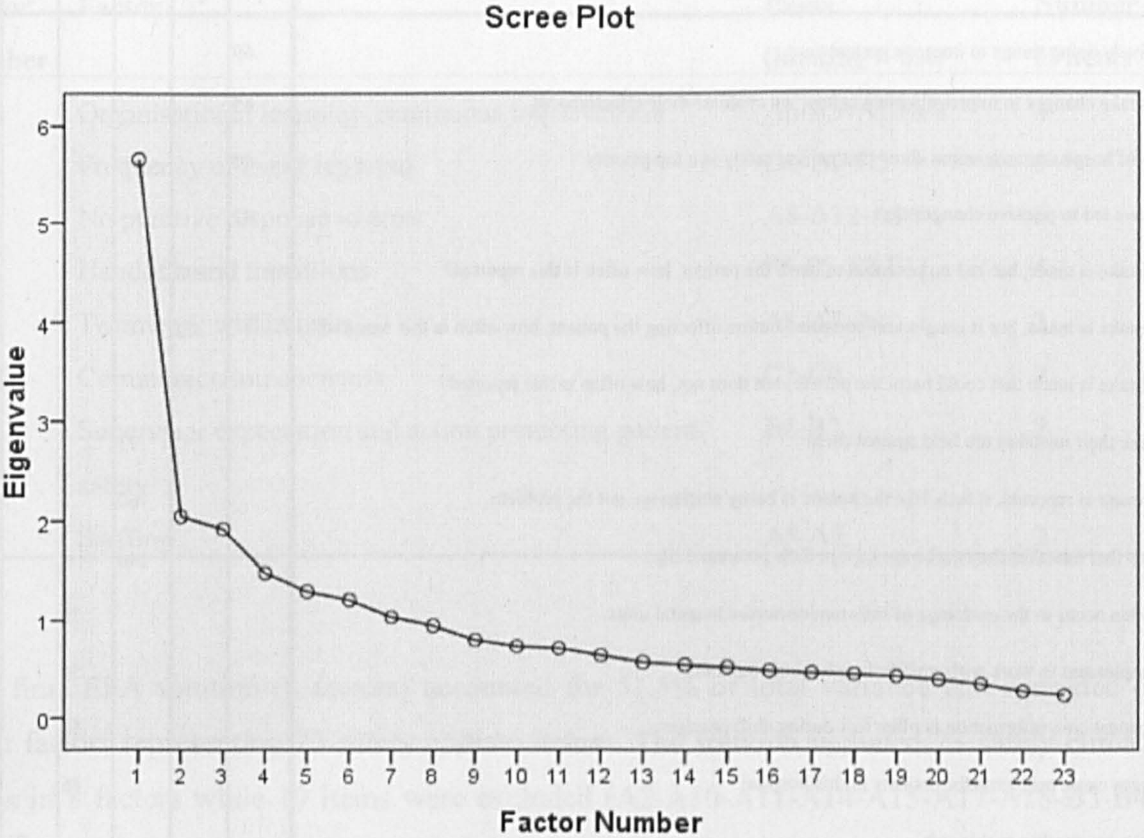
Extraction Method: Principal Axis Factoring

Table 6- 31 Total variance explained of the final 8 factor EFA solution (n=431)

Factor	Initial Eigenvalues			Extraction Sums of Squared			Rotation
	Total	% of	Cumulative %	Total	% of	Cumulative %	Total
1	5.65	24.6	24.6	5.21	22.6	22.6	3.0
2	2.04	8.8	33.4	1.67	7.2	29.9	2.8
3	1.91	8.3	41.8	1.41	6.1	36.1	1.9
4	1.47	6.4	48.2	.98	4.2	40.4	2.3
5	1.29	5.6	53.8	.89	3.9	44.3	2.5
6	1.20	5.2	59.0	.65	2.8	47.1	2.3
7	1.02	4.4	63.5	.56	2.4	49.6	2.9
8	**0.93**	**4.0**	**67.6**	**.44**	**1.9**	**51.5**	**1.3**
9	.79	3.4	71.0				
10	.72	3.1	74.1				
11	.70	3.0	77.2				
12	.63	2.7	79.9				
13	.56	2.4	82.4				
14	.53	2.3	84.7				
15	.51	2.2	86.9				
16	.47	2.0	89.0				
17	.45	1.9	91.0				
18	.44	1.9	92.9				
19	.42	1.8	94.7				
20	.38	1.7	96.5				
21	.33	1.6	97.1				
22	.25	1.2	99.4				
23	.22	.5	100				

The total variance explained table shows the 8 factors solution accounts for 51.5% of total variance. Figure 6-4 shows the Scree plot of the final 8 factor EFA solution.

Figure 6- 2 Scree plot of the final 8 factor EFA solution



The break in this Scree plot suggested the eight factor solution. The following table shows the pattern matrix of the final 8 factor solution.

Table 6- 32 Pattern matrix of the final 8 factor EFA solution (n=431)

Safety climate items	Factor							
	1	2	3	4	5	6	7	8
A6 We are actively doing things to improve patient care	.69							
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.65							
F8 The actions of hospital management show that patient safety is a top priority	.40							
A9 Mistakes have led to positive changes here	.42							
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?		.98						
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		.72						
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?		.77						
A8 Staff feel like their mistakes are held against them			.73					
A12 When an event is reported, it feels like the person is being written up, not the problem			.60					
A16 Staff worry that mistakes they make are kept in their personnel file			.46					
F7 Problems often occur in the exchange of information across hospital units				.75				
F6 It is often unpleasant to work with staff from other hospital units				.56				
F5 Important patient care information is often lost during shift changes				.58				
F11 Shift changes cause problems for patients in this hospital				.46				
A1 Staff support one another in this unit					-.71			
A4 In this unit, people treat each other with respect					-.71			
A3 When a lot of work needs to be done quickly, we work together as a team to get the work done					-.50			
C4 Staff feel free to question the decisions or actions of those with more authority						.75		
C2 Staff will freely speak up if they see something that may negatively affect patient care						.55		
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety							-.76	
B1 My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures							-.71	
A5 Staff in this unit work longer hours than they should, which is not good for patient care								.59
A7 We use more temporary staff than we should, which is not good for patient care								.49

Extraction Method: Principal Axis Factoring.
Rotation Method: Oblimin with Kaiser Normalization

a. Rotation converged in 11 iterations.

Table 6-33 shows the structure and factor loadings of the final EFA solution (8 factors).

Table 6- 33 Structure of the final EFA solution

Factor number	Factor	Items (loading > 0.4)	Number of items
1	Organisational learning- continuous improvement	A6-A9-A13-F8	4
2	Frequency of event reported	D1-D2-D3	3
3	No punitive response to error	A8-A12-A16	3
4	Handoffs and transitions	F5-F6-F7-F11	4
5	Teamwork within units	A1-A3-A4	3
6	Communication openness	C2-C4	2
7	Supervisor expectation and action promoting patient safety	B1-B2	2
8	Staffing	A5-A7	2

The final EFA solution (8 factors) accounted for 51.5% of total variance and consisted of eight factors representing 23 safety climate items. The solution included 23 safety climate items in 8 factors while 19 items were excluded (A2-A10-A11-A14-A15-A17-A18-B3-B4-C1-C3-C5-C6-F1-F2-F3-F4-F9-F10). Factor loadings were between 0.43 and 0.97. There were only small shifts among items across factors for instance, F6 moved from "teamwork across units" to handoffs and transitions. F8 moved from "management support for patient safety" to organisational learning-continuous improvement. All dimensions consisted of two to four safety climate items. The structure of the 8 factor final EFA solution makes theoretical sense, as all 23 safety climate items that are theoretically related were grouped together as a factor. There was no cross-loading. There were no free - standing items (just one item in one factor). All the 23 safety climate items were loading quite strongly (loading > 0.4).

The best solution is one where it makes theoretical sense (items in one factor theoretically related), it explains the most total variance, each item is explained well by this number of factors, the rotated solution has no low–loading items and all items load upon factors. There is no cross-loading items (item is heavily in one factor and low on another). There is no free -standing item (one item in one factor).

The most items loading quite strongly (above 0.4) in the final model. Three items and above upon each factor is the best but two items are acceptable especially if they are very high loading items (above 0.5) and theoretically related. The next step investigated each factor of the final 8 factor EFA solution.

EFA of each potential scale of the final solution (8 factors solution)

This step aimed to check the final solution (8 factors) derived from these exploratory factor analyses. Therefore, conducting an exploratory factor analysis on each scale (factor) to check each set of items is satisfactorily explained by a single factor as structured in the final solution in table 6-33. In the other words this step aimed to make sure that these items for the scale only load onto one scale. In general, the reason for this extra EFA is to check the overall (final) EFA of the final solution. The output of this step showed that each set of items was loaded on one factor as they were structured in the final solution in table 6-33. Overall, all items (23 items) and 8 factors were satisfactorily explained by a single factor (the output of this step is provided in appendix 46). The next section concerns with testing the fit of the optimal model (8 factors).

6.5.2 Testing the fit of the optimal model: CFA

This step aimed to test, using the validation half of the data, the fit of the optimal model (eight factors) that emerged from the EFA that was performed on the construction half of the data.

The process of CFA analysis of the eight factors solution was followed:

1 AMOS Graphics was used to open up a blank diagram window
2 Opening the data (the validation half of the data, 431 questionnaires)
3 Building the model (drawing the eight factors by using the model drawing area in step one)
4 Adding the variable names to the model
5 Running the model and using the output window

Table 6-34 shows the output of CFA of 8 factors solution.

Table 6- 34 Output of CFA of 8 factors solution (n=431)

Model	Chi-square	DF	CMIN/DF	CFI	RMSEA	RMR	SRMR	TLI
Eight Factors	407 (good)	202 (good)	2 (good)	0.93 (good)	0.04 (good)	0.04 (good)	0.04 (good)	0.92 (good)

The output in table 6-34 above shows that this model achieved good fit, Chi-square (χ^2) (202) = 407, P< 0.001; CMIN/DF = 2 (good model $\leq$2), CFI = 0.93 (CFI > 0.90); RMSEA = 0.049 (RMSEA < 0.06); SRMR = 0.047 (SRMR < 0.08). Overall, the fit indices from CFA of eight factors indicated that this model fit was good. Furthermore, the fit of the optimal model (eight factors) was tested for whole data (862) to confirm it as optimal model of the current study. Table 6-35 shows the output of the CFA testing the fit of optimal models for whole data (862 questionnaires).

Testing the fit of optimal model for whole data

Table 6- 35 Output of the CFA testing for whole data (n=862)

Model	Chi-square	DF	CMIN/DF	CFI	RMSEA	RMR	SRMR	TLI
Eight factors	553 (good)	202 (good)	2 (good)	0.94 (good)	0.04 (good)	0.03 (good)	0.04 (good)	0.93 (good)

The values of the fit indices of the Saudi data (8 factors) meet the general agreed parameters in table 6-15 page 174. Therefore, this model fit was a good fit. Consequently this model was acceptable as the optimal model of the current study. Moreover, the comparison of CFA of USA and UK models and the optimal model (8 factors) of the current study was performed in order to check the results of the CFA of the optimal model of the current study. Table 6-36 presents the comparison of CFA of the USA (Sorra and Nieva, 2004) and the UK (Waterson et al., 2009) models and the optimal model (8 factors) of the current study.

Table 6- 36 Comparison of CFA OF USA, UK and the current study

Model	Chi-square	DF	CMIN/DF	CFI	RMSEA	RMR	SRMR	TLI
USA	2064	746	-	0.94	0.04	-	-	-
UK	587	288	-	0.94	0.04	-	0.04	0.93
The current study	553	202	2	0.94	0.04	0.03	0.04	0.93

The results of the CFA of the optimal model of the current study are in line with other results of CFA in USA and UK studies. It is clear that the optimal model that fits the Saudi data is the eight factor solution.

6.5.3 Construct validity (factor correlations of the optimal model)

The factor correlations of the optimal model were examined to find out whether the eight factors related to each other or not. The construct validity was studied by calculating correlations between the scale scores for every factor and subsequently calculating Pearson correlation coefficients between the scale scores. Table 6-37 shows the inter-correlations of the 8 dimensions (correlation coefficient).

Table 6- 37 Inter-correlation of the 8 dimensions

N	Dimension	1	2	3	4	5	6	7
1	Organisational learning- continuous improvement	-						
2	Frequency of event reported	.15	-					
3	No punitive response to error	.25	.35	-				
4	Handoffs and transitions	.31	.38	.29	-			
5	Teamwork within units	.41	.38	.62	.45	-		
6	Communication openness	.29	.50	.46	.39	.58	-	
7	Supervisor expectation and action promoting patient safety	.25	.52	.25	.51	.35	.33	-
8	Staffing	.23	.36	.48	.31	.65	.56	.29

Note: All correlations are significant, P<.001

Table 6-37 shows that inter-correlation between the eight factors range between .154 up to .658 supporting that the factors are not independent from each other. The construct validity of each factor is reflected in scale scores that are moderately related. High correlations ($r > 0.7$), however, would indicate that factors measure the same concept (Smits et al., 2008). The highest correlation were those between teamwork within units and staffing(r = 0.658), but no correlation was exceptionally high. The construct validity was satisfactory for all factors; the moderate correlations of the factors show that there are no two factors measuring the same construct. The eight factors (dimensions of patient safety culture) of the optimal model are related to each other. The next section concerns reliability analysis of the optimal model.

6.5.4 Reliability analysis (internal consistency)

This step was concerned with reliability analysis (internal consistency) of the optimal model. The negatively formulated items were first recoded on the whole sample (862) to ensure that all items are coded in the same conceptual direction. The internal consistency was calculated for every factor according to the optimal model dimensions and items structure (8 factor solutions). Table 6-38 shows the results of the reliabilities of each scale of the eight factor model.

Table 6- 38 results of the reliability analysis of the 8 factor model (n=862)

Factor	Items	Cronbach's Alpha
Factor 1	A6-A9-A13-F8	0.68
Factor 2	D1-D2-D3	0.84
Factor 3	A8-A12-A16	0.72
Factor 4	F5-F6-F7-F11	0.69
Factor 5	A1-A3-A4	0.79
Factor 6	C2-C4	0.69
Factor 7	B1-B2	0.83
Factor 8	A5-A7	0.41

The reliability analysis indicated that Cronbach's alpha values of the factors are above 0.68, except for factor 8 which is low. This factor consists of two items. However, this factor is still acceptable because the various fit indices in confirmatory factor analysis of the model meet the agreed parameters. Furthermore, the theoretical structure of this factor is related to the staffing dimension. It is possible that a set of items will be below 0.7 on Cronbach's alpha, yet various fit indices in confirmatory factor analysis will be above the cut off levels. Alpha coefficient may be low because of lack of homogeneity of variances among items, for instance, and it is also lower when there are fewer items in the scale/factor (Kline, 2005).

In summary, the 8 factor model (23 safety climate items) is the optimal model for the Saudi data. The next section provides the dimensions and items comprising the eight structure of the optimal model.

6.6 Proposed optimal model

Table 6- 39 Proposed optimal model

Factor 1: Organisational learning-continues improvement (4 items)
A6: We are actively doing things to improve patient care
A9: Mistakes have led to positive change here
A13: After we make changes to improve patient safety, we evaluate their effectiveness
F8: The actions of hospital management show that patient safety is a top priority
Factor 2: Frequency of events reported (3 items)
D1: When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?
D2: When a mistake is made, but has no potential to harm the patient, how often is this reported?
D3: When a mistake is made that could harm the patient, but does not, how often is this reported?
Factor 3: No punitive response to error (3 items)
A8: Staff feel like their mistakes are held against them®
A12: When an event is reported, it feels like the person is being written up, not the problem®
A16: Staff worry that mistakes they make are kept in their personnel file®
Factor 4: Handoffs and transition (4 items)
F5: Important patient care information is often lost during shift changes®
F6: It is often unpleasant to work with staff from other hospital units®
F7: Problems often occur in the exchange of information across hospital units®
F11: Shift changes cause problems for patients in this hospital®
Factor 5: Teamwork within units (3 items)
A1: Staff support one another in this unit
A3: When a lot of work needs to be done quickly, we work together as a team to get the work
A4: In this unit, people treat each other with respect
Factor 6: Communication openness (2 items)
C2: Staff will freely speak up if they see something that may negatively affect patient care
C4: Staff feel free to question the decisions or actions of those with more authority
Factor 7: Supervisor expectation and action promoting patient safety (2 items)
B1: My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures
B2: My supervisor/manager seriously considers staff suggestions for improving patient safety
Factor 8: Staffing (2 items)
A5: Staff in this unit work longer hours than they should, which is not good for patient safety®
A7: We use more temporary staff than we should, which is not good for patient care®

R indicates negatively worded items

Table 6-39 shows the structure of the optimal model consists of 23 items (14 positively worded items and nine negatively worded items). The optimal model (eight factors) includes five positively worded factors and three negatively worded factors.

6.7 Summary of overall findings

The validity and reliability of the HSOPSC questionnaire was rigorously tested using Saudi data (862 completed questionnaires). The results of descriptive analysis show that the majority of respondents agree and strongly agree with positively worded items. The majority of respondents disagree and strongly disagree with negative items. The pre-analysis showed that the Saudi data was suitable to be subjected to factor analysis.

The initial results of the CFA and reliability analysis showed that when applying the original USA HSOPSC model (Sorra and Nieva, 2004) to the Saudi data, the fit indices from CFA and values of Cronbach's alpha (α) indicated that this model fit was not satisfactory. The results of EFA, CFA, correlation and reliability analysis showed that the optimal model to the Saudi data consists of eight factors (23 safety climate items).

The findings of this study indicated that the original USA HSOPSC model (Sorra and Nieva, 2004) was not valid and reliable in Saudi hospitals. The optimal model could be used in Saudi hospitals to assess patient safety culture. In the next chapter, the findings are discussed.

Chapter Seven: Discussion

7.1 Introduction

This chapter discusses the research findings that emerged from this study. The purpose of this chapter is to discuss the findings of this thesis with reference to the literature of patient safety culture measurement that was reviewed in chapter two. This chapter addresses the key findings in relation to three topics: face validity (section 7.2), testing the original English language HSOPSC model (Sorra and Nieva, 2004) (section 7.3) and developing an optimal model in a Saudi context (section 7.4). The methodological issues as well as the strengths and limitations of the study are addressed. Section 7.5 discusses some methodological issues related to negatively worded items and reporting psychometric properties of patient safety climate questionnaires. Section 7.6 presents the strengths and limitations of the study. Finally, section 7.7 summarises the findings and impact of the study.

7.2 Face validity findings

This section aims to discuss the findings of the face validity testing of the original HSOPSC questionnaire (Sorra and Nieva, 2004) and the Teamwork and Safety Climate survey (Sexton et al., 2004) in the Saudi context. Face validity is a measure of whether a tool seems reasonable, and produces reasonable data from the viewpoint of its respondents (Carmines and Zeller, 1979). Face validity refers to whether the test seems to measure what it is intended to measure. In other words, face validity is an initial assessment of how a test looks (Streiner and Norman, 1995).

In terms of the importance of face validity, a number of studies demonstrated that establishing the face validity of a patient safety climate questionnaire is an essential element before full application. For example, Hutchinson et al. (2006) asked a number of staff members to complete the Stanford University Patient Safety Climate in Healthcare Organisations questionnaire (Singer et al., 2003) and the Teamwork and Safety Climate Survey (Sexton et al., 2004) for comparison. A number of changes were made to the Teamwork and Safety Climate Survey (Sexton et al., 2004) to make it clear and accessible for frontline staff. Hutchinson et al., (2006) demonstrated a more general need for thorough validation of safety climate questionnaires before widespread usage because environmental differences might exist at the national level. Waterson et al. (2009) discussed the original HSOPSC questionnaire (Sorra and Nieva, 2004) with NHS staff members before full application. As a result a number of changes were made to the wording of the questionnaires with respect to terminology used within the UK settings. Waterson et al., (2009) emphasised that there is a need for caution in using patient safety climate questionnaires in different settings and they stress the importance of appropriate validation before widespread use in different contexts.

It seems that assessing face validity is a critical issue whenever patient safety climate questionnaires are used. According to Pronovost and Sexton (2005) it is important to validate patient safety climate questionnaires before extensive use in a new context. Therefore, attention should be paid to establish face validity before extensive use, especially in a new context.

The approach taken to test the face validity of a patient safety climate questionnaire varies between studies. The first approach is used where patient safety climate questionnaires have been translated and validated in other languages for use in different countries. For example, Deilkas and Hofoss (2008) translated the SAQ (Sexton et al., 2004) to Norwegian and validated the translated version. The original HSOPSC questionnaire (Sorra and Nieva, 2004) was translated and validated into Dutch for application in the Netherlands (Smits et al., 2008), into German (Pfeiffer and Manser, 2010) and into Turkish (Bodur and Filiz, 2010). These studies used their national language by using forward-backward translation (Sperber, 2004). They used a translation to their most commonly spoken language and validated the translated questionnaire: this might be because English was not used as the professional language in their hospital settings.

However, a translation of a patient safety climate questionnaire is based on the common professional language used in each country while the validation of a patient safety climate questionnaire should be performed before full application in different contexts. The current study used the same language as the original questionnaires, which is English, because the common language in the Saudi hospitals is English as the professional language.

The face validity testing of the two patient safety climate questionnaires was conducted in order to select the most appropriate one of them to use in the current study. Moreover, testing two questionnaires provided new information in terms of how staff can understand the content of different questionnaire items.

The second approach is testing the face validity of a patient safety climate questionnaire when using its original language without translation of the questionnaire to another language. For example, in the study conducted by Hutchinson et al. (2006) minor adaptations were made to the Teamwork and Safety Climate Survey (Sexton et al., 2004) before it was used in their study. Similarly, in Waterson et al. (2009) a number of changes were made to the wording of the HSOPSC questionnaire (Sorra and Nieva, 2004) before full application with respect to terminology used within the UK settings. These studies keep the same language but they changed some words because of different terminology.

The face validity stage (an initial assessment stage) of the current study highlighted a number of issues. For example, the current study indicated that there is a range of spoken language ability and understanding of the written language in the questionnaires, because of the ethnic cultural mix of staff in Saudi settings. The interviews revealed variation of English language skills amongst participants. This variation is expected because they use English as a professional language but it is not their first language since they are from different nationalities. Therefore, it seems plausible that the participants might vary in their understanding of the questionnaires due to variation in language ability among participants. However, it was observed that simple and clear items in the questionnaires could be understood by participants who speak English regardless of their nationalities. Overall, this suggests that in a multi cultural context the cultural differences should be taken into account whenever patient safety climate questionnaires are applied in different cultural settings, such as Saudi hospitals settings. Therefore, rigorous validation should be performed to reduce the impact of the complexities of cultural and language issues which might exist, and to enhance the quality and validity of the research (Sperber, 2004).

In the current study, face validity testing indicated that there were problems and difficulties of comprehension with some wordings of both questionnaires. For example, some words of the original HSOPSC questionnaire (Sorra and Nieva, 2004) were difficult to understand such as "than is", "crisis mode", and "fall between the cracks". Similarly, some words of the Teamwork and Safety Climate questionnaire (Sexton et al., 2004) were difficult to understand such as "briefings", "contingencies" and "knowingly compromise". These problems might be because the variation of clarity of language and the wording of both questionnaires which led to some participants understanding the items in a certain way while others did not understand them at all. However, with regard to comprehension and competence of the language and wording of the patient safety climate questionnaires, it was observed in the interviews that simple, clear and straightforward wording of items in the questionnaires could be understood by participants.

For the purpose of assessing the comprehensibility of items and identifying problems with the wording of questionnaires, face validity testing is an essential element of the application of patient safety climate questionnaires. For example, Bodur and Filiz (2010) tested the comprehensibility of the HSOPSC questionnaire (Sorra and Nieva, 2004) by discussing the wording of the questionnaire with 5 doctors and 8 nurses and their opinions were used to make the final version of the questionnaire clear, simple and easy for respondents to complete.

The face validity testing in the current study highlighted a very important issue regarding the scale that is used in the questionnaires. It was observed that the majority of the participants had no difficulty linking their answers with the 5-point Likert responses scale, ranging from strongly disagree to strongly agree with a midpoint called "neither", of the original HSOPSC questionnaire (Sorra and Nieva, 2004). Furthermore, it was observed that most of the respondents read the items of the original HSOPSC questionnaire (Sorra and Nieva, 2004) only once before linking their answers with the scale. This indicates the clarity of the items and that the scale was easy to use with answers. On the other hand, the participants experienced significant difficulty linking their answers with the 6-point Likert responses scale of the Teamwork and Safety Climate Survey (Sexton et al., 2004). The participants believed it was not easy to use because more chances prevented them from expressing their feeling correctly. Observation of how participants approached answering the questionnaires was valuable in identifying where they were encountering difficulties.

The current study highlighted another important issue which was observed regarding negatively worded items. It is worth noting that the positive and negative items were clear and the participants were able to distinguish between them. However, this issue will be discussed in detail in section (7.5) in the current chapter.

The current study indicated that the face validity testing was a helpful tool for identifying the most appropriate patient safety climate questionnaire for use in the study. The first method of the research was concerned with selecting appropriate patient safety climate questionnaires for assessing the perceptions of the workforce towards patient safety culture in hospitals, for use in the investigation (see chapter four, section 4.2 for more details). This method identified two questionnaires, the HSOPSC questionnaire (Sorra and Nieva, 2004) as a first appropriate questionnaire and the Teamwork and Safety Climate Survey (Sexton et al., 2004) as a second appropriate questionnaire.

The HSOPSC and the Teamwork and Safety Climate Survey were used in a number of studies because they are valid and reliable questionnaire (Sorra and Nieva, 2004; Hutchinson et al., 2006). However, the first method of the research was helpful to identify appropriate questionnaires but it did not tell us about how staff understand the meaning of the items of patient safety climate questionnaires. Therefore, there was a need to test and assess the wording of individual items to select the most appropriate patient safety climate questionnaire to use in the current study before the full application.

The participants perceived that the language and wording of the original HSOPSC questionnaire (Sorra and Nieva, 2004) was clearer and easier to understand than the Teamwork and Safety Climate questionnaire (Sexton et al., 2004) because the language and wording of the HSOPSC questionnaire is simple and clear and more straightforward than that of the Teamwork and Safety Climate Survey. Moreover, the terminology of the original HSOPSC questionnaire is directly related to patient safety, medical errors and reporting incidents. This might be because of the simplicity of the wording of individual items of the original HSOPSC questionnaire and because it was developed specifically for healthcare settings (Sorra and Nieva, 2004). The wording of the Teamwork and Safety Climate Survey (Sexton et al., 2004) was perceived as more complicated and difficult for participants to understand easily. In addition, the participants found the scale used in the questionnaire difficult to apply.

However, these differences might be because of the two questionnaires were from different sources, the Teamwork and Safety Climate Survey (Sexton et al., 2004) was adapted from industry and the original HSOPSC questionnaire (Sorra and Nieva, 2004) was developed for specifically for healthcare settings.

Selecting an appropriate patient safety climate questionnaire should be based on not only on reviewing available questionnaires but also an initial assessment of patient safety climate questionnaires (face validity testing) is very important and an essential element in validation studies. The current study has highlighted that face validity is a helpful tool in terms of identifying changes that should be made to questionnaires to be clear and easy to understand by respondents. However, while only minor changes needed to be made to the original HSOPSC questionnaire (Sorra and Nieva, 2004), the Teamwork and Safety Climate Survey (Sexton et al., 2004) needed many changes because a number of its items were ambiguous and difficult to understand, which makes the decision to make changes extremely difficult as it may alters the meaning of the items.

A number of studies made changes to questionnaires as a result of face validity testing. For example, Hutchinson et al. (2006) made minor changes to the questionnaire wording based on face validity results. Waterson et al. (2009) made a number of changes to the original HSOPSC questionnaire (Sorra and Nieva, 2004) based on feedback from group discussion with staff members with respect to terminology used within UK. Changes should be made to make items easier for the respondents to understand them.

Summary

The current study found that staff varied in terms of their understanding and interpretation of the wording of the items of the two patient safety climate questionnaires. Therefore, an initial assessment is a very important element before the full application of any patient safety climate questionnaire in a different context, such as Saudi hospitals, because of language and cultural variation due to different cultural and ethnic groups. The current study highlights that face validity is an essential element before the widespread application of a patient safety climate questionnaire in different settings environmentally and culturally. It seems that the face validity of the current study is more than just identifying ambiguous words in the questionnaires that should be changed to make them clear and easy to understand (minor adaptations).

It also takes account of the range of language ability among participants, and comprehensibility and competence of the language of the patient safety climate questionnaire, the applicability of the scale, and the ability to recognise negatively worded items. When comparing two questionnaires it is also a helpful tool in terms of selecting the appropriate patient safety climate questionnaire. On the basis of the above issues and important benefits, it is worthwhile and valuable to undertake face validity as good practice and an essential element in validation studies, especially where environmental differences might exist. Therefore, attention should be paid to face validity before extensive use especially in a new context (Hutchinson et al., 2006; Waterson et al., 2009).

The face validity in the current study was aimed at more than how the two patient safety climate questionnaires look. The additional value is to adapt an appropriate questionnaire in a culturally relevant and comprehensible form while maintaining the meaning of the original items of the selected patient safety climate questionnaire. The original HSOPSC questionnaire (Sorra and Nieva, 2004) was identified as the most appropriate patient safety climate questionnaire to use for the study. Testing the validity of the factor structure of the original HSOPSC questionnaire (Sorra and Nieva, 2004) with Saudi data will be discussed in the next section.

7.3 Testing the original model findings

The pre-analysis (Bartlett's test and KMO) was performed to assess the suitability of the Saudi data for factor analysis. The results showed that the Saudi data was sufficient for performing factor analysis. Pallant (2007) highlights the importance of undertaking pre-analysis in order to assess the suitability of data for factor analysis prior to assessing the psychometric properties of patient safety climate questionnaires and more recent studies are adopting this as good practice (e.g. Smits et al., 2008; Waterson et al., 2009; Bodur and Filiz, 2010).

One of the main findings of the current study relates to the applicability of using the original English language HSOPSC questionnaire (Sorra and Nieva, 2004) for assessing patient safety culture in Saudi hospitals. In the current study the first step of psychometric analysis aimed to investigate whether the factor structure of the original USA HSOPSC questionnaire (12 factors and 42 items) can be used with the Saudi data by using CFA and reliability analysis.

The current study demonstrated that the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) did not fit the Saudi data well (poor fit). Therefore, the factor structure of the original USA HSOPSC questionnaire cannot be effectively used in Saudi hospitals. The results of CFA and reliability analysis are discussed and compared with the results of the key studies below.

Firstly with regard to CFA in the current study, the fit indices were used to evaluate the adequacy of the original model fit and their values were as follows: (Chi-square=4995, DF=805, CFI=0.642, RMSEA=0.678, RMR=0.178, SRMR=0.193 and TLI=0.617). These fit indices from CFA indicated that when applying the original USA HSOPSC model (Sorra and Nieva, 2004) to the Saudi data, this model fit was not satisfactory because overall, the values of the fit indices of the Saudi data were outside the general agreed parameters. In other words, the fit indices did not meet the goodness of fit criteria (see table 6-15, page 174). In contrast, the fit indices were used in the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) as follows: (Chi-square=2064, DF=746, CFI=0.94, RMSEA=0.040). Although they used just four fit indices, they achieved the general agreed parameters. However, the relatively high values of fit indices of CFA achieved in the original model (Sorra and Nieva, 2004) may be due to their use of the same sample for the EFA and CFA, in other words the split half validation was not undertaken and they tested the fit of their model by using the same data (Waterson et al., 2009). In general, it is recommended that use of a wide range of fit indices is the best means of evaluating the degree of fit (Hu and Bentler, 1999), as has been done in the current study.

The current study indicated that the fit indices of CFA of the original HSOPSC model (Sorra and Nieva, 2004) using Saudi data were unsatisfactory. Other studies found similar results, for example, Smits et al. (2008) examined the applicability of the factor structure of the HSOPSC questionnaire (Sorra and Nieva, 2004) to the Dutch data (Dutch translated version of the HSOPSC questionnaire). The fit indices from CFA indicated that this model fit was not satisfactory. Similarly, Waterson et al. (2009) tested the original HSOPSC model (Sorra and Nieva, 2004) in the UK context and they found that the fit indices of CFA were a poor fit when they compared them with the original American model (Sorra and Nieva, 2004).

Bodur and Filiz (2010) performed CFA to investigate whether the factor structure of the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) could be used with Turkish data (Turkish translated version of the HSOPSC questionnaire). They (Bodur and Filiz, 2010) concluded that the original model was not a satisfactory fit with the Turkish settings. In a study by Pfeiffer and Manser (2010) they examined the applicability of the original HSOPSC questionnaire (Sorra and Nieva, 2004) to assess patient safety climate in a German speaking hospital setting in Switzerland (German translated version of the HSOPSC questionnaire). They found the values of fit indices of CFA indicated that the fit is not sufficiently good to confirm the proposed factor structure of the HSOPSC questionnaire (Sorra and Nieva, 2004). It appears that the overall fit was consistently unsatisfactory for the above studies when they compared with Sorra and Nieva's (2004) original USA HSOPSC questionnaire.

It seems, based on the evidence from the results of CFA in different studies above, that the factor structure of the original HSOPSC questionnaire (Sorra and Nieva, 2004) might not work in a satisfactory way in these countries. It appears that the original HSOPSC questionnaire measures different dimensions of patient safety culture in different countries. Table 7-1 shows the comparative CFA data of these countries (six countries).

Table 7- 1 Comparative CFA data from six countries

Study	Fit indices criteria of CFA
Original HSOSPC (Sorra and Nieva, 2004)	Chi-square=2064, DF=746, CFI=0.94, RMSEA=0.040
The current study	Chi-square=4995, DF=805, CFI=0.64, RMSEA=0.678, RMR=0.178, SRMR=0.193 and TLI=0.617
The UK study (Waterson et al., 2009)	Chi-square=1906, DF=674, CFI=0.91, RMSEA=0.045, SRMR=0.046
German study (Pfeiffer and Manser, 2010)	RMSEA=0.047, PCLOSE=0.91, CMIN/df=2.271, GFI=0.878, NFI=0.859, and TLI=0.901
Dutch study (Smits et al., 2008)	NA
Turkish study (Bodur and Filiz, 2010)	NA

NA: not available.

Table 7-1 shows that three studies reported the values of the fit indices of CFA when they tested the fitting of the original HSOPSC questionnaire (e.g. Sorra and Nieva, 2004; Waterson et al., 209; Pfeiffer and Manser, 2010) while two studies did not report this (e.g. Smits et al., 2008; Bodur and Filiz, 2010). This kind of incompleteness might be because of the difficulty of reporting fit indices. It might be also because some studies depend on reporting reliability analysis which is an important indicator but not enough to evaluate the fitting of the original model in terms of a comprehensive psychometric assessment of patient safety climate questionnaires in a different context. According to Hoyle (1995) CFA is the best procedure analysis for examining the factor structure of models.

Secondly, with regard to reliability analysis in the current study, the internal consistency of the 12 factors of the original USA questionnaire (Sorra and Nieva, 2004) was calculated with Cronbach's alpha (α) (Field, 2000). The internal consistency of the Saudi data for each dimension was greater than 0.6 except for three dimensions that were poor or unacceptable: for overall perceptions of safety (α=0.31), staffing (α=0.57) and hospital handoffs and transitions (α=0.59). Overall, the internal consistency of the Saudi data was lower for each dimension than the American data (Sorra and Nieva, 2004).

The first dimension with low internal consistency was the overall perception of patient safety which consists of four items. This dimension relates to the extent to which procedures and systems in hospitals are good at preventing errors and there is a lack of patient safety problem (Sorra and Nieva, 2004). There is a multi cultural environment in Saudi hospitals because the staff there are from different countries. Therefore, their perceptions may be affected by their cultural backgrounds and experiences in their countries. Accordingly, they might answer these items of overall perceptions of patient safety dimension based in comparison with the procedures and systems in their countries. Moreover, the majority of staff have experiences and communications training outside Saudi Arabia such as the UK, USA and Canada. All these cultural issues might affect the overall perceptions of the staff.

On the other hand, this dimension works with the UK data that was gathered from similar cultural backgrounds in an English context (Waterson et al., 2009). Similarly, the dimension works with the Dutch data (Dutch translated version of the HSOPSC questionnaire) that was gathered from the same culture (Smits et al., 2008). It seems that this kind of dimension is affected by cultural background.

Therefore, it did not work in a multi cultural environment such as the Saudi context but it works in data that gathered from the same culture such the UK and Dutch contexts. However, it is seemed that there is a cultural variation between staff and also between contexts. Therefore, it may be the perceptions of staff toward patient safety culture dimensions in the questionnaire may be affected by their cultural backgrounds and experiences.

The second dimension that had low internal consistency was the staffing dimension (α=0.57). It consists of four items and it is about the extent to which there is enough staff to handle the workload and whether work hours are appropriate to provide the best care for patients (Sorra and Nieva, 2004). This dimension had low internal consistency in a number of studies. For example, Smits et al. (2008) found the staffing dimension had low internal consistency (α=0.49) when they tested the fit of the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) in Dutch data. Similarly, the staffing dimension had low internal consistency (α=0.58) in Waterson et al. (2009) study when they tested the fit of the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) in the UK data.

The staffing dimension had very low internal consistency (α = 0.19) in a study by Bodur and Filiz (2010) when they tested the fit of the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) in the Turkish data. It seemed that this dimension did not work well in different contexts. It might be that the composition of this dimension was not simple and clear as it has conflicting items (a mixture of one positive and three negative items), therefore it is difficult to interpret this kind of composition (Schmitt and Stults, 1985).

The third dimension was hospital handoffs and transitions. It consists of four items and it is about how important patient care information is transferred between hospital departments during shift changes (Sorra and Nieva, 2004). The current study indicated that the internal consistency of hospital handoffs and transitions might be acceptable because it was close to 0.6. This dimension might work with a different structure of items in the Saudi data. However, this point may be answered by EFA in the next section.

In summary, the current study indicated that the internal consistency was lower for each dimension than the American data (Sorra and Nieva, 2004). Three factors were poor or unacceptable: overall perceptions of safety, staffing and hospital handoffs and transitions.
A similar finding was reported by a number of studies. For example, in the study by Smits et al. (2008) the internal consistency of the Dutch items was lower than that of the original items in the AHRQ study (Sorra and Nieva, 2004) except for communication openness, which was the same. The internal consistency of three factors was poor or even unacceptable: organisational learning–continuous improvement (α = 0.57), staffing (α = 0.49) and teamwork across hospital units (α = 0.59). The internal consistency of the UK items was lower for each dimension than that of the original items of the HSOPSC questionnaire. The internal consistency of one dimension was unacceptable, which was staffing (α=0.58) (Waterson et al., 2009).

Pfeiffer and Manser (2010) reported that the internal consistency of the German items was lower for seven dimensions than the original items of the HSOPSC questionnaire (Sorra and Nieva, 2004). Similarly, Bodur and Filiz (2010) reported that the internal consistency of the Turkish items was lower for each dimension than the original items in the HSOPSC questionnaire (Sorra and Nieva, 2004), except for frequency of events reported (α =0.86) and teamwork within units (α=0.83). The internal consistency of two factors was poor: Staffing (α=0.19) and non-punitive response to error (α=0.31). Table 7-2 provides comparative data of internal consistency of a number of studies (six countries).

Table 7- 2 Comparative internal consistency data from six countries

HSOPSC dimensions	Internal consistency [Cronbach's alpha (α)]					
	USA	**The Current study**	**UK**	**Germany**	**Netherlands**	**Turkey**
Overall perceptions of safety	0.74	***0.31***	0.67	0.75	0.74	NA
Frequency of error reporting	0.84	0.83	0.83	0.88	0.79	0.86
Supervisor/manger expectations and actions promoting patient safety	0.75	0.75	0.68	0.78	0.70	NA
Organisational learning-continuous improvement	0.76	0.63	0.66	0.68	***0.57***	NA
Teamwork within units	0.83	0.75	0.73	0.73	0.66	0.83
Communication openness	0.72	0.67	0.67	0.64	0.72	NA
Feedback and communication about error	0.78	0.74	0.80	0.79	0.75	NA
No punitive response to error	0.79	0.72	0.65	0.71	0.69	***0.31***
Staffing	0.63	***0.57***	***0.58***	0.61	***0.49***	***0.19***
Hospital management support for patient safety	0.83	0.65	0.69	0.71	0.68	NA
Teamwork across hospital units	0.80	0.69	0.70	0.76	***0.59***	NA
Hospital handoffs and transitions	0.80	***0.59***	0.77	0.71	0.68	NA

NA: not available but the internal consistency of each dimension was lower than USA dimensions in the Turkish study (Bodur and Filiz, 2010).

In summary, it seemed that the internal consistency of the current study using Saudi data, UK, German, Dutch, Turkish data was lower for each dimension than the American data (Sorra and Nieva, 2004). The lowest internal consistencies of dimensions across these different studies are overall perception of patient safety, organisational learning, non punitive response to error, staffing, teamwork across hospital units and hospital handoffs and transitions. The results of the reliability analysis of the studies provide evidence that the original model does not work well in different countries.

On basis of the results of testing the original model in the current study (CFA and reliability analysis), the question of investigating the psychometric properties of the HSOPSC questionnaire (Sorra and Nieva, 2004) in the Saudi hospital settings could be answered. It seems that the reliability and validity of the original factor structure of the HSOPSC questionnaire (Sorra and Nieva, 2004) is not replicated in Saudi hospital settings. Thus the original model of the HSOPSC should not be used in Saudi hospitals. This finding is in contrast with other recent studies in Saudi hospitals that were produced after the current study began. For example, Alahmadi's (2009) study assessed patient safety culture in Saudi hospitals by using the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) before examining the reliability and validity of the questionnaire in a different context. Similarly, in a study by another author (Alahmadi. Hanan, 2010) used the original HSOPSC questionnaire (Sorra and Nieva, 2004) to assess patient safety culture in a number of Saudi hospitals without performing a proper validation of the questionnaire before its application in the Saudi context.

It seems that these two Saudi studies (Alahmadi. Talal, 2009; Alahmadi. Hanan, 2010) did not assess the psychometric properties of the HSOPSC questionnaire whereas the current study performed rigorous validation to assess the psychometric properties of the HSOPSC questionnaire. However, the HSOPSC questionnaire (Sorra and Nieva, 2004) needs to be used with caution in Saudi hospitals because of the variation of cultures and language in the Saudi context as discussed earlier in section (7.2) of this chapter. Therefore, it is important to check the validity and reliability of a patient safety climate questionnaire before applying it in a new context (Smits et al., 2008).

In terms of testing the original HSOPSC questionnaire at an international level (different countries), evidence from other studies supports the findings from testing the original HSOPSC questionnaire in the current study. For example, the factor structure of the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) was tested in different countries. Smits et al. (2008) examined the applicability of the factor structure of the original HSOPSC questionnaire to the Dutch data. They indicated that the Dutch version was not able to replicate the factor structure proposed by Sorra and Nieva (2004), but found some factors corresponding to those proposed for the original instrument. Similarly, in a UK study (Waterson et al., 2009) investigated whether the factor structure of the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) could be used with the UK data study. Waterson et al. (2009) found that the UK version was not able to replicate the factor structure of the HSOPSC questionnaire. Similarly, Bodur and Filiz (2010) examined the applicability of the factor structure of the original HSOPSC questionnaire (Sorra and Nieva, 2004) to the Turkish data. Bodur and Filiz (2010) found that the factor structure of the original HSOPSC questionnaire (Sorra and Nieva, 2004) cannot be used with Turkish data. In a study by Pfeiffer and Manser (2010) they examined the applicability of the original HSOPSC questionnaire to assess patient safety climate to a German speaking hospital setting in Switzerland. They also found the German version was not able to replicate the proposed factor structure of the HSOPSC by Sorra and Nieva (2004).

Summary

In summary, the findings from testing the original HSOPSC questionnaire (Sorra and Nieva, 2004) highlight a number of important issues. For example, the testing of the original HSOPSC questionnaire might be useful when it is based on reporting the results of CFA and reliability analysis in terms of evaluating the psychometric properties of the HSOPSC questionnaire. The results from CFA and the internal consistency of the current study using Saudi data indicated that the twelve dimensions of the original HSOPSC questionnaire (Sorra and Nieva, 2004) did not match the findings in Saudi hospitals. As a result, the original HSOPSC questionnaire cannot be used with the English language Saudi data. Therefore, it appeared that the factor structure of the original HSOPSC questionnaire may be measuring different dimensions of patient safety culture in the Saudi context as compared to the USA (Sorra and Nieva, 2004). This might be because of cultural and contextual differences between the United States and the Saudi hospital settings.

The original factor structure of the HSOPSC questionnaire (Sorra and Nieva, 2004) has recently been applied and empirically evaluated in different countries (e.g. Netherlands: Smits et al., 2008; the UK: Waterson et al., 2009; Turkey: Bodur and Filiz 2010; Germany: Pfeiffer and Manser, 2010). None of these studies were able to replicate the factor structure proposed by Sorra and Nieva (2004). Based on this, it is important to investigate whether or not the dimensional structure of patient safety climate questionnaires can be replicated in different contexts to ensure that patient safety climate questionnaire is valid and reliable, therefore, a questionnaire developed in one context should ideally always be validated before wider use in a different context (Pronovost and Sexton, 2005). Patient safety climate questionnaires need to be used with caution because of cultural and language variations between different contexts (Nieva and Sorra, 2003; Hutchinson et al., 2006; Waterson et al., 2009). These issues above show the importance of testing the original HSOPSC questionnaire (Sorra and Nieva, 2004) carefully before full application in different healthcare environments.

However, a number of recent studies in patient safety culture in Saudi Arabia (e.g. Alahmadi Talal, 2009; Alahmadi Hanan, 2010) did not investigate whether the factor structure of the original USA HSOPSC questionnaire (12 factors and 42 items) (Sorra and Nieva, 2004) can be used with the Saudi data by using psychometric analysis such as CFA and reliability analysis. The current study has addressed the need to identify an optimal model for using to assess patient safety culture in Saudi Arabia. The findings of EFA, CFA and reliability analysis in terms of developing the optimal model are discussed in the next section.

7.4 Developing the optimal model

As mentioned earlier, the original HSOPSC questionnaire (Sorra and Nieva, 2004) is not valid and reliable in the Saudi context using English language data. Therefore, there was a need to identify an optimal model for the Saudi data. An optimal measurement model was constructed via EFA and CFA with the Saudi data split into halves. In the current study the results of psychometric analysis (EFA, CFA and Reliability analysis) show that the optimal model for the Saudi data consists of eight factors (see table 6-39 in page 216). The optimal model could be used in Saudi hospitals to assess patient safety culture. The findings of EFA, CFA and Reliability analysis are discussed below. A comparison of optimal models across different countries is provided.

With regard to EFA, it was performed in order to investigate if there is a factor structure that better fits the Saudi data. In the current study, the Saudi data set was split randomly into two halves. The first half of the Saudi data set was used for model construction by exploring a number of factors (patient safety culture dimensions). The second half of the Saudi data set was used for model validation to test the fit of the results of the optimal factor structure. A split half validation strategy (EFA followed by CFA) was recommended by a number of studies for providing realistic results of the psychometric properties of patient safety climate questionnaires. For example, Waterson et al. (2009) split their data when they identified an optimal model in the UK context. On the other hand, a number of recent studies did not split their data. For example, in Sorra and Nieva's (2004) study, the split half validation was not undertaken and they tested the fit of their model by using the same data (Waterson et al., 2009). Smits et al. (2008) did not split Dutch data into halves when they identified their optimal model in Netherlands hospitals. Similarly, Bodur and Filiz (2010) did not split the Turkish data into halves. However, the complexity of psychometric analysis (cross validation) might be the reason for not doing the split half validation in these studies.

In terms of method of extraction, rotation and other criteria for EFA, in the current study EFA was performed to identify an optimal model, using Principle Axis Factoring and Varimax rotation, as well as both Kaiser's criterion and the Scree plot. Changing the rotations was performed (from Varimax to Oblique rotation) to enable interpretation of the factors.

According to Costello and Osborne (2005), Oblique (Orthogonal) rotation is used to produce more easily interpretable results especially in terms of cross loading items. All these criteria were taken into consideration for identifying the optimal model of the current study with no low loading, no low communalities, no cross-loaded items and including the theoretical related structure of the items of the optimal model. According to Flin (2007) identification of a patient safety climate questionnaire with a high standard of measurement means its results can be relied on. Therefore, using the criteria above was helpful in terms of ensuring a high standard measurement of the original HSOPSC questionnaire dimensions (Sorra and Nieva, 2004) in the Saudi context and identifying the optimal model.

Studies vary in their use of EFA for developing a measurement model. For example, Pfeiffer and Manser (2010) applied EFA using principle component analysis, Varimax rotation to interpret the factor loadings independently and Kaiser's criterion (Eigenvalues>1). Although, this strategy seems comprehensive, there is a lack in terms of changing rotation to produce an easily interpretable measurement model. As a result of this, their optimal model contains a number of items which cross-loaded in two factors and also some items with low loading. It might also be due to not having examined a series of possible models and they did not gradually remove low loading and cross-loaded items (Pfeiffer and Manser, 2010).

Smits et al. (2008) applied EFA using principle component analysis, Varimax rotation, Kaiser's criterion (Eigenvalues>1) and the Scree plot. Their model (11 factors) consists of highly loading items (>0.36). On the other hand, Waterson et al. (2009) applied EFA using principle axis factoring, Varimax rotation, Kaiser's criterion (Eigenvalues>1) and the Scree plot. Their model also consists of highly loading items (>0.36). An oblique rotation was used to aid interpretation of their resulting factors (9 factors). However, it seems that the methods of extraction and rotation are different in these studies because selecting extraction and rotation methods is based on the purpose of study (Conway and Allen, 2003).

In the current study, a number of exploratory factor analyses were performed and a number of solutions were identified. Each possible solution was examined in order to identify an optimal model including 11, 10 and 8 factor solutions. At the end of this stage the eight factor solution was identified as an optimal model for the current study. The total variance explained by the optimal model (8 factors) accounts for 51.5% of total variance.

The optimal model consists of 23 items while 19 items were removed gradually that were either cross-loaded or had low loading (<0.3) or no loading across different solutions. Factor loadings were between 0.43 and 0.97. All dimensions of the optimal model in the current study consist of two to four safety climate items.

The optimal model of the current study is in line with other studies. For example, Waterson et al. (2009) identified 9 factors as the optimal model of their data. Their model accounts for 51.5% of total variance. The optimal model consists of 27 items and 13 items were removed gradually that were either cross-loaded or had low loading (<0.3). Factor loadings were between 0.38 and 0.98. All dimensions consist of two to five items. Smits et al. (2008) identified 11 factors as the optimal model of their data. Their model accounts for 57.1% of total variance and the optimal model consists of 40 items (two items were removed). No items cross-loaded or had loading less than 0.3. Factor loadings were between 0.36 and 0.88. All dimensions consist of two to five items. This means that the current study followed recommended practice. However, the studies vary in terms of the composition of dimensions.

In terms of the composition of the items and factors of the optimal model of the current study, the optimal model consists of eight dimensions. Two dimensions were formed as before, these were frequency of events reported and non punitive response to error. Three dimensions lost one item (Teamwork within units, handoffs and transitions, and communication openness). Two dimensions lost two items (staffing, supervisor expectations and actions promoting patient safety). One dimension had a new item "organisational learning-continuous improvement". There were only small shifts among items across factors. For instance, F6 moved to "Handoffs and transitions", and F8 moved to "organisational learning-continuous improvement".

On the other hand, in the optimal model of the current study, four dimensions are absent: "overall perception of patient safety", "feedback and communication about error", "teamwork across hospital units" and "hospital management support for patient safety". The composition of the optimal model of the current study consists of 23 items which represent 8 dimensions of patient safety culture, while 19 items were excluded because their loading either they did not load upon any factor or they had low loading. The composition of the optimal model is discussed below.

In the optimal model of the current study, four dimensions are absent. For example, "overall perception of patient safety", this might be absent because the respondents are from 23 countries and therefore they have different perceptions of patient safety because they have different cultural backgrounds. This dimension combined with the staffing dimension in the optimal model derived from the UK data (Waterson et al., 2009) and German data (Pfeiffer and Manser, 2010). As mentioned earlier in section 7.3, the "overall perception of patient safety" works better in other countries such as the Dutch and the British (e.g. Smits et al., 2008; Waterson et al., 2009) either because it seemed that they have shared similar perceptions of safety within their countries or because their understanding of English was similar. On the other hand, this dimension did not work in multi cultural environment such as the Saudi context. Moreover, it seems that the "overall perception of patient safety" and staffing could be formed as one dimension. This may be because of the "overall perception of patient safety'' regarding the issues that could prevent problems of patient safety and staffing could be one of the issues that contribute to provide the best care for patients (Sorra and Nieva, 2004).

Another dimension that was lost in the optimal model of the current study is "feedback and communication about error". It might be because staff do not trust the incident report system because almost half (46.7%) of respondents agreed that their mistakes are held against them. This dimension works in a number of studies (Netherlands: Smits et al., 2008; UK: Waterson et al., 2009). Additionally, this dimension combined with the "communication openness" dimension in the optimal model derived from both the Turkish data and German data (Turkey: Bodur and Filiz, 2010; Germany: Pfeiffer and Manser, 2010). This might indicate that there is no a blame culture and they support reporting mistakes that happen in hospitals to learn from their mistakes and to improve patient safety. Moreover, it seems that "feedback and communication about error" dimension and "communication openness" could be formed as one dimension because both of them are concerned with how the communication between staff should be about how errors happen (Sorra and Nieva, 2004).

The teamwork across hospital units dimension was lost in the current study (except item F6). This dimension combined with the handoffs and transitions dimension in the optimal model derived from the German data (Pfeiffer and Manser, 2010). This dimension combined with hospital management support for patient safety dimension in the optimal model derived from the Turkish data (Bodur and Filiz, 2010).

It seems that the items of this dimension could be correlated with different items of dimensions. The hospital management support for patient safety dimension consists of three items. Two items were dropped whereas item number F8 moved to organisational learning-continuous improvement. This dimension also did not work in the optimal model derived from the UK data (Waterson et al., 2009). However, the absence of this dimension might be considered as an indicator of a lack of hospital management support for patient safety or may not be aware.

"Supervisor/manager expectations and actions promoting patient safety" dropped two negative items (B3-B4). These two items are about the negative role of managers towards patient safety (i.e. ignoring patient safety problem). Similarly, these two items were dropped in the optimal model derived from the UK data (Waterson et al., 2009). It is expected because if the respondents agreed with B1 and B2 as positive items of this dimension they disagreed to B3 and B4, therefore, the negative items were discarded from this dimension (Spector, 1997). Therefore, the majority of respondents in the current study (89.8%) disagreed that supervisors ignore patient safety problems and they agreed (76.1%) that supervisors promote patient safety.

"Staffing" dropped two items (A2-A14). These items are about having enough numbers of staff and how they handle the workload. It seems that almost half of respondents (51.8%) agreed that there is a shortage of staff and there is a high workload. These two items work in a number of optimal models as an indicator of having enough staff to handle the workload properly (e.g. Waterson et al., 2009; Bodur and Filiz, 2010).

A single item was dropped from "Hospital handoffs and transitions" (F3: things lost when transferring patients from one unit to another), from "teamwork within units" (A11: when one area in this unit gets busy, others help out) and "communication openness" (C6: staff are afraid to ask question when something does not seem right). This means these items are not working in any dimension of the optimal model. This dropping of some items is expected. For example, in Waterson et al's (2009) study, a single item dropped from both "teamwork within units" and "teamwork across units". Similarly, in Smits et al's (2008) study, a single item dropped from "hospital handoffs and transitions".

In the optimal model of the current study, there were only small shifts among items across factors. For instance, F6 (it is often unpleasant to work with staff from other hospital units) moved from "teamwork across units" to "handoffs and transitions'', and F8 (the actions of hospital management show that patient safety is a top priority) moved from "management support for patient safety" to "organisational learning-continuous improvement". It seemed that this item movement (shifting) is acceptable because F6 is related to staff that work in same shift and shift changes. Also F8 is related because there is a link between patient safety as a top priority and learning from mistakes to improve patient safety. Similarly, shifting of items happened in different optimal models of studies. For example, F6 moved to handoffs and transitions dimension in optimal model derived from the Turkish data (Bodur and Filiz, 2010). F6 moved to communication openness in optimal model derived from the Dutch data (Smits et al., 2008). It seems that shifting of items depends on how staff understand the content of the items and the relationships between items.

In summary, the eight factor structures of the Saudi and the American HSOPSC versions are reasonably consistent. The overall structure of eight factors is the same and the composition of dimensions is approximately similar because the main part of the factor structures is the same. Table 7-3 shows the comparison between the structures of the American version and the Saudi version of eight factors of the HSOPSC questionnaire.

Table 7- 3 Comparison between the structures of the American version and the English language Saudi version of eight factors of the HSOPSC

Eight factors (dimensions)	American version	Saudi version	Note
No punitive response to error	A8®-A12®-A16®	A8®-A12®-A16®	Same
Teamwork within units	A1-A3-A4-A11	A1-A3-A4	Lost one item (A11)
Handoffs and transition	F5®-F7®-F11®-F3®	F5®-F7®-F11®-F6®	Lost one item (F3) and add one item (F6)
Organisational learning-continues improvement	A6-A9-A13	A6-A9-A13-F8	Add one item (F8)
Communication openness	C2-C4-C6	C2-C4	Lost one item (C6)
Staffing	A5®-A7®-A2-A14®	A5®-A7®	Lost two items (A2-A14)
Supervisor expectation and action promoting patient safety	B1-B2-B3®-B4®	B1-B2	Lost two items (B3-B4)
Total	28	23	7 items lost and 2 items add

® indicates negative items.

Table 7-3 shows that seven items were lost (A11-F3-C6-A2-A14-B3-B4) and two items (F6-F8) were added to the Saudi version across the eight factors. In total, the differences between two versions are five items. The items of each factor are theoretically structure related and the optimal model of the current study (Saudi version) demonstrates generally good psychometric properties. The construction of the optimal model of the current study was confirmed by using CFA. The following section discusses the CFA of the optimal model of the current study.

Following EFA, CFA was performed, using the validation half of the data, to test the fit of the resulting models that emerged from the EFA that was performed on the construction half of the data. These models were 11, 10, and 8 factor solutions. However, the values of the fit indices from CFA of 11 and 10 factors were outside the general agreed parameters as shown on page 174 (see appendix 47). Therefore, the model fit of both 11 and 10 factors were not satisfactory. Consequently these models were rejected. The fit indices from CFA of eight factors indicated that this fit model was satisfactory because the values of the fit indices of the Saudi data (8 factors) meet the general agreed parameters (Chi-square=407, DF=202, CFI >0.90, SRMR <0.08, RMSEA <0.06 and TLI>0.90). Consequently this model (eight factors) was acceptable as the final optimal model.

Finally, testing the fit of the optimal model for the whole data set was performed by using CFA. The result of this step also confirmed that the fit of the optimal model was appropriate to the whole Saudi data. Through this rigorous process the optimal model (eight factors) of the current study was tested carefully and confirmed via two confirmatory analyses. In terms of using CFA to confirm the optimal model, it seemed that an application of this procedure was not conducted in a number of studies (e.g. Smits et al., 2008; Alahmadi, 2009; Alahmadi, 2010; Bouder and Filiz, 2010; Pfeiffer and Manser, 2010). This situation might be referring to the complexity of CFA because most of studies used reliability analysis and correlations instead of CFA. However, some studies performed CFA to confirm their optimal model such as Waterson et al. (2009). According to Hoyle (1995) CFA is the best analysis procedure in terms of examining the factor structure of models.

With regard to reliability analysis, in the current study, the optimal model's internal consistency (reliability) was assessed using Cronbach's alpha (α). When different items are supposed to measure the same dimension, it is recommended that internal consistency (reliability) should be greater than or equal to 0.6 (Field, 2000). Since the original HSOPSC questionnaire (Sorra and Nieva, 2004) contains both positively worded items (n=24) and negatively worded items (n=18), the negatively formulated items were first recoded to make sure that a higher score always means a more positive response (Pallant, 2007).

The internal consistency was calculated for every factor according to the optimal model dimensions and items structure (8 factors) by using Cronbach's alpha values (α). The reliability analysis indicated that Cronbach's alpha values (α) of the factors are equal or above

0.68 for all factors. Factor 7 is low (<0.68). This factor consists of two items. Although three items and above upon each factor is the best, two items are acceptable especially if they are very high loadings items (above 0.5) and theoretically related. This factor is acceptable because the two items are high loading and the theoretical structure of this factor is related to staffing dimension. Furthermore, various fit indices in CFA of the optimal model met with the agreed parameters. It is important to mention that it is possible that a set of items will be below 0.7 on Cronbach's alpha (α), yet various fit indices in confirmatory factor analysis will be above the cut off (usually 0.9) levels. Alpha may be low when there are fewer items in the dimension (Kline, 2005). The value of Cronbach's alpha (α) depends on the number of items on the scale. If a number of items on the scale are increased thus Cronbach's alpha (α) will increase. Therefore, it is possible to get a large value of Cronbach's alpha (α) because a lot of items are present, and not because a scale is reliable (Field, 2009).

A number of studies found two items with low Cronbach's alpha (α). For example, the staffing dimension was 0.50 in Handler et al. (2006). Singer et al's (2007) study found Cronbach's alpha (α) ranged from 0.50 to 0.89 across the factors. However, it seemed that the application of reliability analysis was conducted in a number of studies (e.g. Smits et al., 2008; Waterson et al., 2009; Bodur and Filiz, 2010; Pfeiffer and Manser, 2010). According to Field (2009) it is useful to check the reliability of the scale in validation studies. Moreover, the application of reliability analysis may also refer to the simplicity of the reliability procedure compared with the CFA procedure.

In summary, the results of the EFA, CFA and reliability analysis indicate that eight factors solution is the optimal model of the current study. The composition of the optimal model was considered appropriate. The composition of the eight factors of the optimal model was similar to that of the American HSOPSC questionnaire (Sorra and Nieva, 2004) because the main part of the eight factors structure was unchanged. It seems that the psychometric analysis strategy of the current study contributes to the knowledge of patient safety climate measurement in terms of using rigorous assessment of psychometric properties of the original HSOPSC questionnaire in new settings. Moreover, it seems that there are common dimensions of patient safety culture across different countries (at international level). The next section examines a number of validation approaches and optimal models in different contexts in order to identify if there is a common patient safety culture dimensions.

Validation studies and optimal models in different contexts

The original HSOPSC questionnaire (Sorra and Nieva, 2004) has recently been validated in a number of different countries (e.g. the UK, Netherlands, Germany, and Turkey). Table 7-4 presents approaches of validation of the HSOPSC questionnaire of the current study compared with these countries.

Table 7- 4 Approaches of validation of the HSOPSC

Study	Current study	UK (Waterson et al., 2009)	Netherlands (Smits et al., 2008)	Germany (Pfeiffer and Manser, 2010)	Turkey (Bodur and Filiz, 2010)
Language	English	English	Dutch	German	Turkish
Face validity testing	Performed	Performed	Translation into Dutch	Translation into German	Translation into Turkish
Testing original model	CFA was conducted (a weak fit).	CFA was conducted (a weak fit).	CFA was conducted (not satisfactory fit).	CFA was conducted (a weak fit.	CFA was conducted (a weak fit.
	The internal consistency was calculated (Cronbach's alpha (α) was not satisfactory).	The internal consistency was calculated (Cronbach's alpha (α) was not satisfactory	The internal consistency was calculated (Cronbach's alpha (α) was not satisfactory).	The internal consistency was calculated (Cronbach's alpha (α) was Satisfactory scores).	The internal consistency was calculated (Cronbach's alpha (α) was not satisfactory).
Split data	Performed	Performed	Not performed	Not performed	Not performed
Optimal model	Eight factors	Nine factors	10 factors	Eight factors	11 factors
Confirmed optimal model	CFA was conducted. It was satisfactory fit.	CFA was conducted. It was satisfactory fit.	CFA was not conducted.	CFA was not conducted.	CFA was not conducted.
Reliability analysis for optimal model	The internal consistency was calculated with Cronbach's alpha (α).	The internal consistency was calculated with Cronbach's alpha (α).	The internal consistency was calculated with Cronbach's alpha (α).	The internal consistency was calculated with Cronbach's alpha (α).	The internal consistency was calculated with Cronbach's alpha (α).

Table 7-4 shows that studies are varied in terms of the extent validation approaches (psychometric assessment) conducted when using the HSOPSC questionnaire at an international level and assessing patient safety culture in different countries. However, there is adherence to recommended practice across these studies in terms of validation patient safety climate questionnaire including face validity testing, testing original model, split data, EFA, CFA and reliability analysis.

It seems that each country has developed a somewhat different optimal model. Table 7-5 shows the factor structure of the optimal model of the current study compared with optimal models that developed in these countries in addition to the original USA HSOPSC questionnaire (Sorra and Nieva, 2004). This comparison is aimed to identify the common dimension of patient safety culture across different countries.

Table 7- 5 Common patient safety culture dimensions across different countries

Dimension	Original study (Sorra and Nieva, 2004)	The current study	UK study (Waterson et al., 2009)	Germany study (Pfeiffer and Manser, 2010)	Dutch study (Smits et al., 2008),	Turkey study (Bodur and Filiz, 2010)
Organisational learning – continuous improvement	√	√		√ || (Teamwork within unit)		√
Frequency of event reported	√	√	√	√	√	√
Non punitive response to error	√	√	√	√	√	√
Handoffs and transitions	√	√	√	√ || (Teamwork across units)	√	√
Teamwork within units	√	√	√		√	√
Communication openness	√	√	√		√	
Supervisor expectation and action promoting patient safety	√	√	√	√	√	√
Staffing	√	√			√	√
Feedback and communication about error	√		√	√ || (Communication openness)	√	√ || (Communication openness)
Management support for patient safety	√			√	√	√ || (Teamwork across units)
Overall perception of patient safety	√		√ || (Staffing)	√ || (Staffing)	√	√
Teamwork across units	√		√		√	
Total number of dimension	12	8	9	8	11	10

√Indicates dimension is included
||Indicates two dimensions combined in one dimension.

Two dimensions were combined into one dimension (factor) in three studies. For example, "staffing" and "overall perception of safety" combined as one factor in the UK study (Waterson et al., 2009). In the German study (Pfeiffer and Manser, 2010) "communication openness" and "feedback and communication about error" combined as one factor. "Organisational learning-continuous improvement" and "teamwork within units" also combined as one factor. "Staffing" and "overall perceptions of safety" combined as one factor. "Teamwork across units" and "handoffs and transitions" combined as one factor (Pfeiffer and Manser, 2010). In the Turkish study, "hospital management support for patient safety" and "teamwork across units" combined as one factor. "Communication openness" and "feedback and communication" combined as one factor, while the other 8 factors work as separate factors (Bodur and Filiz, 2010). The current study has 8 factors and each factor works separately. Similarly the Dutch study has 11 factors and each factor works separately (Smits et al., 2008).

In three studies of the six studies in table 7-5, two dimensions combined in one dimension (items from two dimensions grouped together to form one dimension), still each dimension counts separately. Therefore, it appears that, there are a number of common dimension across these studies. The common patient safety culture dimensions at an international level are:

1 Frequency of event reported.
2 Non punitive response to error.
3 Communication openness.
4 Supervisor expectation and action promoting patient safety.
5 Handoffs and transitions.
6 Teamwork within units.
7 Staffing.

These dimensions are present in different countries, maybe because they are related to patient safety elements at an organisational level and not to patient safety practices at the individual level. Therefore, staff are varied in terms of their safe practice for patient care but they agreed about understanding the common dimensions of patient safety as organisational factors because safety climate is constituted by organisational factors (Neal et al., 2000).

The system approach that is based on investigation of organisational factors which lead to errors is widely used in organisations and is becoming increasingly used in healthcare to improve patient safety (Currie and Watt, 2007). Thus, errors in organisations usually happen because of poorly designed systems rather than weakly performing workers (IOM, 2000).

It appears that "teamwork across units", "overall perceptions of safety", "feedback and communication about error" and "management support for patient safety" were absent in the current study only, while, "organisational learning" was absent in two countries at the European level (UK and Netherlands). "Hospital management support for patient safety" was absent in the UK study and the current study. However, the common patient safety culture dimensions at the European level are:

1 Frequency of event reported.
2 Non punitive response to error.
3 Handoffs and transitions.
4 Communication openness.
5 Supervisor expectation and action promoting patient safety.
6 Teamwork within units.
7 Staffing.
8 Overall perceptions of safety.
9 Feedback and communication about error.
10 Teamwork across units.

However, it was difficult to identify the structure of these common dimensions across these countries because there was a lack of reporting of the structures of dimensions of some studies. Therefore, it was not possible to report and compare the structure of items and dimensions between these models in different countries. However, a number of studies mentioned that the composition of the dimensions of their optimal model was similar to that of the original HSOPSC questionnaire (Smits et al., 2008; Bodur and Filiz, 2010). This means, maybe, that the original model of the HSOPSC questionnaire (Sorra and Nieva, 2004) was not succeeding in a number of countries but found some dimensions corresponding to those proposed for the original HSOPSC questionnaire. It seems that the absence of number of patient safety climate dimensions such as organisational learning-continuous improvement and hospital management support for patient safety disagree with a number of studies that reviewed a number of patient safety climate questionnaires. For example, Fleming (2005) mentioned that organisational learning-continuous improvement and hospital management support for patient safety are reported as common dimensions in a number of patient safety climate questionnaires. Flin et al. (2006b) stated that management commitment to safety is the most common dimension in nine patient safety climate questionnaires. Singla et al. (2006) mentioned that most of the questionnaires included four dimensions. These were: management commitment to safety, communication openness, beliefs about causes of errors and teamwork. However, this disagreement across reviews may be expected because in these review papers they compared patient safety culture dimensions across a number of different patient safety climate questionnaires. Meanwhile, in the current study the patient safety culture dimensions of the HSOPSC questionnaire (Sorra and Nieva, 2004) were compared across different countries to identify the common dimensions in different contexts. The difference arises because there are two different approaches to compare dimensions; one is comparing dimensions across different tools while the second is comparing dimensions of one tool across different countries. However, it is argued that there is a great value of comparing dimensions of one tool in different countries.

Summary of developing an optimal model

The current study is the first extensively validated study of a patient safety climate questionnaire in Saudi hospitals and it identifies the optimal model (eight factors) for assessing patient safety culture in Saudi Arabia. The current study indicated that the psychometric properties of the optimal model are good. The composition of the eight factors of the optimal model of the study was similar to that of the USA HSOPSC questionnaire (Sorra and Nieva, 2004) because the main part of the eight factor structure was unchanged. In general, the structure of the optimal model of the current study was considered appropriate. At the international level, it seemed that the approach to identifying an optimal model in different countries (e.g. the UK, Netherlands, Germany, and Turkey) is varied. However, these countries did in general follow recommended practice in terms of psychometric analysis strategy (EFA, CFA and reliability applications). The composition of the factors of the optimal models varies from country to country. There are some dimensions and items of the original HSOPSC questionnaire (Sorra and Nieva, 2004) that are absent in each country. In addition, some dimensions combined into one dimension and some items shifted to other dimensions. However, it does seem that there are common dimensions of patient safety culture at an international level. The next section will address some methodological issues from the current study.

7.5 Methodological issues

Negatively worded items

According to Marsh (1996) when a questionnaire includes both negative and positive items, then the proportion of negatively and positively worded items should be relatively constant for each factor. This creates balance in a scale and this balance helps to establish distinction between different factors. Most patient safety climate questionnaires include both negative and positive items (Hutchinson et al., 2006). For example, the original HSOPSC questionnaire consists of 12 factors (four positive factors, one negative factor, and seven factors are a mixture of both negative items and positive items). In total, it consists of 18 negative items and 24 positive items. The Teamwork and Safety Climate survey consists of 4 negative items and 23 positive items.

However, there is a debate in the literature regarding negatively and positively worded items that construct the factor structure of questionnaire. A number of studies argued that negative items correlate with positive items to form a separate factor (e.g. Spector et al., 1997). On the other hand, other studies argued that usually a minority of the items in most questionnaires are negative items and they are grouped together as a separate factor (e.g. Schmitt and Coyle, 1976; Schmitt and Stults, 1985). A large body of literature indicates that separate factors are associated with negatively and positively worded items. In other words, negative items are grouped together (correlated with each other) and positive items are grouped together to form a separate factor (Marsh, 1996).

The optimal model of the current study consists of both negative and positive items (nine negative items and 14 positive items). The optimal model consists of eight factors (three negative factors and five positive factors). Moreover, the negative items were grouped together in a number of dimensions such as "no punitive response to error", and "handoffs and transitions". The positive items were grouped together in a number of dimensions such as "organisational learning-continuous improvement", "frequency of event reported" and "supervisors" (see table 6-39 page 216). This result is consistent with the views of Schmitt and Stults (1985); Marsh (1996); and Spector et al. (1997).

The results of the current study differ from the UK study conducted by Waterson et al. (2009), who found four factors in their optimal model (consisting of both negative and positive items) out of nine factors overall. In some studies negative items were not used in data analysis based on responses of respondents. For example, Hutchinson et al. (2006) found that a number of respondents in their study failed to recognise the negative items of the Teamwork and Safety Climate survey. Therefore, four negatively worded items were removed from the final stage of factor analysis.

However, in the current study, it seemed that the respondents were able to distinguish between positive and negative items as mentioned in the face validity stage and the respondents did not experience difficult in interpreting negatively worded items. Therefore, it was decided that there was no need to direct participants' attention towards negative items by using a mark such as underlining. This finding was also reflected later in the psychometric analysis of negative items because the optimal model of the current study contains both negatively and positively worded items as separate factors and they did not cause problems in terms of interpreting the results. In general, the respondents in the current study distinguished between positively worded and negatively worded items and they succeeded to notice negatively worded items without any difficulty. Therefore, the negatively worded items were included in the factor analysis of the study.

Reporting psychometric properties of patient safety climate questionnaires

In terms of reporting psychometric data, it seemed that there is a lack of reporting the psychometric properties of patient safety climate questionnaires in the published literature, even though the need for analysing and reporting psychometric properties of patient safety climate questionnaires has been stressed by several authors (Nieva and Sorra, 2003; Colla et al., 2005; Hutchinson et al., 2006; Flin et al., 2006b). According to Nieva and Sorra (2003) more evidence is needed in relation to reporting the psychometric analysis and data of patient safety climate questionnaires. In Singla et al's (2006) review no psychometric testing had been reported for eight questionnaires from their review of 13 questionnaires.

Similarly, Flin, et al. (2006b) mentioned that the main limitation of their review was the lack of provision of psychometric data in publication of results of patient safety questionnaire use. A possible explanation of this limitation might be due to complexity of factor analysis, especially confirmatory factor analysis.

Alternatively, it might be due to a misconception about assessing the psychometric properties of patient safety climate questionnaires in some studies, in particular, what psychometric analysis should be performed and how to report the psychometric data of questionnaires. It appears there is a need for better practice regarding psychometric properties of patient safety climate questionnaires in terms of reporting them properly. According to Flin et al. (2006b) it is becoming increasingly important to obtain information about the psychometric properties of patient safety climate questionnaires. Therefore, the psychometric analysis strategy of the current study was performed according to a recommended standard, to ensure a rigorous scientific approach. Moreover, the current study reports the details about the assessment of the psychometric properties of the HSOPSC questionnaire with the Saudi data. The next section will discuss the strengths and limitations of the current study.

7.6 Study Strengths and limitations

This study has some strengths and limitations that are discussed in this section. A mixed method approach was used. Initial assessment of the questionnaires was conducted. Three hospitals were included in the study for data collection, and 862 completed questionnaires were returned so the data was tested in a large sample. An intensive advanced psychometric assessment including EFA and CFA was performed. The rigorous psychometric analysis strategy was performed according to recommended practice to validate the psychometric properties of the HSOPSC questionnaire for use in Saudi hospitals.

This study had a number of challenges such as time available for data collection; especially as the data collection was divided in two stages. Firstly, hospital agreements were obtained and 12 interviews were conducted in Saudi Arabia. Then, the researcher returned to the place of the study (University of Sheffield in the UK) to discuss and to confirm the decisions and the results of the face validity stage with the supervisors before going back to Saudi Arabia to collect the data from Saudi hospitals. Secondly, the HSOPSC questionnaires (Sorra and Nieva, 2004) were distributed and collected in three hospitals in Saudi Arabia. All these stages lasted around six months. However, the most practical challenge of this study was achieving a high HSOPSC questionnaires return rate among hospitals staff.

The study encountered some challenges during the data collection stage. For example, summer holidays of staff during the data collection of the current study, shortage of staff in certain departments and a delay in ethics review in the third hospital due to the establishment of new regulations there.

A theoretical challenge encountered in the current study was a lack of reporting of explicit psychometric data in some relevant studies used in the comparative analyses. The measurement of patient safety climate is a dynamic growing field and includes some limitations such as not reporting currently patient safety climate questionnaires under development but not published (Colla et al., 2005). Some aspects of the questionnaires such as psychometric properties may have been performed but not yet published. Some versions of questionnaires are not available (Flin et al., 2006b).

The current study may not have included all relevant existing patient safety climate questionnaires in the literature review; however, it included the most widely used questionnaires which are representative of the patient safety climate questionnaires currently available in the published literature. Moreover, the current study discussed key studies that report data about the psychometric properties of patient safety climate questionnaires.

This research was carried out as a PhD project; therefore, all these stages were undertaken by the researcher. However, all the stages of the current study was discussed and supervised by research supervisors to ensure the quality of the study including developing the research question, aim and objectives, the methodology, the data collection and data analysis.

The researcher received statistical analysis training and support course to aid with their psychometric analysis of the HSOPSC questionnaire. Written materials provided information on correlation, validity, reliability, data splitting, EFA and CFA. Workshops were also conducted on factor analysis (EFA and CFA) and the use of AMOS software was conducted. The course instructor explained how to undertake both EFA and CFA. The research was undertaken independently. Follow up meetings were held to ensure that the psychometric analysis (CFA and EFA) were performed correctly and satisfactorily and to discuss the results.

7.7 Summary of the main findings and impact of the study

The current chapter offers a general overview of the most significant findings of the study and provides an interpretation of these findings in the context of the patient safety culture measurement. The originality and the research contributions of the study findings are discussed in this chapter.

In general, the current study followed recommended practice in terms of assessing the psychometric properties of patient safety climate questionnaires from key studies (e.g. Hutchinson et al., 2006; Smits et al., 2008; Waterson et al., 2009; Bouder and Filiz, 2010; Pfeiffer and Manser, 2010). For example, the current study established the face validity of the two patient safety climate questionnaires for comparison (Hutchinson et al., 2006). It also used CFA and reliability analysis when testing the original HSOPSC questionnaire in Saudi hospitals. A split half validation strategy (EFA followed by CFA) was performed as it is recommended by a number of studies for providing realistic results of the psychometric properties of patient safety climate questionnaires (e.g. Waterson et al., 2009). Finally, an extensive EFA, CFA and reliability analysis was performed in order to identify the optimal model for Saudi hospitals.

The current study provides four main findings. Firstly, in terms of the importance of face validity, the current study demonstrated that establishing face validity of a patient safety climate questionnaire is very important and an essential element before wider application in a new context. Secondly, the current study demonstrated that the factor structure of the original USA HSOPSC questionnaire (12 factors and 42 items) is not valid and reliable when used with the English language Saudi data collected in this study because the psychometric properties of the original HSOPSC questionnaire are not a satisfactory fit with the Saudi data. The original HSOPSC questionnaire may be effectively measuring different dimensions of patient safety culture within Saudi Arabia, as compared to the USA (Sorra and Nieva, 2004). Therefore, the factor structure of the original USA HSOPSC questionnaire (Sorra and Nieva, 2004) cannot be used with the Saudi data and the original USA HSOPSC model was not suitable for use in Saudi hospitals.

Thirdly, the results of psychometric analysis (EFA, CFA and Reliability analysis) showed that eight factors was the optimal model for the Saudi data. The optimal model could be used in Saudi hospitals to assess patient safety culture. Finally, the current study compared number of optimal models in different countries. The comparison shows the seven common patient safety culture dimensions in different contexts. The next chapter will provide the conclusion of the current study and recommendation for the future use of the HSOPSC questionnaire in Saudi Arabia.

Chapter eight: Conclusion

8.1 Introduction

This chapter concludes this thesis by summarising the key findings in relation to the research question, aim and objectives of the study. In section 8.2 the implications of the study are presented, including theoretical implications, practical implications and recommendations for future research of patient safety culture measurement, in particular, patient safety culture measurement in Saudi Arabia. Finally, in section 8.3 the conclusion of this chapter is provided.

The current study investigated whether there was an existing patient safety climate questionnaire that would be suitable for assessing patient safety culture in hospitals in Saudi Arabia. The main aim of the study was to identify a suitable measure for assessing patient safety culture for use in hospitals in Saudi Arabia. In this investigation four main objectives needed to be met in order to achieve the aim of the study. The main objectives of the study were:

1. To select an appropriate questionnaire to assess hospital patient safety culture.
2. To evaluate the face validity of the selected patient safety climate questionnaire.
3. To assess the psychometric properties of the selected patient safety climate questionnaire in hospitals in Saudi Arabia.
4. To develop the most appropriate measure for assessing patient safety culture for use in hospitals in Saudi Arabia.

In terms of achievement of the objectives, a mixed methods study design has been employed to identify a suitable patient safety climate questionnaire for use in hospitals in Saudi Arabia. The original HSOPSC questionnaire (Sorra and Nieva, 2004) and Teamwork and Safety Climate Survey (Sexton et al., 2004) were identified as appropriate questionnaires in the first stage of the research. The second objective was testing the face validity of the two questionnaires above for comparison.

The original HSOPSC questionnaire (Sorra and Nieva, 2004) was the most appropriate questionnaire for use in the current study although some changes were made to the wording. Thirdly, this questionnaire was used to collect the data from three Saudi Arabian hospitals using 862 completed questionnaires, and finally, the evaluation of the psychometric properties of the HSOPSC using Saudi data.

In terms of findings, the current study provides three main findings. Firstly, the current study demonstrated that establishing face validity of a patient safety climate questionnaire is very important and an essential element before the full application of a questionnaire. Secondly, the current study demonstrated that the factor structure of the original USA HSOPSC questionnaire (12 factors and 42 items) (Sorra and Nieva, 2004) was not valid and reliable in Saudi hospitals. Thirdly, the current study developed an English language version of the HSOPSC questionnaire, consisting of eight patient safety culture dimensions, as an optimal model which can be used in Saudi hospitals for assessing patient safety culture.

8.2 Implications of the study

This research contributes to the measurement of patient safety culture in three ways: contribution to the current knowledge (theoretical implications), implications for practice and implications for future research (empirical implications).

Contribution to the current knowledge

In terms of theoretical implications, measuring safety climate in healthcare is still a developing science. Therefore, there is a need to measure patient safety climate in different healthcare environments carefully to avoid the risk of inappropriately applying patient safety climate questionnaires in a different environment (Waterson et al., 2009). The current study highlights the necessity of assessing the face validity of patient safety climate questionnaire before full application in different settings. It indicates that there is a need for caution in using the original English language version of the HSOPSC questionnaire (Sorra and Nieva, 2004) in Saudi Arabia and underlines the importance of appropriate validation of patient safety climate questionnaires before extending their usage in healthcare contexts different from those in which they were developed.

The current study shows that the HSOPSC questionnaire may be measuring different dimensions of patient safety culture within Saudi Arabia, as compared to the USA (Sorra and Nieva, 2004). In addition, the HSOPSC questionnaire may also be measuring different dimensions of patient safety culture within different countries such as the UK, Netherlands, Germany and Turkey as compared to the USA (Sorra and Nieva, 2004). Moreover, the current study provides international comparative information regarding the use of the HSOPSC questionnaire in different countries. This comparison has identified the seven common patient safety culture dimensions of this questionnaire across these countries.

Implications for practice

In terms of practical implications, based on this study, the original English language version of the HSOPSC questionnaire (Sorra and Nieva, 2004) is not appropriate for use in Saudi hospitals, while the validated Saudi English language version of the HSOPSC questionnaire can be used to assess patient safety culture in the Saudi hospitals. The optimal model of the current study (Saudi English language version of the HSOPSC) demonstrates generally good psychometric properties. The eight factor structures of the Saudi and the American HSOPSC versions are reasonably consistent because the overall structure of eight factors is the same and the composition of dimensions is approximately similar. This study demonstrates that the Saudi English language version of the HSOPSC questionnaire is an appropriate patient safety climate questionnaire to assess patient safety culture in Saudi hospitals.

Implications for future research

Several areas for further research have emerged from the findings of the current study. In terms of empirical implications, the current study highlights that there is a weakness in reporting psychometric properties and psychometric analysis in the relevant literature. More safety climate questionnaire validation studies are needed that include the reporting of all the assessment data regarding the psychometric properties of patient safety climate questionnaires. Additional studies on patient safety culture assessment in Saudi healthcare using the validated Saudi English language version of the questionnaire developed in the current study will help to provide better understanding of patient safety in Saudi Arabia.

8.3 Conclusion

The current study is one of few studies to provide an evaluation of an American patient safety climate questionnaire using data from Saudi Arabia and applying a rigorous psychometric analysis strategy. It also appears to be the first study to identify the Saudi English language version of the HSOPSC questionnaire as the optimal model for assessing patient safety culture in Saudi hospitals. In conclusion, the findings of the current study contribute to the measurement of patient safety climate in healthcare organisations. Moreover, the current study established a basis for measuring the patient safety culture in Saudi hospitals, thereby potentially contributing to creating a safer environment for hospital patients in Saudi Arabia.

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The University Of Sheffield.

School of Health and Related Research

Appendix 1 Consent form

Title of Project: An evaluation of a patient safety culture tool in Saudi Arabia

Name of Researcher: Mamdooh Shrier Alonazi

Participant Identification Number for this project:

Please initial box

1. I confirm that I have read and understand the information sheet dated .... for the above project and have had the opportunity to ask questions.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.

3. I understand that my responses will not be anonymised before analysis. I give permission for members of the research team to have access to my responses.

4. I agree to take part in the above research project.

Name of Participant	Date	Signature
Lead Researcher	Date	Signature

To be signed and dated in presence of the participant

Copies: *Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form, the information sheet and any other written information provided to the participants. A copy for the signed and dated consent form should be placed in the project's main record (e.g. a site file), which must be kept in a secure location.*

The University of Sheffield
Western Bank
Sheffield
S10 2TN
UK

The University Of Sheffield.

School of Health and Related Research

Appendix 2 Participant Information Sheet

Research project title: An evaluation of a patient safety culture tool in Saudi Arabia

Invitation to participate:

You are being invited to take part in this PhD research project. It is important for you to understand why this research is being done and what it will involve before you consider your participation. Please read the following information, which explains the purpose of this research and what participation will involve and you may discuss this with others if you wish. If you would like further information or you have questions, please contact the researcher. You will be given a period of 5-7 days to decide whether or not you wish to participate.

Thank you for reading this information. If you decide to participate, you will be given a copy of this information sheet and your signed consent form.

Purpose of the research:

The purpose of this research is to identify a suitable measure for assessing patient safety culture for use in hospitals in Saudi Arabia. The methods that will be used to collect the information include interviews and questionnaires related to the development of the patient safety culture tool. It is expected that data collection will be undertaken over a period of five months.

Why have I been chosen?

The participants in this study are frontline healthcare providers (doctors and nurses). Therefore, you have been selected because you are one of the doctors or the nurses in the hospital. You would be one of a total of twelve doctors and nurses helping with this part of the study.

Do I have to participate?

No, it is up to you to decide whether or not you want to take part. If you decide to take part you will be given this information sheet to keep and you will be asked to sign a consent form. Even after deciding to take part in this research, you are still free to withdraw from the research at any point in time and without giving a reason. If you decide to participate in the interviews we will ask you not to take part in completing the questionnaires.

What will happen to me if I participate?

If you decide to participate then you will be interviewed in an informal conversational style. The researcher will ask you to sign a consent form. Then the researcher will organise an interview schedule. The interview will last about 50 to 60 minutes, you will fill in the questionnaire (Hospital Survey on Patient Safety Culture Questionnaire) and notes will be taken by the researcher during the interview. Three questions will be asked for each item of the questionnaire:

Q1: Is the wording of the item clear for you?

Q2: What does the item mean to you?

Q3: Do you find the item easy or difficult to understand?

The interview will be conducted in a private office and everything said and written during the interview will remain in confidence. There is no potential for physical and/or psychological harm / distress to participants during the research.

What are the possible benefits of taking part?

This study seeks to contribute to the knowledge base by investigating the suitability of an appropriate patient safety culture measure for use in hospitals in Saudi Arabia. It is hoped that the knowledge generated will contribute to the literature on the measurement of the patient safety culture, in particular in Saudi Arabia. There are no direct benefits to you.

What will happen to the results of the research study?

The results will be published in the PhD thesis. No named information about you will be mentioned in the thesis.

Will my taking part in this research be kept confidential?

All of the data that will be collected will be securely stored by the researcher. The interviews notes will be disposed of 24 months after the researcher receives the PhD degree. The computer used for analysing the data will be password protected. Research notes will be stored in a locked filing cabinet in an office that is locked. Your anonymity and confidentiality will be preserved at all times. Access to the research data is limited to the research team, which include the supervisors of this research and the researcher (Professor Allen Hutchinson, Dr. Jenny Freeman, Dr. Rachel O'Hara and Mr Mamdooh Shereir Alonazi).

Who is organising and funding the research?

The research is part of the PhD studies and no organisation is involved in funding.

Who has ethically reviewed the project?

The research has been scientifically reviewed by the University of Sheffield, School of Health and Related Research in the United Kingdom. It has also been reviewed and approved by the School of Health and Related Research Ethics Committee. In addition, it has been reviewed by the Medical and Health Sciences Research Centre at King Abdul-Aziz Medical City and Research department at King Faisal Specialist Hospital and Research Centre Riyadh, Saudi Arabia.

Contact for further information:

Should you need more information you can contact the supervisors of the research and the researcher:

1. Professor Allen Hutchinson

Professor in Public Health

School of Health and Related Research (ScHARR)

Section of Public Health

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Sheffield, S1 4DA, UK

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4. Mamdooh Sherier Alonazi

PhD student in

Section of Public Health

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Thank you for taking the time to participate in the research.

Appendix 3 Original Hospital Survey on Patient Safety Culture Survey

HOSPITAL SURVEY ON PATIENT SAFETY CULTURE

INSTRUCTIONS

This survey asks for your opinions about patient safety issues, medical error, and event reporting in your hospital and will take about 10 to 15 minutes to complete.

- An "event" is defined as any type of error, mistake, incident, accident, or deviation, regardless of whether or not it results in patient harm.
- "Patient safety" is defined as the avoidance and prevention of patient injuries or adverse events resulting from the processes of healthcare delivery.

SECTION A: Your Work Area/Unit

In this survey, think of your "unit" as the work area, department, or clinical area of the hospital where you spend <u>most of your work time or provide most of your clinical services</u>

What is your primary work area or unit in this hospital? Mark ONE answer by filling in the circle.

? a. Many different hospital units/No specific unit

? b. Medicine (non-surgical) ? g. Intensive care unit (any type) ? l. Radiology

? c. Surgery ? h. Psychiatry/mental health ? m. Anaesthesiology

? d. Obstetrics ? i. Rehabilitation ? n. Other, please specify

? e. Pediatrics ? j. Pharmacy

? f. Emergency department ? k. Laboratory

Please indicate your agreement or disagreement with the following statements about your work area/unit. Mark your answer by filling in the brackets.

Think about your hospital work area/unit	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. People support one another in this unit	[1]	[2]	[3]	[4]	[5]
2. We have enough staff to handle the workload	[1]	[2]	[3]	[4]	[5]
3. When a lot of work needs to be done quickly, we work together as a team to get the work done	[1]	[2]	[3]	[4]	[5]
4. In this unit, people treat each other with respect.	[1]	[2]	[3]	[4]	[5]
5. Staff in this unit work longer hours than is best for patient care	[1]	[2]	[3]	[4]	[5]
6. We are actively doing things to improve patient safety	[1]	[2]	[3]	[4]	[5]
7. We use more agency/temporary staff than is best for patient care	[1]	[2]	[3]	[4]	[5]
8. Staff feel like their mistakes are held against them	[1]	[2]	[3]	[4]	[5]
9. Mistakes have led to positive changes here	[1]	[2]	[3]	[4]	[5]
10. It is just by chance that more serious mistakes don't happen around here	[1]	[2]	[3]	[4]	[5]
11. When one area in this unit gets really busy, others help out	[1]	[2]	[3]	[4]	[5]
12. When an event is reported, it feels like the person is being written up, not the problem	[1]	[2]	[3]	[4]	[5]

SECTION A: Your Work Area/Unit (continued)

Think about your hospital work area/unit	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
13. After we make changes to improve patient safety, we evaluate their effectiveness	[1]	[2]	[3]	[4]	[5]
14. We work in "crisis mode" trying to do too much, too quickly	[1]	[2]	[3]	[4]	[5]
15. Patient safety is never sacrificed to get more work done	[1]	[2]	[3]	[4]	[5]
16. Staff worry that mistakes they make are kept in their personnel file	[1]	[2]	[3]	[4]	[5]
17. We have patient safety problems in this unit	[1]	[2]	[3]	[4]	[5]
18. Our procedures and systems are good at preventing errors from happening	[1]	[2]	[3]	[4]	[5]

SECTION B: Your Supervisor/Manager

Please indicate your agreement or disagreement with the following statements about your immediate supervisor/manager or person to whom you directly report. Mark your answer by filling in the brackets.

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	[1]	[2]	[3]	[4]	[5]
2. My supervisor/manager seriously considers staff suggestions for improving patient safety	[1]	[2]	[3]	[4]	[5]
3. Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	[1]	[2]	[3]	[4]	[5]
4. My supervisor/manager overlooks patient safety problems that happen over and over	[1]	[2]	[3]	[4]	[5]

SECTION C: Communications

How often do the following things happen in your work area/unit? Mark your answer by filling in the brackets.

Think about your hospital work area/unit	**Never**	**Rarely**	**Some times**	**Most of the time**	**Always**
1. We are given feedback about changes put into place based on event reports	[1]	[2]	[3]	[4]	[5]
2. Staff will freely speak up if they see something that may negatively affect patient care	[1]	[2]	[3]	[4]	[5]
3. We are informed about errors that happen in this unit	[1]	[2]	[3]	[4]	[5]
4. Staff feel free to question the decisions or actions of those with more authority	[1]	[2]	[3]	[4]	[5]
5. In this unit, we discuss ways to prevent errors from happening again	[1]	[2]	[3]	[4]	[5]
6. Staff are afraid to ask questions when something does not seem right	[1]	[2]	[3]	[4]	[5]

SECTION D: Frequency of Events Reported

In your hospital work area/unit, when the following mistakes happen, how often are they reported? Mark your answer by filling in the brackets.

	Never	**Rarely**	**Some times**	**Most of the time**	**Always**
1. When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported	[1]	[2]	[3]	[4]	[5]
2. When a mistake is made, but has no potential to harm the patient, how often is this reported	[1]	[2]	[3]	[4]	[5]
3. When a mistake is made that could harm the patient, but does not, how often is this reported?	[1]	[2]	[3]	[4]	[5]

SECTION E: Patient Safety Grade

Please give your work area/unit in this hospital an overall grade on patient safety. Mark ONE answer.

☐	☐	☐	☐	☐
A	B	C	D	E
Excellent	**Very Good**	**Acceptable**	**Poor**	**Failing**

SECTION F: Your Hospital

Please indicate your agreement or disagreement with the following statements about your hospital. Mark your answer by filling in the brackets.

Think about your hospital	**Strongly Disagree**	**Disagree**	**Neither**	**Agree**	**Strongly Agree**
1. Hospital management provides a work climate that promotes patient safety	[1]	[2]	[3]	[4]	[5]
2. Hospital units do not coordinate well with each other	[1]	[2]	[3]	[4]	[5]
3. Things "fall between the cracks" when transferring patients from one unit to another	[1]	[2]	[3]	[4]	[5]
4. There is good cooperation among hospital units that need to work together	[1]	[2]	[3]	[4]	[5]
5. Important patient care information is often lost during shift changes	[1]	[2]	[3]	[4]	[5]
6. It is often unpleasant to work with staff from other hospital units	[1]	[2]	[3]	[4]	[5]
7. Problems often occur in the exchange of information across hospital units	[1]	[2]	[3]	[4]	[5]

8. The actions of hospital management show that patient safety is a top priority	[1]	[2]	[3]	[4]	[5]
9. Hospital management seems interested in patient safety only after an adverse event happens	[1]	[2]	[3]	[4]	[5]
10. Hospital units work well together to provide the best care for patients	[1]	[2]	[3]	[4]	[5]
11. Shift changes are problematic for patients in this hospital	[1]	[2]	[3]	[4]	[5]

SECTION G: Number of Events Reported

In the past 12 months, how many event reports have you filled out and submitted? Mark ONE answer .

? a. No event reports

? b. 1 to 2 event reports

? c. 3 to 5 event reports

? d. 6 to 10 event reports

? e. 11 to 20 event reports

? f. 21 event reports or more

SECTION H: Background Information

This information will help in the analysis of the survey results. Mark ONE answer by filling in the circle .

1. What is your staff position in this hospital? Mark ONE answer that best describes your staff position.

? a. Physician in training

? b. Physician (general physician)

? c. Resident physician

? d. Specialist

? e. Consultant

? f. Professor

? g. Head nurse

? h. Registered nurse

? i. Other, please specify:........................

2. What is your gender?

? a. Male

? b. Female

3. What is your nationality?

? a. Saudi

? b. Non-Saudi, please specify:..................

4. What is your educational level?

? a. PhD

? b. Master degree

? c. Bachelor degree

? d. Diploma

? e. other, Please specify....................................

5. How long have you worked in this hospital ?

- [?] a. Less than 1 year
- [?] b. 1 to 5 years
- [?] c. 6 to 10 years
- [?] d. 11 to 15 years
- [?] e. 16 to 20 years
- [?] f. 21 years or more

6. How long have you worked in your current hospital work area/unit ?

- [?] a. Less than 1 year
- [?] b. 1 to 5 years
- [?] c. 6 to 10 years
- [?] d. 11 to 15 years
- [?] e. 16 to 20 years
- [?] f. 21 years or more

7. Typically, how many hours per week do you work in this hospital ?

- [?] a. Less than 20 hours per week
- [?] b. 20 to 39 hours per week
- [?] c. 40 to 59 hours per week
- [?] d. 60 to 79 hours per week
- [?] e. 80 to 99 hours per week
- [?] f. 100 hours per week or more

8. In your staff position, do you typically have direct interaction or contact with patients?

☐ a. YES, I typically have direct interaction or contact with patients

☐ b. NO, I typically do NOT have direct interaction or contact with patients

9. How long have you worked in your current specialty or profession ?

☐ a. Less than 1 year

☐ b. 1 to 5 years

☐ c. 6 to 10 years

☐ d. 11 to 15 years

☐ e. 16 to 20 years

☐ f. 21 years or more

SECTION I: Your Comments

Please feel free to write any comments about patient safety, error, or event reporting in your hospital.

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Appendix 4 Teamwork and Safety Climate

Please answer the following items with respect to your specific unit or clinical area. Choose your responses using the scale below:

Teamwork climate							
No	Item	Disagree strongly	Disagree slightly	neutral	Agree slightly	Agree strongly	Not Applicable
1	Nurse input is well received in this clinical area.						
2	In this clinical area, it is difficult to speak up if I perceive a problem with patient care.						
3	Decision-making in this clinical area utilizes input from relevant personnel.						
4	The physicians and nurses here work together as a well –coordinated team.						
5	Disagreements in this clinical area are resolved appropriately (i.e., not who is right, but what is best for the patient).						
6	I am frequently unable to express disagreement with the attending/staff physicians here.						
7	It is easy for personnel here to ask questions when there is something that they do not understand.						
8	I have the support I need from other personnel to care for patients.						
9	I know the first and last names of all the personnel I worked with during my last shift.						
10	Important issues are well communicated at shift changes.						
11	Briefing personnel before the start of a shift (i.e., to plan for possible contingencies) is important for patient safety.						
12	Briefings are common in this clinical area.						
13	I am satisfied with the quality of collaboration that I experience with staff physicians in this clinical area.						
14	I am satisfied with the quality of collaboration that I experience with nurses in this clinical area.						

Safety climate							
15	The levels of staffing in this clinical area are sufficient to handle the number of patients.						
16	I would feel safe being treated here as a patient.						
17	I am encouraged by my colleagues to report any patient safety concern I may have.						
18	Personnel frequently disregard rules or guidelines (e.g., hand-washing, treatment protocols/clinical pathways, sterile field, etc.) that are established for this clinical area.						
19	The culture in this clinical area makes it easy to learn from the errors.						
20	I receive appropriate feedback about my performance.						
21	Medical errors are handled appropriately here.						
22	I know the proper channels to direct questions regarding patient safety in this clinical area.						
23	In this clinical area, it is difficult to discuss errors.						
24	Hospital management does not knowingly compromise the safety of patients.						
25	This institution is doing more for patient safety now, than it did one year ago.						
26	Leadership is driving us to be a safety-centred institution.						
27	My suggestion about safety would be acted upon if I expressed them to management.						

Background information:

1. What is your staff position in this hospital? Mark ONE answer that best describes your staff position.

O. Physician in training

O. Physician (general physician)

O. Resident physician

O. Specialist

O Consultant

O. Professor

O. Head nurse

O. Registered nurse

O. other, please specify:

2 What is your gender?

O. Male

O. Female

3 What is your nationality?

O. Saudi

O. non-Saudi, please specify...

4 Experience in organisation

O. Less than 6 months

O. 6 to 11 months

O. 1 to 2 years

O. 3 to 7 years

O. 8 to 12 years

O. 13 to 20 years

O. 21 or more

5 How long have you worked in your current hospital work area/unit ?

O. a. Less than 1 year

O. b. 1 to 5 years

O. c. 6 to 10 years

O. d. 11 to 15 years

O. e. 16 to 20 years

O. f. 21 years or more

6 Unit clinical area: please write in your unit title/location:...

7 What is your educational level?

O. PhD degree

O. Master degree

O. Bachelor degree

O. Diploma degree

O. e other, please specify

8 In your staff position, do you typically have direct interaction or contact with patients?

O. YES, I typically have direct interaction or contact with patients

O. NO, I typically do NOT have direct interaction or contact with patients

9 Typically, how many hours per week do you work in this hospital ?

O. Less than 20 hours per week O. 60 to 79 hours per week

O. 20 to 39 hours per week O. 80 to 99 hours per week

O. 40 to 59 hours per week O. 100 hours per week or more

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Appendix 5 University ethics approval 1

The University Of Sheffield.

Cheryl Oliver
Ethics Committee Administrator

Regent Court
30 Regent Street
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Telephone: +44 (0) 114 2220871
Fax: +44 (0) 114 272 4095 (non confidential)
Email: c.a.oliver@sheffield.ac.uk

Our ref: /CAO

DATE

Mamdooh Alonazi
ScHARR

Dear Mamdooh,

An evaluation of a patient culture tool in Saudi Arabia

Thank you for submitting the above research project for approval by the ScHARR Research Ethics Committee. On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that the project was approved.

If during the course of the project you need to deviate significantly from the documents you submitted for review, please inform me since written approval will be required.

Yours sincerely

Cheryl Oliver
Ethics Committee Administrator

Appendix 6 University ethics approval 2

The University Of Sheffield.

Cheryl Oliver
Ethics Committee Administrator

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Our ref: /CAO

16 June 09

Mamdooh Alonazi
ScHARR

Dear Mamdooh,

An evaluation of a patient culture tool in Saudi Arabia

Thank you for the additional papers you have submitted to Jennifer Burr.

ScHARR ethics has looked through the changes and is happy to approve the amendment. Please note this does not replace the ethical approval that you may require from the King Fahad Hospital in Saudi Arabia.

Yours sincerely

Cheryl Oliver
Ethics Committee Administrator

Appendix 7 Research ethics review

Research ethics review was required from the School of Health and Related Research at the University of Sheffield. Thereafter, ethics review and agreements were sought from the three hospitals in Saudi Arabia.

Ethics in School of Health and Related Research

The first stage involved ethical approval from the University of Sheffield. The present study followed the university ethics review procedure ('UER Procedure') from the School of Health and Related Research at the University of Sheffield as follows:

Scientific Review

The study was reviewed not only in terms of ethical aspects, but also from scientific quality such as the methodology and strategy of data analysis. Therefore, this stage involved the scientific review and the ethics approval in March-April 2009. As a starting point, the scientific review document was sent to the two scientific reviewers in the School of Health and Related Research on 4th March 2009. Once the feedbacks received from the scientific peer review, the following suggestions have been taken into account and acted upon.

Reviewer 1:

The application should be approved with the suggested, optional amendments as follows:

1. Clarifying as to whether the patient safety tool is to be used only in English with English speaking staff or whether it will be used in translation.
2. Providing copies of consent forms and information sheets to demonstrate how the confidentiality of interviews will be assured.
3. Clarifying the differences between the two hospitals particularly in terms of the justification of conducting the interviews in only one hospital.

Reviewer 2:

The study is well thought out and scientifically sounds. The application should be approved with the suggested optional amendments as follows:

1. Will the questionnaire be in English or will it need to be translated? Suggested that it will need to be clarified in the protocol.
2. Suggestion that the cover letter is printed on the same document as the questionnaire, or that information is included directly on the questionnaire about how to return it.
3. Will the student undertake the factor analysis and if so will he have access to a statistician to advise him on this?
4. There are two potential scenarios described for the factor analysis. The suggestion is that there is a lack of clarity about the first stage and the second stage of the proposed analytical strategy (which stage comes first?), but it is also strongly recommended to check with a statistician with expertise in factor analysis.
5. Re-time schedule between the interviews and questionnaires, ensuring that enough time is allowed for making and agreeing changes to the questionnaires and then getting them printed.
6. Ensure identification in advance of somewhere in Saudi Arabia to get the questionnaires printed.

Ethics Review

After all the comments of the scientific reviewers were considered to account and acted upon. The protocol includes the University Research Ethics Application Form, the Interview Consent Form and Participant Information Sheet (see appendix 4). The protocol then was submitted to the ethics administrator at School of Health and Related Research on 12th March 2009 to obtain ethics approval for the study. The ethics reviewer's comments indicated the need for some work before approval can be given, these comments were as follows:

1. Application form [We have made the changes you resolved, please see the responses below and changes in documentation].
2. Start date of project is stated as in 2007 (presumably the start of the PhD). We cannot give retrospective ethical permission to proceed, so this should be changed [The date has been changed]

3. In stage 1 there should be a clear statement about the balance between nurses and doctors in the interview sample? (It may mean 12 doctors and 12 nurses or 6 of each, etc.). There should be a statement if more than 12 or 24 volunteer after reading the information how selection and rejection will be handled [It has been clarified]
4. For stage 1 in the application form it needs to be clear what the doctor/nurse does once they decide whether to participate. It is also not clear how the 12 participants are selected or what happens if they refuse [I have clarified]
5. Needs to be clear that those who have taken part in Stage 1 will be asked not to take part in Stage 2 (Information sheet) [We have mentioned it in information sheet]
6. In A9.1 it should state there is an opportunity for the participant to ask questions?! (see covering letter)[we have done this]
7. In A10 it states data 'will be saved securely on the managed desktop at the university and be password protected during the study period' ; There must be a statement that explains what happens to the data after the study.[We have mentioned what will happen to the data and the period in application form]
8. Not clear from the application whether the student would, in his normal capacity, have access to the hospital administration. If not then he should not expect to access the personal details for staff through this system and should request that this information be obtained, and letters circulated to staff, on his behalf. Please confirm.[The local research ethics and scientific committee approval in each hospital will enable the student to approach member of staff]
9. Covering letter Change "I would be grateful if you would take a few minutes ...." to "I would be grateful if you would volunteer to take a few minutes ...." - there is nothing to clearly indicate participation is voluntary. There should be some indication that as many 300 participants are sought.[We have done this]
10. Information sheet. Somewhere the potential participants should be told that they would be 1 of 12 or 24 people helping with this part of the study. Also should mention right to withdraw at any time.[It has been done]
11. Those who have taken part in Stage 1 should be asked not to take part in Stage 2 (see comment above)[It has been done]
12. In the information sheet specify what the doctor/nurse should do when they decide to participate in the interview. Some indication of the type of interview questions expected is necessary[We mentioned it]

13. Under 'What will happen if I take part', there is reference to a questionnaire. Is this a different questionnaire to the one being circulated later in the study? If so we would need a copy. If it's the same one please could this be clarified [The questionnaire mentioned is the same questionnaire]
14. Questionnaire. Reformat questionnaire, as currently several questions go across 2 pages and this means that they are difficult to compete e.g. section D, H6 etc.[We have made some formatting changes but further work required after the interview stage]
15. Consent form. The following should be resolved and amendments made as necessary. Although item 3 evidently implies that at least the researcher will collect participant identifiable data they are not given permission to have access to it by the participant ticking the box! The questionnaire as it stands has no name on it so at the point of collection it could be anonymised. If the latter is the case and also in recording what happens during the interview the researcher does not record the name of the participant (other than on the consent form) then item 3 could stand as worded. However this does raise the issue that if the data is anonymous at the point of collection then it cannot subsequently be withdrawn from the study (if a participant decides to withdraw). It could be argued that participants should be told that once anonymised their data can no longer be removed from the study. [Item three has been changed on the interview consent form].

The above suggestions have been taken into account and acted upon and the documentation has resubmitted on 7/4/2009 to get the ethical approval from the ethics committee in the School of Heath and Related Research at the University of Sheffield. Finally, the study was approved (See copy of ethics approval in appendix 2).

Ethics and agreements in Saudi hospitals

The second stage was the hospitals' approval to conduct the study. Communication has been established with the research centres in the three hospitals in Riyadh for ethics application forms and regulations (instructions) for research requirements to obtain their agreement to undertake the survey as follows:

1. Institutional Review Board Committee of the Research Centre, King Fahad Hospital (submitted on April 2009)

2. Research department in King Faisal Specialist Hospital and Research Centre (submitted on April 2009)
3. Institutional Review Board of the King Fahad Medical City (submitted on June 2009)

The proposal was submitted to the three research centres above in hospitals in Riyadh in Saudi Arabia. These hospitals are the largest tertiary hospitals in terms of bed capacity and workforce in Saudi Arabia.

This task started on 11 April 2009 by preparing research proposal and the application form of King Fahad Hospital. The researcher completed the application form according to the general instructions of the research centre of the hospital. After that the proposal and all relevant forms were completed and submitted to the Medical & Health Sciences Research Centre (MHSRC) in King Fahad Hospital to obtain a reference number for the study. Thereafter it was forwarded to the Research Committee meeting and Institutional Review Board (IRB) for peer review and discussion. Finally, the decision approving the proposal was made by the Chairman of the Research Committee (See appendices for the copy of the approval letter from Institutional Review Board of King Abdullah International Medical & Health Sciences Research Centre).

King Faisal Specialist Hospital and Research Centre (KFSH&RC) was the second hospital on 14/4/2009. According to the King Faisal Specialist Hospital and Research Centre's guidelines and instructions for submission of research proposals, the researcher must have successfully completed the National Institute of Health (NIH) Web based training course "Protecting Human Research Participants" which was done on 22/3/2009 (see appendix for the copy of the certificate). Then the principal investigator was identified. Subsequently, the research proposal format and the application form were completed. The principal investigator submitted the proposal with all relevant forms to the Office of Research Affairs (ORA). This office screened the proposal for compliance with submission guidelines, then forwarded it for peer review and sent it to the appropriate research committee for evaluation. There was a delay in obtaining the ethical approval because of the establishment of a new research committee there, once the new committee members were designated the proposal has submitted. However below is a time history of the research. "An Evaluation of Patient Safety Culture Tool in Saudi Arabia''.

20 April 2009: Proposal submitted to the Research Advisory Council, King Faisal Specialist Hospital and Research Centre for evaluation. 02 May 2009: Proposal forwarded to the Research Ethics Committee (REC). 04 May 2009: approved by the REC through the review process. 18 May 2009: Scheduled for discussion by the Clinical Research Committee (CRC) on next meeting. 26 May 2009: Proposal discussed by CRC - some clarifications were requested from the investigator. The clarification was provided and the proposal was scheduled for discussion again by the CRC. However, this may take some time due to the change of the membership of the Research Advisory Council Supporting Committees. After that, the proposal of the study was reviewed and approved by two committees, Research Ethics Committee (REC) and Clinical Research Committee (CRC). Finally, the decision approving the proposal was made by the Research Advisory Council (See appendices for the copy of the approval letter from the Research Advisory Council, King Faisal Specialist Hospital and Research Centre).

The third hospital was King Fahad Medical City Riyadh, Saudi Arabia approached on 6/6/2009. The proposal and relevant forms were submitted to the External Research Review Committee, a subcommittee of the Institutional Review Board in King Fahad Medical City. The proposal was reviewed by the External Research Review Committee after that the principal investigator was informed the proposal has approved by the Institutional Review Board (See appendices for the copy of the approval letter from Institutional Review Board of the King Fahad Medical City).

It is important to mention that time is an important factor in the fieldwork of the study. Therefore, the face validity interviews were held in the hospital which issued its agreement the first. King Fahad Hospital was the first one where the interviews were conducted.

Appendix 8 King Fahad National Guard Hospital agreement

Health Affairs Executive Office | File #
4/19/2009 10:58 17/4513/2009 | 4513/2009

Kingdom of Saudi Arabia
National Guard-Health Affairs
King Abdulaziz Medical City

المملكة العربية السعودية
الحرس الوطني - الشؤون الصحية
مدينة الملك عبدالعزيز الطبية

Institutional Review Board 16586/16669 1515 16567 CLNResearch1@ngha.med.sa

MEMORANDUM

Ref. #: IRBC/021/09

Date: (G) 14 April 2009
(H) 18 Rabi'Il 1430

To: **Mr. Mamdooh Sherier Alonazi**
PhD Student
University of Sheffield U.K.

Subject: **Protocol RC09/015 - "An Evaluation of a Patient Safety Culture Tool in Saudi Arabia**

This is in reference to your subject proposal, which has been expedited reviewed by the IRB on 14th of April 2009. Upon recommendation of the Research Committee, and following the review of the IRB on the ethical aspects of the proposal, you are granted permission to conduct your study.

Your research proposal is **approved for one year** commencing from the above date with the following conditions:

TERMS OF APPROVAL:

1. **Annual Reports:** Continued approval of this project is dependent on the submission of an Annual Report. Please provide KAIMRC with an Annual Report **determined by the date of your letter of approval.**

2. **Amendments to the approved project:** Changes to any aspect of the project require the submission of a Request for Amendment to KAIMRC and must not begin without an approval from KAIMRC. Substantial variations may require a new application.

3. **Future correspondence:** Please quote the project number and project title above in any further correspondence.

4. **Monitoring:** Projects may be subject to an audit or any other form of monitoring by KAIMRC at any time.

5. **Retention and storage of data:** The PI is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

A. Kashmeery

Prof. Amin Kashmeery	Dr. Mohammed Al Jumah	for Dr. Bandar Al Knawy
Head, Biomedical Ethics Section	Executive Director, KAIMRC	Chief Executive Officer
National Guard Health Affairs	National Guard Health Affairs	National Guard Health Affairs

AK/mja

P. O. Box 22490 Riyadh 11426
Tel. 2520088
Telex : 403450 NGRMED SJ

ص. ب ٢٢٤٩٠ الرياض ١١٤٢٦
تلفون : ٢٥٢٠٠٨٨
تلكس ٤٠٣٤٥٠ NGRMED

KFH-MATERIALS 14574 (05/96) (ORACLE 29795) ٣٨١٢٠٨

Appendix 9 Support letter from Associate Executive Director of Nursing department

Kingdom of Saudi Arabia National Guard-Health Affairs King Abdulaziz Medical City	المملكة العربية السعودية الحرس الوطني - الشؤون الصحية مدينة الملك عبدالعزيز الطبية

NURSING SERVICES
Reference: NSG.JM152.09

DATE: **19 May 2009**

Memorandum

TO: **Mr. Mandooh Sherier Alonazi**
PHD Student, University of Sheffield, UNK

FROM: **Rob Hemmelder**
(A) Associate Executive Director, Nursing Services, Central Region

SUBJECT: **Research Survey –**
"An Evaluation of a Patient Safety Culture Tool in Saudi Arabia"
Ref: IPRC/021/09

Attached is the above referenced memorandum confirming the approval of the Research Committee for you to conduct the above research survey in KAMC-Riyadh.

We support your request to conduct this research survey; and in view thereof, you are authorized to coordinate with the nursing leadership and staff to "face validate" your tool and distribute your research questionnaire in the clinical units / wards.

Best regards.

JM/mj

Cc: H,E, Dr. Bandar Al Knawy, Chief Executive Officer, NGHA
Mr. Abdullah Al Aamer, Executive Director, Operations
Dr. Mohammed Al Jumah, Executive Director, KAIMRC
Directors, Clinical Nursing

Att: IPRC/021/09

File: Research
Chrono

✉1522 ☎ +9661-2520088 ext. 11584 / 12818 / 11882 / 11780 Fax +9661-2520088 ext. 12778 nurserv1@ngha.med.sa

P. O. Box 22490, Riyadh 11426
Tel. 2520088
Telex : 403450 NGRMED SJ

ص. ب ٢٢٤٩٠ الرياض ١١٤٢٦
تلفون : ٢٥٢٠٠٨٨
تلكس ٤٠٣٤٥٠ NGRMED

KFH-MATERIALS 14574 (05/96) (ORACLE 29795) ٣٨/٢٠٨

Appendix 10 Support letter from Chairman of Surgery department

KINGDOM OF SAUDI ARABIA
NATIONAL GUARD HEALTH AFFAIRS
KING ABDULAZIZ MEDICAL CITY
KING FAHAD HOSPITAL

Department of Surgery

1446 | 966-1-252-0088 x14118/14117/14119/14137/14136/14122 | 966-1-252-0051 (direct - incoming) or 966-1-252-0088x14138 | email: surgery@ngha.med.sa

DR AZZAM Chairman Pgr 9988	DR YOUSEF Deputy Chairman Pgr 8271	DR MAZROU Head ENT Pgr 8333	DR BEDAH Head Gen Surgery Pgr 7060	DR RUSSELL Head Neurosurgery Pgr 8241	DR JOBAIR Head Ophtha Pgr 8888	DR TUWAIRGI Head O&MFS Pgr 8395	DR KHELAIFI Head Ortho Pgr 7236	DR NAMSHAN Head Paeds Pgr 8265	DR THUNYAN Head Plastic Surg Pgr 8300	DR GANNASS Director Ped Surg Pgr 6868	DR ABDULATIEF Head Thoracic Pgr 8283	DR SHAMMARI Head Urology Pgr 7226

Office of the Chairman

REF: 036-05-2009rvs
DATE: 18 May 2009
23 Jumada I 1430

MEMORANDUM

TO : **ALL DIVISION HEADS (as per distribution list)**
Department of Surgery
National Guard Health Affairs

FROM : **DR. SALEH AL AZZAM**
Chairman
Department of Surgery
National Guard Health Affairs

SUBJECT : **RESEARCH PROJECT, AN EVALUATION OF A PATIENT SAFETY CULTURE TOOL IN SAUDI ARABIA BY MR MANDOOH SHERIER ALONAZI**

Please be advised that Mr. Mandooh Alonazi has the approval of the CEO to conduct research on the above mentioned subject, which consists of two parts:

1) Interview
2) Filling up questionnaire

The first part which is the interview is conducted by Mr. Mandooh Alonazi over 50-60 minutes, this interview is confidential and if you are willing to participate it will be carried out at your convenient time and location and the information obtained will help the principle's investigation in his thesis for PhD please see attached form if you do agree to participate, please sign below as follows:

Agree ☐ No ☐ Yes , if yes please complete at your convenience.

Date: ________________ Time: ______________ Location: ________________

I look forward to your support and I thank you for taking time to read and participate in either the interview, the questionnaire or both, for any further information please contact Mr. Mandooh Alonazi, please see attached form.

Notice: Please drop your response in the box assigned for this project in the Department of Surgeries office.

Kind regards.

Distribution List:

1. Dr. Khalid Al Mazrou, Head, Division of ENT Surgery
2. Dr. Khalid Al Bedah, Head, Division of General Surgery
3. Dr. Neville Russell, Head, Division of Neurosurgery
4. Dr. Khalid Al Jobair, Head, Division of Ophthalmology Surgery
5. Dr. Othman Al Tuwairgi, Head, Division of Oral and Maxillofacial Surgery
6. Dr. Ahmad Al Khelaifi, Head, Division of Orthopedic Surgery
7. Dr. Mohammed Al Namshan, Head, Division of Pediatric Surgery
8. Dr. Abdullah Al Thunyan, Head, Division of Plastic Surgery
9. Dr. Mohammed Al Abdulatief, Head, Division of Thoracic Surgery

Administrative Assistant 1 Ronel ext: 14118

Appendix 11 King Fahad Medical City agreement

Kingdom of Saudi Arabia
Ministry of Health
King Fahad Medical City

المملكة العربية السعودية
وزارة الصحة
مدينة الملك فهد الطبية

Dear Mr Mamdooh AlOnazi, June 16, 2009

ERRC Number: 09-013

It is my pleasure to inform you that the External Research Review Committee, a subcommittee of the Institutional Review Board, has approved your study titled: "Evaluation of a Patient Safety Culture Tool in Saudi Arabia".

Please be informed that in conducting this study, you as the Principal Investigator is required to abide by the rules and regulations of the Government of Saudi Arabia and KFMC/ERRC. The approval of this proposal will automatically be suspended on June 15, 2010 pending the reapplication to renew the approval.

Please observe the following:

1. Personal identifying data should only be collected when necessary for research;
2. The data collected should only be used for this proposal;
3. Secondary disclosure of personal identifiable data is not allowed.
4. No medical tests for study purposes are permitted to be conducted on patients.

We wish you every success in your research endeavor.

Sincerely,

Mohamad Al Tannir, DMD, MPH
Head of External Research Review Committee
Institutional Review Board
King Fahad Medical City, Riyadh, Saudi Arabia
Tel: 966 1 288 999 Ext.8391/1299
Email: maltannir@kfmc.med.sa

المرفقات :

الرقم : 09-013
التاريخ : 16-6-09

Appendix 12 Support letter from Executive director of Medical Affairs

Kingdom of Saudi Arabia
Ministry of Health
King Fahad Medical City
Executive Director of Medical Affairs Office

المملكة العربية السعودية
وزارة الصحة
مدينة الملك فهد الطبية
مكتب المدير التنفيذي للشؤون الطبية

Executive Director of Medical Affairs Office

30001 2889000 / 8020 7933/4336

To:	**Directors, Hospitals/Centers** **Directors, Medical Administrations** **Department Heads**	**Date:**	20 Sha'ban 1430 11 August 2009
		Ref. No.:	30001/ /1430
From:	**Dr. Abdulrahman M. Al Mazrou** Executive Director, Medical Affairs Chairman, Medical Consultant Council	**Attachment:**	Questionnaire (8p)

Subject: Completion of Research Questionnaire

Assalamu alaykum wa rahmatullah.

The External Research Review Committee under the Institutional Review Board at KFMC has approved the conduct of the research entitled "An Evaluation of a Patient Safety Culture Tool in Saudi Arabia" by Mr. Mamdooh AlOnazi (PhD candidate) of the University of Sheffield, UK.

In order to make this study significant and successful, I am encouraging my colleagues to participate in completing the attached questionnaire prepared by the researcher.

Your cooperation will bring more value to this research as this would be a step towards creating a safer environment for our patients.

Thank you and best regards.

Appendix 13 King Faisal Specialist Hospital & Research Centre agreement

مستشفى الملك فيصل التخصصي ومركز الأبحاث
King Faisal Specialist Hospital & Research Centre
Gen. Org. مؤسسة عامة

OFFICE OF RESEARCH AFFAIRS

☎32937 🖷27894 ✉MBC 03

INTERNAL MEMO

TO: **Nahar Alanezi, MD**
Associate Consultant Vascular Surgeon
Department of Surgery

DATE: 02 Ramadan 1430
23 August 2009

FROM: **Mohamed M. Al-Turki, CCRP**
Co-Director
Office of Research Affairs

REF: ORA/1140/30

SUBJECT: **PROPOSAL # 2091 025**
An Evaluation of Patients Safety Culture Tool in Saudi Arabia

---

Further to the Office of Research Affairs (ORA) memo, ORA/0992/30, your Emailed reply to the Clinical Research Committee (CRC), (received at 05 July 2009), was reviewed by the CRC at 19 August 2009.

We are pleased to inform you that the CRC has accepted the reply and recommended the above-referenced proposal for approval. We take this opportunity to congratulate you on behalf of the Research Advisory Council (RAC).

In conducting this study, the Investigators are required to abide by the rules and regulations of the Government of Saudi Arabia, KFSH&RC, and the RAC. Further, you are required to submit a Final report by 19 July 2010, so it can be reviewed by the Committees without a lapse in approval. The approval of this proposal will automatically be suspended on 10 August 2010, pending the acceptance of the Final Report. You also need to notify the ORA as soon as possible in the case of:

1. Any amendments to the proposal
2. Termination of the study
3. Any event or new information that may affect the benefit/risk ratio of the proposal

Please observe the following:

1. Personally identifying data should only be collected when necessary for research
2. The data collected should only be used for this proposal
3. Data should be stored securely so that only a few authorized users are permitted access to the database
4. Secondary disclosures of personally identifiable data are not allowed
5. Should there be a need to contact the research subjects for follow-up information, you will need to seek the authorization of the RAC prior to such contact.

We wish you success in your research endeavors.

ORA
A
cc: Chairman, Clinical Research Committee
Chairman of PI(s)

E-Mail: ora@kfshrc.edu.sa

Form 11100-01 (Rev. 09-27) I.C. 202028

Appendix 14 King Faisal Specialist Hospital & Research Centre agreement

مستشفى الملك فيصل التخصصي ومركز الأبحاث
King Faisal Specialist Hospital & Research Centre
Gen. Org. مؤسسة عامة

OFFICE OF RESEARCH AFFAIRS

MBC: 03, TEL: 32937, FAX: 27894

INTERNAL MEMO

TO: **Nahar Alanezi, MD**
Associate Consultant Vascular Surgeon
Department of Surgery

DATE: 11 Rajab 1430
04 July 2009

THROUGH: **Mohamed Al Turki, CCRP**
Co- Director
Office of Research Affairs

REF: ORA/0992/30

FROM: **Sasha M. Abu Rass, MPharm**
Proposal Processing Section
Office of Research Affairs

SUBJECT: **Proposal # 2091 025**
An Evaluation of Patients Safety Culture Tool in Saudi Arabia – Research Study

The above-referenced proposal was reviewed by the Clinical Research Committee (CRC) and the Research Ethics Committee (REC) on 26 May and 04 May 2009, respectively.

The REC has recommended approving the proposal as submitted.

The CRC was not able to accept the proposal in the current format and request the following:

1. Abstract/Summary of the proposal
2. Copy of the Questionnaire and Data Collection Sheet
3. Detailed work plan for each investigator.
4. The investigators were planning to start the project early in year 2009, during the active period of the year for 5 months? What will be the situation if it will start now in summer? Will the investigators be able to conclude the study in the specified period of time?
5. There is no indication in the recruitment plan for which hospitals will be included in the study and who are the participants?
6. How the participants will be selected (i.e. randomized or invited)? How the selection bias be minimized?

Please forward your reply/ revised proposal to the Office of Research Affairs (ORA) at your convenience, but not later than two months from the date of this memo

ORA
m 11100-01 (Rev. 09-27) I.C. 202028
C

E-Mail: ora@kfshrc.edu.sa

Appendix 15 Support letter from Deputy Executive Director Nursing Affairs

مستشفى الملك فيصل التخصصي ومركز الأبحاث
King Faisal Specialist Hospital & Research Centre
Gen. Org. مؤسسة عامة

Ext: 23442	NURSING AFFAIRS - MBC 73	Fax: 23021

TO: **Nursing Leadership Team**
Nursing Affairs

DATE: 11 Ramadan 1430
01 September 2009

FROM: **Rita Anderson, RN, BSN, MSN**
Deputy Executive Director
Nursing Affairs

OUR REF: DEDNA: 090 30

SUBJECT: **PROPOSAL # 2091 025 - An Evaluation of Patients Safety Culture Tools in Saudi Arabia**
Ref: ORA/1140/30

As per the attached memo from RAC, Mr. Mamdooh Sherier Alonazi's research proposal is approved for application in King Faisal Specialist Hospital & Research Center.

Please extend your support in this important study for Patient Safety.

Thank you.

RA/erl

11100-01 (Rev. 09-27) I.C. 202028 Printed by Reprographics KFSH&RC

Appendix 16 Incomplete questionnaires

Uncompleted questionnaires

Q.N	A	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	D1	D2	D3	E	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	G	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10
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The yellow colour represents uncompleted items.

Appendix 17 Data management table (background items)

Number of variable	Variable label	Type	Measurement
A	Work area of respondent	Numeric	Nominal
H1	Current position	Numeric	Nominal
H2	Gender	Numeric	Nominal
H3	Nationality	Numeric	Nominal
H4	Highest educational qualification	Numeric	Ordinal
H5	Training outside S.A	Numeric	Nominal
H6	Years of working in this hospital	Numeric	Ordinal
H7	Years of working in current hospital work area	Numeric	Ordinal
H8	Working hours in the hospital	Numeric	Ordinal
H9	Direct contact with patients	Numeric	Nominal
H10	Years of experience in current specialty	Numeric	Ordinal

Appendix 18 Data management (safety climate items)

Number of variable	Variable	Type	Measurement
A1	Staff support one another in this unit	Numeric	Ordinal
A2	We have enough staff to handle the workload	Numeric	Ordinal
A3	When a lot of work needs to be done quickly, we work together as a team to get the work done	Numeric	Ordinal
A4	In this unit, people treat each other with respect	Numeric	Ordinal
A5	Staff in this unit work longer hours than they should, which is not good for patient care	Numeric	Ordinal
A6	We are actively doing things to improve patient care	Numeric	Ordinal
A7	We use more temporary staff than we should, which is not good for patient care	Numeric	Ordinal
A8	Staff feel like their mistakes are held against them	Numeric	Ordinal
A9	Mistakes have led to positive changes here	Numeric	Ordinal
A10	It is just by chance that more serious mistakes do not happen around here	Numeric	Ordinal
A11	When one area in this unit gets really busy, others help out	Numeric	Ordinal
A12	When an event is reported, it feels like the person is being written up, not the problem	Numeric	Ordinal
A13	After we make changes to improve patient safety, we evaluate their effectiveness	Numeric	Ordinal
A14	We work in a hurry, trying to do too much, too quickly	Numeric	Ordinal
A15	Patient safety never takes second place to get more work done	Numeric	Ordinal
A16	Staff worry that mistakes they make are kept in their personnel file	Numeric	Ordinal
A17	We have patient safety problems in this unit	Numeric	Ordinal

A18	Our procedures and systems are good at preventing errors from happening	Numeric	Ordinal
B1	My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	Numeric	Ordinal
B2	My supervisor/manager seriously considers staff suggestions for improving patient safety	Numeric	Ordinal
B3	Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	Numeric	Ordinal
B4	My supervisor/manager ignores patient safety problems that happen over and over	Numeric	Ordinal
C1	We are given feedback about changes put into place based on event reports	Numeric	Ordinal
C2	Staff will freely speak up if they see something that may negatively affect patient care	Numeric	Ordinal
C3	We are informed about errors that happen in this unit	Numeric	Ordinal
C4	Staff feel free to question the decisions or actions of those with more authority	Numeric	Ordinal
C5	In this unit, we discuss ways to prevent errors from happening again	Numeric	Ordinal
C6	Staff are afraid to ask questions when something does not seem right	Numeric	Ordinal
D1	When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?	Numeric	Ordinal
D2	When a mistake is made, but has no potential to harm the patient, how often is this reported?	Numeric	Ordinal
D3	When a mistake is made that could harm the patient, but does not, how often is this reported?	Numeric	Ordinal

E	An overall grade on patient safety	Numeric	Ordinal
F1	Hospital management provides a work climate that promotes patient safety	Numeric	Ordinal
F2	Hospital units do not coordinate well with each other	Numeric	Ordinal
F3	Some things do not happen or get missed when transferring patients from one unit to another	Numeric	Ordinal
F4	There is good cooperation among hospital units that need to work together	Numeric	Ordinal
F5	Important patient care information is often lost during shift changes	Numeric	Ordinal
F6	It is often unpleasant to work with staff from other hospital units	Numeric	Ordinal
F7	Problems often occur in the exchange of information across hospital units	Numeric	Ordinal
F8	The actions of hospital management show that patient safety is a top priority	Numeric	Ordinal
F9	Hospital management seems interested in patient safety only after an adverse event happens	Numeric	Ordinal
F10	Hospital units work well together to provide the best care for patients	Numeric	Ordinal
F11	Shift changes cause problems for patients in this hospital	Numeric	Ordinal
G	Number of event reports in the past 12 months	Numeric	Ordinal

Appendix 19 Duple data entry (15%)

NO	Number of questionnaire	Number of item	Value in DF1A1 (original file)	Value in DF1A2 (re-entering)	Correct Value in questionnaire	Site of data entry errors
1	728	A4	5	3	3	DF1A1
2	728	A6	3	4	4	DF1A1
3	728	A8	4	2	2	DF1A1
4	728	A9	2	4	4	DF1A1
5	520	A5	2	3	3	DF1A1
6	687	A5	3	2	2	DF1A1
7	687	H10	6	3	6	DF1A2
8	486	A9	4	2	4	DF1A2
9	486	A11	2	5	2	DF1A2
10	486	A12	5	3	5	DF1A2
11	486	A14	3	4	3	DF1A2
12	486	A17	4	3	4	DF1A2
13	486	A18	3	2	3	DF1A2
14	246	A11	4	2	4	DF1A2
15	232	A13	2	4	4	DF1A1
16	339	A15	2	3	3	DF1A1
17	720	B3	2	1	1	DF1A1
18	720	B4	2	1	1	DF1A1
19	577	C1	3	2	3	DF1A2
20	707	D1	3	2	2	DF1A1
21	707	D2	3	2	2	DF1A1
22	583	D2	3	2	3	DF1A2
23	653	D2	5	3	3	DF1A1
24	633	F1	4	2	4	DF1A2
25	633	F2	2	3	2	DF1A2
26	633	F3	3	4	3	DF1A2
27	633	F4	4	1	4	DF1A2
28	633	F6	1	2	1	DF1A2
29	633	F7	2	5	2	DF1A2

30	653	F8	5	2	5	DF1A2
31	633	F9	2	4	2	DF1A2
32	633	F11	4	2	4	DF1A2
33	633	G	2	6	2	DF1A2
34	633	H1	6	1	6	DF1A2
35	633	H5	1	4	1	DF1A2
36	633	H6	4	2	4	DF1A2
37	633	H7	2	3	2	DF1A2
38	633	H8	3	1	3	DF1A2
39	633	H9	1	3	1	DF1A2
40	390	G	2	1	2	DF1A2
41	268	H1	9	11	9	DF1A2
42	268	H4	5	3	5	DF1A2
43	570	H1	12	11	12	DF1A2
44	570	H10	1	2	1	DF1A2
45	7	H3	2	1	2	DF1A2
46	196	H4	4	5	5	DF1A1
47	231	H4	4	3	3	DF1A1
48	462	H4	5	4	5	DF1A2
49	722	H5	1	2	2	DF1A1
50	822	H5	1	2	2	DF1A1
51	835	H5	1	2	2	DF1A1
Total	23	51	51	51	51	51

Appendix 20 Duple data entry for the rest of the questionnaires

NO	Number of questionnaire	Number of item	Value in First entry	Value in Double entry	Correct Value in questionnaire	Site of data entry errors
1	10	A	3	4	3	Double
2	10	A2	4	5	4	Double
3	10	A3	5	4	5	Double
4	10	A5	4	5	4	Double
5	10	A6	5	1	5	Double
6	10	A8	1	5	1	Double
7	10	A10	5	4	5	Double
8	10	A11	4	5	4	Double
9	10	A12	5	4	5	Double
10	10	A14	4	5	4	Double
11	10	A16	5	4	5	Double
12	14	H5	1	2	1	Double
13	14	H6	3	1	3	Double
14	14	H10	3	1	3	Double
15	38	H5	2	1	2	Double
16	41	F9	2	4	2	Double
17	41	F10	4	2	4	Double
18	64	H10	3	2	2	First
19	67	H4	5	4	5	Double
20	74	H2	1	2	1	Double
21	74	H3	1	2	1	Double
22	74	H8	3	5	5	First
23	77	A12	3	4	4	First
24	79	A15	4	5	4	Double
25	79	A16	5	4	5	Double
26	79	A17	2	4	2	Double
27	79	A18	4	3	4	Double
28	79	B2	3	2	3	Double
29	79	C3	2	1	2	Double
30	79	C4	1	3	1	Double
31	79	C5	3	4	3	Double

32	79	C6	4	1	4	Double
33	79	D1	1	2	1	Double
34	79	D2	2	3	2	Double
35	134	H2	2	1	2	Double
36	136	H1	12	11	12	Double
37	136	H8	3	4	4	First
38	137	C1	2	4	4	First
39	137	C2	2	4	4	First
40	137	C3	2	4	4	First
41	137	C5	2	4	4	First
42	137	C4	2	4	4	First
43	144	A1	4	3	3	First
44	144	A2	5	4	4	First
45	144	A3	3	5	5	First
46	144	A4	1	3	3	First
47	144	A5	5	1	1	First
48	144	A6	1	5	5	First
49	144	A7	5	1	1	First
50	145	H8	4	6	6	First
51	162	H5	1	2	1	Double
52	164	A	4	11	4	Double
53	168	H5	1	2	1	Double
54	170	H8	3	1	3	Double
55	170	H7	2	3	2	Double
56	171	H5	1	2	1	Double
57	179	H5	1	2	1	Double
58	252	F10	2	3	3	First
59	252	F9	2	3	3	First
60	252	H5	1	2	2	First
61	253	H4	5	4	5	Double
62	255	C5	4	3	4	Double
63	261	H5	2	1	1	First
64	262	H8	4	3	3	First
65	263	H5	2	1	1	First
66	264	H5	2	1	1	First

67	266	H5	2	1	1	First
68	276	H9	2	1	1	First
69	284	F8	4	3	4	Double
70	288	B4	2	4	2	Double
71	288	C4	4	3	4	Double
72	288	H1	12	11	11	First
73	314	H10	4	5	5	First
74	318	H1	9	11	11	First
75	319	H10	1	6	1	Double
76	322	A	11	2	11	Double
77	324	C4	4	5	4	Double
78	324	C5	5	4	5	Double
79	324	C6	2	5	2	Double
80	324	D1	4	2	4	Double
81	324	D2	3	4	3	Double
82	324	D3	5	3	5	Double
83	325	A5	5	2	2	First
84	325	A4	2	4	4	First
85	325	A6	4	5	5	First
86	326	H1	9	11	9	Double
87	335	A17	3	5	3	Double
88	337	A17	2	4	2	Double
89	339	A13	.	4	3	Double
90	341	A8	2	4	2	Double
91	341	A9	4	2	4	Double
92	341	A10	2	4	2	Double
93	341	A11	4	2	4	Double
94	341	A12	2	4	2	Double
95	345	A9	5	2	5	Double
96	346	A	4	7	7	First
97	367	C6	1	4	1	Double
98	367	D1	4	5	4	Double
99	391	D3	3	4	4	First
100	393	A	5	7	5	Double
101	396	A1	4	2	4	Double

102	396		A2	2		4		2		Double
103	396		A5	4		5		4		Double
104	396		A6	5		2		5		Double
105	396		A7	2		4		2		Double
106	396		A9	4		2		4		Double
107	396		A10	2		4		2		Double
108	396		A12	4		5		4		Double
109	396		A13	5		4		5		Double
110	396		A14	4		5		4		Double
111	396		A15	5		4		5		Double
112	396		A16	4		3		4		Double
113	396		A17	3		4		3		Double
114	396		B2	4		2		4		Double
115	396		B4	2		5		2		Double
116	400		B4	4		2		4		Double
117	400		B2	2		4		4		First
118	407		F1	4		5		5		First
119	424		F7	4		3		4		Double
120	430		H3	2		1		2		Double
121	455		F1	4		2		4		Double
122	455		F2	2		4		2		Double
123	455		F4	4		3		4		Double
124	455		F6	3		4		3		Double
125	457		E	3		4		3		Double
126	463		F1	5		4		5		Double
127	471		A18	2		4		4		First
128	476		B2	2		4		4		First
129	476		B3	1		2		2		First
130	476		B4	4		1		1		First
131	478		F8	2		4		4		First
132	478		F9	4		2		2		First
133	478		F10	2		4		4		First
134	478		F11	4		2		2		First
135	494		A8	4		2		2		First
136	494		F11	2		3		3		First

137	508	A14	5	2	2	First
138	513	A8	4	5	5	First
139	521	F10	4	3	4	Double
140	522	F9	2	3	3	First
141	522	F8	2	4	4	First
142	526	H3	2	1	1	First
143	531	H5	1	2	1	Double
144	532	A12	3	2	2	First
145	532	A13	5	3	5	Double
146	532	A14	2	5	2	Double
147	532	A15	3	2	3	Double
148	532	A17	2	3	2	Double
149	532	A18	4	2	4	Double
150	534	A14	3	2	3	Double
151	534	A15	3	2	3	Double
152	536	H9	1	2	1	Double
153	536	H10	3	2	3	Double
154	537	A5	2	3	2	Double
155	537	A12	2	3	2	Double
156	540	F9	4	5	4	Double
157	543	C6	1	5	1	Double
158	543	D1	2	1	2	Double
159	543	E	5	2	5	Double
160	543	F2	2	5	2	Double
161	543	F3	5	2	5	Double
162	543	F4	4	5	4	Double
163	543	F5	1	4	1	Double
164	543	F6	2	1	2	Double
165	543	F8	5	2	5	Double
166	543	F9	1	5	1	Double
167	543	F10	5	1	5	Double
168	543	F11	3	5	3	Double
169	543	G	1	3	1	Double
170	547	C5	2	3	3	First
171	547	C6	2	3	3	First

172	548	H3	2	1	1	First
173	550	H1	6	11	11	First
174	554	A	2	5	5	First
175	554	A1	3	4	4	First
176	554	A2	3	4	4	First
177	554	A3	3	4	4	First
178	554	A4	3	4	4	First
179	554	A5	3	2	2	First
180	554	A6	4	2	2	First
181	554	A7	3	4	4	First
182	554	A9	4	2	2	First
183	554	A8	3	4	4	First
184	554	A11	4	2	2	First
185	554	A13	3	2	2	First
186	554	A18	4	2	2	First
187	554	B1	4	1	1	First
188	554	B2	4	1	1	First
189	554	B3	4	2	2	First
190	554	B4	4	2	2	First
191	554	C1	3	2	2	First
192	554	C2	3	2	2	First
193	554	C3	3	2	2	First
194	554	C4	3	2	2	First
195	554	C5	3	2	2	First
196	554	D1	3	2	2	First
197	554	D2	3	4	4	First
198	554	D3	3	5	5	First
199	554	F1	4	2	2	First
200	554	F3	4	5	5	First
201	554	F4	4	2	2	First
202	554	F6	4	5	5	First
203	554	F7	4	5	5	First
204	554	F8	3	2	2	First
205	554	F9	3	4	4	First
206	554	F10	3	2	2	First

207	554	H1	1	6	6	First
208	554	H2	1	2	2	First
209	554	H4	3	1	1	First
210	554	H5	2	1	1	First
211	554	H6	2	6	6	First
212	554	H7	2	6	6	First
213	554	H10	2	6	6	First
214	556	A9	2	4	2	Double
215	565	E	3	4	3	Double
216	548	H2	2	1	2	Double
217	567	A17	2	3	2	Double
218	567	C5	5	4	5	Double
219	567	D1	2	3	2	Double
220	578	B1	3	5	3	Double
221	578	B2	3	2	3	Double
222	575	G	3	2	3	Double
223	590	F7	2	3	3	First
224	590	F9	3	4	4	First
225	590	F10	4	3	3	First
226	590	F11	3	1	1	First
227	602	F11	2	4	2	Double
228	602	G	1	2	1	Double
229	615	A	11	3	3	First
230	619	A	11	3	3	First
231	641	A10	2	4	2	Double
232	635	H9	2	1	1	First
233	638	D1	2	3	3	First
234	641	A13	4	2	2	First
235	641	F8	5	4	4	First
236	641	H6	4	5	5	First
237	642	H9	2	1	1	First
238	646	H9	2	1	1	First
239	652	G	4	5	5	First
240	689	C3	3	4	4	First
241	692	A12	2	3	3	First

242	702	F1	5	4	5	Double
243	703	F3	2	3	3	First
244	711	A5	3	2	2	First
245	712	D1	3	2	2	First
246	715	A7	4	5	4	Double
247	715	D2	5	4	4	First
248	719	A9	4	5	4	Double
249	719	A10	3	2	3	Double
250	719	A11	4	3	4	Double
251	719	A12	3	2	3	Double
252	719	A13	5	4	5	Double
253	719	A14	3	4	3	Double
254	719	A15	2	3	2	Double
255	719	A16	4	3	4	Double
256	719	A18	4	3	4	Double
257	719	B1	4	5	4	Double
258	719	B2	4	5	4	Double
259	719	B3	2	3	2	Double
260	719	B4	2	3	2	Double
261	719	C1	4	3	4	Double
262	719	C2	2	3	3	Double
263	719	C3	5	3	5	Double
264	719	C4	4	4	4	Double
265	719	C5	5	4	5	Double
266	719	C6	1	2	1	Double
267	719	D1	5	4	5	Double
268	719	D2	5	4	5	Double
269	719	D3	1	2	1	Double
270	719	E	3	2	3	Double
271	719	F1	4	3	4	Double
272	719	F2	2	3	2	Double
273	719	F3	4	3	4	Double
274	719	F4	4	3	4	Double
275	719	F5	1	2	1	Double
276	719	F6	2	1	2	Double

277	719	F7	2	1	2	Double
278	719	F8	4	2	4	Double
279	719	F9	2	1	2	Double
280	719	F10	4	3	4	Double
281	719	F11	2	4	2	Double
282	719	A17	5	4	5	Double
283	732	A11	1	4	4	First
284	732	A12	5	1	1	First
285	732	A13	1	5	5	First
286	732	A14	5	1	1	First
287	732	A15	2	5	5	First
288	732	A16	5	2	2	First
289	732	A17	4	5	5	First
290	732	A18	5	4	4	First
291	736	B2	4	2	2	First
292	743	A3	3	2	3	Double
293	743	A4	3	2	3	Double
294	743	B1	3	4	3	Double
295	743	B2	3	4	3	Double
296	743	H5	1	2	1	Double
297	754	A15	5	4	5	Double
298	754	A16	1	5	1	Double
299	756	B4	2	1	1	First
300	763	B3	2	3	3	First
301	766	C4	4	3	4	Double
302	766	C5	3	4	4	First
303	769	A5	2	3	3	First
304	770	A2	3	2	2	First
305	782	C6	2	5	2	Double
306	792	A14	3	2	2	First
307	800	C1	4	2	4	Double
308	800	C2	2	2	4	Double
309	803	F4	4	3	3	First
310	818	C1	4	5	5	First
311	818	C2	4	5	5	First

312	818	C3	4	5	5	First
313	826	A6	4	5	5	First
314	829	C2	4	5	5	First
315	832	A10	4	2	2	First
316	836	F9	3	2	2	First
317	836	H1	9	8	8	First
318	847	H1	11	8	8	First
319	854	F9	2	3	3	First
320	860	A	5	7	5	Double
Total	118	320	320	320	320	

The University Of Sheffield.

School of Health and Related Research

Appendix 21 Cover letter

Dear respondents,

I am a PhD student at the University of Sheffield in the U.K and I am currently in the process of collecting data for my study entitled "An evaluation of patient safety culture tool in Saudi Arabia". This study aims to identify a suitable measure for assessing the patient safety culture for use in hospitals in Saudi Arabia. The knowledge generated will contribute to the measurement of the patient safety culture in hospitals in Saudi Arabia, and ultimately the creation of a safer environment for patients in hospital. As a healthcare professional, your assistance is very important and useful to this study to get at least 300 completed questionnaires. Your Participation is voluntary in the study.

I would be grateful if you would volunteer to take a few minutes of your valuable time to fill in this questionnaire. Your privacy and confidentiality will be fully respected as this questionnaire was designed in such a way as to be completely anonymous. If you have any question or queries or concern about the questionnaire you are welcome to contact me through my contact numbers or be sending an email to the address below.

Please post the completed questionnaire to secretary of your department. Alternatively, the questionnaire can be returned to head nurse in your clinical area. I am very grateful for your participation in this study and your commitment and dedication to the healthcare services in Saudi Arabia.

Thank you very much for your patience and cooperation,

Yours sincerely,

Mamdooh Sherier Alonazi

The University of Sheffield Faculty of Medicine

School of Health and Related Research

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Appendix 22 Hospital Survey on Patient Safety Culture with changes

HOSPITAL SURVEY ON PATIENT SAFETY CULTURE

INSTRUCTIONS

This survey asks for your opinions about patient safety issues, medical error, and event reporting in your hospital and will take about 10 to 15 minutes to complete.

- An "event" is defined as any type of error, mistake, incident, accident, or deviation, regardless of whether or not it results in patient harm.
- "Patient safety" is defined as the avoidance and prevention of patient injuries or adverse events resulting from the processes of health care delivery.

SECTION A: Your Work Area/Unit

In this survey, think of your "unit" as the work area, department, or clinical area of the hospital where you spend **most of your work time or provide most of your clinical services**

What is your primary work area or unit in this hospital? Mark ONE answer by filling in the brackets [√]

a Many different hospital units/No specific unit [ ]
b Medicine (non-surgical) [ ]
c Surgery [ ]
d Obstetrics [ ]
e Pediatrics [ ]
f Emergency department [ ]
g Intensive care unit (any type) [ ]
h Psychiatry/mental health [ ]
i Rehabilitation [ ]
j Anaesthesiology [ ]
k Other [ ]
Please specify......................

Please indicate your agreement or disagreement with the following statements about your work area/unit. Mark your answer by filling in the brackets.

Think about your hospital work area/unit	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. Staff support one another in this unit	[1]	[2]	[3]	[4]	[5]
2. We have enough staff to handle the workload	[1]	[2]	[3]	[4]	[5]
3. When a lot of work needs to be done quickly, we work together as a team to get the work done	[1]	[2]	[3]	[4]	[5]
4. In this unit, staff treat each other with respect	[1]	[2]	[3]	[4]	[5]
5. Staff in this unit work longer hours than they should, which is not good for patient care	[1]	[2]	[3]	[4]	[5]
6. We are actively doing things to improve patient safety	[1]	[2]	[3]	[4]	[5]
7. We use more temporary staff than we should, which is not good for patient care	[1]	[2]	[3]	[4]	[5]
8. Staff feel like their mistakes are held against them	[1]	[2]	[3]	[4]	[5]
9. Mistakes have led to positive changes here	[1]	[2]	[3]	[4]	[5]
10. It is just by chance that more serious mistakes do not happen around here	[1]	[2]	[3]	[4]	[5]
11. When one area in this unit gets really busy, others help out	[1]	[2]	[3]	[4]	[5]
12. When an event is reported, it feels like the person is being written up, not the problem	[1]	[2]	[3]	[4]	[5]

SECTION A: Your Work Area/Unit (continued)

Think about your hospital work area/unit	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
13.After we make changes to improve patient safety, we evaluate their effectiveness	[1]	[2]	[3]	[4]	[5]
14.We work in a hurry, trying to do too much, too quickly	[1]	[2]	[3]	[4]	[5]
15.Patient safety never takes second place to get more work done	[1]	[2]	[3]	[4]	[5]
16.Staff worry that mistakes they make are kept in their personnel file	[1]	[2]	[3]	[4]	[5]
17.We have patient safety problems in this unit	[1]	[2]	[3]	[4]	[5]
18.Our procedures and systems are good at preventing errors from happening	[1]	[2]	[3]	[4]	[5]

SECTION B: Your Supervisor/Manager

Please indicate your agreement or disagreement with the following statements about your immediate supervisor/manager or person to whom you directly report. Mark your answer by filling in the brackets.

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	[1]	[2]	[3]	[4]	[5]
2. My supervisor/manager seriously considers staff suggestions for improving patient safety	[1]	[2]	[3]	[4]	[5]
3. Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	[1]	[2]	[3]	[4]	[5]
4. My supervisor/manager ignores patient safety problems that happen over and over	[1]	[2]	[3]	[4]	[5]

SECTION C: Communications

How often do the following things happen in your work area/unit? Mark your answer by filling in the brackets.

Think about your hospital work area/unit	Never	Rarely	Some times	Most of the time	Always
1. We are given feedback about changes put into place based on event reports	[1]	[2]	[3]	[4]	[5]
2. Staff will freely speak up if they see something that may negatively affect patient care	[1]	[2]	[3]	[4]	[5]
3. We are informed about errors that happen in this unit	[1]	[2]	[3]	[4]	[5]
4. Staff feel free to question the decisions or actions of those with more authority	[1]	[2]	[3]	[4]	[5]
5. In this unit, we discuss ways to prevent errors from happening again	[1]	[2]	[3]	[4]	[5]
6. Staff are afraid to ask questions when something does not seem right	[1]	[2]	[3]	[4]	[5]

SECTION D: Frequency of Events Reported

In your hospital work area/unit, when the following mistakes happen, how often are they reported? Mark your answer by filling in the brackets.

		Never	Rarely	Some times	Most of the time	Always
1	When a mistake is made, *but is caught and corrected before affecting the patient,* how often is this reported	[1]	[2]	[3]	[4]	[5]
2	When a mistake is made, but has *no potential to harm the patient*, how often is this reported	[1]	[2]	[3]	[4]	[5]
3	When a mistake is made that *could harm the patient*, but does not, how often is this reported?	[1]	[2]	[3]	[4]	[5]

SECTION E: Patient Safety Grade

Please give your work area/unit in this hospital an overall grade on patient safety. Mark ONE answer.

[ ]	[ ]	[ ]	[ ]	[ ]
A	**B**	**C**	**D**	**E**
Excellent	**Very Good**	**Acceptable**	**Poor**	**Failing**

SECTION F: Your Hospital

Please indicate your agreement or disagreement with the following statements about your hospital. Mark your answer by filling in the brackets.

	Think about your hospital	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1	Hospital management provides a work climate that promotes patient safety	[1]	[2]	[3]	[4]	[5]
2	Hospital units do not coordinate well with each other	[1]	[2]	[3]	[4]	[5]
3	Some things do not happen or get missed when transferring patients from one unit to another	[1]	[2]	[3]	[4]	[5]
4	There is good cooperation among hospital units that need to work together	[1]	[2]	[3]	[4]	[5]
5	Important patient care information is often lost during shift changes	[1]	[2]	[3]	[4]	[5]
6	It is often unpleasant to work with staff from other hospital units	[1]	[2]	[3]	[4]	[5]
7	Problems often occur in the exchange of information across hospital units	[1]	[2]	[3]	[4]	[5]
8	The actions of hospital management show that patient safety is a top priority	[1]	[2]	[3]	[4]	[5]
9	Hospital management seems interested in patient safety only after an adverse event happens	[1]	[2]	[3]	[4]	[5]
10	Hospital units work well together to provide the best care for patients	[1]	[2]	[3]	[4]	[5]
11	Shift changes cause problems for patients in this hospital	[1]	[2]	[3]	[4]	[5]

SECTION G: Number of Events Reported

In the past 12 months, how many event reports have you filled out and submitted? Mark ONE answer.

a No event reports [ ]
b 1 to 2 event reports [ ]
c 3 to 5 event reports [ ]
d 6 to 10 event reports [ ]
e 11 to 20 event reports [ ]
f 21 event reports or more [ ]

SECTION H: Background Information

This information will help in the analysis of the survey results. Mark ONE answer by filling in the brackets.

1. What is your current position in this hospital? Mark ONE answer that best describes your current position.

a Physician in training [ ]
b Physician (general physician) [ ]
c Resident physician [ ]
d Assistant consultant [ ]
e Associate consultant [ ]
f Consultant [ ]
g Head nurse/Nurse manager [ ]
h Nurse supervisor [ ]
i Registered nurse [ ]
j Clinical resource nurse [ ]
k Staff nurse [ ]
l Other [ ]
Please specify.......................

2. What is your gender?

a Male [ ]
b Female [ ]

3. What is your nationality?

a Saudi [ ]
b Non-Saudi [ ]
Please specify.......................

4. What is your highest educational qualification?

a PhD Doctorate / Board Certified/Fellowship [ ]
b Master degree [ ]
c Bachelor degree [ ]
d Diploma [ ]
e Other [ ]
Please specify.......................

5. <u>Do you have any training outside Saudi Arabia?</u>

a Yes [ ]
b No [ ]

If yes, please specify...

6. How long have you worked in this hospital ?

a Less than 1 years [ ]
b 1 to 5 years [ ]
c 6 to 10 years [ ]
d 11 to 15 years [ ]
e 16 to 20 years [ ]
f 21 years or more [ ]

7. How long have you worked in your current hospital work area/unit?

a Less than 1 years [ ]
b 1 to 5 years [ ]
c 6 to 10 years [ ]
d 11 to 15 years [ ]
e 16 to 20 years [ ]
f 21 years or more [ ]

8. Typically, how many hours per week do you work in this hospital ?

a Less than 20 hours per week [ ]
b 20 to 39 hours per week [ ]
c 40 to 59 hours per week [ ]
d 60 to 79 hours per week [ ]
e 80 to 99 hours per week [ ]
f 100 hours per week or more [ ]

9. In your current position, do you typically have direct interaction or contact with patients?

a YES, I typically have direct interaction or contact with patients [ ]
b NO, I typically do NOT have direct interaction or contact with patients [ ]

10. How long have you worked in your current specialty or profession ?

a Less than 1 year [ ]
b 1 to 5 years [ ]
c 6 to 10 years [ ]
d 11 to 15 years [ ]
e 16 to 20 years [ ]
f 21 years or more [ ]

SECTION I: Your Comments

Please feel free to write any comments about patient safety, error, or event reporting in your hospital.

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Appendix 23 Comparison between an overall grade of patient safety and number of event reports

Item		G: Number of event report in the past 12 months			
		No event reports and 1 to 2 event reports	3 to 5event reports and 6 to 10 event reports	11 to 20 event reports and 21 event reports or more	Total
E: An overall grade of patient safety	Very good and Excellent	433	88	15	536
	Acceptable	242	58	8	308
	Poor and Failing	12	5	1	18
	Total	687	151	24	862

The table above presents the comparison between an overall grade of patient safety and number of event reports in the past 12 months. It shows that only one respondent reported poor and failing whom reported lots of event while 12 respondents also reported poor and failing they reported no event reports and 1 to 2 event reports. This means those reporting poor/failing were not the same individuals who reported lots of events.

Appendix 24 Communalities of the initial solution (11 factors)

Safety climate items	Initial	Extractio
A1 Staff support one another in this unit	.51	.64
A2 We have enough staff to handle the workload	.24	.24
A3 When a lot of work needs to be done quikly, we work together as a team to get the work	.48	.56
A4 In this unit, people treat each other with respect	.48	.62
A5 Staff in this unit work longer hours than they should, which is not good for patient care	.24	.31
A6 We are actively doing things to improve patient care	.40	.50
A7 We use more temporary staff than we should, which is not good for patient care	.23	.31
A8 Staff feel like their mistakes are held against them	.45	.64
A9 Mistakes have led to positive changes here	.33	.38
A11 When one area in this unit gets really busy, others help out	.36	.40
A12 When an event is reported, it feels like the person is being written up, not the problem	.43	.55
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.46	.55
A14 We work in a hurry, trying to do too much, too quickly	.35	.38
A16 Staff worry that mistakes they make are kept in their personnel file	.30	.35
A18 Our procedures and systems are good at preventing errors from happening	.41	.42
B1 My supervisor/manager says a good word when he/she sees a job done according to	.59	.81
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety	.62	.69
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it	.38	.46
B4 My supervisor/manager ignores patient safety problems that happen over and over	.39	.60
C1 We are given feedback about changes put into place based on event reports	.41	.45
C2 Staff will freely speak up if they see something that may negatively affect patient care	.45	.52
C3 We are informed about errors that happen in this unit	.42	.48
C4 Staff feel free to question the decisions or actions of those with more authority	.40	.57
C5 In this unit, we discuss ways to prevent errors from happening again	.54	.56
C6 Staff are afraid to ask questions when something does not seem right	.27	.33
D1 When a mistake is made, but is caught and corrected before affecting the patient, how	.53	.58
D2 When a mistake is made, but has no potential to harm the patient, how often is this	.66	.88
D3 When a mistake is made that could harm the patient, but does not, how often is this	.53	.55
F2 Hospital units do not coordinate well with each other	.44	.46
F4 There is good cooperation among hospital units that need to work together	.45	.56

Appendix 24 (continued)		
F5 Important patient care information is often lost during shift changes	.38	.46
F6 It is often unpleasant to work with staff from other hospital units	.33	.36
F7 Problems often occur in the exchange of information across hospital units	.42	.54
F8 The actions of hospital management show that patient safety is a top priority	.43	.44
F10 Hospital units work well together to provide the best care for patients	.52	.63
F11 Shift changes cause problems for patients in this hospital	.33	.39

Extraction Method: Principal Axis Factoring.

Appendix 25 Total Variance Explained of the initial solution (11 factors)

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	9.168	25.4	25.4	8.7	24.1	24.1	2.9
2	2.223	6.1	31.6	1.7	4.9	29.1	3.7
3	2.175	6.0	37.6	1.6	4.7	33.8	2.8
4	1.764	4.8	42.5	1.2	3.5	37.4	3.3
5	1.598	4.4	47.0	1.1	3.1	40.6	3.7
6	1.452	4.0	51.0	.9	2.7	43.3	2.3
7	1.214	3.3	54.4	.7	2.1	45.4	4.3
8	1.149	3.1	57.6	.6	1.8	47.2	3.1
9	1.008	2.8	60.4	.5	1.5	48.8	4.8
10	.897	2.4	62.9	.4	1.1	49.9	.6
11	**.867**	**2.4**	**65.3**	.3	.9	**50.8**	**3.3**
12	.857	2.3	67.6				
13	.748	2.0	69.7				
14	.722	2.0	71.7				
15	.713	1.9	73.7				
16	.679	1.8	75.6				
17	.663	1.8	77.4				
18	.630	1.7	79.2				
19	.607	1.6	80.9				
20	.589	1.6	82.5				
21	.571	1.5	84.1				
22	.509	1.4	85.5				
23	.492	1.3	86.9				
24	.486	1.3	88.2				
25	.451	1.2	89.5				
26	.441	1.2	90.7				
27	.422	1.1	91.9				
28	.412	1.1	93.0				
29	.379	1.0	94.1				

Appendix 25 (continued)							
30	.375	1.0	95.1				
31	.353	.9	96.1				
32	.331	.9	97.0				
33	.311	.8	97.9				
34	.292	.8	98.7				
35	.253	.7	99.4				
36	.198	.5	100				

Appendix 26 Pattern Matrix of the initial solution (11 factors)

Safety climate items	Factor										
	1	2	3	4	5	6	7	8	9	10	11
C3 We are informed about errors that happen in this unit	.47										
C1 We are given feedback about changes put into place based on event reports	.45										
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.39										-.33
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?		.96									
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?		.73									
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is		.72									
A8 Staff feel like their mistakes are held against them			.78								
A12 When an event is reported, it feels like the person is being written up, not the problem			.66								
A16 Staff worry that mistakes they make are kept in their personnel file			.51								
A14 We work in a hurry, trying to do too much, too quickly			.33								
F7 Problems often occur in the exchange of information across hospital units				-.70							
F5 Important patient care information is often lost during shift changes				-.55							
F6 It is often unpleasant to work with staff from other hospital units				-.51							
F11 Shift changes cause problems for patients in this hospital				-.50							
A1 Staff support one another in this unit					.76						
A4 In this unit, people treat each other with respect					.73						
A3 When a lot of work needs to be done quikly, we work together as a team to get the work done					.56						
A2 We have enough staff to handle the workload											
A7 We use more temporary staff than we should, which is not good for patient care						.52					
A5 Staff in this unit work longer hours than they should, which is not good for patient care						.45					
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means						.41					
B1 My supervisor/manager says a good word when he/she sees a job done according to established							-.90				
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety							-.67				
C4 Staff feel free to question the decisions or actions of those with more authority								-.67			
C2 Staff will freely speak up if they see something that may negatively affect patient care								-.51			
C6 Staff are afraid to ask questions when something does not seem right								.41			
C5 In this unit, we discuss ways to prevent errors from happening again								-.31			
F10 Hospital units work well together to provide the best care for patients									.70		
F4 There is good cooperation among hospital units that need to work together									.64		

Appendix 26 (continued)											
F2 Hospital units do not coordinate well with each other									-.46		
F8 The actions of hospital management show that patient safety is a top priority									.45		
B4 My supervisor/manager ignores patient safety problems that happen over and over										.52	
A11 When one area in this unit gets really busy, others help out											
A6 We are actively doing things to improve patient care											-.56
A9 Mistakes have led to positive changes here											.48
A18 Our procedures and systems are good at preventing errors from happening											-.30

Extraction Method: Principl Axis Factoring.
Rotation Method: Oblimin with Kaiser Normalization
a. Rotation converged in 21 iterations.

Appendix 27 Communalities of initial solution (11 factors) with safety climate items (n=31)

Safety climate items	Initial	Extraction
A1 Staff support one another in this unit	.49	.65
A3 When a lot of work needs to be done quickly, we work together as a team to get the	.43	.52
A4 In this unit, people treat each other with respect	.47	.61
A5 Staff in this unit work longer hours than they should, which is not good for patient care	.19	.34
A6 We are actively doing things to improve patient care	.39	.61
A7 We use more temporary staff than we should, which is not good for patient care	.21	.28
A8 Staff feel like their mistakes are held against them	.43	.62
A9 Mistakes have led to positive changes here	.31	.35
A12 When an event is reported, it feels like the person is being written up, not the problem	.42	.55
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.45	.56
A16 Staff worry that mistakes they make are kept in their personnel file	.28	.35
B1 My supervisor/manager says a good word when he/she sees a job done according to	.59	.84
B2 My supervisor/manager seriously considers staff suggestions for improving patient	.62	.68
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it	.35	.64
B4 My supervisor/manager ignores patient safety problems that happen over and over	.36	.40
C1 We are given feedback about changes put into place based on event reports	.41	.46
C2 Staff will freely speak up if they see something that may negatively affect patient care	.44	.55
C3 We are informed about errors that happen in this unit	.40	.47
C4 Staff feel free to question the decisions or actions of those with more authority	.36	.56
C6 Staff are afraid to ask questions when something does not seem right	.26	.34
D1 When a mistake is made, but is caught and corrected before affecting the patient, how	.53	.58
D2 When a mistake is made, but has no potential to harm the patient, how often is this	.65	.89
D3 When a mistake is made that could harm the patient, but does not, how often is this	.52	.55
F2 Hospital units do not coordinate well with each other	.43	.47
F4 There is good cooperation among hospital units that need to work together	.43	.52
F5 Important patient care information is often lost during shift changes	.37	.445
F6 It is often unpleasant to work with staff from other hospital units	.328	.37
F7 Problems often occur in the exchange of information across hospital units	.39	.56
F8 The actions of hospital management show that patient safety is a top priority	.39	.42
F10 Hospital units work well together to provide the best care for patients	.51	.68

Appendix 27 (continued)		
F11 Shift changes cause problems for patients in this hospital	.39	.37

Extraction Method: Principal Axis Factoring.

Appendix 28 Total Variance Explained of the initial solution (11 factors) with safety climate (n=31)

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.897	25.4	25.4	7.4	24.0	24.0	2.1
2	2.078	6.7	32.1	1.7	5.5	29.5	3.4
3	2.053	6.6	38.7	1.5	5.0	34.6	3.0
4	1.689	5.4	44.2	1.2	4.0	38.6	2.2
5	1.441	4.6	48.8	1.0	3.3	41.9	3.3
6	1.362	4.3	53.2	.8	2.8	44.7	2.5
7	1.169	3.7	57.0	.7	2.3	47.1	3.2
8	1.112	3.5	60.6	.6	2.0	49.1	1.4
9	.983	3.1	63.8	.5	1.7	50.8	4.0
10	.855	2.7	66.5	.3	1.1	51.9	3.1
11	**.800**	**2.5**	**69.1**	**.2**	**.9**	**52.9**	**2.5**
12	.763	2.4	71.6				
13	.707	2.2	73.8				
14	.682	2.1	76.0				
15	.623	2.0	78.1				
16	.594	1.9	80.0				
17	.565	1.8	81.8				
18	.533	1.7	83.5				
19	.519	1.6	85.2				
20	.498	1.6	86.8				
21	.487	1.5	88.4				
22	.460	1.4	89.8				
23	.437	1.4	91.3				
24	.430	1.3	92.6				
25	.393	1.2	93.9				
26	.387	1.2	95.2				
27	.363	1.1	96.3				
28	.335	1.0	97.4				

Appendix 28 (continued)						
29	.327	1.0	98.5			
30	.255	.8	99.3			
31	.204	.6	100			

Appendix 29 Pattern Matrix of the initial solution (11 factors) with safety climate items

Safety climate items (n=31)	Factor										
	1	2	3	4	5	6	7	8	9	10	11
C3 We are informed about errors that happen in this unit	.45										
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.44										
C1 We are given feedback about changes put into place based on event reports	.41										
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?		.97									
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is		.73									
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?		.72									
F7 Problems often occur in the exchange of information across hospital units			.73								
F6 It is often unpleasant to work with staff from other hospital units			.54								
F5 Important patient care information is often lost during shift changes			.52								
F11 Shift changes cause problems for patients in this hospital			.46								
A8 Staff feel like their mistakes are held against them				.74							
A12 When an event is reported, it feels like the person is being written up, not the problem				.66							
A16 Staff worry that mistakes they make are kept in their personnel file				.50							
A1 Staff support one another in this unit					.77						
A4 In this unit, people treat each other with respect					.72						
A3 When a lot of work needs to be done quikly, we work together as a team to get the work done					.57						
C4 Staff feel free to question the decisions or actions of those with more authority						.65					
C2 Staff will freely speak up if they see something that may negatively affect patient care						.51					
C6 Staff are afraid to ask questions when something does not seem right						-.41					
B1 My supervisor/manager says a good word when he/she sees a job done according to							-.91				
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety							-.64				
A5 Staff in this unit work longer hours than they should, which is not good for patient care								.55			
A7 We use more temporary staff than we should, which is not good for patient care								.37			
F10 Hospital units work well together to provide the best care for patients									.74		
F4 There is good cooperation among hospital units that need to work together									.59		
F8 The actions of hospital management show that patient safety is a top priority									.44		
F2 Hospital units do not coordinate well with each other									-.41		
A6 We are actively doing things to improve patient care										-.70	
A9 Mistakes have led to positive changes here										-.43	

Appendix 29 (continued)

B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it											.73
B4 My supervisor/manager ignores patient safety problems that happen over and over											.39

Extraction Method: Principl Axis Factoring.
Rotation Method: Oblimin with Kaiser Normalization
Rotation converged in 21 iterations

Appendix 30 Communalities of the 12 factors solution

Communalities		
	Initial	Extraction
A1 Staff support one another in this unit	.52	.59
A2 We have enough staff to handle the workload	.25	.29
A3 When a lot of work needs to be done quickly, we work together as a team to get	.50	.58
A4 In this unit, people treat each other with respect	.50	.68
A5 Staff in this unit work longer hours than they should, which is not good for	.25	.28
A6 We are actively doing things to improve patient care	.41	.47
A7 We use more temporary staff than we should, which is not good for patient care	.25	.36
A8 Staff feel like their mistakes are held against them	.46	.66
A9 Mistakes have led to positive changes here	.35	.39
A10 It is just by chance that more serious mistakes do not happen around here	.13	.17
A11 When one area in this unit gets really busy, others help out	.38	.47
A12 When an event is reported, it feels like the person is being written up, not the	.44	.53
A13 After we make changes to improve patient safety, we evaluate their	.47	.53
A14 We work in a hurry, trying to do too much, too quickly	.36	.37
A15 Patient safety never takes second place to get more work done	.20	.25
A16 Staff worry that mistakes they make are kept in their personnel file	.31	.36
A17 We have patient safety problems in this unit	.18	.19
A18 Our procedures and systems are good at preventing errors from happening	.42	.43
B1 My supervisor/manager says a good word when he/she sees a job done	.60	.76
B2 My supervisor/manager seriously considers staff suggestions for improving	.63	.72
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster,	.38	.48
B4 My supervisor/manager ignores patient safety problems that happen over and	.42	.58
C1 We are given feedback about changes put into place based on event reports	.42	.44
C2 Staff will freely speak up if they see something that may negatively affect	.46	.54
C3 We are informed about errors that happen in this unit	.44	.49
C4 Staff feel free to question the decisions or actions of those with more authority	.41	.56
C5 In this unit, we discuss ways to prevent errors from happening again	.56	.57
C6 Staff are afraid to ask questions when something does not seem right	.28	.35
D1 When a mistake is made, but is caught and corrected before affecting the	.54	.59
D2 When a mistake is made, but has no potential to harm the patient, how often is	.66	.88
D3 When a mistake is made that could harm the patient, but does not, how often is	.54	.56
F1 Hospital management provides a work climate that promotes patient safety	.41	.41
F2 Hospital units do not coordinate well with each other	.45	.47
F3 Some things do not happen or get missed when transferring patients from one	.15	.18

Appendix 30 Continued		
F4 There is good cooperation among hospital units that need to work together	.47	.56
F5 Important patient care information is often lost during shift changes	.39	.46
F6 It is often unpleasant to work with staff from other hospital units	.37	.39
F7 Problems often occur in the exchange of information across hospital units	.42	.48
F8 The actions of hospital management show that patient safety is a top priority	.45	.49
F9 Hospital managemnet seems interested in patient safety only after an adverse	.36	.40
F10 Hospital units work well together to provide the best care for patients	.53	.63
F11 Shift changes cause problems for patients in this hospital	.34	.42

Extraction Method: Principal Axis Factoring.

Appendix 31 Total variance explained of the 12 factors solution

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.930	23.6	23.6	9.434	22.5	22.5	2.387	5.6	5.6
2	2.413	5.7	29.3	1.867	4.4	26.9	2.205	5.2	10.9
3	2.227	5.3	34.6	1.827	4.3	31.3	2.166	5.1	16.0
4	1.869	4.4	39.1	1.380	3.2	34.5	2.152	5.1	21.2
5	1.626	3.8	43.0	1.180	2.8	37.4	1.943	4.6	25.8
6	1.516	3.6	46.6	1.033	2.4	39.8	1.928	4.5	30.4
7	1.288	3.0	49.6	.809	1.9	41.7	1.786	4.2	34.6
8	1.188	2.8	52.5	.669	1.5	43.3	1.649	3.9	38.6
9	1.095	2.6	55.1	.629	1.4	44.8	1.519	3.6	42.2
10	1.086	2.5	57.7	.482	1.1	46.0	1.311	3.1	45.3
11	1.057	2.5	60.2	.437	1.0	47.0	.623	1.4	46.8
12	**.961**	**2.2**	**62.5**	**.399**	**.9**	**48.0**	**.501**	**1.1**	**48.0**
13	.913	2.1	64.6						
14	.847	2.0	66.6						
15	.786	1.8	68.5						
16	.761	1.8	70.3						
17	.737	1.7	72.1						
18	.731	1.7	73.8						
19	.698	1.6	75.5						
20	.661	1.5	77.1						
21	.634	1.5	78.6						
22	.619	1.4	80.0						
23	.612	1.4	81.5						
24	.598	1.4	82.9						
25	.579	1.3	84.3						
26	.561	1.3	85.6						
27	.519	1.2	86.9						
28	.491	1.1	88.0						
29	.472	1.1	89.2						
30	.460	1.0	90.3						
31	.436	1.0	91.3						

Appendix 31 (continued)

32	.431	1.0	92.3							
33	.412	.8	93.3							
34	.396	.4	94.2							
35	.370	.8	95.1							
36	.351	.8	96.0							
37	.342	.8	96.8							
38	.325	.7	97.6							
39	.284	.6	98.2							
40	.278	.6	98.9							
41	.251	.5	99.5							
42	.194	.4	100							

Extraction Method: Principal Axis Factoring

Appendix 32 Rotated Matrix of the 12 factors solution

Safety climate items (n=42)	Factor											
	1	2	3	4	5	6	7	8	9	10	11	12
F7 Problems often occur in the exchange of information across hospital units	.64											
F5 Important patient care information is often lost during shift changes	.59											
F11 Shift changes cause problems for patients in this hospital	.54											
F6 It is often unpleasant to work with staff from other hospital units	.54											
F9 Hospital management seems interested in patient safety only after an adverse event happens	.34						-.34					
A17 We have patient safety problems in this unit												
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?		.90										
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?		.70										
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is		.69										
C3 We are informed about errors that happen in this unit			.57									
C1 We are given feedback about changes put into place based on event reports			.54									
C5 In this unit, we discuss ways to prevent errors from happening again			.48									
A13 After we make changes to improve patient safety, we evaluate their effectiveness			.48				.41					
A4 In this unit, people treat each other with respect				.72								
A1 Staff support one another in this unit				.76								
A3 When a lot of work needs to be done quikly, we work together as a team to get the work done				.61								
F10 Hospital units work well together to provide the best care for patients					.65							
F4 There is good cooperation among hospital units that need to work together					.58							
F8 The actions of hospital management show that patient safety is a top priority					.45		.36					
F2 Hospital units do not coordinate well with each other	.39				-.44							
A18 Our procedures and systems are good at preventing errors from happening					.35		.33					
F1 Hospital management provides a work climate that promotes patient safety					.33		.32					
A8 Staff feel like their mistakes are held against them						.77						
A12 When an event is reported, it feels like the person is being written up, not the problem						.65						
A16 Staff worry that mistakes they make are kept in their personnel file						.52						
A14 We work in a hurry, trying to do too much, too quickly						.39			.37			
A6 We are actively doing things to improve patient care							.51					
A9 Mistakes have led to positive changes here							.50					

Appendix 32 (continued)												
A15 Patient safety never takes second place to get more work done							.30					
B1 My supervisor/manager says a good word when he/she sees a job done according to								.76				
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety								.68				
B4 My supervisor/manager ignores patient safety problems that happen over and over								-.36			.34	.31
A5 Staff in this unit work longer hours than they should, which is not good for patient care									.48			
A7 We use more temporary staff than we should, which is not good for patient care									.48			
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means									.44			
A11 When one area in this unit gets really busy, others help out				.33					-.35		.31	
A2 We have enough staff to handle the workload				.31					-.31			
C4 Staff feel free to question the decisions or actions of those with more authority										.61		
C2 Staff will freely speak up if they see something that may negatively affect patient care			.38							.48		
C6 Staff are afraid to ask questions when something does not seem right										-.45		
A10 It is just by chance that more serious mistakes do not happen around here											.38	
F3 Some things do not happen or get missed when transferring patients from one unit to another												

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 19 iterations.

Appendix 33 Communalities of the 10 factors solution

Safety climate items (N=42)	Initial	Extraction
A1 Staff support one another in this unit	.52	.57
A2 We have enough staff to handle the workload	.25	.26
A3 When a lot of work needs to be done quickly, we work together as a team to	.50	.58
A4 In this unit, people treat each other with respect	.50	.70
A5 Staff in this unit work longer hours than they should, which is not good for	.25	.28
A6 We are actively doing things to improve patient care	.41	.42
A7 We use more temporary staff than we should, which is not good for patient	.25	.29
A8 Staff feel like their mistakes are held against them	.46	.61
A9 Mistakes have led to positive changes here	.35	.33
A10 It is just by chance that more serious mistakes do not happen around here	.13	.10
A11 When one area in this unit gets really busy, others help out	.38	.38
A12 When an event is reported, it feels like the person is being written up, not	.44	.55
A13 After we make changes to improve patient safety, we evaluate their	.47	.54
A14 We work in a hurry, trying to do too much, too quickly	.36	.38
A15 Patient safety never takes second place to get more work done	.20	.19
A16 Staff worry that mistakes they make are kept in their personnel file	.31	.36
A17 We have patient safety problems in this unit	.18	.17
A18 Our procedures and systems are good at preventing errors from happening	.42	.42
B1 My supervisor/manager says a good word when he/she sees a job done	.60	.71
B2 My supervisor/manager seriously considers staff suggestions for improving	.63	.74
B3 Whenever pressure builds up, my supervisor/manager wants us to work	.38	.44
B4 My supervisor/manager ignores patient safety problems that happen over and	.42	.48
C1 We are given feedback about changes put into place based on event reports	.42	.44
C2 Staff will freely speak up if they see something that may negatively affect	.46	.50
C3 We are informed about errors that happen in this unit	.44	.48
C4 Staff feel free to question the decisions or actions of those with more	.41	.57
C5 In this unit, we discuss ways to prevent errors from happening again	.56	.57
C6 Staff are afraid to ask questions when something does not seem right	.28	.34
D1 When a mistake is made, but is caught and corrected before affecting the	.54	.56
D2 When a mistake is made, but has no potential to harm the patient, how often	.66	.88

Appendix 33(continued)		
D3 When a mistake is made that could harm the patient, but does not, how often	.54	.55
F1 Hospital management provides a work climate that promotes patient safety	.41	.40
F2 Hospital units do not coordinate well with each other	.45	.45
F3 Some things do not happen or get missed when transferring patients from one	.15	.12
F4 There is good cooperation among hospital units that need to work together	.47	.52
F5 Important patient care information is often lost during shift changes	.39	.46
F6 It is often unpleasant to work with staff from other hospital units	.37	.39
F7 Problems often occur in the exchange of information across hospital units	.42	.49
F8 The actions of hospital management show that patient safety is a top priority	.45	.47
F9 Hospital management seems interested in patient safety only after an adverse	.36	.36
F10 Hospital units work well together to provide the best care for patients	.53	.53
F11 Shift changes cause problems for patients in this hospital	.34	.36

Extraction Method: Principal Axis Factoring.

Appendix 34 Total variance explained of the 10 factors solution

Factor	Initial Eigenvalues			Extraction Sums of Squared			Rotation Sums of Squared		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.930	23.6	23.6	9.432	22.4	22.4	3.626	8.6	8.6
2	2.413	5.7	29.3	1.852	4.4	26.8	2.509	5.9	14.5
3	2.227	5.3	34.6	1.816	4.3	31.1	2.183	5.1	19.7
4	1.869	4.4	39.1	1.356	3.2	34.4	2.029	4.8	24.6
5	1.626	3.8	43.0	1.166	2.7	37.1	1.853	4.4	29.0
6	1.516	3.6	46.6	1.009	2.4	39.5	1.649	3.9	32.9
7	1.288	3.0	49.6	.791	1.8	41.4	1.482	3.5	36.4
8	1.188	2.8	52.5	.651	1.5	43.0	1.467	3.4	39.9
9	1.095	2.6	55.1	.602	1.4	44.4	1.395	3.3	43.2
10	**1.086**	**2.5**	**57.7**	**.444**	**1.0**	**45.5**	**.934**	**2.2**	**45.5**
11	1.057	2.5	60.2						
12	.961	2.2	62.5						
13	.913	2.1	64.6						
14	.847	2.0	66.6						
15	.786	1.8	68.5						
16	.761	1.8	70.3						
17	.737	1.7	72.1						
18	.731	1.7	73.8						
19	.698	1.6	75.5						
20	.661	1.5	77.1						
21	.634	1.5	78.6						
22	.619	1.4	80.0						
23	.612	1.4	81.5						
24	.598	1.4	82.9						
25	.579	1.3	84.3						
26	.561	1.3	85.6						
27	.519	1.2	86.9						
28	.491	1.1	88.0						

Appendix 34 (continued)

29	.472	1.1	89.2						
30	.460	1.0	90.3						
31	.436	1.0	91.3						
32	.431	1.0	92.3						
33	.412	.9	93.3						
34	.396	.9	94.2						
35	.370	.8	95.1						
36	.351	.8	96.0						
37	.342	.8	96.8						
38	.325	.7	97.6						
39	.284	.6	98.2						
40	.278	.6	98.9						
41	.251	.5	99.5						
42	.194	.4	100						

Extraction Method: Principal Axis Factoring.

Appendix 35 Rotated Factor Matrix of the 10 factors solution

Safety climate items (n=42)	Factor									
	1	2	3	4	5	6	7	8	9	10
F8 The actions of hospital management show that patient safety is a top priority	.61									
F10 Hospital units work well together to provide the best care for patients	.55	-.35								
A6 We are actively doing things to improve patient care	.54									
A18 Our procedures and systems are good at preventing errors from happening	.52									
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.51							.40		
F4 There is good cooperation among hospital units that need to work together	.46									
F1 Hospital management provides a work climate that promotes patient safety	.46									
A9 Mistakes have led to positive changes here	.42									
C5 In this unit, we discuss ways to prevent errors from happening again	.41							.41		
F9 Hospital managemnet seems interested in patient safety only after an adverse event happens	-.35									
A15 Patient safety never takes second place to get more work done										
F7 Problems often occur in the exchange of information across hospital units		.66								
F5 Important patient care information is often lost during shift changes		.59								
F6 It is often unpleasant to work with staff from other hospital units		.54								
F11 Shift changes cause problems for patients in this hospital		.49								
F2 Hospital units do not coordinate well with each other	-.36	.46								
F3 Some things do not happen or get missed when transferring patients from one unit to another										
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?			.90							
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?			.70							
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is			.68							
A4 In this unit, people treat each other with respect				.75						
A1 Staff support one another in this unit				.68						
A3 When a lot of work needs to be done quickly, we work together as a team to get the work done	.33			.59						
A8 Staff feel like their mistakes are held against them					.73					
A12 When an event is reported, it feels like the person is being written up, not the problem					.66					
A16 Staff worry that mistakes they make are kept in their personnel file					.51					
B1 My supervisor/manager says a good word when he/she sees a job done according to established						.73				
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety						.71				
A5 Staff in this unit work longer hours than they should, which is not good for patient care							.48			

Appendix 35 (continued)										
A7 We use more temporary staff than we should, which is not good for patient care							.42			
A14 We work in a hurry, trying to do too much, too quickly					.37		.39			
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means							.39			.34
A2 We have enough staff to handle the workload							-.37			
A11 When one area in this unit gets really busy, others help out				.30			-.35			
C3 We are informed about errors that happen in this unit	.32							.51		
C1 We are given feedback about changes put into place based on event reports								.48		
C4 Staff feel free to question the decisions or actions of those with more authority									.62	
C2 Staff will freely speak up if they see something that may negatively affect patient care								.33	.46	
C6 Staff are afraid to ask questions when something does not seem right									-.45	
B4 My supervisor/manager ignores patient safety problems that happen over and over										.47
A10 It is just by chance that more serious mistakes do not happen around here										
A17 We have patient safety problems in this unit										

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization
Rotation converged in 15 iterations

Appendix 36 Communalities of the 9 factors solution

Safety climate items (n=42)	Initial	Extraction
A1 Staff support one another in this unit	.51	.57
A2 We have enough staff to handle the workload	.24	.24
A3 When a lot of work needs to be done quikly, we work together as a team to	.50	.58
A4 In this unit, people treat each other with respect	.50	.71
A5 Staff in this unit work longer hours than they should, which is not good for	.25	.28
A6 We are actively doing things to improve patient care	.41	.41
A7 We use more temporary staff than we should, which is not good for patient	.25	.25
A8 Staff feel like their mistakes are held against them	.46	.62
A9 Mistakes have led to positive changes here	.35	.33
A10 It is just by chance that more serious mistakes do not happen around here	.13	.07
A11 When one area in this unit gets really busy, others help out	.38	.36
A12 When an event is reported, it feels like the person is being written up, not	.44	.53
A13 After we make changes to improve patient safety, we evaluate their	.47	.52
A14 We work in a hurry, trying to do too much, too quickly	.36	.37
A15 Patient safety never takes second place to get more work done	.20	.16
A16 Staff worry that mistakes they make are kept in their personnel file	.31	.36
A17 We have patient safety problems in this unit	.18	.15
A18 Our procedures and systems are good at preventing errors from happening	.42	.41
B1 My supervisor/manager says a good word when he/she sees a job done	.60	.69
B2 My supervisor/manager seriously considers staff suggestions for improving	.63	.76
B3 Whenever pressure builds up, my supervisor/manager wants us to work	.38	.45
B4 My supervisor/manager ignores patient safety problems that happen over	.42	.39
C1 We are given feedback about changes put into place based on event reports	.42	.41
C2 Staff will freely speak up if they see something that may negatively affect	.46	.50
C3 We are informed about errors that happen in this unit	.44	.44
C4 Staff feel free to question the decisions or actions of those with more	.41	.58
C5 In this unit, we discuss ways to prevent errors from happening again	.56	.57
C6 Staff are afraid to ask questions when something does not seem right	.28	.28
D1 When a mistake is made, but is caught and corrected before affecting the	.54	.55
D2 When a mistake is made, but has no potential to harm the patient, how often	.66	.89

Appendix 36 (Continued)		
D3 When a mistake is made that could harm the patient, but does not, how	.54	.55
F1 Hospital management provides a work climate that promotes patient safety	.41	.40
F2 Hospital units do not coordinate well with each other	.45	.45
F3 Some things do not happen or get missed when transferring patients from	.15	.11
F4 There is good cooperation among hospital units that need to work together	.47	.55
F5 Important patient care information is often lost during shift changes	.39	.42
F6 It is often unpleasant to work with staff from other hospital units	.37	.38
F7 Problems often occur in the exchange of information across hospital units	.42	.46
F8 The actions of hospital management show that patient safety is a top priority	.45	.46
F9 Hospital managemnet seems interested in patient safety only after an	.36	.34
F10 Hospital units work well together to provide the best care for patients	.53	.53
F11 Shift changes cause problems for patients in this hospital	.34	.36

Extraction Method: Principal Axis Factoring.

Appendix 37 Total variance explained of the nine factors solution

Factor	Initial Eigenvalues			Extraction Sums of Squared			Rotation Sums of Squared		
	Total	% of	Cumulative %	Total	% of	Cumulative %	Total	% of	Cumulative %
1	9.930	23.6	23.6	9.421	22.4	22.4	4.235	10.0	10.0
2	2.413	5.7	29.3	1.841	4.3	26.8	2.957	7.0	17.1
3	2.227	5.3	34.6	1.812	4.3	31.1	2.167	5.1	22.2
4	1.869	4.4	39.1	1.348	3.2	34.3	1.993	4.7	27.0
5	1.626	3.8	43.0	1.161	2.7	37.1	1.835	4.3	31.3
6	1.516	3.6	46.6	.998	2.3	39.4	1.590	3.7	35.1
7	1.288	3.0	49.6	.782	1.8	41.3	1.566	3.7	38.9
8	1.188	2.8	52.5	.642	1.5	42.8	1.443	3.4	42.3
9	**1.095**	**2.6**	**55.1**	**.588**	**1.3**	**44.2**	**.808**	**1.9**	**44.2**
10	1.086	2.5	57.7						
11	1.057	2.5	60.2						
12	.961	2.2	62.5						
13	.913	2.1	64.6						
14	.847	2.0	66.6						
15	.786	1.8	68.5						
16	.761	1.8	70.3						
17	.737	1.7	72.1						
18	.731	1.7	73.8						
19	.698	1.6	75.5						
20	.661	1.5	77.1						
21	.634	1.5	78.6						
22	.619	1.4	80.0						
23	.612	1.4	81.5						
24	.598	1.4	82.9						
25	.579	1.3	84.3						
26	.561	1.3	85.6						
27	.519	1.2	86.9						
28	.491	1.1	88.0						
29	.472	1.1	89.2						

Appendix 37 (continued)									
30	.460	1.0	90.3						
31	.436	1.0	91.3						
32	.431	1.0	92.3						
33	.412	.9	93.3						
34	.396	.9	94.2						
35	.370	.8	95.1						
36	.351	.8	96.0						
37	.342	.8	96.8						
38	.325	.7	97.6						
39	.284	.6	98.2						
40	.278	.6	98.9						
41	.251	.5	99.5						
42	.194	.4	100						

Extraction Method: Principal Axis

Appendix 38 Rotated Factor Matrix of the 9 factors solution

Safety climate items (n=42)	Factor								
	1	2	3	4	5	6	7	8	9
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.67								
F8 The actions of hospital management show that patient safety is a top priority	.57								
A6 We are actively doing things to improve patient care	.56								
C5 In this unit, we discuss ways to prevent errors from happening again	.55						.37		
C3 We are informed about errors that happen in this unit	.59								
A18 Our procedures and systems are good at preventing errors from happening	.48								
C1 We are given feedback about changes put into place based on event reports	.47								
A9 Mistakes have led to positive changes here	.46								
F10 Hospital units work well together to provide the best care for patients	.44	-.42							
F1 Hospital management provides a work climate that promotes patient safety	.38	-.35							
B4 My supervisor/manager ignores patient safety problems that happen over and over	-.34								
A15 Patient safety never takes second place to get more work done									
F7 Problems often occur in the exchange of information across hospital units		.65							
F5 Important patient care information is often lost during shift changes		.56							
F6 It is often unpleasant to work with staff from other hospital units		.55							
F2 Hospital units do not coordinate well with each other		.50							
F11 Shift changes cause problems for patients in this hospital		.50							
F9 Hospital management seems interested in patient safety only after an adverse event happens	-.35	.36							
A17 We have patient safety problems in this unit									
F3 Some things do not happen or get missed when transferring patients from one unit to another									
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?			.91						
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?			.70						
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is this			.68						
A4 In this unit, people treat each other with respect				.76					
A1 Staff support one another in this unit				.67					
A3 When a lot of work needs to be done quikly, we work together as a team to get the work done	.39			.57					
A8 Staff feel like their mistakes are held against them					.74				
A12 When an event is reported, it feels like the person is being written up, not the problem					.65				
A16 Staff worry that mistakes they make are kept in their personnel file					.51				

Appendix 38 (continued)									
A5 Staff in this unit work longer hours than they should, which is not good for patient care						.48			
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking						.44			.33
A7 We use more temporary staff than we should, which is not good for patient care						.41			
A14 We work in a hurry, trying to do too much, too quickly					.36	.40			
A2 We have enough staff to handle the workload						-.36			
A11 When one area in this unit gets really busy, others help out	.30					-.35			
C4 Staff feel free to question the decisions or actions of those with more authority							.68		
C2 Staff will freely speak up if they see something that may negatively affect patient care	.36						.52		
C6 Staff are afraid to ask questions when something does not seem right							-.37		
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety	.30							.71	
B1 My supervisor/manager says a good word when he/she sees a job done according to established patient	.36							.69	
F4 There is good cooperation among hospital units that need to work together		-.34							.40
A10 It is just by chance that more serious mistakes do not happen around here									

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization
Rotation converged in 10 iterations

Appendix 39 Communalities of the 8 factors solution

Safety climate items (n=42)	Initial	Extraction
A1 Staff support one another in this unit	.52	.60
A2 We have enough staff to handle the workload	.25	.24
A3 When a lot of work needs to be done quickly, we work together as a team to get the work done	.50	.54
A4 In this unit, people treat each other with respect	.50	.63
A5 Staff in this unit work longer hours than they should, which is not good for patient care	.25	.28
A6 We are actively doing things to improve patient care	.41	.41
A7 We use more temporary staff than we should, which is not good for patient care	.25	.25
A8 Staff feel like their mistakes are held against them	.46	.62
A9 Mistakes have led to positive changes here	.35	.33
A10 It is just by chance that more serious mistakes do not happen around here	.13	.06
A11 When one area in this unit gets really busy, others help out	.38	.36
A12 When an event is reported, it feels like the person is being written up, not the problem	.44	.53
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.47	.51
A14 We work in a hurry, trying to do too much, too quickly	.36	.37
A15 Patient safety never takes second place to get more work done	.20	.15
A16 Staff worry that mistakes they make are kept in their personnel file	.31	.35
A17 We have patient safety problems in this unit	.18	.15
A18 Our procedures and systems are good at preventing errors from happening	.42	.41
B1 My supervisor/manager says a good word when he/she sees a job done according to established	.60	.50
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety	.63	.61
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means	.38	.43
B4 My supervisor/manager ignores patient safety problems that happen over and over	.42	.39
C1 We are given feedback about changes put into place based on event reports	.42	.37
C2 Staff will freely speak up if they see something that may negatively affect patient care	.46	.49
C3 We are informed about errors that happen in this unit	.44	.41
C4 Staff feel free to question the decisions or actions of those with more authority	.41	.60
C5 In this unit, we discuss ways to prevent errors from happening again	.56	.56
C6 Staff are afraid to ask questions when something does not seem right	.28	.27
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is	.54	.55
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?	.66	.88

Appendix 39 (continued)		
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?	.54	.53
F1 Hospital management provides a work climate that promotes patient safety	.41	.37
F2 Hospital units do not coordinate well with each other	.45	.45
F3 Some things do not happen or get missed when transferring patients from one unit to another	.15	.10
F4 There is good cooperation among hospital units that need to work together	.47	.45
F5 Important patient care information is often lost during shift changes	.39	.41
F6 It is often unpleasant to work with staff from other hospital units	.37	.38
F7 Problems often occur in the exchange of information across hospital units	.42	.46
F8 The actions of hospital management show that patient safety is a top priority	.45	.46
F9 Hospital management seems interested in patient safety only after an adverse event happens	.36	.33
F10 Hospital units work well together to provide the best care for patients	.53	.53
F11 Shift changes cause problems for patients in this hospital	.34	.36

Extraction Method: Principal Axis Factoring.

Appendix 40 Total variance explained of the 8 factors solution

Factor	Initial Eigenvalues			Extraction Sums of Squared			Rotation Sums of Squared		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.930	23.6	23.6	9.3	22.3	22.3	4.402	10.4	10.4
2	2.413	5.7	29.3	1.834	4.3	26.7	2.837	6.7	17.2
3	2.227	5.3	34.6	1.796	4.2	31.0	2.173	5.1	22.4
4	1.869	4.4	39.1	1.336	3.1	34.1	2.1	5.0	27.4
5	1.626	3.8	43.0	1.123	2.6	36.8	1.820	4.3	31.8
6	1.516	3.6	46.6	.981	2.3	39.2	1.641	3.9	35.7
7	1.288	3.0	49.6	.745	1.7	40.9	1.452	3.4	39.1
8	**1.188**	**2.8**	**52.5**	**.632**	**1.5**	**42.4**	**1.393**	**3.3**	**42.4**
9	1.095	2.6	55.1						
10	1.086	2.5	57.7						
11	1.057	2.5	60.2						
12	.961	2.2	62.5						
13	.913	2.1	64.6						
14	.847	2.0	66.6						
15	.786	1.8	68.5						
16	.761	1.8	70.3						
17	.737	1.7	72.1						
18	.731	1.7	73.8						
19	.698	1.6	75.5						
20	.661	1.5	77.1						
21	.634	1.5	78.6						
22	.619	1.4	80.0						
23	.612	1.4	81.5						
24	.598	1.4	82.9						
25	.579	1.3	84.3						
26	.561	1.3	85.6						
27	.519	1.2	86.9						

Appendix 40 (continued)

28	.491	1.1		88.0						
29	.472	1.1		89.2						
30	.460	1.0		90.3						
31	.436	1.0		91.3						
32	.431	1.0		92.3						
33	.412	.9		93.3						
34	.396	.9		94.2						
35	.370	.8		95.1						
36	.351	.8		96.0						
37	.342	.8		96.8						
38	.325	.7		97.6						
39	.284	.6		98.2						
40	.278	.6		98.9						
41	.251	.5		99.5						
42	.194	.4		100						

Extraction Method: Principal Axis Factoring.

Appendix 41 Rotated Factor Matrix of the 8 factors solution

Safety climate items (n=42)	Factor							
	1	2	3	4	5	6	7	8
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.65							
F8 The actions of hospital management show that patient safety is a top priority	.59							
A6 We are actively doing things to improve patient care	.50							
C5 In this unit, we discuss ways to prevent errors from happening again	.53					.37		
A18 Our procedures and systems are good at preventing errors from happening	.51							
A9 Mistakes have led to positive changes here	.48							
F10 Hospital units work well together to provide the best care for patients	.48	-.46						
C3 We are informed about errors that happen in this unit	.48							
F1 Hospital management provides a work climate that promotes patient safety	.44	-.33						
C1 We are given feedback about changes put into place based on event reports	.43							
F4 There is good cooperation among hospital units that need to work together	.36	-.32		.33				
A15 Patient safety never takes second place to get more work done								
F7 Problems often occur in the exchange of information across hospital units		.65						
F5 Important patient care information is often lost during shift changes		.56						
F6 It is often unpleasant to work with staff from other hospital units		.55						
F11 Shift changes cause problems for patients in this hospital		.50						
F2 Hospital units do not coordinate well with each other	-.31	.50						
F9 Hospital managemnet seems interested in patient safety only after an adverse event happens	-.34	.36						
A17 We have patient safety problems in this unit								
F3 Some things do not happen or get missed when transferring patients from one unit to another								
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?			.90					
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?			.69					
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is			.68					
A4 In this unit, people treat each other with respect				.71				
A1 Staff support one another in this unit				.70				
A3 When a lot of work needs to be done quickly, we work together as a team to get the work done	.37			.57				
A8 Staff feel like their mistakes are held against them					.74			
A12 When an event is reported, it feels like the person is being written up, not the problem					.65			
A16 Staff worry that mistakes they make are kept in their personnel file					.51			

Appendix 41 (continued)

C4 Staff feel free to question the decisions or actions of those with more authority						.70		
C2 Staff will freely speak up if they see something that may negatively affect patient care	.34					.51		
C6 Staff are afraid to ask questions when something does not seem right						-.37		
A5 Staff in this unit work longer hours than they should, which is not good for patient care							.49	
A7 We use more temporary staff than we should, which is not good for patient care							.41	
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means							.41	-.40
A14 We work in a hurry, trying to do too much, too quickly					.36		.40	
A2 We have enough staff to handle the workload							-.34	
A11 When one area in this unit gets really busy, others help out	.32			.33			-.33	
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety	.37							.54
B1 My supervisor/manager says a good word when he/she sees a job done according to	.43							.47
B4 My supervisor/manager ignores patient safety problems that happen over and over	-.31							-.42
A10 It is just by chance that more serious mistakes do not happen around here								

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization
Rotation converged in 14 iterations

Appendix 42 Pattern Matrix of the 8 factors solution

Safety climate items (n=42)	Factor							
	1	2	3	4	5	6	7	8
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.60							
F8 The actions of hospital management show that patient safety is a top priority	.50							
A6 We are actively doing things to improve patient care	.49							
A9 Mistakes have led to positive changes here	.44							
A18 Our procedures and systems are good at preventing errors from happening	.39							
F1 Hospital management provides a work climate that promotes patient safety	.30							
A8 Staff feel like their mistakes are held against them		.76						
A12 When an event is reported, it feels like the person is being written up, not the problem		.66						
A16 Staff worry that mistakes they make are kept in their personnel file		.49						
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?			-.98					
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?			-.74					
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?			-.74					
F7 Problems often occur in the exchange of information across hospital units				.67				
F6 It is often unpleasant to work with staff from other hospital units				.56				
F5 Important patient care information is often lost during shift changes				.54				
F11 Shift changes cause problems for patients in this hospital				.47				
F2 Hospital units do not coordinate well with each other				.45				
F10 Hospital units work well together to provide the best care for patients	.31			-.35				
F9 Hospital management seems interested in patient safety only after an adverse event happens				.30				
F3 Some things do not happen or get missed when transferring patients from one unit to another								
A17 We have patient safety problems in this unit								
A4 In this unit, people treat each other with respect					-.76			
A1 Staff support one another in this unit					-.74			
A3 When a lot of work needs to be done quickly, we work together as a team to get the work done					-.54			
F4 There is good cooperation among hospital units that need to work together								
C4 Staff feel free to question the decisions or actions of those with more authority						.82		
C2 Staff will freely speak up if they see something that may negatively affect patient care						.59		
C5 In this unit, we discuss ways to prevent errors from happening again	.31					.44		
C6 Staff are afraid to ask questions when something does not seem right						-.39		

appendix 42 (continued)

C3 We are informed about errors that happen in this unit	.32					.33		
C1 We are given feedback about changes put into place based on event reports						.31		
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety						.33	-.49	
B1 My supervisor/manager says a good word when he/she sees a job done according to established patient safety							-.43	
B4 My supervisor/manager ignores patient safety problems that happen over and over							.38	
A10 It is just by chance that more serious mistakes do not happen around here								
A5 Staff in this unit work longer hours than they should, which is not good for patient care								-.49
A7 We use more temporary staff than we should, which is not good for patient care								-.40
B3 Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking							.36	-.37
A2 We have enough staff to handle the workload								.36
A14 We work in a hurry, trying to do too much, too quickly		.31						-.35
A11 When one area in this unit gets really busy, others help out								.32
A15 Patient safety never takes second place to get more work done								

Extraction Method: Principal Axis Factoring.
Rotation Method: Oblimin with Kaiser Normalization
Rotation converged in 46 iterations

Appendix 43 Communalities of the step eight

Safety climate items (n=25)	Initial	Extraction
A1 Staff support one another in this unit	.48	.64
A3 When a lot of work needs to be done quickly, we work together as a team	.42	.52
A4 In this unit, people treat each other with respect	.46	.63
A5 Staff in this unit work longer hours than they should, which is not good	.17	.31
A6 We are actively doing things to improve patient care	.38	.45
A7 We use more temporary staff than we should, which is not good for	.17	.23
A8 Staff feel like their mistakes are held against them	.42	.61
A9 Mistakes have led to positive changes here	.31	.34
A12 When an event is reported, it feels like the person is being written up,	.41	.54
A13 After we make changes to improve patient safety, we evaluate their	.39	.49
A16 Staff worry that mistakes they make are kept in their personnel file	.27	.34
B1 My supervisor/manager says a good word when he/she sees a job done	.57	.66
B2 My supervisor/manager seriously considers staff suggestions for	.61	.82
C2 Staff will freely speak up if they see something that may negatively affect	.42	.50
C4 Staff feel free to question the decisions or actions of those with more	.36	.64
C5 In this unit, we discuss ways to prevent errors from happening again	.50	.55
D1 When a mistake is made, but is caught and corrected before affecting the	.52	.56
D2 When a mistake is made, but has no potential to harm the patient, how	.64	.89
D3 When a mistake is made that could harm the patient, but does not, how	.50	.52
F2 Hospital units do not coordinate well with each other	.35	.37
F5 Important patient care information is often lost during shift changes	.35	.43
F6 It is often unpleasant to work with staff from other hospital units	.31	.38
F7 Problems often occur in the exchange of information across hospital units	.37	.54
F8 The actions of hospital management show that patient safety is a top	.32	.36
F11 Shift changes cause problems for patients in this hospital	.31	.39

Extraction Method: Principal Axis Factoring.

Appendix 44 Total variance explained of the step eight

Factor	Initial Eigenvalues Total	Initial Eigenvalues % of Variance	Initial Eigenvalues Cumulative %	Extraction Sums of Squared Total	Extraction Sums of Squared % of Variance	Extraction Sums of Squared Cumulative %	Rotation Total
1	6.404	25.6	25.6	5.948	23.7	23.7	3.3
2	2.053	8.2	33.8	1.681	6.7	30.5	3.0
3	1.963	7.8	41.6	1.462	5.8	36.3	2.7
4	1.521	6.0	47.7	1.040	4.1	40.5	2.0
5	1.331	5.3	53.0	.927	3.7	44.2	2.7
6	1.203	4.8	57.8	.679	2.7	46.9	2.9
7	1.033	4.1	62.0	.603	2.4	49.3	3.1
8	**.986**	**3.9**	**65.9**	**.481**	**1.9**	**51.2**	**1.5**
9	.801	3.2	69.1				
10	.746	2.9	72.1				
11	.717	2.8	75.0				
12	.663	2.6	77.6				
13	.597	2.3	80.0				
14	.566	2.2	82.3				
15	.545	2.1	84.5				
16	.520	2.0	86.5				
17	.472	1.8	88.4				
18	.470	1.8	90.3				
19	.445	1.7	92.1				
20	.417	1.6	93.8				
21	.395	1.5	95.3				
22	.348	1.3	96.7				
23	.331	1.3	98.1				
24	.255	1.0	99.1				
25	.217	.8	100				

Appendix 45 Pattern Matrix of the 8 factors solution

Safety climate items (n=25)	Factor							
	1	2	3	4	5	6	7	8
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.60							
A6 We are actively doing things to improve patient care	.56							
F8 The actions of hospital management show that patient safety is a top priority	.45							
A9 Mistakes have led to positive changes here	.434							
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?		.98						
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is this		.73						
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?		.72						
F7 Problems often occur in the exchange of information across hospital units			.74					
F6 It is often unpleasant to work with staff from other hospital units			.56					
F5 Important patient care information is often lost during shift changes			.54					
F11 Shift changes cause problems for patients in this hospital			.47					
F2 Hospital units do not coordinate well with each other			.38					
A8 Staff feel like their mistakes are held against them				-.73				
A12 When an event is reported, it feels like the person is being written up, not the problem				-.65				
A16 Staff worry that mistakes they make are kept in their personnel file				-.48				
A1 Staff support one another in this unit					-.76			
A4 In this unit, people treat each other with respect					-.73			
A3 When a lot of work needs to be done quikly, we work together as a team to get the work done					-.57			
C4 Staff feel free to question the decisions or actions of those with more authority						.80		
C2 Staff will freely speak up if they see something that may negatively affect patient care						.54		
C5 In this unit, we discuss ways to prevent errors from happening again	.30					.41		
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety							-.84	
B1 My supervisor/manager says a good word when he/she sees a job done according to established							-.74	
A5 Staff in this unit work longer hours than they should, which is not good for patient care								.54
A7 We use more temporary staff than we should, which is not good for patient care								.42

Extraction Method: Principal Axis Factoring.
Rotation Method: Oblimin with Kaiser Normalization
Rotation converged in 9 iterations

Appendix 46 EFA of each scale of the optimal model (8 factors)

Factor one	Item loadings
A6:	.699
A9:	.563
A13:	.672
F8:	.583
Factor two	Item loadings
D1:	.730
D2:	.953
D3:	.725
Factor three	Item loadings
A8:	.805
A12:	.707
A16:	.541
Factor four	Item loadings
F5:	.639
F6:	.548
F7:	.706
F11:	.581
Factor five	Item loadings
A1:	.818
A3:	.662
A4:	.709
Factor six	Item loadings
C2:	.694
C4:	.994
Factor seven	Item loadings
B1	.846
B2	.846
Factor eight	Item loadings
A5:	.510
A7:	.510

The table above shows that each set of items was loaded in one factor as they were structured in the optimal model. The overall of all items (23 items) and 8 factors satisfactorily explained by a single factor.

Appendix 47 Extra factor analysis investigations

In order to explore potential improvements and because exploratory factor analysis is based on exploration approach another investigation was performed by exploring the conclusion of the comparison between 11-12-10-9-8 factors solutions that produced the common factor structure which consists 10 factors. The summary of the conclusion indicated that the common factor structure consisted of 10 factors. In addition 10 factor solution was suggested by scree plot (see page 12) and also it was suggested by 11 and 12 factors solution. Items number A10-A15-A17-F3 did not load upon any factor. Items number A2-A5-A10-A15-A17-F3 had low communalities. Items number F1-F3-F9-A11-A14-A18-A2-C5-B3 had low loadings. Therefore, Items numbers A10-A15-A17-F3-A2-A11-A14-A18-B3-C5-F1-F9 were removed in the next step.

Step 1:

Run EFA exclude A10-A15-A17-F3-A2-A11-A14-A18-B3-C5-F1-F9 and number of factors (10) with using oblique rotation to aid interpretation of the items in each factor of the solution. The following tables show the communalities, Total Variance Explained and Pattern Matrix of this step.

Table 1 Communalities of the 10 factors solution

Safety climate items (n=30)	Initial	Extraction
A1 Staff support one another in this unit	.494	.653
A3 When a lot of work needs to be done quickly, we work together as a team to get the work done	.433	.526
A4 In this unit, people treat each other with respect	.468	.622
A5 Staff in this unit work longer hours than they should, which is not good for patient care	.187	.290
A6 We are actively doing things to improve patient care	.392	.595
A7 We use more temporary staff than we should, which is not good for patient care	.196	.318
A8 Staff feel like their mistakes are held against them	.432	.620
A9 Mistakes have led to positive changes here	.316	.365
A12 When an event is reported, it feels like the person is being written up, not the problem	.424	.551
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.453	.552
A16 Staff worry that mistakes they make are kept in their personnel file	.278	.345
B1 My supervisor/manager says a good word when he/she sees a job done according to established	.591	.827
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety	.619	.698
B4 My supervisor/manager ignores patient safety problems that happen over and over	.313	.327
C1 We are given feedback about changes put into place based on event reports	.399	.450
C2 Staff will freely speak up if they see something that may negatively affect patient care	.436	.529
C3 We are informed about errors that happen in this unit	.400	.489
C4 Staff feel free to question the decisions or actions of those with more authority	.364	.591
C6 Staff are afraid to ask questions when something does not seem right	.262	.345
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?	.535	.586
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?	.656	.887
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?	.524	.552
F2 Hospital units do not coordinate well with each other	.436	.472
F4 There is good cooperation among hospital units that need to work together	.424	.531
F5 Important patient care information is often lost during shift changes	.366	.446
F6 It is often unpleasant to work with staff from other hospital units	.323	.377
F7 Problems often occur in the exchange of information across hospital units	.397	.575
F8 The actions of hospital management show that patient safety is a top priority	.392	.422

Table 1 (continued)		
F10 Hospital units work well together to provide the best care for patients	.514	.649
F11 Shift changes cause problems for patients in this hospital	.323	.384

Extraction Method: Principal Axis Factoring.

Table 2 Total Variance Explained of the 10 factors solution

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.707	25.692	25.692	7.253	24.176	24.176	2.329
2	2.069	6.897	32.589	1.709	5.695	29.871	3.387
3	2.044	6.813	39.402	1.546	5.155	35.026	2.955
4	1.623	5.409	44.810	1.171	3.905	38.931	2.285
5	1.388	4.627	49.438	.995	3.317	42.248	3.288
6	1.282	4.272	53.710	.778	2.592	44.840	2.483
7	1.161	3.871	57.581	.714	2.380	47.220	3.938
8	1.112	3.705	61.287	.555	1.850	49.070	1.552
9	.975	3.250	64.537	.513	1.709	50.779	4.175
10	**.847**	**2.825**	**67.362**	**.340**	**1.132**	**51.911**	**2.903**
11	.781	2.603	69.965				
12	.755	2.517	72.482				
13	.695	2.318	74.799				
14	.631	2.102	76.901				
15	.600	1.999	78.900				
16	.591	1.971	80.871				
17	.565	1.883	82.754				
18	.533	1.776	84.530				
19	.500	1.666	86.196				
20	.491	1.638	87.834				
21	.463	1.543	89.377				
22	.444	1.478	90.855				
23	.430	1.432	92.288				

Table 2 (continued)						
24	.428	1.426	93.714			
25	.392	1.306	95.020			
26	.367	1.224	96.244			
27	.340	1.133	97.377			
28	.328	1.092	98.469			
29	.255	.851	99.320			
30	.204	.680	100.000			

Extraction Method: Principal Axis Factoring.

Table 3 Pattern Matrix of the 10 factors solution

Safety climate items (n=30)	Factor									
	1	2	3	4	5	6	7	8	9	10
C3 We are informed about errors that happen in this unit	.488									
C1 We are given feedback about changes put into place based on event reports	.444									
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.418									
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?		.968								
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?		.734								
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is this		.732								
F7 Problems often occur in the exchange of information across hospital units			.741							
F6 It is often unpleasant to work with staff from other hospital units			.534							
F5 Important patient care information is often lost during shift changes			.513							
F11 Shift changes cause problems for patients in this hospital			.462							
A8 Staff feel like their mistakes are held against them				-.755						
A12 When an event is reported, it feels like the person is being written up, not the problem				-.664						
A16 Staff worry that mistakes they make are kept in their personnel file				-.506						
A1 Staff support one another in this unit					.773					
A4 In this unit, people treat each other with respect					.721					
A3 When a lot of work needs to be done quikly, we work together as a team to get the work done					.569					
C4 Staff feel free to question the decisions or actions of those with more authority						.679				
C2 Staff will freely speak up if they see something that may negatively affect patient care						.490				
C6 Staff are afraid to ask questions when something does not seem right						-.410				

Table 3 (continued)

B1 My supervisor/manager says a good word when he/she sees a job done according to established patient							-.926			
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety							-.704			
B4 My supervisor/manager ignores patient safety problems that happen over and over							.311			
A7 We use more temporary staff than we should, which is not good for patient care								.521		
A5 Staff in this unit work longer hours than they should, which is not good for patient care								.478		
F10 Hospital units work well together to provide the best care for patients									.714	
F4 There is good cooperation among hospital units that need to work together									.637	
F2 Hospital units do not coordinate well with each other									-.458	
F8 The actions of hospital management show that patient safety is a top priority									.440	
A6 We are actively doing things to improve patient care										-.676
A9 Mistakes have led to positive changes here										-.448

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization

a. Rotation converged in 46 iterations.

The pattern matrix above showed that B4 had low loading 0.311. Therefore this item was excluded in the next step.

Step 2:

Run EFA exclude A10-A15-A17-F3-A2-A11-A14-A18-B3-C5-F1-F9-B4 with using oblique rotation and number of factors (10). The following tables show the communalities, Total Variance Explained and Pattern Matrix of this step.

Table 4 Communalities of the 10 factors solution

Safety climate items (n=29)	Initial	Extraction
A1 Staff support one another in this unit	.490	.645
A3 When a lot of work needs to be done quickly, we work together as a team to get the work done	.433	.532
A4 In this unit, people treat each other with respect	.465	.621
A5 Staff in this unit work longer hours than they should, which is not good for patient care	.186	.315
A6 We are actively doing things to improve patient care	.391	.591
A7 We use more temporary staff than we should, which is not good for patient care	.183	.283
A8 Staff feel like their mistakes are held against them	.430	.628
A9 Mistakes have led to positive changes here	.316	.370
A12 When an event is reported, it feels like the person is being written up, not the problem	.423	.549
A13 After we make changes to improve patient safety, we evaluate their effectiveness	.453	.553
A16 Staff worry that mistakes they make are kept in their personnel file	.277	.343
B1 My supervisor/manager says a good word when he/she sees a job done according to established patient safety	.578	.808
B2 My supervisor/manager seriously considers staff suggestions for improving patient safety	.619	.706
C1 We are given feedback about changes put into place based on event reports	.393	.444
C2 Staff will freely speak up if they see something that may negatively affect patient care	.436	.531
C3 We are informed about errors that happen in this unit	.400	.492
C4 Staff feel free to question the decisions or actions of those with more authority	.362	.585
C6 Staff are afraid to ask questions when something does not seem right	.262	.347
D1 When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?	.535	.591
D2 When a mistake is made, but has no potential to harm the patient, how often is this reported?	.654	.882
D3 When a mistake is made that could harm the patient, but does not, how often is this reported?	.523	.553
F2 Hospital units do not coordinate well with each other	.436	.472
F4 There is good cooperation among hospital units that need to work together	.424	.529
F5 Important patient care information is often lost during shift changes	.365	.449
F6 It is often unpleasant to work with staff from other hospital units	.322	.375
F7 Problems often occur in the exchange of information across hospital units	.396	.577
F8 The actions of hospital management show that patient safety is a top priority	.391	.422
F10 Hospital units work well together to provide the best care for patients	.513	.654
F11 Shift changes cause problems for patients in this hospital	.322	.390

Extraction Method: Principal Axis Factoring.

Table 5 Total Variance Explained of the 10 factors solution

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.442	25.662	25.662	6.995	24.120	24.120	2.232
2	2.068	7.131	32.793	1.704	5.876	29.996	3.325
3	2.034	7.013	39.806	1.538	5.304	35.300	2.861
4	1.619	5.583	45.389	1.170	4.036	39.336	2.270
5	1.386	4.779	50.168	.985	3.398	42.734	3.132
6	1.239	4.274	54.441	.736	2.537	45.271	2.454
7	1.138	3.926	58.367	.709	2.445	47.716	3.686
8	1.100	3.793	62.160	.552	1.903	49.619	1.451
9	.973	3.354	65.515	.509	1.756	51.375	4.048
10	**.846**	**2.918**	**68.432**	**.335**	**1.156**	**52.531**	**2.843**
11	.755	2.605	71.037				
12	.731	2.521	73.558				
13	.690	2.378	75.936				
14	.623	2.148	78.084				
15	.598	2.063	80.147				
16	.567	1.955	82.102				
17	.536	1.847	83.949				
18	.500	1.724	85.673				
19	.491	1.694	87.367				
20	.464	1.600	88.968				
21	.444	1.530	90.498				
22	.434	1.496	91.994				
23	.428	1.476	93.470				
24	.395	1.363	94.833				
25	.368	1.270	96.103				
26	.340	1.172	97.275				
27	.328	1.130	98.405				

Table 5 (continued)						
28	.255	.880	99.285			
29	.207	.715	100.000			

Table 6 pattern matrix of the final solution (10 factors)

Safety climate items (n=29)	Factor									
	1	2	3	4	5	6	7	8	9	10
C3 We are informed about errors that happen in this unit	.490									
C1 We are given feedback about changes put into place based on	.439									
A13 After we make changes to improve patient safety, we evaluate	.416									
D2 When a mistake is made, but has no potential to harm the patient,		.963								
D1 When a mistake is made, but is caught and corrected before		.736								
D3 When a mistake is made that could harm the patient, but does not,		.734								
F7 Problems often occur in the exchange of information across			.738							
F6 It is often unpleasant to work with staff from other hospital units			.529							
F5 Important patient care information is often lost during shift			.518							
F11 Shift changes cause problems for patients in this hospital			.468							
A8 Staff feel like their mistakes are held against them				.762						
A12 When an event is reported, it feels like the person is being				.657						
A16 Staff worry that mistakes they make are kept in their personnel				.502						
A1 Staff support one another in this unit					-					
A4 In this unit, people treat each other with respect					-					
A3 When a lot of work needs to be done quikly, we work together as										
C4 Staff feel free to question the decisions or actions of those with						.675				
C2 Staff will freely speak up if they see something that may						.488				
C6 Staff are afraid to ask questions when something does not seem						-				
B1 My supervisor/manager says a good word when he/she sees a job							-			
B2 My supervisor/manager seriously considers staff suggestions for							-			
A5 Staff in this unit work longer hours than they should, which is not								.511		
A7 We use more temporary staff than we should, which is not good								.477		
F10 Hospital units work well together to provide the best care for									.719	
F4 There is good cooperation among hospital units that need to work									.628	

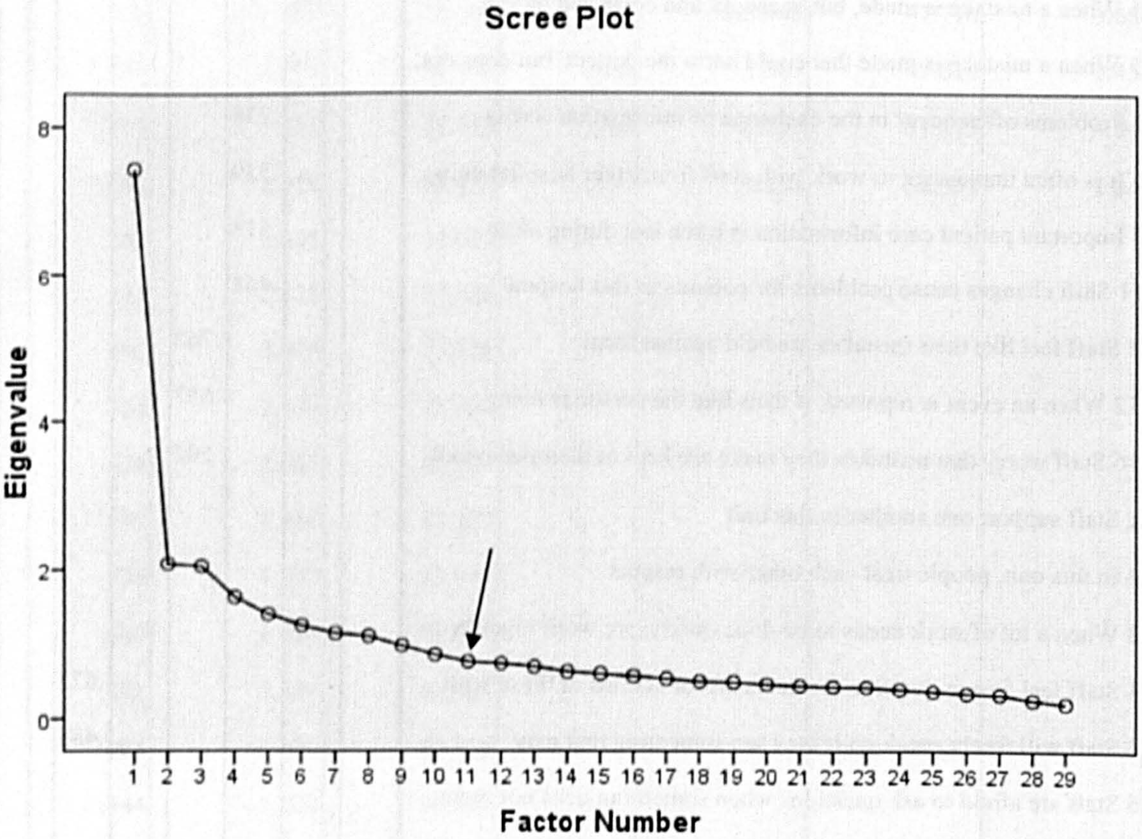
Table 6 (continued)										
F2 Hospital units do not coordinate well with each other									-	
F8 The actions of hospital management show that patient safety is a									.440	
A6 We are actively doing things to improve patient care										-
A9 Mistakes have led to positive changes here										-

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization

a. Rotation converged in 11 iterations.

Figure 1 Scree Plot of the final solution (10 factors)



The following table shows the structure of the 10 factor solution and its loadings.

Table 7 Structure of the final solution (10 factors)

Factor number	Factor	Items (loading)	Number of items
1	Feedback and communication about error	C1-C3-A13	3
2	Frequency of event reported	D1-D2-D3	3
3	No punitive response to error	A8-A12-A16	3
4	Handoffs and transitions	F5-F6-F7-F11	4
5	Teamwork within units	A1-A3-A4	3
6	Communication openness	C2-C4-6	3
7	Supervisor expectation and action promoting patient safety	B1-B2	2
8	Staffing	A5-A7	2
9	Teamwork across units	F2-F4-F10-F8	4
10	Organisational learning- continuous improvement	A6-A9-	2

The 10 factors solution included 29 safety climate items in 13 factors while 11 items were excluded (A2-A10-A11-A14-A15-A17-A18-B3-B4-C5-F1-F3-F9). Factor loadings were between 0.41 and 0.97. There were only small shifts among items across factors for instance, A13 moved to Feedback and communication about error. F6 moved to Handoffs and transitions. F8 moved to Teamwork across units. All dimensions consisted of two to four safety climate items. The composition of the factors of this solution was very similar to that of the 11 factors solution except B3 and B4 were lost in the 10 factors solution which they grouped as a factor in 11 factors solution. In conclusion three factors solutions (11-10-8) were identified by explorative factor analysis. The following table shows the structure of each solution produced in EFA.

Table 8 Comparison of the three final solutions

Solution	Number of factors (number of items)	Structure	Items excluded	Total Variance Explained (%)
One	11 factors (31 items)	F1: D1-D2-D3 F2: A8-A12-A16 F3: A1-A3-A4 F4: F5-F6-F7-F11 F5: A6-A9 F6: C2-C4-C6 F7:A5-A7 F8:B1-B2 F9: C1-C3-A13 F10:F2-F4-F8-F10 F11: B3-B4	A10-A15- A17-F3-F1- F9-C5-A2- A11-A14- A18	52.9
Two	10 factors (29 items)	F1: D1-D2-D3 F2: A8-A12-A16 F3: A1-A3-A4 F4: F5-F6-F7-F11 F5: A6-A9 F6: C2-C4-C6 F7:A5-A7 F8:B1-B2 F9: C1-C3-A13 F10:F2-F4-F8-F10	A10-A15- A17-F3-F1- F9-C5-A2- A11-A14- A18-B3-B4	52.5
Three	8 factors (23 items)	F1: D1-D2-D3 F2: A8-A12-A16 F3: A1-A3-A4 F4: F5-F6-F7-F11 F5: A6-A9-A13-F8 F6: C2-C4 F7: A5-A7 F8: B1-B2	A10-A15- A17-F3-F1- F9-C5-A2- A11-A14- A18-B3-B4- F4-F10-F2- C6-C3	51.5

Step 3: Testing the fit of optimal models

This step aimed to test, using the validation half of the data, the fit of the resulting models that emerged from the EFA that was performed on the construction half of the data. These models included 11, 10, and 8 factor solutions.

11 factors solution

The process of CFA of the 11 factor solution was performed (as practical steps that described in the process of CFA of the original 12 factors in page 2)

1 AMOS Graphics was used to open up a blank diagram window
2 Opening the data (The validation half of the data, 431 questionnaires)
3 Building the model (Drawing the11 factors by using model drawing area in step one)
4 Adding the variable names to the model
5 Checking the diagram and running the model and using the output window

Table 4 shows the output of CFA of 11 factors solution.

Table 9 Output of CFA of 11 factors solution

Model	Chi-square	DF	CMIN/DF	CFI	RMSEA	RMR	SRMR	TLI
11 Factors	922	381	2.4	0.881	0.678	0.057	0.093	0.855

The output above shows the value of CMIN/DF was greater than 2 (good model ≤2). The value of CFI < 0.90 (good model > 0.90). The value of SRMR > 0.08 (good model <0.05). The value of RMSEA > 0.06 (good model ≤0.06). Thus, the values of the fit indices from CFA of 11 factors are outside the general agreed parameters in table one and this model fit was deemed not satisfactory. Consequently this model was rejected.

10 factors solution

The process of CFA of the 10 factors solution was as follows:

1 AMOS Graphics was used to open up a blank diagram window
2 Opening the data (The validation half of the data, 431 questionnaires)
3 Building the model (Drawing the10 factors by using model drawing area in step one)
4 Adding the variable names to the model
5 Checking the diagram and running the model and using the output window

Table 5 shows the output of CFA of 10 factors solution.

Table 10 Output of CFA of 10 factors solution

Model	Chi-square	DF	CMIN/DF	CFI	RMSEA	RMR	SRMR	TLI
10 Factors	716	332	2.1	0.90	0.52	0.046	0.052	0.88

The output above shows the value of CMIN/DF was greater than 2 (good model ≤2). The value of CFI=0.90. The value of SRMR <0.08. The value of RMSEA <0.06. Overall, the values of the fit indices from CFA of 10 factors indicated that this model fit was not satisfactory.

Eight factors solution

The process of CFA analysis of the eight factors solution was followed:

1 AMOS Graphics was used to open up a blank diagram window
2 Opening the data (The validation half of the data, 431 questionnaires)
3 Building the model (Drawing the eight factors by using model drawing area in step one)
4 Adding the variable names to the model
5 Running the model and using the output window

Table 6 shows the output of CFA of 8 factors solution.

Table 11 Output of CFA of 8 factors solution

Model	**Chi-square**	**DF**	**CMIN/DF**	**CFI**	**RMSEA**	**RMR**	**SRMR**	**TLI**
8 Factors	407 (good)	202 (good)	2 (good)	0.93 (good)	0.049 (good)	0.044 (good)	0.047 (good)	0.916 (good)

The output above shows the value of CMIN/DF was 2 (good model ≤2). The value of CFI >0.90. The value of SRMR <0.08. The value of RMSEA <0.06. Overall, the fit indices from CFA of eight factors indicated that this model fit was good.

The values of the fit indices of the Saudi data (8 factors) meet the general agreed parameters in table one. Therefore, this model fit was a good fit. Consequently this model was acceptable as the optimal model.

Table 7 shows the comparison of CFA between USA and UK models and the three solutions of the current study (11, 10 and 8 factor solutions).

Table 12 Comparison of CFA of USA and UK models and the current study

Model	Chi-square	DF	CMIN/DF	CFI	RMSEA	RMR	SRMR	TLI
USA data (Sorra and Nieva, 2004)	2064	746	-	0.94	0.040	-	-	-
UK data (original model) (Waterson et al, 2009)	1906	674	-	0.91	0.045	-	0.046	-
UK data 9 factors, 27 items(Waterson et al, 2009)	587	288	-	0.94	0.043	-	0.043	0.93
Current study								
12 Factors (original model)	4995	805	6.2	0.642	0.678	0.178	0.1931	0.617
11 Factors	922	381	2.4	0.881	0.678	0.057	0.093	0.855
10 Factors	716	332	2.1	0.90	0.52	0.046	0.052	0.88
8 Factors	407	202	2	0.93	0.049	0.044	0.047	0.916

It is clear that the optimal model that fitting the Saudi data is the eight factor solutions because of the value of the fit indices indicate that this model meets the general agreed parameters.

Appendix 48 Actual texts of answers of open question in the HSOPSC questionnaire

N	I D	Job	Actual text
1	6	Nurse	Shortcuts still been practised in the hospital. Difficult to ask some medical staff. (-) 2
2	10	Nurse	Polices and producers are excellent. Feedbacks on reports are almost available. Reporting system is effective (+) 3
3	14	Doctor	Many patients left in pediatric emergency. Many days for transfer to wards. 1-5 days waiting in very crowded atmosphere. (-) 1
4	15	Doctor	The only thing affect the patient safety in emergency is crowded and no bed available in the wards. Patients stay for two to five days in the emergency.
5	21	Nurse	No cooperation between staff. The staff are not helping in problems. (-) 1
6	22	Nurse	I believe when you take care of patients you have to be oriented to your work place and with people you work with them. (+) 1
7	23	Nurse	We always talk about patient safety, patient comfort and patient rights. Management never helped the staff and their safety and welfare. Shift staff without giving them enough time to orient themselves. Nurses having basic knowledge on nursing nurses fear to speak. Management is not helpful and supportive the staff.
8	24	Nurse	If we will maintain patient safety we should in the first place maintain staff safety, so when they come to work, their mind will be concentrated on safe patient care e.g. if the staff living outside the hospital compound with family and no medical and education coverage all these so how the staff is going to concentrate and provide safe care to the patients (-) one
9	26	Nurse	We are not familiar with staff from other area. (-) one
10	27	Doctor	The questionnaire concentrated on patient safety in patient not outpatient. We see more problems with patient safety due to short time spent with patient. Lack of cooperation between different specialities. (-) 3
11	34	Nurse	Our hospital following international patient safety goals as we are JCIA hospital. (+) 1
12	35	Doctor	This hospital is probably is the best hospital in the KSA regarding this issue. Good research (+) 2
13	36	Nurse	Sometimes we are concentrating more with paper works than patient care. Honestly they should decrease paper work and we should concentrate on patient care and safety. Thank you. (-) 2.
14	45	Doctor	I feel that patient safety in our hospitals depend on the physician himself; I mean his own rules and beliefs not on the hospital regulations.
15	53	Nurse	Patient safety is the first and ultimate goal in this unit and we as nurse are really practicing it in an excellent way. (+) 2
16	58	Nurse	We have <u>electronic incident reporting system</u>. In the past it was a paper based. Patient safety has been <u>made number one priority</u> by senior management<u>. Quality management is effectively striving to enhance patient safety through its leadership. (+) 3 themes</u>
17	62	Doctor	Encourage staff to disclose his/her medical errors to others for learning purpose. Holding regular session to present morbidity/mortality cases to all staff in each units for learning. Thanks (+) 2
18	63	Doctor	They are working on good patient safety maintaining. (+) 1
19	65	Doctor	Easy and clear to complete questionnaire. (+) 1
20	67	Doctor	They have excellent reporting system. (+) 1
21	71	Doctor	Good survey we would be interested in seeing the results. (+) 1
22	72	Doctor	My hospital is a tertiary hospital in Saudi Arabia in which patient all over Saudi Arabia come plus international patients. I believe in such hospital are efficient number of medical staff should work especially in critical area but it is not the case in my hospital. I believe there is no respect to junior staff opinion although sometimes it is important and true. I think sometimes patient care is sometimes missed when discharged from hospital. I mean the outpatient follow up is not optimal. Many patients are lost between clinics. Many patients do not know why to visit the clinics. Last point is patient education is still need more to do. I wish your study will help us. God bless you. (-) 6
23	77	Doctor	With environment of working when everybody concentrates on patient safety these action affect patient treatment , because everybody wants to protect himself than patients (-) 1

24	96	Doctor	We still need further improvement of patient safety system although it is better than other hospital. Reporting the physician who made the mistakes need more confidential. Thank you for your effort. (-) 3
25	97	Doctor	There is no justice in the working hours, load of the work, and position of physicians. Even there is no balance in the salary. Emergency department is not large. Some departments are supported by their head; even if they did mistake nobody care. (-) 4
26	100	Doctor	I wish you all luck. This questionnaire is too long and some questions are reported in other with same idea (-) 2
27	106	Doctor	This is a good hospital but the problem here, it is from the patient contact, and knowledge and contact with their relative it is difficult. Thank you. (-) 3
28	111	Doctor	Wish you best research good luck (+) 1
29	112	Doctor	We hope that we can share patient safety so we can learn from the people mistakes. (+) 2
30	116	Doctor	I hope we will receive feedback
31	117	Doctor	Clear to patient safety research no comments thank you so much. (+)
32	138	Nurse	Science our department personnel involved a multi disciplinary team from different culture patient safety is always our priority. Our scope of practice must be reported mistakes even near miss. Reporting system. In behalf of our department we wish you good luck, doctor + our congratulations. (+) 4.
33	144	Nurse	Blame on what happened rather than what caused the problem. (-) 1
34	148	Nurse	My observation is those critical incidences are not freely reported. Professionals continue to cover up mistakes, I believe will continue until individuals are no longer blamed, punished for incidents in which they are involved.
35	146	Nurse	Patient safety is number issue in the hospital. Event reporting is good tool to improve patient safety (+) 2
36	140	Nurse	The hospital setting is good. The structure is good. Programs some are good but most very unnecessary and stressful for the staff on the floor. Every unit is doing its own thing that may be good or bad but at least there is competition on trying to get better. Staff on the floor is overworked, overloaded with patients. Nobody is taking care of the staff on the floor. (-) 6
37	166	Nurse	Patient safety precautions program have been presented by means of posters, conference and workshop that provides full information to staff. (+) 1
38	170	Nurse	Theory practice gap still exist. It is difficult at times to practice what is being taught in clinical areas. Too much paper work more than patient care. Staffing problems (in balance of staffing) (-) 3
39	171	Nurse	The hospital focuses on patient safety. JCIA put policy and regulations and guidelines related what should be implemented and too many checklists about patient safety.(+) 2
40	181	Nurse	We are very much focus on patient safety (+) 1
41	192	Nurse	Patient safety should be our priority. We should be careful about all things related to patient care (+) 2
42	191	Nurse	I grateful to inform you that the hospital I am working with has a high regard when it comes to patient safety. (+) 1
43	190	Nurse	Our hospital is currently implementing measures to ensure quality patient care for patients. The responsibilities of all healthcare worker to work together to ensure safety to all patients. Polices are being put in place to facilitate patient safety. Errors or events affect patient safety reported and reviewed by the quality assurance management team.
44	197	Nurse	Communication problems sometimes lead to patient safety problem because the patient difficult to understand physicians instructions. (-) 1
45	202	Nurse	I personally think the issues regarding patient safety are of utmost importance in this organisation. (+) 1
46	205	Nurse	More on paper works which delay patient care. (-) 1
47	204	Nurse	Too many paper works to be done, less direct patient care. Patient safety here is our priority. (-) 2
48	206	Nurse	An event reported becomes essential and important. (-) 1
49	207	Nurse	Reporting events is common helpful factor in patient care and safety. (+) 1
50	210	Nurse	For patient safety staff play an vital part for that the staff welfare must be taken care. Nurse mangers and supervisors must attend consulting course regarding how to communicate to staff. Stress for staff will cause more damage in patient safety. Staff satisfaction is important and giving a better safety environment for patients. Patient safety depends on staff satisfaction. Staff with highly stress will causing more harm for

			patient and affected patient safety.
51	212	Nurse	Patient safety becomes a focus at accreditation times.
52	239	Nurse	More information on how to enhance patient safety in this hospital.
53	247	Nurse	Patient safety is the number one priority in this hospital in relation to this all staff should adhere with the international patient safety goals. Identify patient correctly using two unique identities. Improve staff communication using SBAR. Correct site of surgery a time out. Reduce risk of infection by hand hygiene. Do necessary action to correct mistakes.
54	248	Nurse	Patients' awareness is important. Communication between staff and between patients as well is very important to decrease errors.
55	249	Nurse	Honestly, this hospital is very particular in patient safety focus in improvement towards patient care. Mistakes happened yes but there is always room for improvement. Patient safety is the top priority can be achieved through teamwork of excellent staff.
56	274	nurse	Our goal is patient and their family rights first which include them to be safe.
57	280	Nurse	The head nurse is not held accountable for her behaviour and very poor treatment of the staff. Despite numerous reports to the management through the chain of command nothing has been done. She does not lesson to the staff. Lack of communication between and preventing discussion all these lead to unsafe practice.
58	283	Nurse	Visitors could easily come and go towards there is on security guard at the doors.
59	292	Nurse	More time is spent on documentation than bedside care.
60	304	Nurse	Babies should not bring to mothers during visiting hours for safety reason.
61	303	Nurse	Patient safety measures only be taken after event has happened. I am very happy to be given this opportunity to fill up this questionnaire. Thank you.
62	306	Nurse	Patient safety is definitely a priority but due to workload sometimes it becomes practically impossible to ensure safety. The high turnover of patients makes it difficult/impossible to ensure safety of patients because you discharge one patient when you have not even finished the discharge procedure another patient is being transferred to your care. As much as the safety of patient s is important sometimes the practicality becomes impossible.
63	310	Nurse	Top management speaks about patient safety but physically not too much is done. Patient safety should not only be on papers, it should be practiced.
64	312	Nurse	Feedback of this survey would be strongly appreciated. We work without any Arabic speaking. We do not have unit assistance.
65	313	Nurse	I feel nurse want to report near misses but they think it's not worth because of the head of department. People take reporting as an insult instead of something positive for patient outcomes. I do not view reporting as a make against anyone because I came from my country that encouraging reporting so that we can put better systems in place to prevent it from happening again.
66	314	Nurse	A feedback on this survey will beneficial to the staff. Patient safety is a priority in this hospital but is compromised due to the workload that they have. Too much time spent on electronic and written documentation and limited time given to direct patient care. Directives are given to nurses to do things but the problems encountered by the nursing staff are not heard.
67	322	Nurse	Management is active in trying to implement patient safety as one of focus. There seems to be resistance from some staff regarding change and patient safety. It seems that whatever is fastest is the method they will use. They cover each other regarding mistakes that are made. I find alot of problems with compliance to hospital policy's. There is little respect shown to each other and I find manner of staff to be unprofessional at time.
68	334	Nurse	Staff support depends on who one is?. Teamwork : people still find themselves leaving the unit at 9:00 or 10:00 especially if the work is not completed. People still do not feel free to ask question
69	341	Nurse	The most patient safety issue as the nurse that employed in intensive care unit not ICU bored nurses (not qualified).
70	350	Nurse	I would like to suggest for enforcement in the effort to create a non balanced culture in managing event reporting related to patient safety. The system failure should be focused on when there is event reporting such as medication errors, patient safety issue.
71	358	Nurse	Pressure time, when we work faster errors can easily happen. But now a days lots of things are treated by policies and procedures that can help us to work better to prevent

			errors and more safe environment for patients.
72	360	Nurse	As part of member of this hospital I found the hospital and management are working hard in order to keep patient safety continuously.
73	368	Nurse	I think I was just lucky enough working here in KAMC, Riyadh. All programs related and with positive effect to patient are updated. These institution prioritize their patients safety by encourage and support staff who work very well. Thanks for KF NG.
74	369	Nurse	Documentation takes a lot of time than providing patient care because the system emphasise more importance on paper works. There is no enough staff for work therefore the pressure increase because of workload.
75	372	Nurse	Nursing staff are the first person in direct contact with patient. They are potentially hazardous to patient health and life physically and mentally exhausted nurse due to staff shortage, compensated by mandatory overtime, eventually result in compromised patient safety. More errors done than prevented and not being reported. Healthy nurse can actively prevent medico legal or health hazards only if they are given time to rest and do paper work once than many times. Errors should be reported.
76	385	Nurse	No comments thank you.
77	392	Nurse	I think safety for patient is very good in this hospital. Thanks
78	395	Nurse	I did not see much positive changes or action or improvement after near miss incident being reported. This will make staff are rarely willing to report any incident any more.
79	396	Nurse	Patient safety is number one priority in this hospital.
80	399	Nurse	I find my nurse manager in supportive, open, honest and team player. Due to the leadership skills as a staff nurse I have improved my nursing care and patient safety has improved almost 95% I love coming to work now.
81	422	Nurse	Patient safety is our top priority, circumstances like patients with sitter put risk in patient safety. For example patient going to O.R, sitter instructed not to give patient by oral, they cannot resist to give water.
82	424	Nurse	Double up of patients in one cubic. Taking care of 2-3 critically ill patients. 1:3 nursing. Short cuts in doing nursing care. Not checking medication by two nurses. Un experienced nurses in the department. Lack of knowledge and skills
83	426	Nurse	I feel that staff still has misconception of reporting of errors. Fair from reporting system because they feel it kept in their file.
84	437	Nurse	What the hospital says and does are two different things. I feel a big part of good quality care is looking after staff. We do not have temporary staff in times of crisis so all staff work overtime. And the hospital issued a memo saying staff are not allowed to refuse the allocated overtime shifts. Staff therefore are overworked and patient care is at risk. Workload is real problem for patient safety and still no problem solving. Double check procedure for patients is absent i.e. there is no question of elective surgery or elective admission about patient identifications. Under these conditions staff take short cut in practice to cope with the increase workload. Basic practice principles are lost.
85	447	Nurse	Patient safety is the first top priority. Reporting immediately about errors. Provide good quality.
86	453	Nurse	No comments and thank you
87	468	Nurse	Patient safety is one of our major goals in the hospital. We have policies and procedures regarding all aspects regarding patient safety. (+) 2 themes
88	469	Nurse	We often write errors because that is not used for punching people it is for improving and teaching staff member thus improving safety. (+) one theme (report errors and learning from errors (organisational learning not punching people).
89	473	Nurse	Any type of report incident is not regarding as punitive in my hospital. Some of the staff still get worried that the reported mistakes they made go to their files for future response. Reporting incidents is only for correction and improvement purpose not carried over to any staff evaluation. (+) 4 themes.
90	477	Nurse	Patient safety should be first top priority. Reporting immediately any medication errors. Provide good quality of patient care. (+) 3 themes.
91	482	Nurse	Workload effect patient care negatively.
92	491	Nurse	Patient safety awareness has recently only become an important issue as we are being accredited
93	495	Nurse	Most of the errors have been reported but most of staff are taking reporting errors in negative way not in positive one. We should continue reporting errors

94	498	Nurse	Patient safety is number one priority. Supervisors enhance staff to protect patient safety. Thank you.
95	500	Nurse	Do not have good reporting system. No feedback given. Focus on individual rather than systems. No quick response. Communication breakdown. Blame culture exist. Thank you. (-) 7 themes.
96	502	Nurse	I believe patient safety should be maintained all the time. There is workload too many admissions of patients with limited bed capacity. More papers work than nursing your patients.
97	536	Nurse	It does not seem to help if we spoke up onset any problems, our supervisors listen to us nut there is not too much action taken, honestly they will print out on specific person and they will not see that there is too much pressure put in nurses.
98	543	Nurse	All the staff waking together with management to improve patient care. Hospital has good training for staff to upgrade their knowledge. Hospital has new program for the new staff which is very good. All the staff had very high level of confidence when they work in unit. Staff can get latest information from internet.
99	551	Nurse	The management /supervisor must dial with issue with more sensitive of staff who is involved with mistakes/errors in the unit. Majority of the staff feels threaten and fear of punishment in their workplace. Errors should be investigated rather than blame of staff.
100	553	Nurse	The most common error that we are not reporting the near miss errors. It is very important for next time to know how to avoid errors. Thank you Allah help you.
101	560	Nurse	When a mistake or error happens in the unit it is sometimes or most of the time blamed on the nurses, the person is the one being written up and talked about rather than the problem. It should be about the problem or the system and not the person involved.
102	571	Doctor	Thank you for this survey. I think in our institution the patient safety is considering top priority in comparison to other local hospitals. One of disadvantage of reporting errors is that most of staff of the hospital think that is considering personnel and will be recorded in the personnel file.
103	594	Doctor	There is a chance for analysing errors which help to improve patient safety.
104	601	Nurse	Some times staff are not working for improving patient safety. There is no proper communication and cooperative between staff
105	609	Nurse	We do more paper works than providing good and safety care for patients.
106	614	Nurse	Reporting system is important that enable us to give feedback an incident report.
107	620	Nurse	Patient safety is our aim but it is important to activate reporting system and avoid blame and fear from reporting errors. Also mangers role should be supportive to provide safe and good care for patients.
108	635	Nurse	Patient safety education is important for staff and for patients as well.
109	650	Doctor	I hope when the researcher is done the results it becomes start on real life to make it useful for patient safety improvement.
110	658	Nurse	Patient safety is one of the major objectives that every member of the staff in this hospital is aiming to achieve. There are a lots of patient safety programs about patient safety that are followed working towards ensuring patient safety. Errors and events are reported.
111	680	Nurse	Patient identification is very important issue to prevent errors.
112	710	Doctor	I remember one patient who was admitted by mistakes to isolated room for RSV+VE bronchitis patient while the patient was RSV-VE bronchitis. The patient condition was getting worse more respiratory distress, required O2 therapy review by paecl. Pulmonary service who discovered this mistakes, because patient got RSV+VE bronchitis direct contact e RSV+VE bronchitis patient in isolated room in hospital and the patient stayed long time in hospital unit improved (high risk patient). This event was reported.
113	720	Nurse	All is well.
114	721	Doctor	Every individual in medical team must work for patient safety which is goal of our profession.
115	736	Nurse	When problems occur in our area it is solving urgent away to prevent future damage. Good luck with your research.
116	756	Nurse	Enough staff to prevent any errors.
117	763	Nurse	Thank you . failing down the most common risk for the patient in my hospital, so we hope to increase the safety to all patients in the hospital.
118	769	Nurse	The utilisation of opportunity report in our unit is very essential as an excellent tool in

			maintaining patient safety a top priority. Some staff feel that errors held against them which prevent them to report errors.
119	771	Nurse	We need more staff to give the care to patient completely. Thank you
120	775	Nurse	In order to achieve the mission and vision of the hospital patient safety remains a priority in order to avoid errors. Staff feel the reports will be against them. Report should be focused on the problem not to the person who made the error.
121	797	Nurse	The hospital management promotes the patient safety by providing the staff with useful information through seminars and research. All the units and staff coordinate well with each other to provide safe patient care.
122	798	Nurse	Our hospital motto is patient first; we try our best to commit mistakes and if so happens to correct it immediately. If a mistake was committed opportunity report is done not to punish the person involved but to find a way to avoid committing the same mistakes again.
123	801	Nurse	Some important information was not completed such as consent form and patient identification.
124	806	Nurse	To be honest I think we spend too much time filling out papers and forms when we could be directly tending to our patients.
125	815	Nurse	This hospital implements more paper works which affect negatively patient acre. Compulsory overtime which excludes the working time in a week.
126	828	Nurse	I personally feel that the hospital documentation system took more time and efforts from the staff instead of giving more attention and time to patients.

This qualitative data has not analysed completely because the most important is psychometric analysis however, it will use in future.