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**ENTERAL NUTRITION IN THE CRITICALLY ILL. A MIXED-
METHODS STUDY OF ADHERENCE TO EVIDENCE-BASED
PROTOCOLS, NURSING RESPONSIBILITY AND TEAMWORK**

by

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Abstract

Objectives: this study aimed to assess nurses' practice and perception of their knowledge, responsibility and documentation in relation to enteral nutrition in the critically ill and to explore nurses' attitudes towards establishing evidence-based practice and teamwork in three health care sectors in Jordan.

Background: poor nursing adherence to evidence-based guidelines has negative consequences leading to higher mortality rates, delayed recovery and longer length of stay. Evidence-based practice and team working is the key to minimising complications and discrepancies between nurses.

Design and methods: mixed-methods strategies were employed. A cluster randomised sample recruited 253 ICU nurse for the survey. Fourteen nurses were selected purposively for the interviews and fifty five patients were involved in bedside observations. Both statistical and thematic analysis findings were integrated and discussed together.

Results: Nurses revealed a tendency to undertake nutritional care despite the recognition clinical nutrition is a secondary role. In terms of nursing processes, nurses showed greater levels of knowledge and responsibility for 'preventing complications' and 'evaluation' more than 'assessment' and 'identifying goals'. However, female nurses scored higher in taking responsibility for 'assessment' and 'planning' than male nurses. The internet and clinical experience were the most effective sources of knowledge along with university education and colleagues.

Nurses showed inconsistency in assessment tasks such as controlling gastric residual volume and confirming tube placements. Diarrhoea was the most frequent complication followed by abdominal pain, vomiting, tube dislodgment, weight loss. However, nurses realised that the incidences of complications is less likely when applying such evidence-based protocol for enteral nutrition.

Multidisciplinary team work was introduced as a source of evidence-based practice and establishing a nutritional team contributes to a greater nursing involvement in decision making. Poor cooperation and interaction within the team prohibits standardized care and increases the imparity in nursing practice.

Conclusion: increased nursing awareness of nutritional assessment through providing training programs and surveillane of clinical performance is necessary. Management should be concerned with offering an accessible source of knowledge, the required equipment and documentation systems. Enhancing collaboration between health care providers and offering appropriate counselling should also be emphasized.

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List of abbreviations

Abbreviation	Meaning
ASPEN	American Society for Enteral and Parenteral Nutrition
BAPEN	British Association of Parenteral and Enteral Nutrition
BMI	Body Mass Index
CREST	Clinical Resource Efficiency Support Team
CVA	Cerebrovascular Accident
EBP	Evidence-based Practice
EN	Enteral Nutrition, Enteral Feeding
GIT	Gastrointestinal Tract
GRV	Gastric Residual Volume
HOB	Head of Bed Elevation
ICU	Intensive Care Unit
LOS	Length of Hospital Stay
MOH	Ministry of Health-Jordan
MV	Mechanical Ventilation
NGT	Nasogastric Tube
PEG	Percutaneous Endoscopic Gastrostomy
PN	Parenteral Nutrition
RCT	Randomized Controlled Trial
RMS	Royal Medical Services-Jordan
RN	Registered Nurse
TPN	Total Parenteral Nutrition
VAP	Ventilator-Associated Pneumonia

Chapter one: Introduction

1.1. Introduction

Enteral nutrition (EN) is one of the most efficient nutritional methods in intensive care. It has gained popularity over other nutritional methods in terms of promoting patient immunity and enhancing better survival in addition to its cost effectiveness. Nurses in intensive care are in a key position to maintaining patients' nutritional status at an optimal level and closer to the nutritional goals. However, disparity in nursing practice contributes to developing serious deficiencies and complications resulting from poor nutritional care. Unsuccessful prohibition of these complications drives patients towards serious conditions and delay in recovery. Adherence to evidence-based guidelines and developing a multi-disciplinary team are essential to establish standardize care. By those strategies, the discrepancy inherent in nursing practice can be curtailed and the effectiveness of feeding practices can be improved, reflecting better outcomes.

The aim of this study was to assess nurses' practice and perception of their knowledge, responsibility and documentation in relation to EN in the critically ill and to explore nurses' attitudes towards establishing evidence-based practice (EBP) and teamwork in three health care sectors in Jordan. Critical care nurses' perspectives from different health sectors in Jordan were sought to produce an overview of nursing practice in EN. Using mixed-methods strategies through employing quantitative and quantitative data sources was helpful to achieve that goal.

1.2. Background

Critical care nurses are responsible for delivering prescribed nutrition, fluid and medication safely and effectively (Adam and Batson 1997, Persenius et al. 2008). They are also responsible for ascertaining EN volume and quality of given formulae (Swanson and Winkelman 2002, Higgins et al. 2006). The nursing role in delivering tube feeding usually includes insertion of the tube, if a temporary tube is used; maintenance of the tube, administration of feeding, prevention and detection of complications associated with this form of therapy and participation in assessment of the patients' response to tube feeding (Adam and Batson 1997). Currently, nursing practice related to EN is largely carried out by rituals and personal opinions rather than research based interventions (Williams and Leslie 2004). Therefore, many problematic issues as well as serious complications from EN tubes such as pulmonary aspiration could be minimized and corrected by a comprehensive review of existing research and the implementation of EBP (Williams and Leslie 2004).

EBP in the clinical setting has a significant effect by minimizing variation of practice (Bourgault et al. 2007). Evidence-based guidelines use the results of empirical research along with other type of evidence to standardize practice. These can be achieved by cooperation between multidisciplinary health teams to achieve best practice. For example, by using an aspiration reduction algorithm and EN protocol, aspiration and the incidence of pneumonia could be decreased and also decrease the exacerbation of patients' status and length of stay (LOS) (Bowman et al. 2005).

There are few studies focusing on the role of intensive care registered nurse (RN) and nurses' level of knowledge regarding EN. RNs recorded lower score on taking responsibility, having sufficient knowledge and having support from documentation

of EN (Persenius et al. 2006). Although nutritional guidelines are already established, there is a gap between the recommended practice and the actual practice undertaken by nurses (Kenny and Goodman 2010). Lack of nursing responsibility for nutritional therapy led to insufficient nutritional outcomes (Woien and Bjork 2006). Moreover, the RN's autonomy is more notable in action when selecting the appropriate intervention from a set of actions than sharing other professionals to make decisions (Persenius et al. 2006, Wentzel Persenius et al. 2009).

Lack of co-operation in using evidence-based guidelines is another obstacle to successful nutrition, whereby, nurses feel incapable and less confidence when actively interacting with other staff (Swanson and Winkelman 2002, McMahon et al. 2005). EBP have an impact on reducing the variations in clinical practice (Bourgault et al. 2007, Dobson and Scott 2007, Meyer et al. 2009). Atwal and Caldwell (2006) examined problems associated with poor interaction between professionals. The study revealed that different perceptions of teamwork, different levels of professionals' skills and the dominance of medical power mainly affect staff interaction.

Some nursing practices can contribute to patients being hypo-caloric and under-fed (Marshall and West 2006, Fulbrook et al. 2007). Gastric residual measurement was introduced as the most influential factor associated with under-feeding as well as feeding intolerance. Using prokinetic agents and decreasing feeding rate were also undertaken when delaying gastric emptying, whereas essential nursing interventions such as checking tube placement and maintaining appropriate patients' position were much less emphasised (Pancorbo et al. 2001, Ros et al. 2009).

1.3. Introduction to EN in intensive care

1.3.1. Physiological overview of the nutritional needs in the ICU

Critically ill patients suffer many stress responses which are clinically associated with hypermetabolism and hypercatabolism that occur with increased protein breakdown and hyperglycemia secondary to insulin resistance (Lunn and Murray 1998, Elamin and Camporesi 2009). Therefore, stored nutrients such as fat, protein and carbohydrates are used to compensate the metabolic requirements (Shikora and Ogawa 1996, Lunn and Murray 1998). Critically ill patients also face more nutritional difficulties than other patients due to the presence of multiple pre-existing factors such as fluid overload and hyperglycemia which make nutrition and assessment of nutritional status more complicated (Shikora and Ogawa 1996, Elia and Stroud 2004). In addition, the reduction of serum protein and albumin reduces blood colloid concentration. Therefore, osmotic pressure causes diffusion of vascular fluid into tissues and developing of pitting oedema in lower extremities in the absence of heart failure (Swanson and Winkelman 2002, Turner 2010).

1.3.2. Significance of EN in the critically ill

Typically, EN is considered the preferred method of feeding. Compared with total parenteral nutrition (TPN), the enteral route is safer, has better physiological impact and is less expensive (Campbell and McDowell 2007, Cangelosi et al. 2011). Critically ill patients cannot perform self-feeding secondary to weakness, dysphagia, oral intubations, paralysis, gastric surgery, difficulty in swallowing caused by neuromuscular deteriorations and decreased level of consciousness (Pancorbo et al. 2001, Elamin and Camporesi 2009). EN is the preferred route of nutrition for hospitalized patients when oral nutrition fails (Swanson and Winkelman 2002). Tube feeds are liquefied food fed through a tube inserted into the stomach or small

intestine. They are used when the gastrointestinal tract is functioning but the patient is unwilling or unable to eat normally (Eschleman 1991). EN is also indicated for patients with psychological problems such as severe depression and anorexia nervosa (Stroud et al. 2003). The gastrointestinal tract plays an important role in maintaining immunological function; it reduces infection rate and promotes better survival in critical care patients (Curtis 2007, Barrett et al. 2009). Therefore, EN is used for patients who have at least some digestive capabilities but are unable to consume enough food by mouth (Shikora and Ogawa 1996, Posani 2000). However, EN is contraindicated when patients experience refractory diarrhoea, vomiting, bowel obstruction, and when gastrointestinal tract is not intact (Marlan and Allen 1998, Bistran 2011).

EN has specific benefits such as reducing nosocomial infection, improving wound healing and decreasing mortality (Swanson and Winkelman 2002, Btaiche et al. 2010). Despite the fact that TPN is easily established especially when the majority of critically ill patients have sufficient venous access, EN is superior to parenteral nutrition (PN) and more common in the field of critical care (Elamin and Camporesi 2009, Bistran 2011). This is due to its cost-effectiveness, prevention of intestinal and mucosal atrophy, support of intestinal immunological function, decrease of infectious complications, enhancement of wound healing and the fact that it maintains gut-associated lymphoid tissue (GALT), which can prohibit the translocation of intestinal bacteria into harmful forms (Heyland 1998, Marlan and Allen 1998, Btaiche et al. 2010).

EN also restores gastrointestinal blood flow and improves patients' recovery and

survival (Jeejeebhoy 2002, Curtis 2007). In addition, it has a significant effect in reducing blood glucose level and enhancing glycaemic stability. This could reduce the episodes of hypoglycemia/hyperglycemia and decrease the use of insulin (Campbell and McDowell 2007).

One of the most important characteristics of EN is promoting ‘immune-nutrition’, which is the process of reinforcing and restoring body immune response by enriching feeding formulae with some essential elements such as arginine aminoacid which improve wound healing and immune function, and reduce infectious complications (Lunn and Murray 1998, Jeejeebhoy 2002), omega-3 fatty acid which is also beneficial for inflammatory states, and glutamine aminoacid which is defined as a fuel for gastrointestinal endothelium and some blood elements (Lunn and Murray 1998). Therefore, ‘Immune-nutrition’ can reduce critically ill patients’ likelihood of developing complications, and decreasing the LOS (Posani 2000, Cahill et al. 2011). Prebiotics are indigestible food product like fibres (e.g., oat, and Arabic gum) which activate and enhance beneficial intestinal bacteria functioning when used with EN in addition to its impact on preventing respiratory tract infections (Hegazi et al. 2009, Vouloumanou et al. 2009). In fact, these evidence support the premise that using EN is superior to TPN (Shikora and Ogawa 1996, Lunn and Murray 1998).

1.3.3. Types of EN formulae

The type of formulae chosen, which is determined according to the formula contents and the digestible capabilities depends on several factors such as, patient ability to digest and absorb nutrients, the placement of tube (stomach versus intestine), the nutrient requirements, fluid or electrolyte restrictions and individual tolerance levels

(such as food allergies or lactose intolerance) (Eschleman 1991). In general, it is recommended that protein intake should be between 1.2 and 1.5 g/kg of body weight per day, also, that the proportion of fat to carbohydrates should be 60-70% , 30-40% respectively of total non-protein calories (Joillet et al. 1998). Nutritional support is recommended with optimised protein administration followed by lipids. Finally, to determine accurate energy needs especially in cases of fluid overload and obesity, carbohydrates should be used along with direct calorimetry (Elamin and Camporesi 2009).

1.3.4. Route and method of administration

The route of delivery of EN depends on several factors such as conditions of gastrointestinal tract, the expected length of nutrition and the susceptibility of pulmonary aspiration (Marlan and Allen 1998, Grant and Martin 2000). Nasal intubation is the simplest and most commonly used method for gaining access to the gastrointestinal tract (GIT); this method allows access to the stomach, duodenum and jejunum (Barrett et al. 2009). Table 1.1 shows the advantages and disadvantages of each route of administration.

Naso-gastric feeding tube (NGT) is recommended for feeding duration of less than 30 days and also when an infusion pump is not applicable (McMahon et al. 2005). It is beneficial because it does not need any surgical intervention and it allows accessible checking for gastric residues. However, this method of administration could potentially cause nasal irritation, sinusitis, esophagitis and a high risk for pulmonary aspiration (Marlan and Allen 1998).

Naso-duodenal-jejunal tube placement (post-pyloric route) is used for patients who have a high risk for aspiration. Jejunal feeding requires continuous infusion and it limits patient mobility (McMahon et al. 2005). A post-pyloric feeding tube is recommended for patients with high gastric retention, which restricts using gastric route for feeding to minimise the risk for aspiration (Petros and Engelmann 2006). However, insertion of this tube into the small bowel is considered difficult and there is a risk for tube dislodgment. A study by Welpé et al. (2010) showed that using a jejunal feeding tube under fluoroscopic guidance at the bedside is the fastest, safest and also has a high success rate when carried out by well trained ICU staff. The median insertion time was 17 minutes with total of 141 minutes taken from the decision to place the tube until commencement of EN. The technique scored higher success rates of 84.2% with no adverse effects reported (Welpé et al. 2010). A *gastrostomy tube/ Percutaneous Endoscopic Gastrostomy* (PEG), which is inserted directly into the stomach through the abdominal wall, is indicated for patients with severe neurological disorders of swallowing such as cerebrovascular accident (CVA) and cognitive impairment. In addition, a gastrostomy tube is recommended for a long term nutritional plan (Stroud et al. 2003).

The method of administration is influenced by the site of feeding, patients' condition, use of a feeding pump, type of formulae and patient mobility (Marlan and Allen 1998, Grant and Martin 2000). Table 1.1 reviews all methods of administration showing the advantages and disadvantages of each.

Bolus feeding is used for gastric feeding. The amount of formulae between 240-400 ml is delivered within a short period (5-10 min) every 4-6 hours. However, it should

not exceed 450-500 ml per feeding (Bourgault et al. 2007). This method allows more ambulation when there is no need for infusion pump. On the other hand, it is associated with delayed gastric emptying, gastric distension, increasing the risk for vomiting and aspiration, and diarrhoea that eventually may lead to metabolic disturbances. In addition, it should not be used when feeding is given through small bowel to avoid feeding intolerance (Marlan and Allen 1998, Kennedy 1997, Marshall and West 2004).

Intermittent feeding has similar characteristics in terms of advantages and disadvantages to bolus feeding except that it can be administered over a longer period (15-30 min). Intermittent and bolus feeding could minimise the risk for respiratory tract colonisation when feeding is provided intermittently. This process permits the stomach to restore its acidity rather than inhibits acids production by continuous feeding (Marshall and West 2004).

Continuous feeding is generally given during the day by continuous infusion using either gravity or pump. It is also applicable through a post-pyloric feeding tube (Grant and Martin 2000), and it can be initiated at 30 ml/ hour and increased every 4-8 hours by 25-30 ml until the desired goal is met (Marlan and Allen 1998, Bourgault et al. 2007). Continuous feeding contributes in achieving better caloric intake than other methods, but the problem of recurrent feeding cessation for any reasons still challenges critical care staff and creates a discrepancy between the prescribed and delivered nutrition (Marshall and West 2004).

Some clinical evidence recommends shifting feeding to continuous pattern if diarrhoea is developed as a result from the method of administration or formulae. In this situation, intermittent feeding becomes less appropriate (Btaiche et al. 2010). Contrary to the last assertion that switching feeding from intermittent bolus to continuous infusion may help to reduce the incidence of diarrhoea, a randomised controlled trial conducted by Lee and Auyeung (2003) showed no significance difference between a group of intermittent bolus fed patients and a group that was changed from intermittent to continuous feeding in terms of alleviating diarrhoea.

Table 1.1: EN routes and methods of administration

Routes of delivery	Indication	Advantages	Disadvantages
<i>Naso-gastric tube</i>	For feeding duration less than 30 days. When infusion pump is not applicable.	Does not need any surgical intervention. Allows for checking of gastric residues easily.	Could potentially cause nasal irritation, sinusitis, esophagitis and a high risk of pulmonary aspiration.
<i>Naso-duodenal-jejunal tube</i>	Recommended for patients' with high risk of gastric retention.	It lowers the risk of aspiration. Avoid gastric retention.	Insertion of tube is considered difficult. Risk of tube dislodgment. Limits patient mobility.
<i>Gastrostomy tube</i>	Indicated for patients' with severe neurological disorders of swallowing such as CVA, cognitive impairment and long term nutritional care.	More applicable for long term nutrition. It decreases the risk of aspiration and tube complications.	May cause local site inflammation, peritonitis, gastritis and gastric retention.
Method of administration			
<i>Bolus feeding</i>	Used for gastric feeding, 240-400 ml is delivered within a short period (5-10 min) every 4-6 hours.	Allows more ambulation. Minimise the risk of respiratory tracks colonisation.	Could lead to aspiration, delayed gastric emptying, gastric distension, increasing the risk of vomiting, aspiration and diarrhoea.
<i>Intermittent feeding</i>	For feeding administered over a longer time (15-30 min).	Same bolus feeding and it could minimise the risk of respiratory tracks colonisation.	Same bolus feeding
<i>Continuous feeding</i>	For feeding delivered over day, recommended for a post-pyloric feeding tube and patients with high GRVs.	Contributes to achieving caloric intake easier than other methods.	Problems of recurrent feeding cessation, under-feeding, metabolic and electrolytes disturbances.

However, bronchial aspiration is more associated with high gastric residues , which can be minimised by prolonging the duration of feeding during a day to decrease the amount of retained contents (Thorborg 2001, Wah Lee and Auyeung 2003). However, this study did not clearly define the effect of *Clostridium difficile* as a main reason of causing diarrhoea and how they detected the source of diarrhoea. Therefore, the study becomes methodologically less valid in terms of controlling confounding variables and contradicting the common assertion.

1.3.5. Complications of EN

Providing nutritional support for critically ill patients via EN encounters some obstacles. Patients who receive EN might suffer several complications such as diarrhoea (defined as more than three defaecations a day), vomiting, constipation (less than one defaecation a day for three consecutive days), lung aspiration (verified by clinical or radiological signs), tube dislodgment, tube clogging, nasal ulcer (loss of nasal skin integrity), hyperglycaemia (blood glucose level above 200 mg/dl), electrolyte alterations (e.g. Na, K, and Ca) and anxiety (Pancorbo et al. 2001, Madigan et al. 2002).

1.3.5.1. Complication classification

Most of these complications can be classified into access problem and feeding intolerance (Jeejeebhoy 2002) as follows:

Access problems are determined by gastric mobility, electrolyte imbalance, gastritis, peptic ulcer, risk for gastric regurgitation and risk for aspiration (Jeejeebhoy 2002).

Prokinetic agents such as metoclopramide or erythromycin can be used to improve

gastric empty in case of high gastric residues (Bourgault et al. 2007). However, prokinetics are not always efficient to treat high GRVs and therefore the signs of feeding intolerance should be detected (Romand and Suter 2000).

Feeding intolerance is associated with diarrhoea, abdominal bloating or distension. This may develop with poor digestive function. Particularly, it may be associated with formulae osmolarity, fat content, infusion rate, malabsorption, lactose intolerance, low serum albumin, and bacterial contamination (Jeejeebhoy 2002, Btaiche et al. 2010). Petros and Engelmann (2006) showed that the mortality rate in a prospective observational study was significantly higher among patients with gastrointestinal intolerance.

Alternatively, EN complications are classified into four groups; mechanical, gastrointestinal, metabolic, and infectious complications (Marlan and Allen 1998):

- *Mechanical complications* occur with dislodgment, occlusion, or misplacement of feeding tube. These could lead to life threatening pulmonary complications and failure of administration.
- *Gastrointestinal complications* should be taken into account when diarrhoea (the most common gastrointestinal complication), constipation, gastric distension and bloating and delayed emptying of gastric residues are reported (Stechmiller et al. 1997, Elpern et al. 2004, Btaiche et al. 2010). There is, however, a misconception that diarrhoea occurs as a result of tube feeding. It may occur as a result of some medications (e.g. antibiotic-associated diarrhoea), excessive formulation (over-feeding), use of hypertonic formulae, bacterial contamination and

hypoalbuminemia (Marlan and Allen 1998). However, to resolve the problem of diarrhoea, as it is non-infectious in origin; fibre-enriched formulae is recommended to promote bowel regularity (Elpern et al. 2004). On the other hand, nausea, vomiting and diarrhoea potentially occur when the infusion rate exceeds 50 ml/h (McClave et al. 2009, Adam and Batson 1997).

- *Metabolic complications* are another crucial issue in EN, including electrolyte abnormalities that caused by fluid excess or depletion, inadequate free fluid, or excessive renal lose, in addition to hyperglycaemia which results from hyper-metabolism or poor glucose control. Hypoglycaemia is caused by frequent feeding interruption for patients' receiving insulin (Marlan and Allen 1998).
- *Infectious complications* are mainly represented by aspiration pneumonia, which occurs in 40-75% of patients with feeding tubes. High risk for aspiration is developed particularly when patients are kept in supine position. However, it can be avoided by providing sufficient airway management, regular monitoring for gastric residual volume, proper upper body elevation (30-40°), or using a semi-recumbent position. These nursing interventions have shown a significant reduction in gastric content regurgitation (Heyland et al. 2003 , Bourgault et al. 2007).
- *Bacterial contamination* is a problem that arises through poor formulae preparation, administration and storage (Sanko 2004). Contamination of EN system starts from the first point of contact with feeding bottle and feeding tube reaching to the patient gut. Contamination of feeding should be recognised as a critical issue in ICUs because it may causes diarrhoea, vomiting, feeding intolerance and fever as a result of microbial transmission to feeding formulae (Mathus-Vliegen et al. 2006).

- Another adverse effect of EN is associated with gastrointestinal ischemia in patients who are haemodynamically unstable when difference between gastric mucosal PCO₂ and arterial PCO₂ is increased (Shikora and Ogawa 1996, Lunn and Murray 1998, Jeejeebhoy 2002).

1.4. Overview of Jordanian health care system

Jordan offers a good quality of health care in the Middle East that covers more than 95% of the population in rural and urban areas (WHO 2006). In Jordan around 6 million people in whom 82% of them live in the cities and the rest reside in the rural and Bedouin areas. 38% of Jordanians live in Amman, the capital of Jordan. Health care system in Jordan is divided into three main sectors; general (governmental and military), private and charitable sector (MOH 2006, WHO 2006). These sectors comprise of 106 hospitals, more than 11,000 beds and employ 20,000 registered nurses (MOH 2010).

The general sector includes the Ministry of Health (MOH), Royal Medical Services (RMS) and the governmental University Hospitals. MOH provides the primary, secondary and tertiary health care services and operates 31 hospitals and more than 4500 beds in all governorates in Jordan. MOH owns 37.1% of the total number of beds in Jordan. Al Basheer hospital which is located in Amman is the biggest medical centre which refers to the MOH and operates around 1000 beds. RMS also provides the primary, secondary and tertiary health services and comprises 12 hospitals occupy about 20.5% of the total beds in the kingdom. The university hospitals are strategic partners in delivering health services in Jordan. The two university hospitals have the capacity of 9.4% of the total beds (WHO 2006, MOH 2010). The private sector includes 61 hospitals accommodate 3888 beds and represents 33.0 % of the total

number of beds. The private sector contains much of the country's medical expertises, technologies and extra facilities that attract patients from neighbour countries. Finally, the charitable sector (i.e. UNRWA) provides only the primary health services through primary health care centres and there is no concrete facilities provided by them for advance medical illnesses (MOH 2006, MOH 2010).

The majority of Jordanians are medically insured whether by the government or private insurance companies. Because critical care services are regarded as tertiary health care, a wide range of critical care facilities are provided by the governmental, military and private sector that offer treatments for all critically ill patients, including medical and surgical interventions. The average overall hospital LOS in Jordan is 3.3 days which is considered a challengeable issue in term of cost effectiveness (MOH 2006).

1.4.1. Challenges encounter human resources in health care

The following issues impede the development of health care system in Jordan (MOH 2006, WHO 2006, MOH 2010):

- Attrition of highly experienced and trained personnel.
- Frailty in the individual and institutional evaluation systems.
- Absence of professional self-development strategies.
- Insufficient budgets for staff training and conducting of scientific research.
- The issue of low wages in all sectors.

Therefore, health policy makers in Jordan endeavour to employ the following issues in the forthcoming developmental programs (MOH 2010):

- Working to adopt standardized protocols for different health care interventions.
- Maintaining staff training and continuous education programs.
- Supporting scientific research.
- Developing and improving nursing and midwifery colleges.
- Offering incentives for all health care providers.
- Attaining the beds/persons ratio into 21.3bed/10,000 person and nurses/persons ratio into 20.9nurse/10,000 person in 2017.
- Reactivating the strategies of quality assurance in health care system.

1.5. Conclusion

This chapter outlined the purpose of the study. A brief description of nursing practice in the intensive care was provided to highlight the issues of poor nursing adherence to evidence-based recommendations in relation to EN in the critical care. An overview of the physiological needs for supportive nutrition in intensive care and evidence of how EN becomes superior to other nutritional strategies were illustrated. EN types, routes and methods of administrations, and tube feeding complications were also explained. The last section introduced health care services in Jordan showing different sectors and the obstacles facing the development of health services as well as the prospective goals of the future health developmental strategies.

The next chapter will focus on issues surrounding nutritional care in details, using searching and critical appraisal strategies for existing literature. Then, integration between literature and study objectives will be provided to justify the reasons for conducting this study.

Chapter two: Literature review

2.1. Introduction

This chapter provides an overview of the relevant literature associated with EN in the critically ill to gain in-depth understanding of nursing care in this area of practice. The purpose of this chapter is to retrieve and critically appraise studies surrounding EN and its associated practices in critical care. In addition, this chapter focuses on the issues that impede delivering EN in safe and successful ways, showing the gap in nursing practice and other factors associated with tube feeding complications. The critical review of the previous literature helps to justify the objectives of this study and assists to generate research questions.

2.2. Search strategy for identification of studies

Before describing the strategies for retrieving literature, the format of (PICO) questions was used to guide the process of literature extraction (Aveyard 2007) as follows:

P: Problem

I: Intervention

C: Comparison (Optional)

O: Outcomes

Systematic searching represent a crucial step in enhancing external validity (matching of the study findings match with former studies), because it is based on replications across different time, setting and people to verify whether relationships between variables exist (Popary et al. 1998, Polit and Beck 2008). This format is compatible with the research structure; it initially describes the phenomena (i.e. EN practice) and then suggests solutions (for malpractice). Indeed, it is a way of managing and

organizing the search technique to determine the goal and to avoid redundancy of data that are irrelevant to the main purpose. The application of the PICO model works well for questions concerned with health care interventions as well as planning the search strategy (Beecroft et al. 2010).

Example of PICO model:

Increasing the incidence of patient complications while using EN leads to serious illness (**Problem**), does nursing adherence to evidence-based guidelines for EN (**Intervention**) limit the occurrence of patient complications and minimize discrepancy in practice (**Outcome**)?

2.2.1. Electronic data bases

The following online data bases were used between 1995- 2011:

- CINAHL via EBSCO
- MEDLINE via OvidSP
- Cochrane Library (Systematic reviews of research in health care)
- Other search methods: *Google Scholar* web search engine was used to support searching in the previous data bases. Some relevant studies which have not been published can be retrieved from different sources such as academic theses, dissertation and professional reports. Non-English studies were considered if at least abstracts were translated into English.

2.2.2. Inclusion criteria:

The main criteria for selecting studies representative of critically ill patients requiring EN support were:

- Various methodological designs were sought such as RCTs, controlled trials, observational studies, prospective and retrospective studies, case control studies, cohort studies, systematic reviews, and qualitative studies.

- The date of publication should not exceed 15 years.
- Adult patients' research is desired (18-65 years).
- Intensive care units are the main settings for the studies.
- Studies published in peer-reviewed Institute for Scientific Information (ISI) Indexed journals.

2.2.3. Exclusion criteria

The following aspects are excluded from the searching process:

- Studies of chronic illness treatment like 'nutrition in home care settings'
- Studies of parenteral nutrition.
- Paediatric patients, geriatric patients, and EN for animals.

2.2.4. Keywords and samples of searching strategy

The next step after formulating the PICO questions is making a list of all phrases and words required to search for PICO elements (Beecroft et al. 2010). According to the aims of the study which focused on EN in intensive care, thesaurus searching involved the following synonyms:

- EN, Nasogastric Feeding, Nasal/oral/gastrostomy enteral nourishment.
- Intensive Care Unit (ICU), Critical Care Unit.
- Protocol, Guideline, Algorithm, Measures.
- Nursing (Role-Knowledge, Perception, Responsibility, Measurement).
- Discrepancies in nursing practice.
- Outcomes such as mortality, length of stay (LOS), and complications.

Examples: 1. *EN AND protocols OR guidelines*

2. *Intensive care OR Critical care AND EN*

3. *Critical care nurse OR role of ICU nurses AND EN WITH algorithm.*

2.3. Technique of critical appraisal

There are many established ways of appraising literature critically. In this study, **CASP** (Critical Appraisal Skill Program) which was published by the Public Health Resources Unit, England (2006) was used to perform evaluation for each selected study according to their methodological and analytical aspects. Consequently, based on this program, each methodological design has a unique appraisal form. Further, the recommendations of the Joanna Briggs Institute for Evidence Based Nursing and Midwifery were used in classifying literature, and each recommended practice was classified into a level of evidence according to the source of research which is taken from (The Joanna Briggs Institute, 2002). Table 2.1 shows the levels of evidence used in classifying literature.

level	Description
I	Evidence taken from a systematic review of all relevant RCTs.
II	Evidence taken from at least one appropriately designed RCT.
III.1	Evidence taken from well-designed controlled trials, not randomized.
III.2	Evidence taken from comparative studies such as cohort studies, case control studies from more than one research group or centre.
III.3	Evidence taken from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments.
IV	Evidence taken from opinion of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

Adapted from the Joanna Briggs Institute for evidence based nursing and midwifery (2002).

2.3.1. Data extraction

Different ways of managing EN administration have been established from various professional perspectives. Primarily, all relevant research findings that demonstrate the impact of nursing interventions on enterally fed patients' physiological and nutritional status were included. Also the effect of using different feeding strategies (i.e. protocols, guidelines, or algorithms) to assess the effectiveness of treatment were included.

Of 795 retrieved studies, 96 studies were included in the review. Fig. 2.1 shows the process of selecting studies in the literature review which adopted a format used by another systematic review article (Vouloumanou et al. 2009).

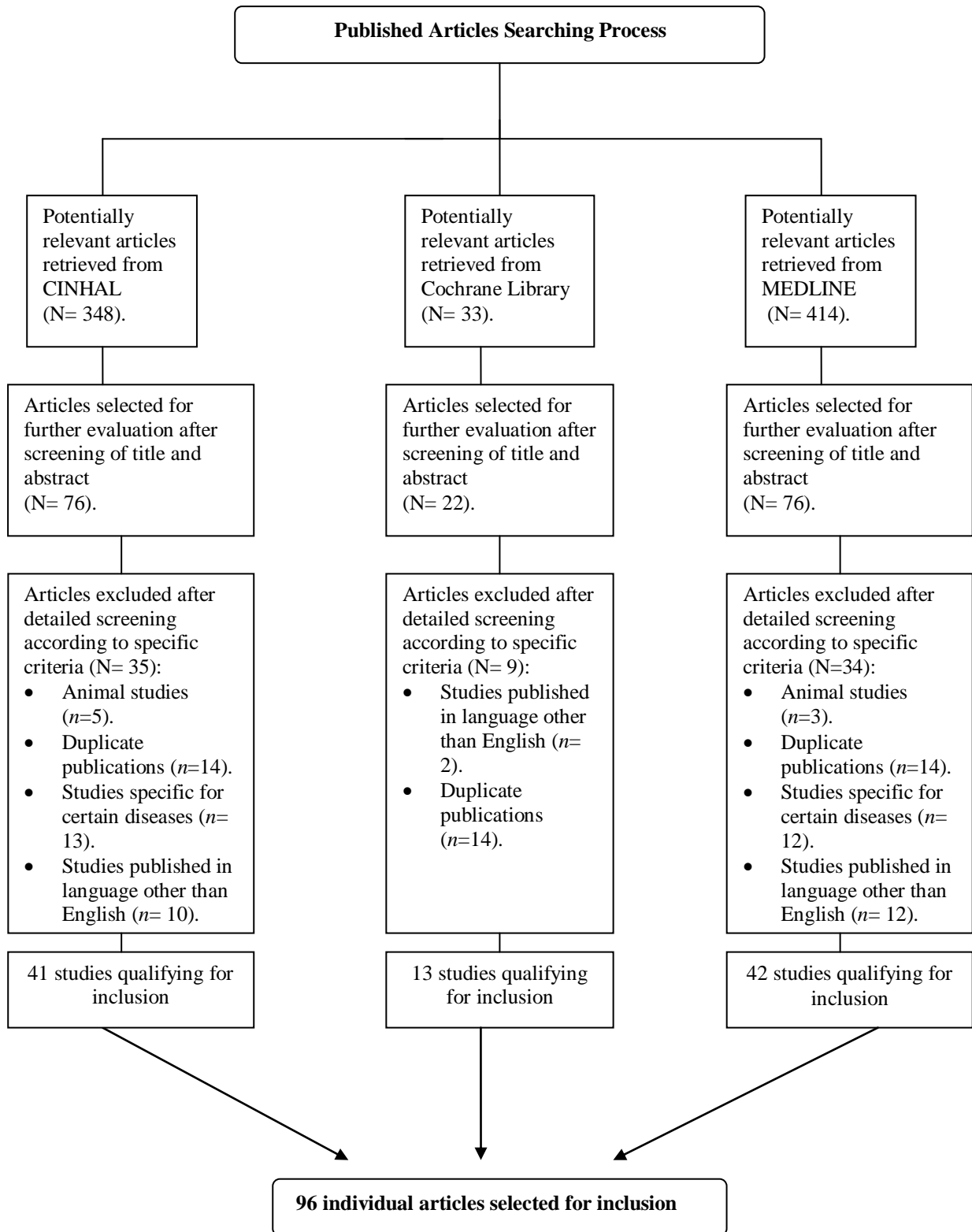


Figure 2.1: The process of selecting studies included in the review.

2.4. Common practical issues associated with EN

2.4.1. Nutritional assessment

Weight loss, history of nutritional intake, the severity of illness, and the function of GIT, are all parameters that should be assessed prior to admission instead of albumin and pre-albumin measures (McClave et al. 2009, Btaiche et al. 2010). The frequent assessment of Body Mass Index (BMI) should also be measured by dividing weight in kilograms by the square of the height in meters (Normal range 19-25). However, a BMI <14 at the time of ICU admission may indicate poor survival rate (Elamin and Camporesi 2009). A review by Joillet et al. (1998) reinforced the importance of nutritional assessment as the first step of EN. Practical elements of nutritional assessment for critically ill patients comprise the evaluation of both patient history (e.g. chronic diseases, recent weight loss, low food intake, drug abuse and alcoholism) and assessment of the present condition (e.g. diseases associated with hypermetabolism, signs of malnutrition and BMI).

Anthropometric data such as skinfold thickness and triceps-mid-arm circumference are useful measurements but are often not applicable with intensive care patients. Also, creatinine height index which relates the creatinine level to the height is not recommended for critically ill patients due to the high incidence of fluid overload and renal dysfunction (Cottrell and Asturi 2004, Elamin and Camporesi 2009). Understanding nutritional parameters required for chronically ill patients is essential for long-term treatment. Chronically ill patients usually suffer from a deficiency in albumin and haemoglobin level and low caloric intake caused by inadequate nutritional calculation (Higgins et al. 2006).

2.4.2. Early initiation of EN

EN should be initiated immediately for critically ill patients who are unable to keep oral intake and should be started as early as possible within the first 24-48 hours from admission (McClave et al. 2009, Ridley and Davies 2011). Marik and Zaloga (2001) investigated the effect of early EN in lowering infectious and non-infectious complications, LOS and mortality rate compared with late EN. Meta-analysis was carried out on 15 randomized-controlled trials (RCTs) to verify the efficiency of early versus late EN. The findings of this study revealed that early EN was significantly associated with less incidence of infection (RR 0.45, 95% CI 0.30-0.66, $p < 0.001$) and reduced LOS (mean reduction of 2.2 days, 95% CI 0.81-3.63 days, $p = 0.004$). However, there were no significant differences in its effectiveness on non-infectious complications or mortality between the two groups of patients.

A multifaceted clinical practice guideline was assessed in a cluster RCT study. This study used evidence of EN practice from the literature. The study which was carried out over a year in Australia and New Zealand in 36 ICUs had included 1118 critically ill patients assigned equally into guideline and control groups. The findings showed that the guideline patients who were fed earlier (mean days to start EN 0.75 vs. 1.37, respectively, $p < 0.001$) had achieved caloric goals more often than the control group ($p = 0.03$). However, both groups did not differ in respect to the mortality rate and LOS ($p = 0.75$, 0.97 , respectively). The study suggested developing evidence-based nutritional guideline that promote early EN and greater nutritional adequacy (Doig et al. 2008).

Likewise, a prospective observational study conducted by Woo et al. (2010) determined the effect of early EN on LOS in intensive care; 36 patients were assigned equally into two groups under strict inclusion criteria; early EN group and delayed EN group. The study showed that early EN had a significant impact on critically ill patients in provision of LOS, which was less in the early feeding group, and the prolongation of mechanical ventilation (MV) use, which also was significantly less among those patients. Moreover, the incidence of new case of pneumonia and hospital mortality rates were fewer within the early EN group when compared with the delayed group (Woo et al. 2010).

This confirms the earlier premise that starting EN earlier can reduce septic and non-septic complications as well as improve healing of critically ill patients recovery (Marik and Zaloga 2001, Doig and Simpson 2006, Owens and Fang 2007). Also, it reinforces the theory of early EN (within 24 to 48 hours of hospital admission) which attenuate the hypermetabolic response (Marlan and Allen 1998, Ros et al. 2009, Btaiche et al. 2010, Moser 2010).

2.4.3. Using EN alongside PN

EN can be used in parallel with PN within the same therapeutic plan. However, PN is recommended in the following circumstances: after the first seven days of hospitalization, if EN is not available or failure to meet energy and caloric requirements after 7-10 days. It can also be initiated concurrently with EN as a supportive nourishment (Silk 2003, Heyland and Dhaliwal 2005, McClave et al. 2009).

A study by Singer et al (2009) generated an evidence-based recommendation for using PN in patients who cannot be initiated with EN within 24 hours of ICU admission or injury. PN should be started within 24-48 hours for patients who are not expected to be fed normally within three days when EN is contraindicated or when the patient encounters problems to tolerate EN (Singer et al. 2009). Therefore, PN is one of the strategies that can be used with EN to reduce the effect of energy deficit due to EN intolerance (Peter et al. 2005, Simpson and Doig 2005, Ridley and Davies 2011).

However, Dhaliwal et al (2004) conducted an evidence based meta-analysis to identify the effect of using PN and EN concurrently compared with using EN alone. Five of eleven RCTs studies were aggregated based on methodological characteristics. The study revealed that the combination between EN and PN had no effect on mortality (RR 1.27, 95% CI 0.82-1.94, p=0.3). Furthermore, starting PN at the same time as EN had shown to have no clinically significant benefits or changes in terms of complications and LOS for critically ill patients who had intact gastrointestinal function. On the contrary, using PN and EN was associated with higher cost than using EN alone (Dhaliwal et al. 2004). This study supports the previous assertion that PN should be undertaken in cases of failure of EN to meet patients' nutritional demands.

2.4.4. EN with MV

Most critically ill patients are maintained on MV which could affect the effectiveness of EN in mechanically ventilated patients (Altintas et al. 2011). A prospective controlled trial by Ibrahim et al. (2002) was carried out on 150 critically ill patients to identify the relationship between early versus late EN for mechanically ventilated

patients and the occurrence of ventilator-associated pneumonia and diarrhoea. Surprisingly, patients who started EN earlier had significantly a greater incidence of ventilator-associated pneumonia than patients with late EN (49.3% versus 30.7%, $p=0.20$). Furthermore, diarrhoea associated with *Clostridium difficile* infection showed the same result (13.3% versus 4.0%, $p=0.42$). This study asserted that the incidence of infectious complications and the prolongation of hospital stay were significantly associated with early over late EN for mechanically ventilated patients (Ibrahim et al. 2002). On the contrary, Barr et al. (2004) stated that the implementation of an evidence-based nutritional management protocol has lowered the duration of MV, in-hospital mortality rate and LOS if prokinetic agents are used for high GRV (Barr et al. 2004). This study has examined the effectiveness of this protocol on mechanically ventilated patients. An evidence-based nutritional management protocol has increased the likelihood of critically ill patients to receive EN and to reduce their need to MV (Barr et al. 2004).

Bowman et al. (2005) established and implemented a new 'evidence-based feeding protocol' and an 'aspiration reduction algorithm' for enterally fed, mechanically ventilated patients in the ICUs. This study showed that the optimal exploitation of these guidelines, which mainly focus on managing GRVs and maintaining an appropriate head of bed (HOB) had a great effect on reducing the incidence of ventilator-associated pneumonia (VAP). In addition to lowering the mortality rate, they reduced treatment costs and decreased the LOS along with enhancing nutritional goals. Indeed, continuous assessment of nursing practice through quality improvement programs and staff development are needed to improve using EBP (Bowman et al. 2005).

Similarly, Metheny et al. (2010) evaluated the effectiveness of using ‘Aspiration Risk-Reduction Protocol’ (ARRP) for enterally fed patients with MV. This protocol consists of three approaches: (a) maintain HOB elevation at 30° or higher, (b) inserting feeding tube into distal small bowel, (c) using an algorithm for high GRV. The incidence of aspiration was significantly lower in the ARRP group than that in the usual care group (39% vs. 88% respectively). Pneumonia was also much lower in the ARRP group than another group (19% vs. 48% respectively). The authors recommended the establishing of small bowel feeding access carried out by qualified critical care nurses. In addition to increase staff awareness by providing sufficient training for using this aspiration reduction protocol which dramatically decreases the incidence of aspiration and pneumonia for mechanically ventilated patients (Metheny et al. 2010).

Using prone position in patients receiving MV is widely accepted practice due to its usefulness in improving the oxygenation status and enhancing the drainage of bronchial secretion. Reignier et al. (2010) examined the implications of this position and a new created protocol for those patients. A number of 34 and 38 patients were occupied for a control and intervention groups, respectively. The protocol include the increasing of feeding rate by 25ml/h every 6 hours until reaching 85ml/h, elevating HOB 25° in prone position and using prophylactic erythromycin (prokinetic agent) when lifting patient to improve gastric empty. The study showed that those patients in the intervention group were received larger feeding volumes ($p < 0.001$) without increasing GRV, vomiting or VAP (Reignier et al. 2010).

Another study by O'Meara et al. (2008) evaluated factors associated with EN interruption in critically ill patients with MV. They found that those patients on MV received approximately 50% of their prescribed caloric needs resulting from inappropriate feeding interruption. Factors associated with feeding interruption include problems with small-bore feeding tube, GRV, weaning process, preparation for surgery, shock, radiology and bathing (O'Meara et al. 2008).

Although the previous studies were not RCTs, they showed a robust adherence to such methodological characteristics and sufficient sample size, excluding the possible confounding factors that might yield false positive results. However, a clear description of techniques used to detect complications (e.g. pneumonia) should be clarified to confirm the incidences rates accurately.

2.4.5. Using EN with multiple disorders

The use of EN in patients with complex or multiple disorders was evident. Decreasing CO₂ production in patients with respiratory failure, which is usually associated with high carbohydrate formulae, is achieved through providing low carbohydrate, high-liquid nutrients and high fat formulae instead. However this assumption is still controversial (Elamin and Camporesi 2009). In addition, EN is recommended for patients with pancreatitis, and it should be initiated as soon as fluid resuscitation is accomplished (McClave et al. 2009, Btaiche et al. 2010). However, it is strongly encouraged to discontinue EN if signs of acute pancreatitis are appeared (Marlan and Allen 1998, Petrov et al. 2008). Accurate calculations for protein and caloric intake in patients with renal failure are essential. Nevertheless, there is no clinical evidence to compare the efficacy of renal formulae against standard products (Elamin and

Camporesi 2009). EN is strongly preferred for acute and chronic hepatic patients. Therefore, protein and other amino acids should be fortified (Zarbock et al. 2008, McClave et al. 2009).

2.5. Factors associated with EN complications

2.5.1. Improper managing of GRV

GRV which is the remaining amount of gastric content, must be checked every 4-6 hours for continuous feeding or prior to each intermittent feeding (Padula et al. 2004). Although there is no evidence to support the assumption that if GRV is high, it absolutely indicates impaired gastric function or increased the risk for gastroesophageal reflux leading to pulmonary aspiration (Elpern et al. 2004, Mullin 2011). Measuring GRV is an essential element in EN therapy that should be maintained under the universal recommended threshold of 200-500 ml (McClave et al. 2009). In contrast, uncommon arguments asserted that GRVs could be unmeasured in the ICU. A before-after prospective study showed that the intervention group in whom GRV was not measured had received significantly higher average amount of EN by 100ml. In addition, the incidence of EN intolerance was less frequently reported in the intervention group (Davies 2010). However, this assertion is controversial because it was launched by a non RCT approach, which is more robust and for granted. Also, using a single-centre for data collection produces debates on the applicability of this practice anywhere else.

Metheny et al. (2008) found no consistent relationship between aspiration and GRV. This observational study examined 206 critically ill patients on EN. Patients were categorised into three groups according to the level of GRV (low, medium, and high),

which were also measured every four hours. The study showed no significant relationship between aspiration and GRVs, but, aspiration occurred more often when GRVs are high. Other factors associated with increasing the risk for aspiration were; decreased level of consciousness, gastroesophageal reflux, HOB elevation, sedation and vomiting. Consequently, it is strongly emphasized that GRVs should be measured at 4 hours intervals and other factors that increase aspiration risk should be considered (Metheny et al. 2008, Bourgault et al. 2007, Mullin 2011).

McClave and Snider (2002) claimed that GRVs should not be taken into account for all potential risks for pulmonary aspiration. Nurses perceive arbitrarily GRVs as a good indicator to gastric motility, feeding tolerance, and measuring GRVs consumes a lot of their time. However, many other reasons should be considered along with GRVs to reduce the risk for aspiration such as trauma, head injury, using of sedation, mental instability. Therefore, precautionary cessation of EN when GRVs < 400-500 ml should be eradicated from our practice, because this amount is not actually considered as an absolute risk for aspiration that keeps physicians vigilant for maintaining GRVs at cut-off/threshold point (McClave and Snider 2002).

The previous two studies relied on robust clinical methods that also generated recommendations compatible with EBP. Both methodologies reflect a higher level of validity and reasonable sizes that make these studies clinically acceptable.

2.5.1.1. GRV evidence-based protocols

Dobson and Scott (2007) established a new ‘nurse-led EN algorithm’ for the critically ill patients. This algorithm comprises solutions for higher GRVs and the use of

prokinetic agents at the same time. A prospective audit design was carried out over three months in 106 artificially fed patients who classified into two categories; patients exposed to the algorithm (on-algorithm), and patients referred to the dietician (off-algorithm). Normally, EN is initiated as early as possible within 24-48 hours of admission. Those patients who need special nutritional consultation were referred to the dietician, and the remaining patients stayed on the algorithm. This algorithm advocates using of prokinetic agents as a necessary action when one or more GRVs are above 200 ml. It also solves the problem of overfeeding for patients with chronic diseases such as lung, liver and kidney disorders by maintaining feeding delivery at optimal caloric level (25-30 kcal/kg). The nurse-led feeding algorithm has shown impressive outcomes in attaining nutritional goals especially when patients receive the correct type and volume of the prescribed feed. Finally, it encouraged staff to use body weight as an essential reference for caloric calculations.

Pinilla et al. (2001) compared the difference in the responses of 96 critically ill patients for two different GRV protocols. The first group was adjusted to control GRVs at 150 ml with optional using of prokinetic. The second group was monitored for controlling GRVs at 250 ml with mandatory using of prokinetic agents. Both groups were matched in their characteristics and without feeding complications. The results of this RCT revealed that the incidence of feeding intolerance was significantly less among the second group that adjusted GRVs at 250 ml along with regular using of prokinetic agents (Pinilla et al. 2001).

The previous two studies represent powerful methodological properties, including sufficient sample sizes. In the second study, all patients included in the RCT had no

risk for feeding intolerance; therefore, it might be less applicable for those with persistent feeding intolerance.

On the contrary, regular use of prokinetic agents was less effective in reducing the incidence of nosocomial pneumonia. A double-blind controlled trial found no significant difference between enterally fed patients who received a regular meteclopramide 8 hourly and those who did not in regard to developing nosocomial pneumonia (Nassaji et al. 2010). However, an unequal sample size in both control and intervention groups and using MV for some cases with no clear evidence of using a reliable measure for detecting pneumonia make these results less reliable in relation to use prokinetic agents along with EN. Rather, meteclopramide and erythromycin are widely used prokinetic medications for managing GRV (Ridley and Davies 2011).

A study by Juvé-Udina et al. (2009) examined the effectiveness of ‘reintroducing gastric contents’ in patients with GRV at 250 ml or more. This RCT examined 125 critically ill patients assigned to the return and the discard group. The study revealed that reintroducing gastric contents did not increase the risk of potential complications. On the opposite, this protocol showed a significant effect in maintaining GRVs closer to the physiological level and decreasing the effect of gastric empty delay. However, frequent elevation of GRVs has cautioned from potential complications and electrolyte imbalance (Juvé-Udina et al. 2009).

Woiem and Bjork (2006) examined the effectiveness of a ‘nutritional support algorithm’ for EN in 42 critically ill patients. This algorithm is based on nutritional studies concerned with nursing management for gastric residues. According to this

algorithm, GRVs must be checked every four hours along with detecting the signs of feeding intolerance frequently. The study revealed that patients in the interventional group had received nutrient higher than those in the control group for both prescribed and delivered nutrient ($p= 0.009$ & 0.047 respectively). The 'nutritional support algorithm' enabled nurses to deliver feeding steadily once they perceived GRVs logically. Therefore, feeding rate can be kept at optimal levels with the possibility of increasing that rate gradually. In addition, unnecessary feeding interruption should be avoided (Woien and Bjork 2006).

The previous two RCTs demonstrated acceptable experimental studies in terms of randomization and controlling the confounding factors. However, the second study showed a defect in gathering data simultaneously from both intervention and control groups in addition to its smaller size that requires further attempts to confirm the validity of this algorithm in managing GRVs.

2.5.2. Unnecessary feeding interruption and under-feeding

There was no clear evidence to support the practice that feeding interruption is actually considered a best practice for reducing the incidence of aspiration, (Griffiths 1997). However, to avoid unnecessary feeding cessation during patient positioning, bathing, linen changes, nurses are encouraged to stop EN two hours prior to and after procedures for treatments requiring Trendelenburg position (McClave and Dryden 2003, Bourgault et al. 2007).

During haemodynamic instability, EN should be withheld until the patient has fully recovered; also feeding should be stopped if GRV exceeds 500ml (McClave et al.

2009). However, regardless of the presence or absence of bowel motility, EN should be maintained and unnecessary cessation should be avoided. In cases involving a high risk for aspiration or feeding intolerance, feeding tube should be placed into the small bowel instead of the stomach (McClave et al. 2009, Rohm et al. 2009). In addition, EN cessation should be only considered when regurgitation and aspiration are expected to avoid under-feeding (Ridley and Davies 2011).

Adam and Batson (1997) described restrictions on EN delivery. This prospective descriptive study examined 193 enterally fed patients at five different ICUs in the United Kingdom. They found that the main causes of feeding interruption in the ICUs were gut dysfunction and procedures preparations. Gut dysfunction should be taken into account when reporting high GRV, abdominal distension or vomiting. This study also showed that high gastric aspirate is a reliable indicator to gut dysfunction. However, the amount of GRV had significantly decreased over the first day and other subsequent days from starting EN, indicating that the patients were tolerating gradually. This study indicated the underestimation of the patients' energy requirements and the discrepancy between prescribed and delivered nutrition in the ICUs (Adam et al. 1997).

2.5.2.1. Underfeeding/re-feeding syndrome

Enterally fed patients often suffer from under-feeding (Bongers and Griffiths 2006, Griffiths 1997). Specific factors such as improper use of tube, feeding intolerance and gastric retention are associated with nutritional failure (Binnekade et al. 2005, Petros and Engelmann 2006). These factors could lead to impeding optimal delivery of feeding, especially when a patient receives fewer nutrients than prescribed. Therefore,

it is recommended to increase the amount of nutrients relatively above the prescribed to avoid under-nutrition along with proper managing of GRVs every six hours (Moore and Weisbrodt 2003, Binnekade et al. 2005).

In a study by Jonghe et al. (2001), the overall prescribed and delivered nutrition for critically ill patients were less than the required amounts. This prospective cohort study (observational longitudinal study) identified the discrepancies between prescribed and required feeds and between prescribed and actual delivered feeds in 51 enterally and intravenously fed patients. Delivery of EN was significantly lower compared with PN in term of the prescribed amount and delivered amount (86.8% vs. 112.4%, $p < .001$). This result showed inadequacy in feeding delivery and under-prescription of EN leading to low caloric intake. In fact, interruption caused by digestive intolerance, airway management and diagnostic procedures was strongly associated with the discrepancies between prescribed and delivered nutrition (Jonghe et al. 2001, Petros and Engelmann 2006).

The same issue was investigated by Heyland et al. (2003). This prospective observational study took a place at several critical care units in Canada. The purpose was to describe the current nutritional practice and the opportunities for improvement. A cross-sectional survey involved mainly dietitians working in ICUs and direct patients' records. They concluded that there is a gap between current practice and ideal practice. Most critically ill patients were considered under-fed because of the discrepancy between what was prescribed and what was tolerated. Additional amounts of EN over the prescribed amount had shown not only a greater nutritional status, but also fewer complications and rapid recovery. This also supports the

previous premise that regular increase in feeding rate is required to compensate nutritional deficit in addition to using nurse-directed protocol for EN to meet patients' nutritional needs (Heyland et al. 2003).

Similarly, Lichtenberg (2010) created further techniques to reduce the effect of unintentional malnutrition and caloric deficit due to frequent feeding interruption. The protocol aims to accelerate the infusion rate of the prescribed formulae which is normally given over 24 hours to be delivered over 20 hours. This compensatory, higher infusion rate was investigated on 58 ICU patients (intervention group) compared with 110 patients (control group), who were on traditional infusion rate. The results were that the mean daily delivered volume for the intervention group was 97.3% whilst, 79.7% for the control group ($p < 0.001$) (Lichtenberg et al. 2010).

The previous studies articulate a consensus for a regular increase in the feeding rate to compensate for under-feeding using robust sampling and controlling techniques. However, the studies did not detect the risk for overfeeding which might resulting from frequent elevation in feeding rate that might lead to over-feeding.

Unlike other studies, Briggs (1996) found that ICUs patients who were fed enterally had received more nutrition than prescribed. The study involved 26 enterally fed patients in ICU who were observed over 135 feeding days to assess the amount and caloric of the given feeding. The problem of over-feeding was associated with the discrepancy between dietitians and physicians orders in prescribing feeding. He asserted that there was an inconsistency in using EN guidelines (Briggs 1996). However, because this study examined that issue in a smaller number of patients, it

becomes less valid and inadequate to refute the common assertion. It is strongly recommended to establish an appropriate documentation system to avoid any discrepancies associated with physicians and dietitians prescription in clinical nutrition. Therefore, under-nutrition can be curtailed by establishing a comprehensive practical guideline that embraces all nutritional aspects within a higher level of evidence (Higgins et al. 2006).

On the contrary to underfeeding, nurses should pay attention to the risk of 're-feeding syndrome' which is characterised by severe fluid and electrolyte shifts that may occur when massive nutritional therapy is commenced, carbohydrate and protein are introduced, to malnourished patients (Crook et al. 2001, Ahmed et al. 2011). Although re-feeding syndrome is less recognised in EN, it is accompanied by serious fluid and electrolyte imbalance such as severe depletion in serum phosphorus, magnesium and potassium along with altered glucose metabolism, vitamins deficiency and fluid-balance abnormalities (Marinella 2005, Mehanna et al. 2008, O'Connor and Goldin 2011). The risk of re-feeding syndrome can be reduced as follows: education of hospital staff, identify those patients at risk, start feeding slowly, electrolyte and electrocardiograph monitoring, detecting signs of neurological disturbances such as tremor, seizures and coma due to electrolyte imbalance (Mehanna et al. 2008, Ahmed et al. 2011).

2.5.3. Ineffective aspiration detection measures

Aspiration reduction is a vitally important aspect of EN care. Nursing practice can play an essential role in detecting aspiration by using the following techniques:

Dye method, which is used by discolouring feeding formulae with blue dye to be easily detected when patients are routinely suctioned (Harris and Miller 2000, Bourgault et al. 2007). However, recent studies opposed using this method for its risk for complications and its inaccuracy in detecting aspiration (Sanko 2004, McClave et al. 2009). *Glucose Oxidase Testing* is another tool used for detecting aspiration by checking glucose concentration in tracheobronchial secretion. Once the result is more than 5 mg of glucose per decilitre, it indicates regurgitation of gastric contents into the respiratory system (Robert 2004, Sanko 2004, McDermid and Bagshaw 2010).

2.5.4. Inadequate checking for tube placement

Checking tube placement is one of the most important measures that should be undertaken by nurses to decrease the risk for aspiration. Various methods are used for checking tube placement. Radiographic confirmation of tube placement remains the 'gold standard' and it is still the most reliable and widely accepted technique despite the risk of radiation exposure (Stroud et al. 2003, Williams and Leslie 2005) The pH method is also used for checking tube placement through analysing the pH of gut aspirate (Harrison et al. 1997, Sanko 2004, Gilbertson et al. 2011). In a study by Turgay and Khorshid (2010), 44 newly inserted tubes were investigated. pH method was more effective in determining tube location than the auscultatory as verified by agreement with X-ray method (Turgay and Khorshid 2010). However, this study failed to show the effect of H₂ blockers on the pH values of different sites in gut (Gastric vs. Intestinal). In addition, there was no indication to the effect of Proton Pumps Inhibitors (PPIs) in changing gastric pH, considering that each type of PPI has a distinct effect on modifying gastric acidity (Al kalaldehy 2010). A study by Jacobs et al (1996) found that using pH-assisted NG tube insertion yielded 100% correct

placement when verified by X-ray compared with standard NG tube insertions methods. Elpern et al (2007) investigated capnometry (carbon dioxide detectors) and air insufflations for detecting NG tube placement. The study showed that 16% of capnometry tube placements were incorrect when verified by X-ray in addition to 5% of air insufflations indicated to inadvertent tube placement in the lung. Miller (2011) reinforces the previous results and found that using carbon dioxide detectors were not accurate as detecting tube placement by pH testing.

Hence, X-ray method and pH testing are the most recommended measures for detecting tube placement. Capnometry is useful in case of detecting inadvertent tube placement in urgent adult intubation. However, it is encouraged that other complementary indicators must be used beside these techniques (Burns et al. 2006, Elpern et al. 2007, Miller 2011). The auscultatory method and listening for air exchange at the end of the tube or detecting bubbling when the distal end of tube is held under water are excluded techniques from nursing practice (Stroud et al. 2003, Padula et al. 2004). Finally, the following techniques are recommended EBP used frequently to reduce the incidence of aspiration: maintaining HOB elevation; is a widely accepted and cost-effective method used by maintaining HOB elevated to 30-45° degrees, continuous feeding, using prokinetic agents for high GRVs, and maintaining endotracheal tube cuff pressure at 20-25 cm H₂O₂. These are factors associated with lowering the incidence of aspiration in patients with higher risks (Harrison et al. 1997, Davies and Bellomo 2004, Sanko 2004, Bourgault et al. 2007, McClave et al. 2009).

2.5.5. Feeding system contamination

Avoiding EN system contamination is another crucial issue in intensive care. The sources of contamination might be endogenous or exogenous, and the spread of infection can be prevented if nurses pay proper attention while handling and administering the feeding (Heyland et al. 2011). For that, some techniques are recommended to lower the incidence of feeding system contamination such as: using closed system than open system (Padula et al. 2004), using non-sterile disposable gloves when handling feeding equipments and doing frequent hand washing (Kennedy 1997). Padula et al. (2004) emphasised on the importance of using aseptic technique in hand washing, using antimicrobial soap or alcohol-based hand rub, and wearing non-sterile disposable gloves before preparing and assembling feeding system.

Mathus-vliegen et al. (2006) investigated the relationship between feeding system contamination and the length of feeding system hanging time. The study found that the risk for developing pathogenic bacteria (e.g. Enterobacteriaceae and Pseudomonaceae) from endogenous source increased over the day and four subsequent days by 48%. This is called a retrograde growth, when bacteria originated in gut, lung and stomach grow into, and ascend along the feeding tube until reach the delivery set (Mathus-Vliegen et al. 2006, Elamin and Camporesi 2009).

Another study by Barrett et al. (2009) supports the previous study that the source of contamination might be endogenous. They addressed that the temperature of the formulae contributes to lowering the contamination rate when opened/partially-used quantities of formulae were kept in appropriate refrigeration. Also, formulae

administration in temperature different from body core temperature may potentially causes abdominal pain and diarrhoea after administration (Barrett et al. 2009). However, avoiding simultaneous inhibition of gastric acids production and introducing breaks between feeds to permit pH fall again are beneficial to lowering microbial contamination and bacterial colonization (Stroud et al. 2003).

Other studies suggested that manufacturers should develop a new feeding system (feeding pack) rather than the traditional glass bottles. This allows disinfecting system during assembly to avoid any potential or unintentional handling errors. These study found that the risk for developing bacterial contamination has significantly reduced ($p < 0.05$) when the feeding system is already disinfected previously (Beattie and Anderton 1998, Klek et al. 2011).

In particular, etiological investigations should be undertaken when diarrhoea, which is resulting from bacterial contamination is developed (McClave et al. 2009). Prompt treatment of persistent diarrhoea is crucial and should be taken into consideration to restore bowel motion and enhance adequate EN delivery. The treatment of diarrhoea should also be based on replacing fluid and electrolytes imbalance and providing appropriate medications (e.g. anti-motility agents) (McClave et al. 2009, Btaiche et al. 2010).

2.5.6. Medication errors through feeding tube

Drug administration through feeding tubes should be avoided whenever it is possible. If oral administration is impossible, medications can be crushed (if permissible) and administered through aseptic technique. Medications instructions should also be taken

into consideration (e.g. enteric coated tablets should not be crushed and given through NGT) (Idzinga et al. 2009). Idzinga et al. (2009) addressed some interventional guidelines aim to reduce medications errors when administered through feeding tube. The incidence of medication errors was significantly decreased when strictly adhered to these guidelines. Overall, crushing and dissolving medications and searching for alternative dosages options should be undertaken when preparing medications for administration to avoid 'preparation error' (Belknap et al. 1997, Idzinga et al. 2009). A flush with 30 ml of water before and after any using of the tube is also necessary to avoid any precipitation of acids on the inner wall of tube, which could clog a feeding tube (Engle and Hannawa 1999, Padula et al. 2004, Williams and Leslie 2005).

2.6. Nursing role toward EN in intensive care

Critical care nurses are responsible for delivering prescribed nutrition, fluid, and medication in a safe and effective way (Adam and Batson 1997, Persenius et al. 2008). Critical care nurses are also responsible for ascertaining EN volume and quality of given formulae, and they are in a key position to influence patients' outcomes (Swanson and Winkelman 2002). The responsibility for the insertion of a fine-bore NGT for EN falls mainly on highly skilled nurses to ensure appropriate insertion that reduces patient anxiety and discomfort and to ensure that the patient receives nutrition with minimal delays (Dobson and Scott 2007). Also, nurses have to be confident in using their clinical judgment to interpret the pH value of gastric aspirate (Dobson and Scott 2007).

Few studies focused on the nursing role and nurses level of knowledge, responsibility and the process of documentation in intensive care units (Persenius et al. 2006).

Nurses can deliver the required nutrition with clearly defined goals through different delivery methods. However, lack of responsibility for nutritional therapy or lack of team cooperation could lead to inadequate nutritional outcomes (Joyce and Deborah 1996). Therefore, providing an extensive educational strategy should be considered in order to improve quality of care (Woien and Bjork 2006).

The RNs' autonomy is more notable in action than in decision-making (Williams and Leslie 2004, Persenius et al. 2006, Kennedy 1997). The nursing roles in intensive care have changed over the years in terms of growing autonomy with greater responsibility, but the traditional hierarchy in clinical practice remains (Heyland et al. 2003). However, nurses conduct their role along with other professionals based on a counterbalance and cooperation between them (Aari et al. 2008). The nursing role is central to approximate gaps between nurses' implementation, dietitians recommendations, and physicians orders to provide adequate convergence to nutritional calculation especially with long-term patients (Higgins et al. 2006).

An effective nutritional care model is required for nursing profession to accomplish optimal nutritional plan with minimal complications. Unlike other professionals, nurses are considered the core of gathering and articulating patients' parameters to determine the nutritional goals. Therefore, nursing research supports and assists professionals in producing unified policies especially when focusing on the controversial issues (Splett and Myers 2001).

Ethical considerations should also be taken into consideration by nurses. However, despite the importance of EN in intensive care, it should not be undertaken unless it is

in the patients' best interest, and all ethical procedures such as informed consent of feeding components are be clearly introduced. In some instances, the decisions regarding patients' nutritional preference should be discussed with the patient's family (Stroud et al. 2003).

Wentzel et al. (2009) developed a theoretical understanding for nursing nutritional care regarding their strategies in managing EN in the intensive care. Grounded theory was used to conduct a multi-bedside observation in fifteen ICUs beds and twelve in-depth nursing interviews. Based on the constant comparative method of analysis, five categories were extracted from one core category which is 'to have and to hold nutritional control-balancing between individual care and routine care'. The summary of this theory revealed that nursing knowledge of patient (nutritional needs, medical history, feeding tolerance, and preferences) in combination with professional confidence (appropriate knowledge and experience), and being a nurse in a team (positive sharing and cooperation, having influence, and responsibilities) associates with patients involvement (opportunity to create options for decision, encouraging fluid and food intake, and inviting relatives to share in nutritional care). On the other hand, they found that nurses with former experience are able to anticipate patients' responses rapidly than those with limited experience. However, it was found that nurses with limited knowledge were open-minded for creating new approaches of treatment (Wentzel Persenius et al. 2009).

In Jordan, where the highest ratio of nursing worker among the non-oil economics of the Middle East, EN practice has gained a significant concern between other nursing roles at different Jordanian health sectors. For instance, 76% of Jordanian nurses

believe in their responsibility for providing feeding through NGT. 68% of staff nurses asserted their capability to assess dietary intake. Also, 51% of them claimed that they are in a position to insert and remove a NGT (Shuriquie et al. 2008).

2.6.1. The gaps in current nursing practice in nutritional care

There is a gap between the recommended care and the actual care in regard to EN. Although the nutritional guidelines are available, RNs scored lower in having responsibility, having sufficient knowledge and having support from documentation compared with other stages of the nursing process (Persenius et al. 2006). Also, a lack of responsibility for nutritional practice or a lack of teamwork may result in inconsistency in nursing care and insufficient nutrition in ICUs (Woien and Bjork 2006).

Marshall and West (2006) conducted a descriptive study to identify the impact of nursing contribution in EN on 'hypo-caloric feeding'. The study was conducted by assessing a range of EN practices such as managing EN tolerance and managing EN complications in 750 randomly selected ICUs nurses. The study revealed that some nursing practices could contribute to patient hypo-caloric and under-feeding. GRV measurement was defined as the most influential factor associated with under-feeding because of its popularity in detecting feeding intolerance. Also, using prokinetic agents and decreasing feeding rate were mainly adopted when gastric emptying was delayed, whereas essential nursing interventions like checking tube placement and changing patients' position were less frequently undertaken. In conclusion, nursing research should be directed toward establishing a foundation of interventional studies

to improve EN practice rather than struggling to reduce the incidence of under-feeding (Marshall and West 2006).

Persenius et al. (2008) asserted that malnutrition is one of the crucial issues that challenge critical care nurses while performing nutritional assessment. Failure to capture patient nutritional needs is failure of nutritional planning. This study described nurses' perceptions of patients' nutritional assessment using screening tools, and nurses' perceptions of documentations in some rarely measured parameters such as BMI, energy intake, and difficulty of swallowingetc. Content analysis and questionnaire were mainly used to assess both malnourishment and documentation. This study revealed that not all patients have a regular nutritional assessment and essential aspects of nutritional documentation are missed. Also, there was no entire screening tool for nutritional evaluation. Therefore, nutritionally compromised patients were at high risk for under-nutrition. In conclusion, increasing nursing knowledge and establishing an evidence-based nutritional assessment guidelines are required to standardize nursing measures (Persenius et al. 2008).

Different myths have emerged in nursing practice. For instance, firm abdomen with minimal abdominal sound has led nurses to assume slow bowel motility. Another example, when a nurse hears no bowel tones after five minutes auscultation, he/she concluded that the bowel is not functioning (Swanson and Winkelman 2002). These misleading conclusions are associated with some undesirable outcomes, because a large, firm abdomen may indicate air trapped in the intestine or colon, which is often associated with ventilated patients. Also, complete absence of bowel sounds may be associated with ambient noise in the ICU. Another faulty nursing practice is the

misconception of the role of gastric residual measurements. In addition, many nurses believe that gastroparesis (absence of gut motility) is associated with large gastric residue. In fact, it is important to consider factors and complications associated with high GRV (Swanson and Winkelman 2002).

Lack of agreement between nursing staff in defining diarrhoea is another issue. Nurses have various points of view regarding diarrhoea definition. For instance, stroke nurses consider faecal consistency as the strongest parameter in defining diarrhoea, whereas, ICU nurses consider it the least important criteria (Whelan et al. 2003). These variations in assessment cause a frailty of practice as well as improper action.

In Europe, EN practice across European critical care units has shown some variations. A study by Fulbrook et al. (2007) was conducted in 20 European countries to identify and describe the current nutritional practice and the tools of nutritional assessment. Despite using convenience sampling, the use of multi-lingual questionnaire introduced this study as a distinctive work compared with other published studies. Nursing had limited involvement in performing nutritional assessment, contributing in evidence-based clinical protocols and evaluating guidelines for enteral tube placement. It might result from the lack of sufficient background or time restrictions to reflect their confidence in developing clinical protocols. However, nurses showed a significant role in nutritional management and continuous nutritional assessment for critically ill patients with EN despite the domination of physicians (Fulbrook et al. 2007).

These variations in nursing practice are caused by the lack of reliable and valid studies associated with the delivery and management of EN. The discrepancies in nursing practice have been defined in relation to the inadequacy of nursing strategies for managing complications, and the frailty of the assessment of feeding tolerance. This provides a good opportunity for nurses to eliminate poor practices and substitute with EBP, considering better nursing involvement (Marshall and West 2004, Ros et al. 2009).

2.6.2. Nursing adherence to evidence-based guidelines

Professional competence in critical care correlates with adherence to practical guidelines (Aari et al. 2008). Nursing staff should evaluate their current competence level by considering the following components; ‘knowledge base’, ‘experience base’, ‘attitude and value base’, and ‘skill base’. These aspects constitute the concept of competence in any critical care issue. Therefore, nursing competence is achieved when nurses successfully use their experiences, attitudes, and skills to establish clinical guidelines that would support their developing to evidence-based concepts (Aari et al. 2008). Jones and Hayland (2008) argue that the success or failure of implementing guidelines may be associated with the interactions between several factors such as the type of the implemented practice, the nature of the institution, the respectability of the ICU practitioners to reforming their practice, and the clinical features of the ICU patients (Jones and Heyland 2008).

Although evidence-based guidelines support practice in intensive care areas, nurses and other professionals do not have sufficient awareness of the importance and the benefits of these guidelines. Also, nurses do not fully embrace the complexity of

nutritional problems which might lead to improper management of any ongoing complications (Wentzel Persenius et al. 2009). A study in a medical ICU founded that evidence-based protocol of EN was used only by 58% of staff due to staff preferences and ordering system failure. However, although EN cessation resulting from high GRV or feeding intolerance occurred, feeding was delivered at caloric goals (Spain et al. 1999).

The role of nursing has also moved toward formulating guidelines for nutritional management and EN in intensive care. These guidelines should comprise strict protocols especially when using high energy formulae to avoid the risk for delivering excessive calories (Kennedy 1997). This also can be fulfilled by the contribution with multidisciplinary medical staff and dietitians to introduce the identity of responsible person for prescribing fluid and caloric requirements (Briggs 1996, Ros et al. 2009).

Nursing knowledge in relation to EN may differ between institutions, especially if there are no clear EN guidelines. Broadly speaking, it is necessary to constitute a standardized evidence-based framework for EN in critical care settings (Marshall and West 2004). However, guidelines are unlikely to change practice without an active implementation strategy. Some studies claimed that, despite implementing a protocol or intensive educational program to increase staff awareness about tube feeding guidelines, ICU patients still only receive 50% of the prescribed nutritional requirements. Therefore, critically ill patients nourishment is still suboptimal related to frequent feeding interruptions (O'Meara et al. 2008).

Williams and Leslie (2004) reviewed the majority of studies that explicated EN practices and the nursing role toward patients with tube feeding. They found that many of nursing guidelines and interventions are not primarily based on research, but on rituals and personal opinions. Of all tube feeding complications, pulmonary aspiration demonstrates one of the most recurrent and problematic issues. Frequent checking for GRV decreases the incidence of this problem, also using continuous feeding rather than intermittent or bolus, good oral hygiene, maintaining the patient in a semi-recumbent position, are all recommended to minimise the risk of airway aspiration. On the other hand, using prokinetics should be limited for impaired feeding absorption (Williams and Leslie 2004).

A prospective observational study was conducted to determine the recurrence of EN complications and some of the nursing interventions which contribute in reducing the occurrence of these complications (Pancorbo et al. 2001). The study revealed that nurses undertook the following actions to achieve that goal as follows: (a) frequent aspiration through NGT to measure GRV, (b) placing tube into duodenum in agitated patients or impaired level of consciousness, (c) avoiding crushing of pills and administering drugs in a liquefied form, (d) using infusion pump if feeding should be continued for more than 24 hours. These guidelines have gained higher clinical benefit to reduce EN complications dramatically (Pancorbo et al. 2001). This change in practice reinforces the previous premises that establishing a specific practical guidelines can support attaining patients' nutritional requirements through improving nursing performance (Adam and Batson 1997, Marshall and West 2006, Dobson and Scott 2007).

2.6.3. Team working

Overall, a group of multidisciplinary professionals include dietitians, pharmacists, nurses, and medical staff have to shoulder the burden of managing the nutritional practice and developing a unified clinical protocols, guidelines, policies and educational programmes in that field (Fulbrook et al. 2007, Kennedy 1997, Anderson 2000, Ros et al. 2009). In addition, they should maintain continuous education for intensive care team and review the current practices (Ros et al. 2009, Marshall and West 2004).

Atwal and Caldwell (2006) explored nurses' perceptions of multidisciplinary team work in acute health care settings. Content analysis and field observation were used to examine the problems associated with poor interaction between professionals. The study revealed that different perceptions of teamwork, different levels of professional skills within team working and the dominance of medical power affected the interaction between staff (Atwal and Caldwell 2006).

Some nurses felt incapable and unconfident to work efficiently within a team. Lack of co-operation between different professions is considered a major obstacle to optimising nutritional practice (Swanson and Winkelman 2002). Therefore, considerable effort should be taken to configure a nutritional team with a mutual cooperation between all health professionals. Thereafter, the strategies of treatment will be easily developed once an effective cooperation between multidisciplinary team members exist (McMahon et al. 2005).

Peterson et al. (2010) found that registered dietitians contributed positively in managing PN for ICU patients. The study included 1080 patients started on PN and 885 patients were assessed after registered dietitians order-writing. It was evident that inappropriate use of PN was significantly decreased from 45-27% after adopting dietitians order ($p < 0.001$) and there was as significant decrease in the total use of PN. Moreover, undertaking the registered dietitians' order-writing was associated with a 20% drop in the cost (Peterson et al. 2010). However, registered dietitians usually disagree with physicians order in prescribing EN and they consider it suboptimal and inadequate to provide a sufficient nutritional support. Braga et al. (2006) showed that enterally fed patients whose registered dietician recommendations were followed had significant weight gain, higher serum albumin level and also shorter LOS, compared with those who were fed with physicians' orders. This provides a good chance for policy makers to give dietitians the entitlement to adjust EN (Braga et al. 2006). This confirms the importance of establishing a mutual cooperation between health care staff to provide a maximal nutritional care with minimal complications.

2.7. EN evidence-based protocols, algorithms and guidelines

The terms protocol, guidelines, algorithm, and clinical pathway are often used interchangeably (Sivakumar and Haigh 2000). They are sometimes distinguished according to the level of structure or the level of freedom allowed, for instance, guidelines are more flexible than protocols and protocols are transformed versions of guideline statements. Indeed, both guidelines and protocols are used to assist practitioners to implement EBP through creating an appropriate healthcare decision for specific clinical issue (Sivakumar and Haigh 2000, Binnekade 2004).

Evidence-based protocols, when implemented, have the greatest impact on patients nutritional outcomes, reducing the variations in clinical practice, maximizing the benefits of nutritional therapy, and avoiding common complications associated with tube feeding alongside promoting nursing care (Bourgault et al. 2007, Btaiche et al. 2010). EBP is based on empirical research findings along with other type of evidences which eventually generate robust guidelines (Spain et al. 1999).

Changing nurses' and physicians' perceptions towards the importance of EN guidelines must be enhanced for two main reasons; enhance using the guidelines and eradicate unnecessary feeding cessation (Bourgault et al. 2007). The majority of studies have shown that launching an EN protocol is an essential strategy to break down barriers hindering potential problems associated with EN. For instance, Adam and Batson (1997) described the effect of adopting protocols for feeding delivery in ICUs. Nurses in intensive care units with well-defined EN protocols have delivered a desired feeding volume ($p < 0.0001$) greater than those without.

2.7.1. Comprehensive EN guidelines

Further to the previous protocols introduced in the previous sections, the following are comprehensive evidence-based guidelines concerned with EN:

The British Association of Parenteral and Enteral Nutrition (BAPEN) has reviewed the majority of EN studies to constitute an exhaustive evidence-based guidelines for EN. The studies were selected based on their level of evidence and under strict methodological characteristics. The review revealed that strict adherence to specific feeding guidelines should be undertaken because the incidence of malnourishment in

the UK hospitals has been raised. These guidelines encompass several components of EN parameters such as, feeding tube, rate of infusion and access options. Also they mentioned the significance of EN for post operative patients as it effectively maintains gut integrity more than PN (Stroud et al. 2003).

McClave et al. (2009) aggregated extensive feeding guidelines for critically ill patients in cooperation with Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN). In this systematic review, RCTs were mainly retrieved under strict methodological properties. Most of the controversial issues related to EN were adequately discussed through providing substantial evidence-based recommendations and guidelines considering their level of evidence.

A study by Miller et al. (2008) measured the proportion of critically ill patients who meet the *Canadian Clinical Practice Guidelines* (CPGs, 2003), which focus on EN for MV patients. This cross-sectional study took place at a specialised hospital in Toronto-Canada. The results of the study revealed that more than 66% of ICUs patients received EN as early as possible within 48 hours from the admission, which is also recommended by the CPGs. Also, the main reasons for delaying the initiation of EN were haemodynamic instability such as cardiogenic-hypovolemic-vasogenic shock and gut dysfunction. On the other hand, only 4.9% of patients met the recommendation of maintaining HOB at 45° which is emphasized by the CPGs. The discrepancy in nursing practice toward HOB has been referred to insufficient nursing knowledge about the relationship between HOB and lowering the risk for VAP. In

general, these guidelines are clinically accepted for mechanically ventilated patients in intensive care (Heyland et al. 2004, Miller et al. 2008).

Martin et al. (2004) showed some improvements in critically ill patients' outcomes when applying an 'evidence based algorithm' for nutritional support. This algorithm embraces some of the multifaceted implementation strategies such as: early EN, management of adverse outcomes and frequent nutritional assessment. Patients in the intervention group had a shorter LOS compared with control group who were not treated by the algorithm ($p=0.003$). Also, patients' outcomes have been improved despite no effect of this algorithm on the mortality rate. In addition, it helped nurses to minimise the variations in practice and supports the efficiency of care (Martin et al. 2004).

CREST (2004) published a booklet for hospital, community professionals that comprise the majority of EN principles, ethical considerations and practical guidelines. This comprehensive work employs evidence-based findings for developing clinical guidelines to provide a robust and applicable nutritional strategy. These guidelines encompass lots of instructions starting from choosing an appropriate feeding method, access, mode of delivery and ethical and legal aspects of nutritional support, reaching to managing feeding complications, using protocols for preventing feeding system contamination and documentation. They are not rigid protocols and therefore are recommended to be used in a conjunction with clinical agreement between multiple health care professionals (CREST 2004).

In conclusion, Table 2.2 shows the majority of tube feeding complications and their causes, potential effects and treatment strategies based on evidence-based recommendations which were addressed previously.

2.7.2. Other relevant evidence-based studies

2.7.2.1. Infusion protocol

The infusion protocol was developed to improve the delivery of EN in intensive care. Spain et al. (1999) developed and tested a feeding protocol that aims to; providing a consistent increase of feeding, improving nutritional outcomes, standardizing nursing practice, limiting feeding cessation due to diagnostic interventions, and introducing solutions for the increased GRV. When the protocol was applied, patients achieved their nutritional goal within 72 hours. Also, the feeding pattern was much closer to the goal (82%) compared with traditional feeding delivery. However, despite physicians being reluctant to accept this evidence, nursing professionals assimilated rapidly with these changes (Spain et al. 1999).

2.7.2.2. Transitional protocol

Patients with EN or PN who are being prepared for weaning or starting oral feeding must be kept under strict monitoring until recovery to avoid underfeeding. The ‘Transitional feeding protocol’ which was launched by The ASPEN was examined by Grossman and Bautista (2001) to see its effectiveness in decreasing the LOS and attaining nutritional goals. One hundred and nineteen medical and surgical critically ill patients were included in this trial. By measuring body weight, serum pre-albumin and urine urea nitrogen (UUN) for pre and post implementation groups, the protocol achieved a desirable nitrogen balance and maintained pre-albumin at an acceptable

level (Grossman and Bautista 2001). In addition, the protocol is not exclusive for adult patients, so it can be used in critically ill infants. The impact of this protocol on feeding delivery and nursing performance was concrete, especially after increasing staff awareness of patients' nutritional requirements (Meyer et al. 2009).

2.7.2.3. Steps for creating evidence-based guidelines

The ASPEN (2009) has published standardised guidelines for establishing clinical protocol in relation to EN or PN. They confirmed the importance of the following principles in developing protocols: clarity, compatibility, practicality, transparency and justifications or rationales. These principles should be taken into consideration when start gathering a literature about specific issue. In fact, not all studies are at the same level of evidence, meaning, each study should be classified and ranked according to their level of evidence, which is absolutely based on the methodological properties such as randomisations, size, and risk of errors (alpha and beta). Each clinical guideline should contain the following essential items: *Background*: which is a brief description of the topic; *Methodology*: the process undertaken to determine the level of evidence; *Practice guideline and rationales*: providing a list of recommendations from the literature; *References*: (i.e. used RCTs and systematic reviews should be referenced); *Algorithm* (optional): used to illustrate guidelines in accessible and practical form; *Notice*: if there is any judgment or comments from experts; *Acknowledgment* (optional): acknowledging people who contributed effectively in the work (ASPEN 2009). Table 2.3 summarizes some of these clinical studies that function as EN evidence-based protocols, showing each study theme, the main objectives and the main findings.

2.8. Discussion of literature

2.8.1. Role of ICU nurse

Critical care nurses are in a key position and their roles of assessing and implementing the strategies of care should be based on evidences. Particularly, nursing interventions in relation to EN are still below the standard and do not reflect a higher level of competence. Therefore, clinical judgments must be carried out by highly trained personnel with higher level of responsibility (Swanson and Winkelman 2002, Woien and Bjork 2006, Dobson and Scott 2007, Persenius et al. 2008, Wentzel Persenius et al. 2009).

Obviously, nutritional care in ICUs should be conducted by a group of professionals involving nurses, physicians, and dietitians. Poor interaction and cooperation between professionals has been highlighted as a factor contributing to failure of nutritional therapy. A nutritional team, which consists of all staff concerned with nutritional care should be configured to manage patients' nutrition and to minimise discrepancies inherent in poor collaboration between health care providers. In addition to enhance adequate interaction between professionals to construct applicable clinical guidelines based on their knowledge, experience and available resources (Anderson 2000, Swanson and Winkelman 2002, Atwal and Caldwell 2006, Braga et al. 2006, Higgins et al. 2006, Ros et al. 2009).

Furthermore, EBP should be undertaken by all nurses especially those who are working in intensive care due to the uniqueness of their patients' special needs. Examples of these evidence-based practices are: managing GRVs, implementing aspiration reduction measures, using accurate strategies for checking tube placement,

selecting a suitable route and method of administration according to patients' conditions, and selecting the appropriate nutritional strategy in patients with special needs (renal, hepatic ...etc). All these practices are derived from robust evidence-based recommendations that nursing practice should adhere to them (Whelan et al. 2003, Sanko 2004, Higgins et al. 2006, Bourgault et al. 2007).

Lack of consistency in nursing practice is another dilemma for nutritional care in the ICU. Because there is no consensus among professionals about defining and managing some of feeding issues (e.g. relation between GRVs and aspiration), many nursing interventions are controversial and should be substituted with research-based evidence away from traditional practice. It should also reflect an effective nursing involvement in decision making as a pivotal team member (Splett and Myers 2001, McClave and Snider 2002, Williams and Leslie 2004, Marshall and West 2006, Fulbrook et al. 2007, Ros et al. 2009). Nursing care should also seek to articulate to patients' perceptions toward artificial nutrition. Thus, nurses should anticipate patients' psycho-social domains alongside their physiological needs prior to initiating nutritional interventions (Stroud et al. 2003, Persenius et al. 2009, Wentzel Persenius et al. 2009).

2.8.2. Evidence-based practice and EN

Several studies have developed various guidelines, protocols and algorithm for EN in the critically ill. The main target of these guidelines is to develop unified and applicable protocols for EN. They were primarily derived from durable evidence-based research based on clinical trials. In fact, these guidelines urge to use an extensive nutritional protocol to minimise variations in practice and to improve

collaboration between health care professionals and consequently, minimising the incidence of complications and improving patients' outcomes (Marlan and Allen 1998, Spain et al. 1999, Bourgault et al. 2007, Fulbrook et al. 2007, Dobson and Scott 2007). Developing a clinical guideline is not easy. The main challenge for nurses is to share in developing clinical guidelines, maintaining continuous education and having a multi-professional team (Kenny and Goodman 2010). By those, nurses would have the opportunity for developing nutritional strategies with other professionals and raising their level of competency using these guidelines (Aari et al. 2008, Kenny and Goodman 2010). In addition, nursing capability to deliver a consistent care depend on their capacities to develop and adhere to these clinical guidelines (Marshall and West 2004, Aari et al. 2008, O'Meara et al. 2008, Ros et al. 2009). Overall, lack of standardization in nursing practice has a negative impact on patients' outcomes. In particular, optimal exploiting for these guidelines would increase their effectiveness in treatment and improve nursing confidence and capabilities to implement EBP (Kenny and Goodman 2010).

2.9. Conclusion

EN is a clinically significant approach in nutritional care in the critically ill. It promotes patients' recovery, reduces the LOS and enhances patients' immunity and healthy gut. EN should be applied committing with EBP. Many clinical guidelines and protocols were established to facilitate safe use of EN and to minimise disparities in nursing practice, consequently, diminishing the occurrence of some complications resulting from poor nursing practice. EBP is derived from clinical trials which, in turn, merge robust research findings to establish clinical guidelines. Nutritional care

in the ICUs should be guided by multidisciplinary team to maximize nursing sharing in making decisions about patients' nutritional plans.

The problem of under-feeding still exists. Unnecessary feeding interruption should be avoided whenever it is possible and the undelivered amount should be compensated accordingly. Nurses should detect feeding intolerance and avoid relying solely on GRVs to assess patient's digestive status. Prokinetic agents are recommended for patients with recurrent gastric retention along with regular checking for gastric residues at least every four hours. Using the pH method for checking tube placement is strongly encouraged after radiographic method. In addition, elevation HOB 30-45°, maintaining endotracheal cuff pressure at 20-25 cm H₂O, providing formulae at suitable temperature, decreasing feeding system hanging time, and using closed feeding packed are all practices contribute to lowering feeding complications. Patient history and current health illness should be considered along with sufficient clinical assessment while administering tube feeding. Nurses should avoid aggressive carbohydrate and protein delivery as it contributes to major electrolyte and fluid imbalance and, eventually, will affect the cardiac and neural functioning. Also, slow starting rate is recommended along with frequent monitoring for the electrolyte, fluid balance and vitamins in the blood

2.10. Integration of literature with the study objectives

This study aimed to assess nurses' practice and perception of their knowledge, responsibility and documentation in relation to EN in the critically ill and to explore nurses' attitudes towards establishing EBP and teamwork in three health care sectors in Jordan, using different methodological approaches. The study generated a holistic

insight into nurses' perceptions and practices in critical care that subsequently used to identify the occurrence of complications in these places which particularly resulting from improper feeding tube management and ineffective adherence to EN evidence-based guidelines. Various practices surrounding EN practice were investigated such as preparing, handling and administering feeds, tools for assessing patients' nutritional status and detecting feeding intolerance. These practices were compared with the recommended evidence-based guidelines to explore strengths and weaknesses in practice. The study can contribute to determining an appropriate nursing education program based on the gaps inherent in practice. In addition, the study findings could assist in developing a convenient nutritional protocol based on the available recourses and polices, considering the institutional differences between discrete health sectors.

Table 2.2 Complications of EN, causes, potential outcomes and preventive strategies and level of evidence.

Category	Examples	Possible causes	Potential outcomes	Prevention strategies and level of evidence	References
Mechanical	Tube dislodgment. Tube misplacement. Tube occlusion.	Inappropriate feeding tube. Inadequate tube irrigation. Formula viscosity Insufficient drugs crash.	Pulmonary complications. Failure of administration.	Choosing suitable feeding tube pore (I), frequent irrigation using sterile water (II), checking tube placement each shift (IV), pH method to check place (III).	(Pancorbo et al. 2001, MarIan and Allen 1998, Stroud et al. 2003)
Gastrointestinal	Diarrhoea Gastrointestinal intolerance. Constipation Gastric distension Gastric bloating Vomiting Delay gastric empty	Formula osmolarity (hypertonic), fat content, low fibre feeds. Improper feeds temperature. Malabsorption Lactose intolerance Low serum albumin (hypoalbuminemia). Bacterial contamination. Medication (e.g. antibiotic-associated diarrhoea). Excessive formulation, Infusion rate	Failure of administration. Electrolyte imbalance. Under-feeding	Fiber-enrich formula (III), Using Prokinetics for feeding intolerance(I), managing feeding rate(I), using aseptic technique (III), withhold feeding if GRVs exceed 500ml (II), reintroducing gastric content less than 500ml (I), detect signs of feeding intolerance (III), using suitable feeding temperature(II).	(Adam and Batson 1997, Pancorbo et al. 2001, Petros and Engelmann 2006, Bourgault et al. 2007, MarIan and Allen 1998, Elpern et al. 2004, Stroud et al. 2003)
Metabolic	Electrolyte imbalance Hyperglycaemia Hypoglycaemia Over hydration Dehydration	Fluid excess Fluid depletion Inadequate free fluid Excessive renal lose Interrupt feeding for patient receiving insulin. Unnecessary feeding cessation.	Metabolic abnormalities. Poor glycaemia control. Electrolyte imbalance Under-feeding CNS deterioration	Accurate nutritional assessment, avoid unnecessary feeding cessation (I), controlling blood glucose level (110-115 mg/dl) (III), additional feeding amount than prescribed (II).	(Pancorbo et al. 2001, MarIan and Allen 1998, Stroud et al. 2003, Eschleman 1991)
Infectious	Pneumonia Diarrhoea Lung aspiration	Positioning (supine). Low level of consciousness. Gastroesophageal reflex (regurgitation). Vomiting, head trauma, bacterial transmission, persistent high GRVs.	Sepsis Delay wound healing. Impaired immunological defence. SIRS/ delay recovery Alter hemodynamic status.	Air way management (I), upper body elevation (30°-40°) (II), regular GRVs check (4 hourly) (IV), avoid acid suppression (II), oral hygiene (III), maintain ETT cuff pressure at 20-25 cm H ₂ O (III), using intestinal feeding (I),	(Heyland et al. 2003 , Pancorbo et al. 2001, Metheny et al. 2008, Bourgault et al. 2007, MarIan and Allen 1998, Williams and Leslie 2004)

				prokinetics use (I).	
Other:	Gastrointestinal ischemia	Increasing gap between mucosal Pco2 and arterial Pco2	Mucosal atrophy Gut dysfunction Poor tissue perfusion	Avoid excessive carbohydrate (III)	(Shikora et al. 1996, Lunn et al. 1998, Jeejeebhoy 2002)
	Feeding system contamination.	Improper preparation, handling, storage, and administration. Prolonged system hanging time. Bacterial contamination (endogenous, exogenous).	Diarrhoea Vomiting Feeding intolerance Fever sepsis	Decrease length of hanging time (II), using non-sterile technique (II), hand wash (II), using feeding pack (Closed Pack) (III), formulae refrigerating (II), flushing feeding tube after each use (III).	(Sanko 2004, Mathus-Vliegen et al. 2006, Beattie and Anderton 1998, Barrett et al. 2009)
	Tube complications	Insertion complications Post insertion trauma	Nasal damage, bleeding. Discomfort, erosion, abscess, sinusitis. Bleeding; intestinal, colonic perforation. Bronchial administration. Oesophagitis, aspiration. Tube dislodgment.	Using guidewire feeding tube (I), avoid larger tube, flushing tube before and after feeds (III), avoid supine position and use semi-recumbent (II), use gravity for administration (II).	(Stroud et al. 2003, McClave et al. 2009, Marlan and Allen 1998, Eschleman 1991)
	Re-feeding syndrome	Aggressive carbohydrate and protein administration to malnourished patients	Electrolyte depletion (i.e. ph, mg & k), vitamin deficiency, fluid-balance disturbances.	Slow feeding start (II), monitoring fluid and electrolyte balance (III), staff education (III), and detecting neural disturbances signs (II).	(Crook et al. 2001, Marinella 2005, Mehanna et al. 2008, Ahmed et al. 2011)
	Anxiety	Abdominal bloating Nasal irritation Undesirable taste Impaired self esteem	Refusing feed Uncooperative patient Emotional problems Fear from death	Patient education (III), Considering ethical issues (IV). Family support (IV). Taking patient choice (IV).	(Madigan et al. 2002, Stroud et al. 2003, Persenius et al. 2009)

Table 2.3 Evidence-based protocols, guidelines and algorithms of EN			
Study	Study theme	Main objectives	Main results
Adam & Batson (1997) (Prospective, descriptive study)	Feeding protocol	The effect of using protocol on delivery of feeding.	Patients on protocol have received greater feeding volume than those without P<0.0001.
Dobson & Scott (2007) (Prospective study)	Nurse-led EN algorithm for critically ill patient	Managing GRV and using prokinetics	Patients received correct type and volume when algorithm was applied. Prokinetics should be used when one or more GRVs are above 200 ml.
Pinilla et al. (2001) (Prospective RCT study)	Comparison between 2 feeding protocols	Maintaining GRVs at 150 ml with optional use of prokinetics OR keeping GRVs at 250 ml with regular use of prokinetics.	The incidence of feeding intolerance decreased when use the second protocol.
Woien & Bjork (2006) (Prospective study)	Nutritional support algorithm of EN in combination with PN.	To assess the effectiveness of algorithm on patient nutritional status.	Patients in interventional group were fed higher than control group p=0.009. This enables nurses to provide constant increment in feeding delivery rate.
Martin et al. (2004) (Cluster-randomised controlled trial)	Evidence-based algorithm for nutritional support in ICU.	Assess the effect of: early nutrition, managing adverse outcomes, and frequent nutritional assessment for critically ill patients.	Patients on interventional group had shorter LOS p = 0.003, better nutritional outcomes.
Barr et al. (2004) (Prospective study)	Evidence-based nutritional management protocol for mechanical ventilated patient.	The effectiveness of using protocol for mechanically ventilated patient.	Patients on protocol had: lower duration on mechanical ventilation, lower in-hospital mortality rate, and decreased LOS.
McClave et al. (2009) (Systematic review)	Comprehensive feeding guidelines for critically ill patient.	Developing new feeding tube guidelines by reviewing the published evidence-based studies considering level of evidence.	Examples: EN with PN, feeding cessation, placement of feeding tube, nutritional assessment, EN with various diseases, early EN.
Miller et al. (2008) (Cross-sectional study)	Canadian practice guidelines (CPGs) for EN with mechanical ventilation.	To assess the proportion of Canadian patients who meet the CPGs guidelines.	66% patients received EN as early as possible within 48 hours. Cardiogenic, hypovolemic, vasogenic are the main reasons of delaying EN. Only 4.9% maintained HOB at 45 degree.

Bowman et al. (2005) (Quasi-experiment study)	Evidence-based feeding protocol and aspiration reduction algorithm for mechanically ventilated patient.	To determine the effectiveness of using these guidelines for different issues.	Patients on protocol had: Lower mortality rate, less treatment cost, reduced LOS, kept patients at feeding goal rate.
Grossman & Bautista (2001) (Prospective study)	Transitional feeding protocol	Assess the effectiveness of transitional feeding protocol on patients who are being prepared for weaning to maintain nutritional status and decrease LOS.	Desirable nitrogen balance, maintained pre-albumin level, and optimal body weight were achieved when using this protocol.
Spain et al. (1999) (Prospective study)	Feeding infusion protocol	Identify the effect of: increment of delivery rate, limiting feeding cessation, managing high GRVs.	Patient on protocol: Achieved their nutritional goal within 72 hours. Feeding pattern much closer to the desired goal (82%).
Metheny et al. (2010) (Quasi-experiment study)	Aspiration risk-reduction protocol (ARRP)	Identify the effect of: maintaining HOB at 30° or higher, inserting feeding tube in distal bowel, and using an algorithm for high GRVs.	Patients in intervention group had: Lower incidence of aspiration and pneumonia at 39%, 19% respectively compared with other group.
Padula et al. (2004) (Review article)	Guidelines for reducing the risk of feeding system contamination, medication administration, and GRVs management.	To assess the usefulness of these guidelines on preventing some serious complications.	i.e. Using antiseptic technique before preparing and assembling feeding system, drug administration should be avoided whenever possible, and GRVs check every 4-6 hours.
Stroud et al. (2003) (Review article) "British Association of Enteral and PN (B.A.P.E.N)"	EN evidence-based guidelines.	Reviewing EN studies based on levels of evidence.	i.e. Types & indications. EN complications. Access techniques. Feed administration. Ethical & legal aspects.
Relevant studies Hospital, community EN, ethical & practical guidelines (CREST), 2004	Guidelines for managing tube feeding in adult patients.	General guidelines for EN	i.e. Choosing feeding route, method. Managing feeding complication. Legal, ethical issues. Managing equipments, documentations.
American Society of PN and EN (ASPEN), 2009	Clinical guidelines for enteral and PN.	Establishing criteria for developing nutritional guidelines.	Principles of guideline: Clarity, compatibility, practicality, transPNcy, and justifications.

Chapter Three: Methods

3.1. Introduction

This chapter focuses on the methodological characteristics of the study. A discussion of the theoretical framework is provided to show how this framework fits the study's concepts. This is followed by an overview of the study aims, questions and the significance of the study. The use of mixed-methods strategies is also addressed, showing the rationale for integrating two different methods into the research framework. After discussing the concepts of each method, a brief description of the settings and sampling strategies is provided. Two different techniques for recruiting study participants are described, considering the ethical issues prior to participation in the study. The mechanisms of data collection and data analysis are also provided to guide the analytical procedure of each method. Thereafter, both results should be combined in a single context through the integration phase which is also explained at the end of this chapter.

3.2 Theoretical framework

The main purpose of using a theory is to make a study coherent, meaningful and interpretable and to enhance the rigour of the study findings. A theoretical framework approximates all phases of a study, making the whole construct reasonable, convincing, and related to the reality (Burns and Grove 2003, Parahoo 2006). Indeed, the theoretical model which is expedient for this study was considered to be able to incorporate all concepts provided which enhance a greater understanding of the nature of nutritional care in the critically ill patients. The quality assurance model of health care by Donabedian (2003) was employed in this study to examine the impact of nursing practice on delivering evidence-based care.

3.2.1. Quality assurance model of Donabedian

Quality assurance is a process encompassing all actions taken to establish, promote, protect and improve quality in health care. The assurance means: improvement or continuous improvement that can be influenced by the quality of health care environment either directly by influencing the performance of practitioners or indirectly by influencing the convenience, safety and comfort of patients (Donabedian 2003). The meaning of quality in health care is associated with a specific approach called Quality Monitoring. Quality Monitoring was established to maintain the quality of health care under constant observation away from any variations inherent in employees' demeanour (Donabedian 1985, Donabedian 2003).

Donabedian's model of quality assurance has solved many problems related to the evaluation of quality of care since its launch. It started by defining some components of quality of health care such as efficacy, effectiveness, efficiency, optimality, acceptability, legitimacy and equity. These principles integrate to substantiate the relationship between science and technology in health care systems, and the applicability of this relationship in the clinical practice. Once these principles are precisely used, nurses and other professionals can embark with the quality of health care and will be able to minimise undesirable practices.

Donabedian's model is a systematic process of monitoring and improving clinical performance and it consists of six stages; it starts from determining what to monitor, then identifying system priorities, which is carried out according to specific criteria such as representativeness, feasibility and organizational requirement. After that,

selecting approaches for assessing the performance, which is demonstrated by the **Structure – Process - Outcome** Model. The remaining stages of Donabedian's model are represented by the mechanism of monitoring as follows, obtaining preliminary information about the phenomena, then determining the monitoring technique that will be used to measure practice, finally, describe the behavioural changes required to be applied based on these observations (Donabedian 1985, Donabedian 2003).

Structure – Process – Outcome Model

Structure designates the conditions under which care is provided, this includes: material resources, human resources and organizational characteristic.

Process is the activities that constitute health care including diagnosis, treatment, rehabilitation, prevention and patients' education, and therefore it is usually carried out by professional personnel. However, it can be affected in particular by the contribution of patients and their families.

Outcome is taken to mean changes, whether desirable or undesirable, in individuals and populations as a result of health care. For instance, change in health status, change in knowledge, change in patients' behaviour and satisfaction of patients and their families (Donabedian 2003).

Employing this model efficiently needs from the researcher to anticipate the relationships between these approaches prior to use it. For instance, *Structure* influences *Process*, or *Process* influences *Outcome*, so the probability of causing

each other should be predicted in advance. In this study, it is assumed that the organizational structures and facilities which include providing sources of knowledge influence nursing practice in which greater nursing performance and adherence to evidence based is appeared in robust institutional policies. In addition, nurses can perform practice with less discrepancies or variations that cause in minimal complications, better surviving and less LOS. Indeed, this model was developed to assess clinical practice according to the existed relationships between these approaches (Donabedian 2003).

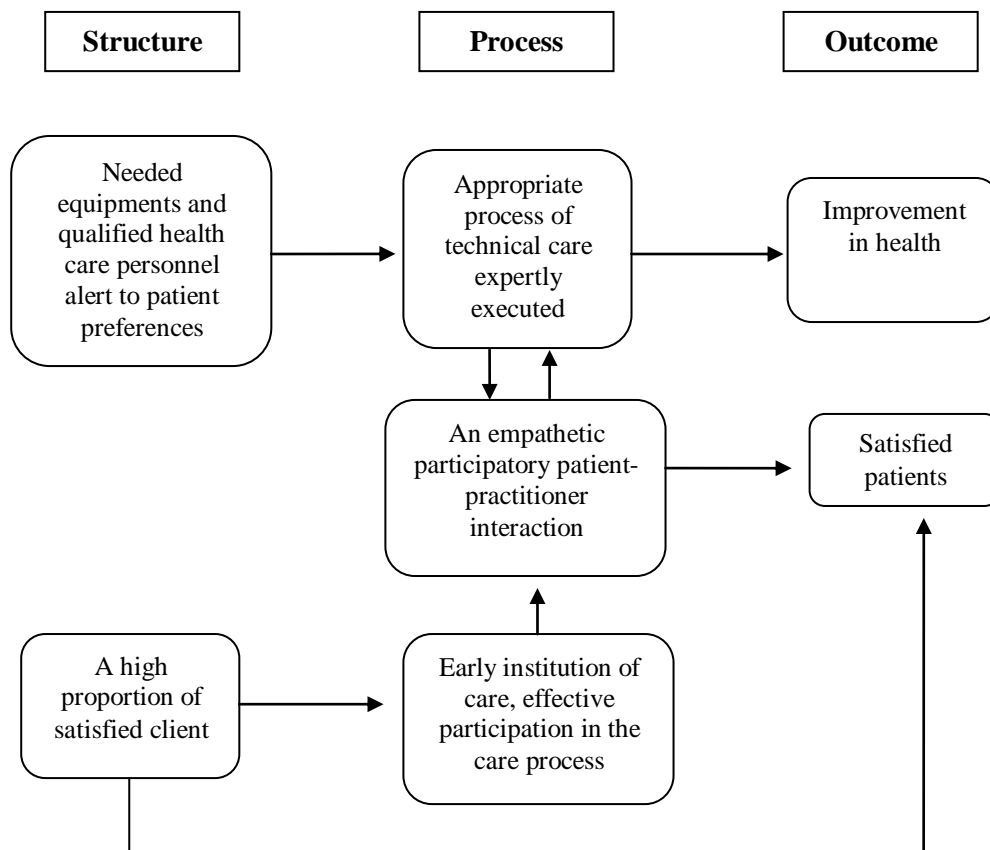


Figure 3.1 The hypothetical relationships between structure, process, and outcome adapted from Donabedian (2003), an introduction of quality assurance in health care, page 50.

Based on the hypothetical relationships between the three approaches which are illustrated in Fig 3.1, there is an apparent integration between these approaches

which enables the researcher to apply them into a research design in a logical way. In this study, where the main focus is assessing critical care nurses' practice and perceptions of their knowledge, responsibility and documentation in relation to EN in intensive care and exploring their attitudes towards establishing EBP and teamwork, Donabedian's model was employed entirely for that purposes so the three approaches (Structure – Process – Outcome) are reflected in a subsequent stage of interpreting the study findings.

It is assumed that the researcher should integrate the *Structure* approach with other approaches. However, because the hierarchal and organisational structures of each health care institution was already established and organised, the role of *Structure* was confined in introducing the sources of knowledge and establishing nutritional teams. Thereby, the study embarked with all approaches, focusing on the *Process* approach and its relationships with the *Outcome* approach based on nurses' perspectives.

Process can provide discriminating and valid judgement about quality of care (Donabedian 2003). Alternatively, quality of care can be elucidated to means 'quality of the *Process of care*'. Therefore, *Process* is likely to be more directly toward *Outcome* than *Structure* and more able to identify small variations in quality than *Structure* (Donabedian 2003). Recently, *Process* is called '*Contemporaneous*' because it offers a current and immediate indication of quality than other approaches (Donabedian 2003). Different methods of data collection can be used to study *Process* such as; medical records, questioning participants or direct observations (Donabedian 2003).

Outcome reflects not only what has been done for the patient, but also how skilfully that was done. It is argued that a good *Outcome* is achieved by good care. The availability of sufficient information about the nature of care should be considered in assessing the usefulness of *Outcome* as a measure of quality of *Process*. Therefore, it is necessary to track not only the consequences of taking actions, but also the consequences of not taking actions to obtain a complete picture about the performance of health care practitioners (Donabedian 1985). Once the features of *Outcome* are evident, it is important to make inferences related to the nature of these outcomes and their relationship with *Process* as an indication of the quality of care (Donabedian 2003).

In fact, the postulated relationship between Structure, Process and Outcome is not necessarily informative all the time, because some inferences may emerge from faulty assumptions or other insufficient scientific justifications that in eventual violate the fundamental principles of this model. Therefore, careful attention should be paid when considering these approaches to ensure that all are fundamentally sufficient for application and comprehensive for depicting real practice (Donabedian 2003). Finally, this framework is operationally applied in this study and integrated with all concepts emerged throughout study process. Structure-Process-Outcome model provides a deep insight into the relationships between the process of nursing practice and the outcome of nutritional care that absolutely demonstrate the quality of nursing care. Thus, the anticipated relationships between Structure, Process and Outcome are able to constitute a deeper understanding of how the reasons for EN complications are inherent in nursing care and nurses' adherence to evidence-based guidelines.

3.3. The aims of the study

The aims of this study were to:

1. Assess nurses' perception of their responsibility, knowledge and documentation in relation to EN in intensive care in Jordan.
2. Assess nursing practice in relation to EN in critical care units.
3. Explore nurses' attitudes towards establishing evidence-based practice.
4. Explore nurses' attitudes towards establishing teamwork.
5. Identify differences in nursing practice between three health care sectors in Jordan focusing on EN practice.

3.4. Study Questions:

1. To what extent have nurses taken responsibility for patients' nutrition in their work setting?
2. How do nurses working in intensive care units perceive their role in terms of responsibility, knowledge and documentation regarding EN?
3. How do nurses deal practically with EN requirements and their congruence to the standardized guidelines?
4. What strategies could be applied to reduce the incidence of patient complications before and after EN implementation?
5. How do nurses in ICUs view their EN practice in relation to EBP?
6. How do nurses contribute to the development of teamwork in ICU?

3.5. Significance of the Study

The study findings provide a holistic view about EN practice in different health care sectors in Jordan that could help nurses and other professionals to achieve the following objectives:

1. Prevent tube feeding complications.
2. Provide a standardized EN practice based on the established evidence-based recommendations.
3. Determine the strengths and weaknesses of EN practice and how nurses can contribute to maintaining the quality assurance of health care.

3.6. Mixed-methods strategies

Methodological design is a critical stage in any research study so the allocated design should be compatible with the research objectives. Based on the nature of the study questions, the selected design integrates two methodological approaches at the same time. Mixed-methods design is the process of blending and nesting or bringing two or more methodological approaches within one frame, allowing for interactions between all methods (Collins and O’Cathain 2009, Simons and Lathlean 2010). Research that blends qualitative and quantitative approaches adds the value of a complementary approach when a relative weakness of one is counterbalanced by the another (Mason 2002, Tooping 2010). In addition, mixed-methods research underpins the pragmatism paradigm in which naturalism and positivism paradigms are used, making both objective and subjective values integrated in one context (Johnson and Onwuegbuzie 2004, Teddlie and Tashakkori 2009). Before deciding which strategy of mixed method is required, four essential

elements should be explained to facilitate choosing the appropriate strategy of mixing methods (Creswell 2009, Tashakkori and Teddlie 2010):

Timing: the concept of *concurrent* data collection was applied, meaning that both quantitative and qualitative data were gathered at the same time in one single point, rather than constructing one design based on the result gained from another as occurs in the sequential mixed-methods models.

Weighting: the study was driven by the quantitative method than the qualitative method. In practice, one method can be given the priority over the other (Creswell 2009). However, in this concurrent triangulation strategy, the weight was equal between both methods, considering that each method has a profound contributing in explaining the study findings.

Mixing: this aspect equates two essential issues: (a) mixing the results from both methods was carried out over the discussion and interpretation phase, which means; data from both methods was kept separated over all stages then merged together on one point of continuum. (b) the kinds of mixing were used: *integrated* (occurs when qualitative and quantitative data collected concurrently then integrated or nested together at one point to find similarities or differences) and *embedded* (occurs when the questions of the second method differ from that in the first method to be used as a supportive and complementary method to the first one). Therefore, both data forms were nested and integrated together to provide deeper understanding of that issue of practice (Creswell 2009, Kroll and Neri 2009).

Theorizing: in the embedded mixed method strategy, *an explicit* theoretical perspective was typically ascertained by the primary method which guided the study and control the direction of all stages, considering that should be compatible with the theoretical framework provided for that purpose (Creswell 2009). According to the previous determinants, it is evident that the appropriate mixed-methods strategies which match all these criteria with the study characteristics are ‘*Concurrent embedded strategy*’ and ‘*Concurrent triangulation strategy*’.

3.6.1. Concurrent embedded strategy (QUANT + qual)

This model of mixed methods research is characterised by collecting both quantitative and qualitative data simultaneously, and then combining data in a single context to be interpreted in the discussion section (Kroll and Neri 2009, Teddlie and Tashakkori 2009). The qualitative design is considered as the second method; therefore, it provides additional worthiness to the quantitative approach. The qualitative data collection involved different questions intersected with the questions employed in the quantitative part because the main idea of embedding is to provide additional and supportive information that reinforces the primary method and immerse the overall data findings (Creswell 2009, Simons and Lathlean 2010). This model is sometime called ‘Multilevel design’, meaning that the researcher employs different methods to examine different groups or levels. Indeed, this enabled the researcher to elicit participants’ perspectives from different data sources. However, this strategy does not affect each method implementation, on the opposite, it maintains sharing information between methods (Creswell and Plano Clark 2009).

3.6.2. Concurrent triangulation strategy

The concurrent triangulation strategy was also used along with the previous embedded design. This strategy is approached when the data from different sources appear to serve the same goal. It is usually used to merge, integrate or compare the results of two data bases side by side (i.e. quantitative statistical findings followed by qualitative findings that can support or disconfirm the first findings) then combined in the discussion section to reveal any congruency or discrepancy between both findings (Creswell 2009, Kroll and Neri 2009).

Alternatively, methodological triangulation used in this study is a ‘between method triangulation’, which involves a mixture of two different approach where qualitative and quantitative method were operationally processed (Parahoo 2006, Cowman 2008). *Component design* is a kind of triangulation occurs when both methods are started separately at the beginning of a study, then combined together in the interpretation phase (Polit and Beck 2008).

3.6.3. Justification for using mixed-methods strategy

This study was polarised by discrete methodological properties. The purposes of using a multifarious strategy were to overcome the intrinsic bias inherent in a single method whilst also enhancing study validity and providing a maximum explanation of the issue under study from different dimensions in a way which cannot be examined by a single method (Holloway and Wheeler 2002, Cowman 2008).

Triangulation contributes to understanding all study dimensions and therefore, poorly understood phenomenon depends on multiple sources of data (e.g. in-depth

discussion or observation) (Johnstone 2004, Parahoo 2006). Moreover, triangulation can assist in recovering the problem of unpredictable biases that potentially happened with one source (Polit and Beck 2008, Creswell 2009). Triangulation adds rigour and credibility to the study and enables the researcher to approach research questions from different angles and explore the multi-faceted understanding in a way that enhances the validity of the study (Mason 2002, Lewis and Ritchie 2003). Qualitative research supports other data findings by providing an explanation of the relationship between variables and provides additional understanding of the therapeutic care (Grypdonck 2006).

The qualitative approach can be used to complement quantitative data in order to provide insightful justifications and help the researcher to place the statistical findings into the social context from which data were collected (Cowman 2008, Holloway and Wheeler 2002). In this study, qualitative materials were added to the quantitative data, but both methods were driven by the quantitative method. Qualitative data are therefore complementary to the quantitative data. For that, the power of triangulation is that 'thick and rich description' which is accomplished by combining both deductive and inductive reasoning to describe a particular phenomenon (Mason 2002, Lewis and Ritchie 2003). Therefore, the qualitative methods was applied to provide a detailed examination of that context gained from the quantitative method to enhance its understanding and to identify the association between variables (Parahoo 2006, Simons and Lathlean 2010).

Clinical judgment is based on understanding of people's perspectives and the process of illness and human experience. Qualitative approaches can help

researchers to shed light on the development of clinical practice and therefore, strengthen the research findings and thus evidence-based (Mason 2002, Grypdonck 2006). The concept of EBP has also been developed alongside triangulation and qualitative research because the efficiency of any evidence-based concept must be associated with people capacity to accept and adhere to that interventional protocol, also, to identify barriers that might impede carrying out these interventions. For that, qualitative research provides a considerable opportunity for researchers to assess practitioners' capability to undertake standardized care (Polit and Beck 2008, Creswell and Plano Clark 2009).

Merging both methods' findings is a critical phase that often takes a place in the later stage of the study once the body of analysis is completed. In this stage, there is a purposeful search for convergence, divergence and discrepancy between the findings from the different methods (Giddings and Grant 2007, Simons and Lathlean 2010). In conclusion, mixing research findings is an effective strategy to legitimise the research process and achieve 'completeness' and 'confirmation' to the data (Bryman 2001, Parahoo 2006). According to the previous justifications of using mixed methods research, the following aspects confirm the ability of mixed-methods strategy to:

- Determines convergence, differences, or some combinations between findings.
- Eradicates biases associated with using single data source.
- Strengthens the study by adding rigours to the findings.
- Identifies and examines overlaps that might emerge when using multiple sources of data.

- Enhances study internal validity and reliability.
- Compensates for deficiencies of data taken from one source.

3.7. Designs within quantitative approach

3.7.1. Descriptive correlation design

In general, description design is used to identify problems in current practice, justify current practice, make judgment and identify what others are doing in similar situation (Burns and Grove 2003). The descriptive survey is preferred to describe the population and to study associations and links between variables (McKenna et al. 2010). The purpose of using a descriptive correlation design is to examine the relationships between two or more variables in a single group. Therefore, it aims to explore the interrelationships between variables that must be clearly defined and identified previously (Burns and Grove 2003). The aim of descriptive correlation design is to describe the relationship between variables rather than determination of cause-effect relationship (Polit and Beck 2008). However, correlational studies enhance the researcher's data collection of participants' demographics and seek to establish links between these and other variables associated with attitudes, behaviours and performance (McKenna et al. 2010).

In this study, a descriptive approach was used to describe nurses' attitudes, actions, knowledge and responsibilities toward patients who are enterally fed and identify the incidence of EN complications, which particularly associated with improper practice. The purpose of descriptive correlation was to generate insightful meaning into the relationships between adherence to EBP and the occurrence of complications from the perspectives of critical care nurses. Eventually, a clear

relationship that links these variables together was developed, considering differences between groups under study.

3.7.2. Comparative descriptive design

Comparative descriptive design is also important when the intention is to describe variables in two or more groups or when a range of settings are involved in the same study (Burns and Grove 2003). In comparative survey studies, once the data are collected, it is permitted to carry out comparisons based on demographic features such as age, gender and place. In other words, it aims to compare variables across people, time and place (Hallberg 2008, McKenna et al. 2010). This study was conducted in various hospitals from different health sectors in Jordan (e.g. governmental, private, military, and military/educational hospitals), so, it was essential to anticipate the differences in nursing practice between them and to presume that some variations in practice might result from differences in organizational structures and policies.

3.8. Design within qualitative approach

3.8.1. Descriptive qualitative design

For the qualitative section of the study a descriptive exploratory approach was used alongside the quantitative element of the study in order to explore the relationship between variables by providing an in-depth description of how that phenomenon is experienced by the study participants (Elo and Kyngas 2007, Polit and Beck 2008). A thematic analysis was conducted with the qualitative data in this study. This is a technique, common in qualitative analysis, in which data are categorised inductively from a narrative to generate an exhaustive thematic framework of the phenomenon

(Bryman 2001, Silverman 2005, Mason 2002). In a thematic analysis, the researcher intends to capture some level of patterned responses in relation to the research question or extract certain meanings from the dataset (Braun and Clarke 2006).

In fact, thematic analysis is regarded as a 'flexible' technique due to its compatibility with essentialist and constructionist paradigm, thereby; thematic analysis is a method of its own right that can be used as a unique approach in any qualitative research (Braun and Clarke 2006). In addition, thematic analysis is not restrained to any pre-existing theoretical framework, and therefore, it can be integrated with different frameworks (Bryman 2001, Braun and Clarke 2006). However, this technique will be discussed in details in the qualitative data analysis section.

3.8.2. Qualitative design questions

The following questions are the main qualitative enquiries that were derived from the previous research questions. Each main question was translated into different interview question as follows:

1. How do nurses perceive their role in EN along with other professions?

Interview questions:

- Tell me about what responsibilities you have in regard to EN in your unit
- What are your experiences of working with other professionals with patients receiving EN?
- How do other professionals respond when you voice your views on EN?

2. How do nurses describe barriers and facilities to successful exploiting of evidence-based protocols of EN?

Interview question

- Can you tell me about your contributions to producing any EN protocols in your department? What role do other nurses take with this?
- Can you tell me how much of the EN practice in your area, including protocols, are evidence based?
- How does your institution support you if you want to improve patients' nutritional strategies?

3. How do nurses describe factors associated with tube feeding complications?

Interview question

- What are your experiences of using an evidence-based protocol to reduction of feeding complications?
- What techniques do you employ when facing any tube feeding complications?
- How do you assess a patient's nutritional status and detect feeding intolerance in your unit?

In summary, Fig. 3.2 shows the overall study methods and designs which embrace various methodological approaches.

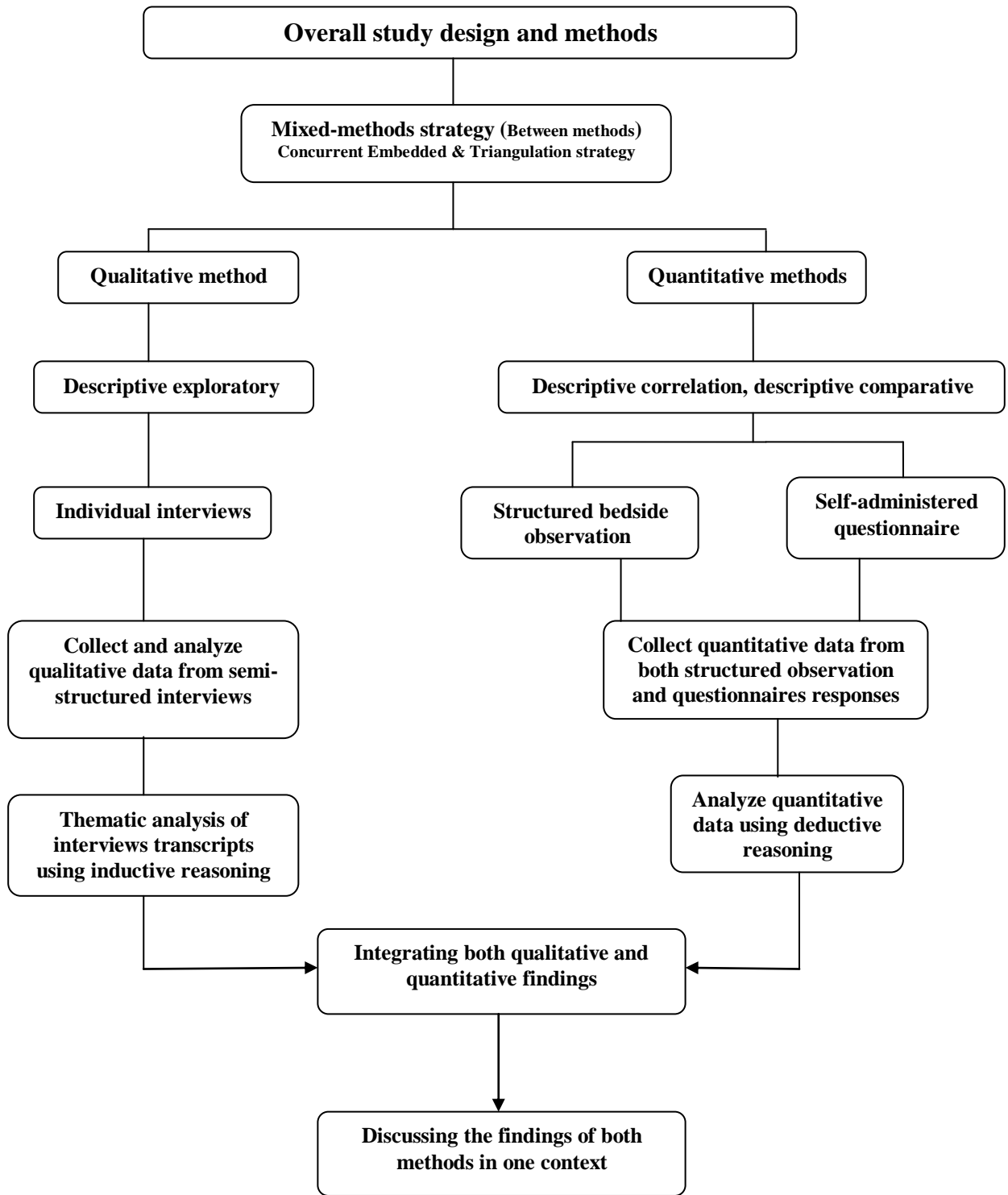


Figure 3.2: An illustration of the overall study design and methods.

3.9. Settings

This study took place in ten critical care units at five different hospitals in Jordan (two MOH hospitals, two military and one private hospital). The targeted hospitals are located in Amman (the capital of Jordan) where the biggest health care services are located. In addition, these hospitals are considered as the central and referral medical centres in Jordan. A list of hospitals based on health care sectors was obtained and clustered into groups. Clustering is a way of selecting places from a range of setting which share the character 'a group of similar things' (Polit and Beck 2008). The process of selecting hospitals was carried out through the following procedure: all hospitals located in Amman were clustered into governmental, military and private hospital groups. The selection of governmental, military and private hospitals was focused on those hospitals providing critical care services and considered as referral and educational medical centres in Amman. Based on these determinants, two main governmental hospitals were selected from a list of four hospitals meeting the selection criteria using a simple random sampling technique (taking a number out of the hat). Regarding the military hospitals, there were three main referral health centres in Amman, two of them were selected and the third one was excluded as it was considered a rehabilitation centre with most of their admitted patients on long term therapy rather than in acute critical care units. In the private sector, six hospitals were subject to random selection after considering a list of all hospitals meeting the above selection criteria as they were recognized as referral and educational health centres in Amman. One of these hospitals was selected randomly using the simple random technique.

Thereafter, each hospital provided a list of the available critical care units which might also use EN on a daily basis. For instance, general ICUs, surgical ICUs (SICU) and Neuro ICUs (NICU) were included. However, paediatric intensive care units were excluded from the study to ensure homogenous sampling in terms of patient categories and nursing care. No specific criteria were applied when selecting units from each hospital, therefore all critical care units available were considered in this study. Figure 3.3 shows the process of selecting hospitals and units from the three health care sectors in Jordan. Because all the hospitals included are considered educational, there was no necessity to include the university-educational hospitals (which refer to the academic institutions, e.g. Jordan University Hospital) because they do not differ in care, structure and patients from other educational hospitals. Therefore, all health care sectors that provide secondary and tertiary health care services were included in the study, and no bias was associated with the selection of places and units. In addition, each hospital included in the study is considered a representative for other hospitals in the same sector. For instance, the hospital selected from the private sector appears to be comparable with other private hospitals in the same category in terms of quality of care, policy, and structure.

3.10. Sampling

3.10.1. Sampling strategy for the survey

The target population is the entire population which the study focuses on, and the study population or the accessible population is that portion from the target population where the sample is taken from (Procter et al. 2010). Registered nurses in Jordan were the *target population*, and registered nurses working in intensive care units were the *accessible population* where the study sample was selected.

Probability sampling was undertaken to identify participants. Clusters sampling was the appropriate sampling technique for this study through clustering groups (hospitals) firstly, then clustering RNs from the ICUs at each hospital. Cluster sampling technique groups or clusters people based on geography or similarity such as the type of hospital and speciality (e.g. cardiac, orthopaedic) (Procter et al. 2010). Therefore, each intensive care nurse had the same probability within the same units for participating in the study. This strategy of sampling is sometime called ‘multi-stage sampling’ because it might use more than two consecutive stages of random sampling selection such as simple random sampling, stratified random, and cluster sampling (Polit and Beck 2008, Procter et al. 2010). The wisdom of selecting a probability sampling is to decrease the systematic bias by providing randomness to the sample characteristics (Polit and Beck 2008, Burns and Grove 2003).

Further to the process of selecting hospitals and units from the three health care sectors in Jordan, the technique used for selecting participants from each unit was the systematic random sampling technique based on the interval of every 2nd nurse. This technique was applied after considering a list of RNs in each unit and determining the intended number of nurses to be approached from each unit in advance. The departmental head nurses were involved in the selection procedure which was entirely anonymous. Figure 3.3 also shows the process of selecting participants from each sector. Eligibility of each participant was essential. Mainly, there were no specific criteria for eligible participants regarding their personal characteristics (i.e. age, sex). However, long work experience was desired and all RNs who had at least one year experience in any ICU were eligible for participation in the survey.

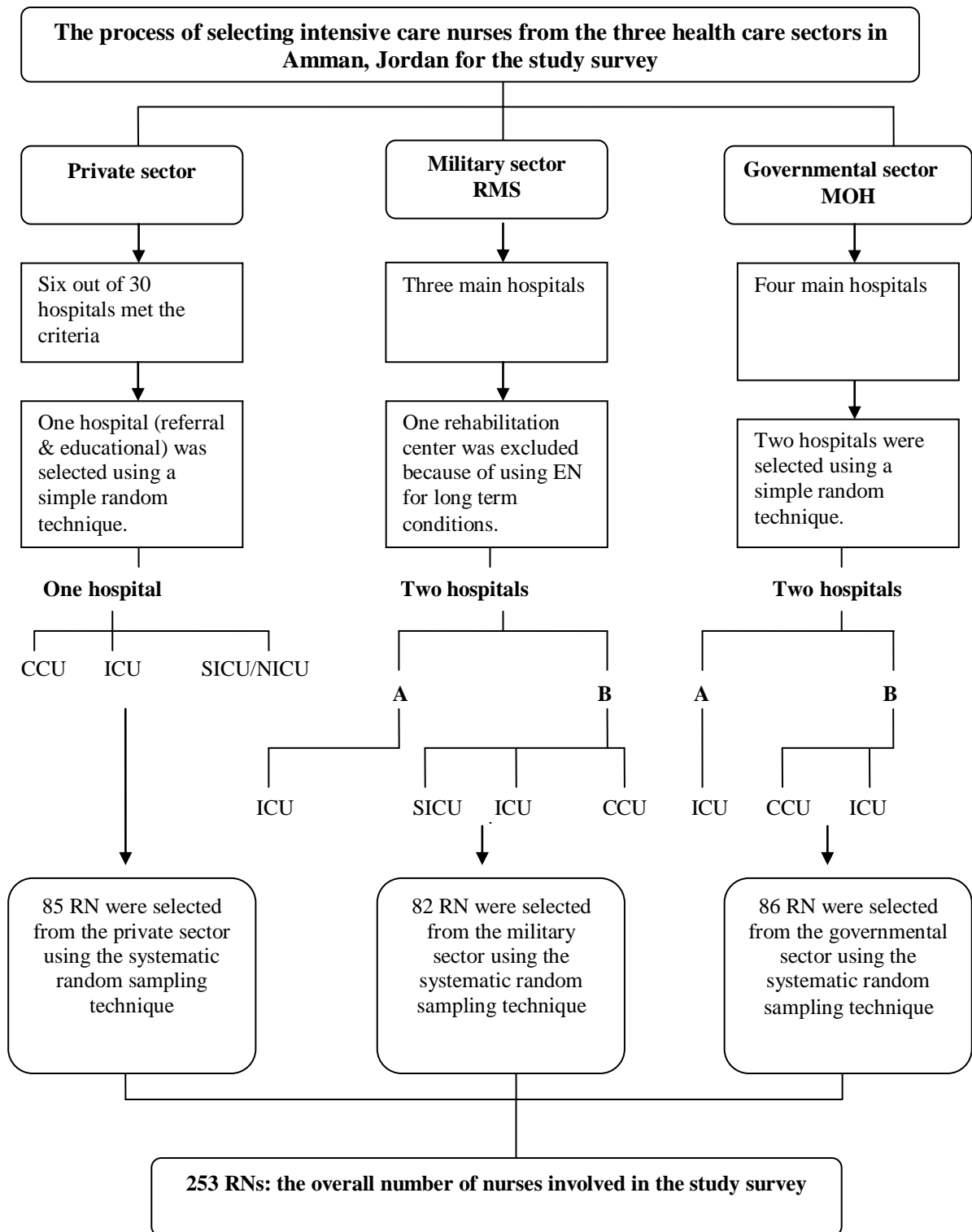


Figure 3.3: The process of selecting study sample form the three health care sectors in Jordan for the study survey.

3.10.1.1. Sample Size

To maintain rigour in data analysis that avoids type II error and enhances power analysis, an effective sample size should be calculated (Hallberg 2008, Cohen 1992). Study sample should be predetermined to ensure that all findings have external validity (Zanotti and Cowman 2008). Various techniques are used to determine the effect-size within different areas of social and life sciences research. The researcher should anticipate the likely size of the differences in measured outcomes that is possible between groups and to provide justifications of the size differences (Procter et al. 2010). However, Cohen (1992) described a method of power analysis based on small, medium and large effect sizes and produced nomograms for the estimation of sample size for a range of statistical tests. Using these tables and aiming to establish a medium effect size, at a conventional power of 0.80 and probability of 0.05 sample size can be estimated as follow:

- Number of group: 3 groups
- Proposed method for comparison: Analysis of variance (ANOVA)
- Sample size according to these parameters is: 52 participants in each group, so the total number of participants in the survey is 156 (Cohen 1992).

This size encompasses also the required size need for conducting a correlation coefficient aiming to establish a medium effect size, at a conventional power of 0.80 and level of significant 0.05 which, as illustrated by Cohen (1992), requires an overall sample of 88 participants. However, the total number of nurses who actually enrolled in the study survey was 253 participants.

3.10.2. Bedside observation

Bedside observation was conducted on a number of patients who were enterally fed in intensive care. The observation was required to obtain some information about patients' feeding tube in the real clinical environment. All patients were enterally fed in intensive care whether using NG feeding or gastric tube, intermittent or continuous feeding, and conscious or unconscious patients were eligible to be included in the study. A convenience sampling or accidental sampling technique was used to select patients for observation. Therefore, any patient who was enterally fed had a chance of being selected in the study.

A total of 55 patients from the three sectors were observed for some issues of EN practices that predetermined previously. This limited number refers to the availability of patients in these ICUs. Although, it is difficult to achieve representative sample using observational techniques (McKenna et al. 2010), Cohen formulae determined the sample size required to conduct Chi-square test for a large effect size at power of 80% and probability of 0.05 to be closer to that gained size.

3.10.3. Sampling within the qualitative element of the study

In qualitative research, the researcher is not concerned with determining the total population of people to develop a sampling frame; rather, he/she aims to identify the key individuals or settings that offer a rich source of data (Procter et al. 2010). To increase the validity of the findings, the researcher is encouraged to choose the appropriate sampling strategy to provide this (Silverman 2005, Procter et al. 2010).

3.10.3.1. Purposive sampling

Purposive sampling is the process of selecting a case because it illustrates some features that are necessary to provide data on the phenomenon under investigation. In other words, the deliberate selection of participants with the necessary expertise and/or experience to provide a detailed description of their experiences (Silverman 2005). In spite of the fact that purposive sampling produces an over-representation of people of interest whereby they are not usually representative of the whole population in the study (Procter et al. 2010), purposive sampling was utilised in order to select informative and valuable participants which often referred to 'information-rich cases' (McCance and Mcilpatrick 2008, Burns and Grove 2003).

Sample size in any qualitative study is strongly linked to the issue of data saturation (Jackson et al. 2008). Therefore, the determination of a sample size in advance could be argued to be inappropriate within a qualitative design. However a preliminary decision on the anticipated sample size is necessary for ethical permission and to get a sense of the size of the data collection task. As such, in this study, the estimated sample size would be between 15-20 participants based on the suggested sample size addressed for this qualitative design by the majority of the qualitative researchers (McCance and Mcilpatrick 2008, Polit and Beck 2008, Holloway and Wheeler 2002).

The total number of the actual participants involved in this study was 14. Those nurses were selected according to the inclusion criteria that aimed to offer rich and informative participants. In line to purposive sampling, intensive care nurses with long work experience and have at least five years clinical experience in an intensive

care unit were eligible for interviews. In addition, nurses who held higher professional roles within their institution such as clinical supervisors, health educators and head nurses or in-charge nurses were also approached for interviewing. This number of participants yielded a sufficient level of saturation to generate an exhaustive understanding of nursing nutritional care in the critically ill.

3.11. Instrument and data collection

3.11.1. Self-administered questionnaire

A questionnaire is a structured self-report form designed to elicit participants' views through written or oral responses of a certain topic. Questionnaires are used in survey or descriptive survey-based design (Burns and Grove 2003). Questionnaires follow a standardised format in which questions were pre-coded to produce a list of potential responses that the respondents use for selecting the appropriate response (McKenna et al. 2010). They also allow inferences to a wider population especially when the data obtained from an appropriate sampling strategy (Jones and Rattray 2010). However, it is thought that self-completed questionnaires yield such bias than those administered by the researcher/interviewer route (Bowling 2001).

In this study, the following domains were investigated using a specific questionnaire. Parts of this questionnaire were taken from a previously published study (Persenius et al. 2006). The researcher developed additional sections to accommodate with the study objectives and also modified the existing sections of Persenius et al's study after obtaining the authors' permission. By estimate, two third of the final structure of both questionnaire and bedside observation was taken directly from Persenius et al's study and one third was developed by the researcher

and revalidated by a panel of experts. The modifications have included additions and removal of some issues that did not directly serve the study objectives. The final form of the questionnaire consists of 85 items divided into the following disciplines. The whole questionnaire was piloted as explained in detail later in this chapter:

- a) Participants' demographics (8 Items)
- b) Source of knowledge regarding EN (9 Items).
- c) Knowledge of responsibility for nutrition (9 Items).
- d) Responsibility (5 Items).
- e) Knowledge (5 Items).
- f) Documentation (5 Items).
- g) EN intervention (20 Items).
- h) EN complications (16 Items).
- i) EN evidence-based practice (5 Items).

The questionnaire was written in English and to ensure its understanding in Arabic, a brief translation for the major headings into Arabic was performed after considering forward-backward translation before using it to ensure the accuracy of translation.

3.11.2. Bedside Observation

Direct observation has a number of advantages in term of practicality and validity in which it provides a true picture of the reality (Mcilfattrick 2008, McKenna et al. 2010). Bedside observation took place in the same hospitals involved in the study. Bedside observation comprises some predetermined items parallel the content of the

interventions section in the questionnaire. The purpose of this is to reinforce the data obtained from the questionnaires and add some descriptions of unexamined issues. It also supports the reliability of nurses' responses in each examined area when described by various ways. Mays and Pope (1995) described observation in nursing research as:

'Observation optimizes the idea of the researcher as the research instrument and involves 'going to the field', describing and analyzing what has been observed' (cited in Mcilfatric 2008, Observation, p.310)

Structured observational techniques were considered for data collection. In structured observation, the researcher is a non-participant observer who observes the phenomenon under study using pre-established framework or structured schedule for data recording. This framework would facilitate the systematic collection along with limiting subjectivity and observer bias that in eventual enhances validity and reliability of the observation (Watson et al. 2010). Also, it can avoid data overlapping (Mcilfattrick, 2008). Structured observation is regarded as a deductive approach because all behaviours and activities were determined before starting the observation process (Mcilfattrick, 2008). However, structured observation might limit the researchers' abilities to capture other complex activities that occur in the field spontaneously (Watson et al. 2010).

In this study, all materials and items under observation were predetermined prior to starting the observation. The observational instrument was adopted from Persenius's study (2006) and modified through creating and removing some items to be consistent with study objectives' then it has been revalidated via the same

validation techniques used in the questionnaire. Indeed, the previously validated observation schedule allows researcher to replicate the observation in different setting and population (Watson et al. 2010).

3.11.2.1. Type of observational role

As mentioned previously, the observer, who is the researcher, was a ‘complete observer’. This kind of observational role is characterized by: no participation, maintain distance, no interaction, concealing role (Mcilfattrick 2008, Watson et al. 2010). The observation role is merely designated for monitoring without any influence on the data to minimize bias and support data reliability especially when no personal interference was undertaken. Establishing rapport between the researcher and field staff and reflecting positive impression are strongly recommended to enable the researcher accessing to the data easily and to minimize the influence of staff members on the reliability of the observed practice (Mason 2002, Mcilfattrick 2008).

It is commonly noted that the behaviour of participants who are being observed may potentially differ to match the observer expectations especially when they are aware of the parameters that the observer looking for. Indeed, this potential risk in the observation is called ‘Hawthorn Effect’ (Nelson et al. 2010). The Hawthorn effect is a bias occurring in participants when they intentionally meet researcher interest that eventually could lead to compromising the overall reliability (Shuttleworth 2009). To solve this problem, it is recommended that the observer partially conceals the intended parameters of observation to avoid any spontaneous changing in participant’s behaviours (Shuttleworth 2009).

3.11.3. Method of qualitative data collection

3.11.3.1. Semi-structured interviews

One of the main methods of collecting data in the qualitative research is semi-structured interviews (Krippendorff 2004, Graneheim and Lundman 2004, Campos and Turato 2009). Semi-structured interviews are widely used in qualitative research adopting a number of methodological approaches in nursing studies (Tod 2010). In this study, semi-structured interviews allowed for in-depth exploration of issues associated with EN by purposively sampling those nurses who have substantial clinical experiences of this procedure. All interviews were conducted on an individual basis with previous arrangements at the participants own preference. Semi-structured interviews were used to determine participants' views and opinions toward their role in managing and solving complications of tube feeding and using practical guidelines and protocols for EN.

To minimise unnecessary data collection and to minimise data overlapping from different sources, semi structured interviews are the most appropriate interviewing technique to fulfil that purpose (Jackson et al. 2008). However, the researcher in turn, has to ask to what extent it is possible to understand the complexities of the interview framework to enable the interviewees to interact and make responses based on logical thinking and to articulate their understanding intellectually (Mason 2002).

Semi-structured interviews were guided by an 'interview schedule' of open ended questions that were flexible and allow participants and interviewer to digress to follow any relevant or interesting new avenue of enquiry (Polit and Beck 2008,

McCance and Mcilpatrick 2008). In addition to the interview schedule questions the guide included prompts to aid the researcher. Semi-structured interviews retain the flexibility required to follow unanticipated issues raised by the interviewees. To achieve the right balance of flexibility and direction, an organised schedule was required in which the central question was addressed and then it allowed for future new and interesting responses to be explored (Jackson et al. 2008, Tod 2010).

In this study, the interviewees were given the chance to select the language of presentation upon their interest. Both English and Arabic language were possible. However, all transcripts were translated into English for data analysis and interpretation.

3.12. Pilot study

A pilot study was conducted to check the feasibility and the clarity of the research instrument prior to using in a larger scale and wasting money and time (Polit and Beck 2008). The process of pilot study may take the form of a ‘dummy run’ to assess if the sampling technique works, or may include testing out a data collection instrument (Lacey 2010). Nineteen RNs were selected in the study using the same criteria of participation which predetermined previously; also, they were selected randomly from different health care sectors in Jordan (MOH, military and private). A preliminary analysis was conducted to examine the internal consistency for the knowledge, responsibility, documentation and evidence-based scales, Cronbach’s alpha values of these items were: 0.93, 0.92, .88 and 0.85 respectively. Because the scale includes a small sample size, it tends to be less accurate to detect the relationships between variables (Polit and Beck 2008). However, a number of

bivariate tests were attempted to find differences between study groups, they revealed some discrepancies in both EN practice and responsibility and knowledge of EN. Generally, few comments emerged by participants related to phrasing and wording of some questions to be clearer and to provide additional instructions for the participants for filling the questionnaire.

Based on this small trial, additional information were provided to eliminate any ambiguity inherent in understanding some questions in addition to rephrasing some questions using simple words rather than complicated words because the majority of nursing staff use English as a second language. As mentioned before, a brief description for the main headings was also provided in Arabic.

3.13. Procedure

3.13.1. Surveys

Questionnaires can be delivered via a variety of routes such as postal or face-to-face administration (Jones and Rattray 2010). Every hospitals included in the study were provided an equal number of questionnaires (approximately 100 for each hospital) to be completed by their intensive care units staff within predetermined time schedule. Particularly, the assumed time for filling the questionnaire is between 30-45 min. Collaboration with the head nurse of each unit was primarily carried out for choosing the sample randomly and distributing the questionnaires. Reminder (e.g. by telephone) were also used to increase the response rate (Parahoo 2008).

As discussed previously, a cluster sampling technique was employed to obtain eligible participants from the three different sectors. The technique was used to

maintain the randomization in selecting participants and this was achieved by the researcher along with head nurses in some circumstances. The process was started after considering a list of the all nurses available in each department.

3.13.2. Bedside observations

Bedside observations were implemented in patients who were fed enterally. During observation, no direct interference with patients or their therapeutic plans was done. Each observation lasted between 10-15 minutes without the need for staff attendance.

3.13.3. Interviews

The time of the interviews was arranged based on the interviewees' interest and convenience at an appropriate place. All the interviews were tap-recorded after obtaining the participant's permission. The estimated time of each interview was 30-45 minutes according to the proposed number of questions.

Both interviewees and surveyed nurses were provided a list of sufficient documentations prior to joining the study such as invitation letters and information sheets. These aim to establish the credibility of the study, improve response rate, and convince the participants of the essence of the study and the importance of their participation (Jones and Rattray 2010). In addition, they enhance ethical considerations and avoid any potential risk that could be inherent in their participation. A detailed explanation of the ethical issues is provided at the end of this chapter.

3.14. Data analysis

3.14.1. Statistical data analysis

The Statistical Package for Social Sciences computer software (SPSS) version 16 was used for coding and analyzing the numerical data. Descriptive and inferential statistical tests were processed to identify the significant findings in relation to the differences between study groups and the relationships between variables. The most logical sequence of data analysis is to start with descriptive analysis, then continue to identify comparisons, correlations, and regression if necessary (Zanotti and Cowman 2008). However, the following study hypothesis guided the statistical analysis of quantitative data gained from questionnaires and bedside observations. Both parametric and nonparametric inferential statistics were applied according to the nature of variables. A range of statistical tests were used to determine the differences between groups such as Mann-Whitney *U* test, Kruskal-wallis test and Chi-square test. Also, statistical tests were used to identify the relationships between variables such as correlation coefficient represented by spearman's rho (Pallant 2007). For testing the reliability of scales, the alpha coefficient test was examined via Cronbach's alpha statistic that measured the levels of internal consistency between some interrelated items. Data were displayed on tables and graphs to assist the readers understanding the findings in a simplified way. The study power is already taken into consideration when determining the sample size needed to achieve $\alpha = 0.05$ probability at a conventional power 0.80 in medium effect size.

3.14.2. Analysing qualitative data

In general, qualitative data analysis consists of three stages: description, analysis, and interpretation (Burns and Grove 2003, Bazeley 2009). Qualitative analysis

inevitably involves breaking the data down, coding and re-ordering the data in order to explain the emerged meanings (Pope et al. 2000, Tooping 2010). This study will employ a thematic analysis of interview data.

3.14.2.1. Thematic analysis

Thematic analysis is the process where the researcher identifies themes and patterns of the interviews which are recorded on tapes and converted into verbatim transcripts. It involves coding the *data* and searching it for related *categories* with similar *meanings*. These are then grouped together to configure *themes* inferred and generated from the data (Marshall and Rossman 2006, Woods et al. 2008). Marshall and Rossman (2006) define thematic analysis as the process of introducing order, structure and interpretation to qualitative data, then identifying particular relationships within categories to formulate themes which are internally convergent (consistent but distinct from one another) and externally divergent (Marshall and Rossman 2006).

A theme is defined by Boyatzis (1998) as ‘a pattern in the information that at minimum describes and organises the possible observation and at maximum interprets aspects of the phenomenon’ (p. 161). Or, it is the abstract structure of such experience and relevant manifestations bring clear meaning and clarification (Polit and Beck 2008). Subsequently, themes should display multiple perspectives of individuals’ yield that can be supported by specific evidence (Creswell 2009).

In fact, the thematic analysis is not a linear process simply move from phase to another. Instead, it is acknowledged as a recursive process capturing the pattern of

the data (Braun and Clarke 2006). In addition, the emerged theme should be internally homogenous and externally heterogeneous, meaning that the data within the theme should be distinctive from other themes but coherent meaningfully (Graneheim and Lundman 2004, Silverman 2005).

All interviews were tape recorded using digital devices for that purpose (MP3) and carried out according to the participants' preference considering their preferred language and their abilities to explain their perspectives. Therefore, the majority of the interviews were conducted in Arabic which was translated into English. The researcher, who is competent in both languages, carried out the translation personally – something that is acknowledged as good practice (Temple and Young 2004). The accuracy of translation were checked by another researcher, equally conversant in both languages but is independent to the data collection using forward-backward translation to enhance the validity of the translation (Temple and Young 2004).

After translating and transcribing all interviews, all transcripts were styled and organized in a consistent manner. Each transcript was given a code number to be used for quotations, considering the anonymity of participants by concealing their names and solely showing their initials and the sector of each. Any other detailed information was stored separately.

Thematic analysis was initiated by employing the technique created by Marshall and Rossman (1999). It was started by creating codes using line by line coding technique and ended by creating themes based on the main research questions. The

codes were categorized subsequently into subthemes based on the specificity of data. All subthemes are internally convergent and externally divergent to show the uniqueness of each group, meaning that no any code was categorized in two places. Then the theoretical understanding of the relationships between these subthemes influenced formulating the main themes. Different innovative strategies have been launched to summarise the process of thematic analysis. However, Marshall and Rossman (1999) described the process of thematic analysis and divided into the following six consecutive phases:

- Organise the data
- Code the data
- Generate categories or themes
- Test emergent understandings of the data
- Search for alternative explanations of the data
- Write-up the data analysis

Organizing the data refers to the process of the researching coming to understand the data and becoming familiar with it. The researcher implemented this stage through organizing and archiving data by indexing every document and having a key index to facilitate transcript accessibly. This stage also involved reading and re-reading all transcripts to become familiar with the data and to develop a holistic image about the dataset.

Coding the data was done by a thorough exploration of the transcript that sees the researcher identify and name (code) small segments – based on the type of activity, feeling, attitude or issue represented by the interviewee. This was done for each

transcript. In addition the researcher made notes about any emerging patterns in the data and which coded segments may be linked. Coding was carried out using 'line-by-line' technique and all data were marked up by codes manually by the same researcher using pencils to enable erasing changes easily. The process of coding adopted a consistent technique of understanding the meaning of the data throughout all transcripts to avoid over-estimation or under-estimation (Mason 2002).

As coding proceeds the researcher searching for larger categories or sub-themes within which coded segments can be placed, the researcher tested these out by an iterative process that involves questioning the data and seeking alternative explanations. As this process continued, the analysis then sought to place categories in larger, explanatory themes. Codes were grouped into a context that reflects certain patterns of characteristics and properties between these codes to make these subthemes internally convergent and externally divergent, meaning that they should be linked together and distinct from each other (Marshall and Rossman 2006).

Throughout the data analysis process the researcher tested out emergent understandings of the data, drawing certain meanings from the data, and comprehending the actual story that the data is telling (Marshall and Rossman 2006). This also entailed interrogating the emerging categories and thematic framework for alternative explanations by seeking out 'negative cases, in other words data that may not fit the emerging framework. This sometimes referred to as being the 'devil's advocate' (Marshall and Rossman 2006). Generally, understanding the data was particularly based on the semantic approach of thematic analysis that concerned with the apparent and visible manifestations rather than

exploring the underlying meaning of the data (Priest et al. 2003, Braun and Clarke 2006).

Finally, the researcher presented the final thematic framework, using paradigm examples of the data to illustrate the themes. This is, also when any links or divergence between and within themes were described. The objective was to provide a thorough, rich and in-depth account of the participants views, attitudes and experiences (Marshall and Rossman 2006). Witting up the final description of the themes is crucial and the researcher proofed the description of themes using evidence taken from the participants' views because it is a data-driven analysis because the researcher carrying out the analysis inductively (Boyatzis 1998).

3.14.3. Integrating quantitative and qualitative data findings

Although the study was driven by the quantitative design, both quantitative and qualitative data findings had equal opportunity to formulate the overall study structure. Whether narrative or statistical, the integration of findings was carried out intellectually, in a broad frame that functions to reflect nurses' attitudes towards nutritional care in the ICU. Data findings, when brought together for discussion, were reconstructed into a form of themes which exhibited the convergences and divergences between all datasets. This final draft of results was prepared for discussion as a single context.

To make the integration more convincing, results from quantitative parts had initiated the exploration of commonalities in findings from the qualitative part. Therefore, the quantitative part has given a larger weight to guide the process of

integration. By this, each major concept which was appeared in the quantitative part was eligible for exploring relevant inferences from the qualitative results to an extent that allows for detaching any qualitative theme into separate fragments to be ascribed later to the relevant section from other sources. Thus, each final constructs compiles the results from all methods regardless the order of presentation of these findings in the original forms. However, some concepts emerged by the study were entirely originated in the qualitative part than in the quantitative part and vice versa. In this situation, no interactions were reported between the methods that are seen to mean embedded-mixing strategy which was anticipated earlier in this chapter (Bazeley 2009, Creswell 2009, Teddlie and Tashakkori 2009).

As both methods were granted equal significance, the priority was also equal. However, in some instances, the priority to give a confidence for certain results over another was appeared depending on the differences between methods in terms of sample size, participants' experiences and the depth of examining such concepts deeper in one method than another. In conclusion, the overall study themes were used for discussion, showing the differences between methods, strengths and weaknesses that force to highlight the most significant findings in comparison with literature.

3.15. Validity and reliability

Generally, in mixed methods research when the quantitative approach is dominant and the qualitative approach is supportive, the concepts of validity, reliability, and generalizability are applied. However, if the qualitative design move toward more abstract shape of interpretation such as thematic analysis, then extra validation

process of trustworthiness are required (Giddings and Grant 2009). In fact, validity of mixed methods research is defined as the ability of the researcher to attain meaningful and accurate inferences from all data forms in the study (Creswell 2009).

3.15.1 Validity and reliability of quantitative data

3.15.1.1. Validity

Validity means to what extent that the selected tool measures the intended research objectives (Bowling 2001, Parahoo 2008). Different types of validity were measured in this stage:

Face validity examines the apparent characteristics of the instrument to confirm that it is unambiguous, clear, well structured and suitable for administering (Bowling 2001, Polit and Beck 2008).

Content validity examines the instrument structure and organization in a comprehensive way to make sure that all variables and concepts of attributes are sufficiently measured (Polit and Beck 2008). Content validity requires expert decisions on the topic being investigated in terms of clarity and relevance. Usually, a panel consists of 3-4 experts is selected upon their relevancy to the study themes (Parahoo 2008).

Internal validity means the extent to which the independent variable is significantly causes and influence the dependent variable (Polit and Beck 2008).

External validity is that validity which reinforces the meaning of generalization which can be fulfilled by maintaining the sample representative (Bannigan and Watson 2009). On the other hand, systematic review enhances the meaning of external validity based on the replications across time, place, and people that

uncover whether the relationships between variables represent the truth (Polit and Beck 2008).

Several strategies were undertaken to validate and refine the content of the questionnaire. The proposed instrument for this study was subjected to an expert panel to establish a face and content validity. Different personal qualifications were taken into account to attain a maximal consistency and comprehensiveness (Polit and Beck 2008). Experts' responses were dichotomous (clear/unclear), or according to relevancy (not relevant, somewhat relevant, quite relevant, and highly relevant) (Polit and Beck 2008). However, all efforts were taken to consider all of the contributions of the panel and their suggestions whether addition or dropping certain items from the questionnaire. Many items of domains and sub-domains were manipulated and reconstructed with minor language adjustments to enhance clarity, and to be assured that the instrument is entirely applicable. All efforts were made to enhance study validity in data collection through recruiting participants in randomized selection, in addition to employing larger sample more than the required to support study generalizability. Validity of data analysis was also maintained, considering the assumptions of each statistical test that is based on minimising the risk of type I and II error.

3.15.1.2. Reliability

Reliability means the extent of measurement for certain participants is similar on applying this tool at different time (Bowling 2001). It can be achieved when keeping results at a consistent level despite changing of time and place (Bowling 2001, Parahoo 2008).

Internal consistency: Internal consistency comprises testing the homogeneity that assesses the extent to which personal items are inter-correlated, and the extent to which they correlate with overall scale findings (Polit and Beck 2008). This can be performed by using Cronbach's alpha test. Many references state that an alpha 0.85 or above indicates adequate internal consistency, meaning, findings are consistent, so the items are representative (Bowling 2001). The reliability of this study instrument was tested. Cronbach's alpha coefficient was used for measuring the internal consistency of the questions relating to responsibility, knowledge and documentation of ICUs nurses, adhering to evidence-based guidelines toward EN and the result showed higher level of internal consistency (>0.85) as shown in chapter 4.

Reliability of observation can be achieved by providing sufficient training for the observer, identify the categories in advance, and clearly exploring dimensions of the observation (Polit and Beck 2008). Reliability of observation refers to the consistency of observation in which the observers reached to the same inferences or activities of intra-observation (one observation at different time) and inter-observation reliability (more than one observer) (Mcilfattrick, 2008). In this study, a structured observation was conducted by the researcher alone. However, the reliability of observation might be violated in this kind of observation related to using one pattern of judgment by one person rather than establishing inter-rater reliability so different observer would be more powerful in term of having accurate measurements.

3.15.2. Enhancing the trustworthiness of the qualitative findings

Linked to, but distinct from positivist paradigms of research quality and reliability, *credibility, transferability, dependability, and confirmability* are the qualitative elements that frequently used to demonstrate trustworthiness in qualitative research (Marshall and Rossman 2006, Creswell 2009, Giddings and Grant 2009). These terms are used to describe numerous activities and procedures aimed at demonstrating trustworthiness within qualitative data analysis.

3.15.2.1. Credibility (internal validity)

Credibility refers to the researcher concern to develop an accurate description in qualitative research. Recognising the socially constructed nature of the data and the phenomenon under study, rigour in qualitative research seeks to demonstrate trustworthiness of findings rather than embraces notions of the true and false or positivist empiricism (Marshall and Rossman 2006, Polit and Beck 2008, Lewis and Ritchie 2003).

Drawing on the work of Cresswell (2009) and Marshall and Rossman (2006), the following strategies were undertaken to enhance the credibility of qualitative findings:

- Triangulation (between methods), as an efficient strategy was used to build a coherent justifications for themes (Giddings and Grant 2009, Creswell 2009).
- Member checking, which aims to determine the accuracy of final reports or specific descriptions when reverting to the participants to identify whether

the study findings are accurate (Marshall and Rossman 2006, Creswell 2009).

- Using of ‘self reflection’ by the researcher to identify any potential bias (Marshall and Rossman 2006, Creswell 2009).
- Presenting and explaining negative or discrepant information that might emerge from the analysis (Creswell 2009)- negative case analysis.
- Peer review of emerging ideas through discussions with supervisors and through seminar presentations to colleagues.

3.15.2.2. Transferability (external validity)

Is the extent to which the findings can be ‘generalized’ to different groups or settings (Graneheim and Lundman 2004, Fereday and Muir-Cochrane 2006).

Transferability in qualitative research does not mean generalizing findings to individuals, setting or place, but it lies in the particularly rich description of themes and descriptions developed from a specific site in contextual form and suited to inform the work of other qualitative researchers in other settings (Marshall and Rossman 2006). Thereby, *Practicality* is more applicable than generalizability in qualitative studies and the task of the researcher is to present the findings of the study in a complete and transparent manner as possible (Creswell 2009).

The following strategies were undertaken to address transferability findings:

- Using ‘rich’ and ‘thick’ description to convey findings. For instance, by providing a detailed description and employing the data to describe the various perspectives on the phenomenon (Creswell 2009, Marshall and Rossman 2006, Lewis and Ritchie 2003).

- Triangulation (between methods), was also used to enhance qualitative findings transferability by producing congruence within the two different data sources (Marshall and Rossman 2006, Lewis and Ritchie 2003).

3.15.2.3. Dependability (reliability)

Dependability relates to the transparency of the research process and its decision trails (Tooping 2010). Credibility cannot be achieved in the absence of dependability (Polit and Beck 2008). But is also accomplished by the researcher accounting for the emergent design and clearly setting out the decisions taken as data is collected and analysed, in other words, accounting for how the social world has influenced the study (Fereday and Muir-Cochrane 2006).

The following strategies were employed to ensure reliability of the findings:

- Data coding was compared constantly with codes reference by doing regular follow up for codes and their definitions (Creswell 2009).
- Transcripts were double checked to be sure that there are no obvious mistakes (Creswell 2009).
- Cross-check coding was applied by using independent researcher for checking the coding strategy and comparing with the primary results (called: intercoder agreement) (Creswell 2009, Lewis and Ritchie 2003).

3.15.2.4. Confirmability (objectivity)

Polit and Beck (2008) reported that confirmability of qualitative data analysis is a pre-requisite for its credibility. Confirmability refers to the trustworthiness of the interpretation and clarity of the data analysis procedures that used to develop and

present the study findings (Marshall and Rossman 2006, Lewis and Ritchie 2003) or, it is the process that helps in establishing clearly linked findings and interpretation (Tooping 2010).

The following strategies were employed to maintain the objectivity of the findings:

- Experts' critique, when seeking 'external auditors' to provide additional checking on the data coding and analysis (Giddings and Grant 2009, Creswell 2009). The supervisory team was used to accomplish this strategy.
- A clear description of the data analysis procedures was provided, though the use of an 'audit trail' (Koch 1994). This was augmented by a thorough and complete account of all data collection and analysis decisions within the thesis.

3.16. Ethical considerations

Researchers may encounter moral dilemmas due to using methods that are seen to have violation against human rights or possibly causing harm (Johnson and Long 2010). The following issues were emphasised along with the researcher-attentions for several strategies to deal adequately and ethically with the prospective participants prior to engaging in the study:

1. Ethical approval from The University of Sheffield was required prior to data collection. The office of quality and governance manager at the University of Sheffield declared that Al-Basheer hospital ethical committee (where the study will mainly be applied) has a sufficient and robust ethics review procedure.

2. Ethical approvals were obtained mainly from three health care bodies in Jordan; MOH (Governmental), Royal Medical Services (Military) and the Islamic Hospital (Private). Each sector has agreed to conduct the study in different hospitals within their authority. In addition, all of them accepted to contribute in the survey, interviews and bedside observations providing the best facilities to accomplish that in a short period. For that, data were gathered within scheduled visits and sufficient arrangements.
3. Approval for using some items from the adopted instrument was obtained from the main author Mona Persenius, Sweden.
4. Each participant, whether in the survey or interview, was provided with an invitation letter, information sheet explaining the aims and purposes of the study and what is expected from their participation, stating that any participant have the right to withdraw from the study at any time. Confidentiality; self determination and subject anonymity were strictly preserved.
5. Completed questionnaires indicated participants' consent to participate in the survey. Written informed consents were taken from all participants who joined study interviews, using special forms prepared for that purpose.
6. Data from primary sources (surveys, interviews, and bedside observation) were kept in a secure place, either in locked cabinet or computer files with a password number. Only the researcher and the supervisors had the right to access the data. All efforts were undertaken to avoid any identification or disclosure of individuals, entities, organizations or systems in order to maintain appropriate anonymity and to safeguard confidentiality.

7. Each participant involved in face-to-face interview was informed that the interview will be recorded by audiotape devices, and the participants should give permission for taping the interview and have the right to withdraw or delete any saved part or refuse to participate in the interview. Also they were informed about any threats that might exist if any part of the interview indicates the source of information; however, there was no expected risk of disclosing any information.
8. Transcripts of tapes were kept anonymous and confidential by keeping all relevant personal details stored separately from transcripts. However, the possibility of indicating to any individual characteristics (other than demographic) was absent because the aim of the interview was solely to reflect nursing perception about nutritional practice in critical care areas.
9. Hospital research policy of observation and interview were strictly taken into consideration in accordance with the previous agreements from hospitals administrators. Any institutional conditions for conducting the research were dealt accurately and were not mentioned in the major discussion body.
10. Because the patients did not interfere directly in the data collection, they were not given any consent or acquaintance while doing the bedside observation. Family or relatives, if present during the observations, were provided with a brief description about the study aims. However, if there was any existing problem observed by the researcher, he was in position to inform nursing staff immediately to preserve patients from any potential consequences.

11. Participations did not interrupt or confuse participants' working. All interviews times were chosen at interviewees' interest and convenience in an appropriate place.
12. The final report of the study will be sent to all relevant parties whether individuals (if required) or institutions, and it is disseminated in a generalised form and refereed to Jordanian critical care nurses in different sectors, rather than indicating to the sources of these inferences. In addition, major discussion and interpretation were neutral and based on general descriptive enquiry.
13. Additionally, the researcher successfully completed the NIH Web-based training course 'Protecting Human Research Participants' running by The National Institutes of Health (NIH) - Office of Extramural Research.

3.17. Conclusion

This chapter focused on the methodological characteristics of the study. The anticipated framework embraces two different methodological approaches and methods for data collection. After appraising the effectiveness of Donabedian's model which sets the study's tenor, the next stage will determine how this theoretical framework attached to the study finding, demonstrating Structure-Process-outcome as three consecutive domains reflect an understanding of the quality of health care. As the study used two different methods, the sampling strategies are also distinguished by clusters and purposive sampling. The validity and reliability of all measures were emphasized whether in using instruments, data collection and data analysis in advance.

All participants are ethically protected and informed about the focus of the study in details. The next chapter will present the findings of the study using all data collection sources, which will be blended together in one context as explained in the last section to produce overall study themes that comprise all dimensions of nursing nutritional care in intensive care areas.

Chapter Four: Results

4.1. Quantitative data findings

This chapter represents the findings of data analysis from all data sources. In this first section, findings from self-administered questionnaires and the bedside observations will be displayed. Next section will present the findings of the qualitative data analysis. Thereafter, the integration between qualitative and qualitative findings will be introduced in the third section of this chapter.

4.1.1 EN survey

This survey was conducted in three health sectors in Jordan (MOH/governmental, military and private). The total number of participants who completed the study questionnaires was 253 nurses from different critical care departments such as ICU, CCU, SICU, and NICU. This represents the overall response rate of 84.3% as 300 questionnaires were distributed equally in the governmental, military and private sectors (100 for each) and the completed questionnaires from all sectors showed higher response rates (86%, 82% and 85% respectively). As mentioned in the previous chapter, regular reminders were used to improve the response rate.

4.1.1.1. Demographic data

Table 4.1 shows the demographic data of the participants who involved in the survey; 253 participants were equally distributed between on three health care sectors. As shown in the table, the majority of participants (47.4%) were under 25 years old, and 32.4% were between 26-30 years old indicating young participants. There were no significant differences between the three sectors regarding participants ages ($p=0.129$). Gender distribution was also similar in the three

sectors; male (56.5%) and females (43.5%) with no significant difference between the hospitals.

Of the participants, 81.8% were registered nurses holding bachelor's degree in nursing and this reflects the majority of participants or in fact, the majority of workers in the ICUs. The remaining has diploma (3 years study) and post-graduate degrees showing no significant differences between the three sectors. It was evident that the majority of participants (52.5%) were working in ICUs (general intensive care units) which might include various critical cases. Other nurses were working in other intensive care areas such as CCU, SICU, and NICU.

The mean length of working as RN was above four years in the three hospitals with no significant differences between groups ($p=0.668$). Similarly, the total length of working as CNS/NP was above three years in the three sectors and also with no significant difference between them ($p=0.454$).

Table 4.1: Comparing participants' demographic data in the three health sectors

Variable	Sector	Governmental	Military	Private	Total	α
		No. (%)	No. (%)	No. (%)	No. (%)	
Age	<25	32 (37.2%)	47 (57%)	41 (48.2%)	120 (47.4%)	Chi-Square test p=0.129
	26-30	33 (48.4%)	26 (31.7%)	23 (27.1%)	82 (32.4%)	
	31-35	13 (15.1%)	6 (7.3%)	11 (12.9%)	30 (11.9%)	
	36-40	6 (7%)	3 (3.7%)	6 (7.1%)	15 (5.9%)	
	>40	2 (2.3%)	0 (0%)	4 (4.7%)	6 (2.4%)	
	Total		86 (100%)	82 (100%)	85 (100%)	
Gender	Male	49 (57.8%)	46 (56.1%)	48 (56.5%)	143 (56.5%)	
	Female	37 (43%)	36 (43%)	37 (43.5%)	110 (43.5%)	
	Total	86 (100%)	82 (100%)	85 (100%)	253 (100%)	
Qualifications	Diploma	19 (22.1%)	3 (3.7%)	8 (9.4%)	30 (11.9%)	
	BSc	63 (73.3%)	72 (87.8%)	72 (84.7%)	207 (81.8%)	
	PGDP	2 (2.3%)	7 (8.5%)	4 (4.7%)	13 (5.1%)	
	MSc	2 (2.3)	0 (0%)	1 (1.2%)	3 (1.2%)	
	Total	86 (100%)	82 (100%)	85 (100%)	253 (100%)	
Work unit	ICU	30 (34.9%)	54 (65.9%)	48 (56.5%)	132 (52.5%)	
	CCU	17 (19.8%)	16 (19.5%)	21 (24.7%)	54 (21.3%)	
	SICU	11 (12.8%)	6 (7.3%)	9 (10.6%)	26 (10.3%)	
	Other	28 (32.6%)	6 (7.3%)	7 (8.2%)	41 (16.2%)	
	Total	86 (100%)	82 (100%)	85 (100%)	253 (100%)	
Total length of experience as a registered nurse (RN). <u>mean (SD)</u>		4.72 (4.32)	4.35 (4.01)	4.74 (3.88)	Kruskal-Wallis Test p=0.668	
Total length of experience as a critical care nurse CNS/NP. <u>mean (SD)</u>		3.49 (2.64)	4.01 (3.91)	4.14 (3.28)	Kruskal-Wallis Test p=0.454	

4.1.1.2. Nurses' knowledge of responsibility for nutrition.

This part demonstrates nurses' knowledge of responsibility toward patients feeding. It was ambiguous if there were written guidelines for EN in the three sectors. 48% of participants claimed the availability of a guideline and the same (48.6%) reported the absence of a guideline. In general, nursing responsibility for nutrition scored lower; only 21.7% of nurses considered themselves to be responsible for patient nutrition with the majority (77.9%) reported that someone else has responsibility for nutrition.

Although some nurses asserted that clinical nutrition is the responsibility of other professions, 85.5% of nurses revealed the absence of nutritional team in their departments. However, 69.6% suggested that there is a nutritional team in their hospitals. The majority of nurses (55.3%) showed the availability of a key person to consult at their hospitals. However, 56.5% indicated that the nutritional consultation is rarely obtained from persons outside their institutions. In particular, no significant differences were reported between nurses in all sectors in regard to nurses' knowledge toward nutritional responsibility and the majority of nurses scored in the same pattern in all sectors.

Table 4.2 compares nurses' knowledge of responsibility toward nutrition in the three health sectors.

Table 4.2: Comparing nurses' knowledge of responsibility toward EN in the three sectors.

Item \ Sector	Governmental			Military			Private			Total		
	Yes	No	D.N	Yes	No	D.N	Yes	No	D.N	Yes N (%)	No N (%)	D.N N (%)
Written guideline regarding EN	35	50	1	42	35	5	46	38	1	123 (48.5%)	123 (48.5%)	7 (3%)
Nurses responsibility for nutrition	20	65	1	14	68	0	21	64	0	55 (21.7%)	197 (77.9%)	1 (0.4%)
Nutritional team in ICU	15	69	2	5	77	0	7	78	0	27 (10.7%)	224 (85.5%)	2 (0.8%)
Nutritional team in hospital	59	19	8	64	18	0	53	27	5	176 (69.6%)	64 (25.3%)	13 (5.1%)
Other key person to consult at the hospital	44	28	14	45	24	13	51	26	8	140 (55.3%)	78 (30.8%)	35 (13.8%)
Other key person to consult outside the hospital	13	52	21	14	44	24	22	47	16	49 (19.4%)	143 (56.5%)	61 (24.1%)

Figure 4.1 shows that more than 80% of nurses in the three hospitals indicated that physicians are responsible for prescribing the amount of feeding allocated for patients with less responsibility reported for nurses and dietitians in that mission. Figure 4.2 also indicates that the majority of nurses in the all sectors (>70%) revealed that physicians are responsible for determining the type of formulae and less than 20% of nurses from all sectors indicated that it is the role of dietitian and nurse.

However, the role of nurses in determining the rate of feeding became more notable in all sectors (>45%) although physicians still had most responsibility in ascertaining the rate of feeding. On the other hand, Figure 4.3 shows that less than 10% of nurses reported the role of dietitians in managing the feeding rate.

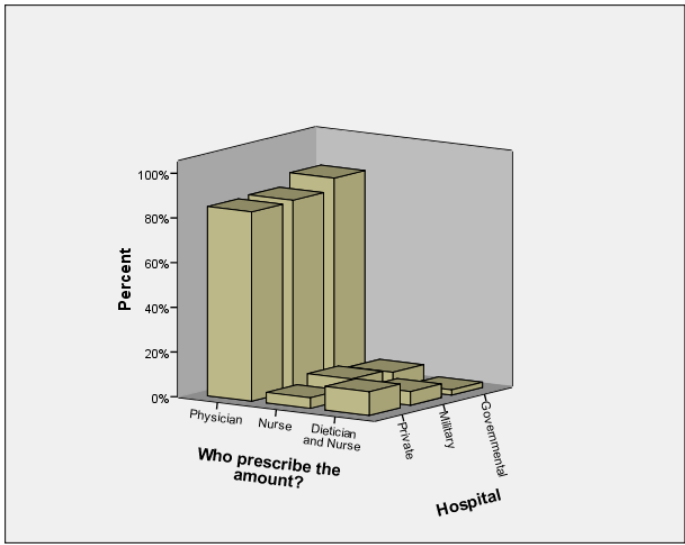


Figure 4.1: Comparing the three hospitals regarding the person who prescribe the amount of feeding

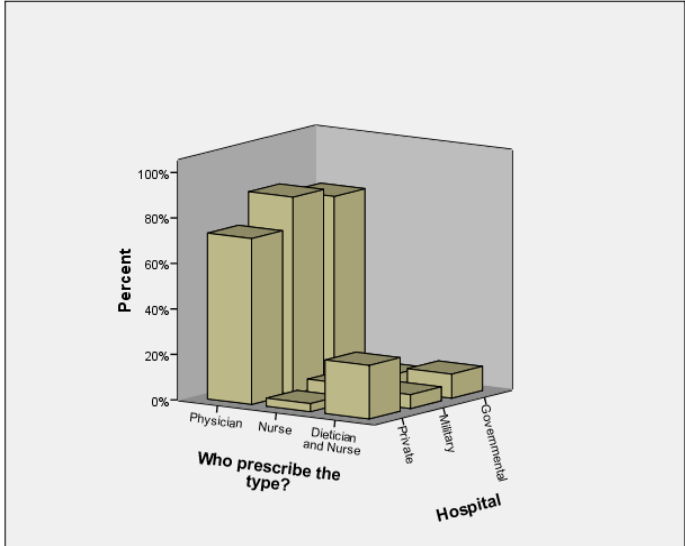


Figure 4.2: Comparing the three hospitals regarding the person who prescribe the type of feeding

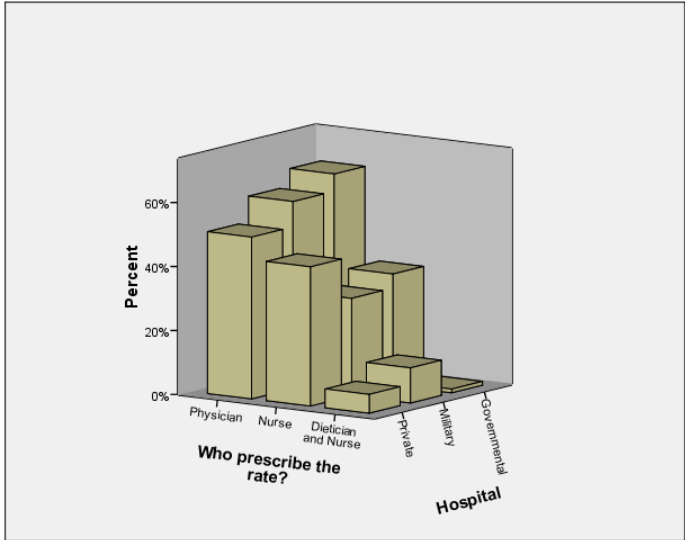


Figure 4.3: Comparing the three hospitals regarding the person who prescribe the rate of feeding

4.1.1.3. Source of knowledge regarding EN

All nurses were asked to indicate the source of knowledge they use for managing EN in their departments. Different sources of knowledge were described. The internet gained the highest scores among nurses in the three sectors compared with other sources and there was no significant difference between them (mean 3.16, SD 1.42, $p=0.256$). Scientific courses came in the second rank followed by school education and both showed no significant difference between all health sectors (mean, 2.75, 2.69, $p=0.493$, 0.314, respectively).

Lectures and in-service training were also scored above the mean (2.50) with no significant difference between sectors (mean 2.59 & 2.54, $p=0.589$ & 0.481, respectively). The other sources of knowledge such as consulting colleagues, specialist education and scientific journal articles scored less than the mean, meaning that were less frequently used as common sources of information. However, these resources had been scored in the same pattern between nurses in the three sectors, showing no significant difference between hospitals regarding using these uncommon resources.

Table 4.3 shows the comparisons between the three health sectors regarding nurses' sources of knowledge about EN in intensive care.

Table 4.3: Comparing nurses in the three sectors regarding the source of knowledge.

Source of Knowledge	Governmental		Military		Private		Total		Kruskal-Wallis test	
	M	S.D.	M	S.D.	M	S.D.	M	S.D.	χ^2 test	<i>p</i> -value
Consulting colleagues	2.69	1.36	2.41	1.15	2.36	1.10	2.49	1.20	2.255	.324
In-service training	2.53	1.29	2.66	1.30	2.42	1.25	2.54	1.27	1.466	.481
lectures	2.52	1.41	2.66	1.16	2.60	1.17	2.59	1.25	1.060	.589
Specialist education	2.51	1.39	2.50	1.39	2.58	1.56	2.53	1.31	.614	.736
Scientific journal articles	2.48	1.27	2.34	1.25	2.14	1.22	2.32	1.25	3.482	.175
Other literature	2.31	1.21	2.26	1.26	2.05	.99	2.21	1.16	1.535	.464
Nursing school	2.81	1.43	2.51	1.27	2.74	1.78	2.69	1.30	2.317	.314
Courses	2.88	1.54	2.73	1.30	2.62	1.46	2.75	1.43	1.415	.493
Internet	3.27	1.51	3.27	1.26	2.95	1.46	3.16	1.42	2.724	.256

Scores range from 1 (to a very small extent) to 5 (very great extent).

4.1.1.4. Nurses' responsibility, knowledge and documentation regarding EN

The following aspects were investigated to elucidate the extent of nursing responsibility, knowledge and documentation in light of EN in intensive care. Each subscale comprises a set of nursing competencies associated with the nursing process (assessment, goal, planning and implementation, prevention of complications and evaluation) which were used to explain how nurses perceive EN in the clinical practice. Prior to describing findings, the internal consistency of each subscales were sought using Cronbach's Alpha reliability test, which showed higher internal consistency levels in the three aspects; responsibility, knowledge and documentation (0.84, 0.87 and 0.87, respectively). Table 4.4 shows the comparison between nurses in the three sectors regarding these aspects.

4.1.1.4.1. Responsibility for EN

Of all nursing responsibility items, nurses stated that the highest responsibility is for 'preventing complications', showing no significant difference between the three sectors. Responsibility for 'evaluation' was ranked secondly. The Mann-Whitney *U* test showed that the means of the 'evaluation' scores of nurses in the military and private sectors were significantly higher than those in the governmental sector (two tailed $p=0.011$, 0.027 , respectively). On the other hand, nurses showed less responsibility in establishing nutritional 'goal' as indicated by the Mann-Whitney *U* test, which found that the means of 'goal' scores of nurses in private sector was significantly higher than those in the governmental and military sector (two tailed $p=0.002$ & 0.048 , respectively). There were some significant differences in the level of responsibility between male and female nurses. Female nurses claimed more responsibility in 'assessment', 'identifying goal' and 'planning' than male nurses

(Mann-Whitney *U* test: $p=0.005$, 0.008 and 0.008 , respectively). However, there was no significant relationship between the level of responsibility and the length of experience whether as RN or critical care nurse ($p>0.05$).

4.1.1.4.2. Knowledge of EN

Similar to the responsibility, nurses showed a greater level of knowledge comprehension regarding ‘preventing complications’, showing significant differences between groups. The Mann-Whitney *U* test found that the mean scores of preventing complications of nurses in both governmental and private sector were significantly higher than those in the military hospitals ($p=0.001$ & 0.029 , respectively). Knowledge comprehension regarding ‘evaluation’ came in the second rank with no significant difference between groups. Similar to the previous findings, the Mann-Whitney *U* test found that the mean of ‘goal’ scores in both governmental and private hospitals were significantly higher than those in the military hospitals ($p=0.011$ & 0.001), and the same issue was reported in knowledge comprehension regarding ‘planning’ and ‘implementation’ between the governmental and private hospitals ($p=0.021$ & 0.001). Finally, nurses scored lower level in knowledge comprehension regarding ‘assessment’ in total and there was no significant difference between the three sectors. In terms of gender, no significant differences were reported between male and female nurses regarding their level of knowledge comprehension. In addition, there was no significant relationship between knowledge comprehension and the length of experience whether as RN or critical care nurse ($p>0.05$).

4.1.1.4.3. Documentation of EN

Nurses in the three sectors scored higher in having support from documentation for evaluation with no significant difference between the three groups (mean 3.07, $\chi^2=2.080$, $p=0.353$). Having support from documentation for ‘preventing complications’ was approximately the same (mean 3.06, $\chi^2= 3.317$, $p=0.190$). However, nurses scored lower in having support from documentation for ‘assessment’ in the three sectors without significance difference between them (mean 3.01, $\chi^2=1.598$, $p=0.450$). However, no significant differences were found between the three sectors regarding the means of having support from documentation. Also, no significant differences between male and female nurses was found in terms of having support from documentation and the level of support from documentation showed no significant relationship with the length of nurses’ experience as RN and critical care nurse ($p>0.05$). (Table 4.4)

Overall, means of nurses’ responsibility, knowledge and documentation were above the midpoint (2.50). In addition, there was no significant difference between nurses in different age groups and the level of knowledge, responsibility and documentation in all sectors. Regarding the relationship between knowledge-responsibility-documentation and nurses’ ‘qualifications’ and ‘working units’, there was less opportunity to examine such statistics due to the unequal distribution of nurses in terms of qualification and working units where the highest proportion of nurses worked in the ICU and most of them held BSc degrees (Table 4.1). Therefore, the statistical power of these comparisons would be low if attempted (e.g. more than 20% of cells have expected count less than 5 in Chi-square test).

Table 4.4: Comparing nurses' responsibility, knowledge and documentation regarding EN in the three sectors.

Sector	Item	Governmental		Military		Private		Total		Kruskal-Wallis test		Mann-Whitney U-test
		M	S.D.	M	S.D.	M	S.D.	M	S.D.	χ^2 test	p-value	
Responsibility	Assessment	2.79	1.28	2.90	1.10	3.22	1.22	2.97	1.21	5.782	0.056	
	Goal	2.71	1.10	2.85	1.30	3.25	1.24	2.94	1.22	9.323	0.009	Milt. vs. Privt. (p=0.048), Gov. vs. Privt. (p=0.002)
	Planning and implementation	2.85	1.17	2.93	1.25	3.25	1.12	3.01	1.19	4.835	0.089	
	Prevention of complications	3.23	1.34	3.34	1.17	3.52	1.31	3.36	1.28	2.474	0.290	
	Evaluation	2.98	1.36	3.49	1.42	3.42	1.36	3.29	1.40	7.787	0.020	Gov. vs. Milt. (p=0.011), Gov. vs. Privt. (p=0.027)
Knowledge	Assessment	2.87	1.19	2.96	1.06	3.26	1.11	3.03	1.13	5.696	0.058	
	Goal	3.27	1.23	2.82	1.07	3.39	1.20	3.16	1.19	12.320	0.002	Gov. vs. Milt. (p=0.011), Milt. vs. Privt. (p=0.001)
	Planning and implementation	3.21	1.22	2.79	1.14	3.34	1.08	3.12	1.17	10.628	0.005	Gov. vs. Milt. (p=0.021), Milt. vs. Privt. (p=0.001)
	Prevention of complications	3.62	1.14	3.02	1.11	3.39	1.10	3.35	1.14	12.217	0.002	Gov. vs. Milt. (p=0.001), Milt. vs. Privt. (p=0.029)
	Evaluation	3.47	1.25	3.24	1.22	3.25	1.33	3.32	1.27	1.994	0.369	
Documentation	Assessment	3.13	1.32	2.89	1.08	3.00	1.08	3.01	1.17	1.598	0.450	
	Goal	2.80	1.26	2.71	.90	2.94	1.18	2.82	1.13	1.647	0.439	
	Planning and implementation	2.94	1.20	3.00	.92	3.12	1.09	3.02	1.07	1.500	0.472	
	Prevention of complications	3.20	1.21	2.90	.92	3.06	1.10	3.06	1.09	3.317	0.190	
	Evaluation	3.01	1.32	2.98	1.08	3.22	1.18	3.07	1.20	2.080	0.353	

Scores range from 1 (to a very small extent) to 5 (very great extent).

4.1.1.5. EN intervention

This section describes the performance of nurses in the three sectors in regard to the common practical issues of tube feeding in the intensive care. Nurses were required to show their daily practice in regard to some assessment and interventional skills to clarify the extent of their adherence to EBP.

4.1.1.5.1. The route of administration

The majority of nurses in the three sectors stated that the gastric feeding is the main route of feeding administration using NGT (mean 3.76), whereas, PEG had less used in the same level between all sectors (mean 2.48). Post-pyloric tube and needle catheter jejunostomy scored least in all groups (mean 2.15, 1.90 respectively).

Figure 4.4 shows the mean differences between the three sectors regarding the route of EN administration.

4.1.1.5.2. Checking tube placement

Nurses in all sectors reported that they confirm tube position before each use (mean 4.00, SD 1.14) and there was a significant difference between them in overall (χ^2 10.176, $p=0.006$) whereby, the means were higher in the governmental and private sector than in the military sector (Table 4.5).

The majority of nurses in all sectors (66.4%) indicated that the air bubbling technique is the most frequent and common technique used for checking tube placement. Not more than 14.5% of nurses claimed using the X-ray technique to confirm tube placement and only 4% indicated their use for the pH technique. In

general, there was a significant difference between nurses in all sectors regarding the use of different measures to confirm tube location (χ^2 21.521, df 6, $p=0.001$). Figure 4.5 shows the differences of using various techniques of checking tube placement between nurses in the three types of hospitals.

4.1.1.5.3. Administering medications through feeding tube

The majority of nurses in all sectors (45.1%) reported that they acquire knowledge about certain medications from medication leaflets to detect whether they could be given through tube and this was more common among nurses in the military hospitals (52.4%). However, 35.2% of nurses in total claimed that any medication given through oral route can be administered through feeding tube and this was more notable among nurses in the governmental sector (47.7%). Generally, there was a significant difference between nurses in the three sectors regarding the ways of obtaining information about specific medication (χ^2 9.720, df 4, $p=0.045$). Figure 4.6 shows the differences between the three sectors regarding that issue. On the contrary, nurses had less tendency to give ‘medications that should not be crushed’ in a crushed form with no significant difference found between hospitals (mean 2.53, χ^2 5.732, $p=0.057$) (Table 4.5).

4.1.1.5.4. Feeding rate and HOB elevation:

Firstly, regarding infusion rate, the mean difference between hospitals was significant in overall ($F=9.978$, df 2, $p<0.001$). When Bonferroni adjustment was made of the number of comparisons, there was a significant difference between the mean of governmental and military hospitals regarding the infusion rate ($t=2.993$, df 166, two-tailed $p=0.003$) where the mean of infusion rate in the governmental

hospitals was higher compared with the military hospitals (means: 85.70, 56.11, and SD: 82.08, 36.55 respectively). In addition, there was a significant difference between the mean of the governmental and private sector regarding the same issue ($t=3.737$, df 169, two-tailed $p<0.001$) whereby, the mean in governmental sector was higher than that in the private hospital (means: 85.70, 48.12 and SD: 82.08, 43.38 respectively). There was no significant difference between the mean of infusion rate between private and military hospitals.

Regarding HOB elevation, there was no significant difference between the three sectors ($F=1.868$, df 2, $p=0.157$) and the mean of the degree of bed elevation in the three sectors was (41.94, SD 17.221). Figure 4.7 shows the differences in the mean between the three types of hospitals regarding nursing perceptions toward the infusion rate and the degree of bed elevation.

4.1.1.5.5. Methods of administration

Using a continuous method of feeding administration showed a significant difference between groups in overall (χ^2 32.863, $p<0.001$). As shown in Table 4.5, means of using a continuous feeding in the private and military hospitals were higher than in the governmental hospitals. Also, it was apparent that the mean of using an infusion pump in the military and private hospitals were higher than in the governmental hospitals, which in eventual, revealed a significant difference between groups regarding that issue (χ^2 75.475, $p<0.001$). However, using bolus (intermittent) feeding showed no significant difference between the three sectors (mean 3.42, SD 1.47) (Table 4.5). In addition, there was a significant difference between groups regarding feeding schedule if feeding at night is allowed (χ^2 10.599,

p=0.005) whereby the mean of the private sector was significantly higher than the mean of governmental and military hospitals (Table 4.5).

4.1.1.5.6. Measuring GRV and using prokinetic agents

In general, the mean of measuring the GRV is acceptable throughout all groups (mean 3.70, SD 1.33). However, there was a significant difference between groups regarding this issue (χ^2 25.909, $p < 0.001$). As appeared in Table 4.5, the mean of measuring GRV in the private and military hospitals were significantly higher than in the MOH hospitals.

Regarding using the prokinetic agents for improving gastric empty, the results showed that there is significant difference between groups in overall (χ^2 18.243, $p < 0.001$). Using these medications was significantly higher in the private hospital than in governmental and military hospitals as shown in Table 4.5.

4.1.1.5.7. Caring for the tube

Flushing feeding tube before and after each use was investigated. Nurses revealed that they normally flush feeding tube more often after administration than before administration (mean: 4.28, 2.62 and SD: 1.15, 1.39, respectively). However, there were no significant differences between nurses in the three sectors regarding these issues. Nurses also claimed that they check the length of the inserted tube regularly along with daily inspection of the nostrils (mean: 3.59, 3.87 and SD: 1.20, 1.13, respectively). These results showed no significant differences between nurses in the three sectors. Obviously, cleaning syringe after each use showed no significant differences between sectors and it was scored higher among nurses in all groups

(mean 4.13, SD 1.08). However, changing the giving set used for NG feeding every 24 hours was scored higher in the military hospitals than in the governmental and private hospitals, recording a significant difference in the means between them (χ^2 19.191, $p < 0.001$) (Table 4.5).

In fact, using EN over TPN was more notable among nurses in the private hospital than in MOH and military hospitals making a significant difference between groups (χ^2 12.488, $p = 0.002$) (Table 4.5).

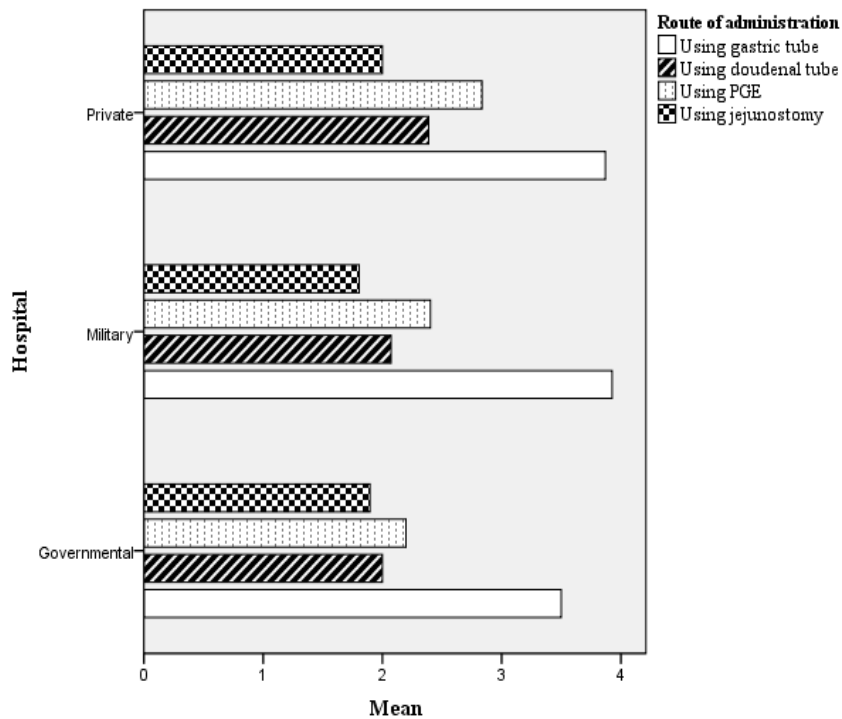


Figure 4.4: Comparing the three hospitals regarding the route of administration

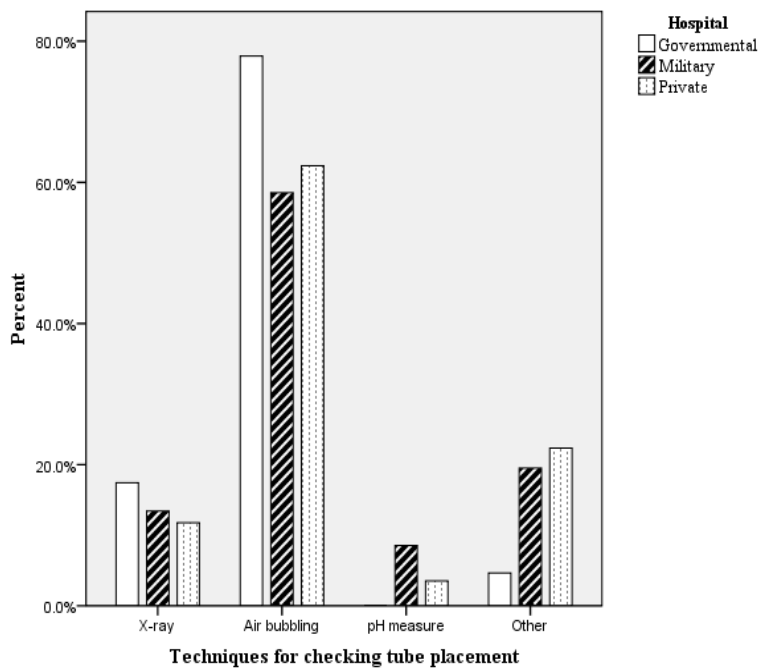


Figure 4.5: Comparing the three hospitals regarding the way of checking tube placement.

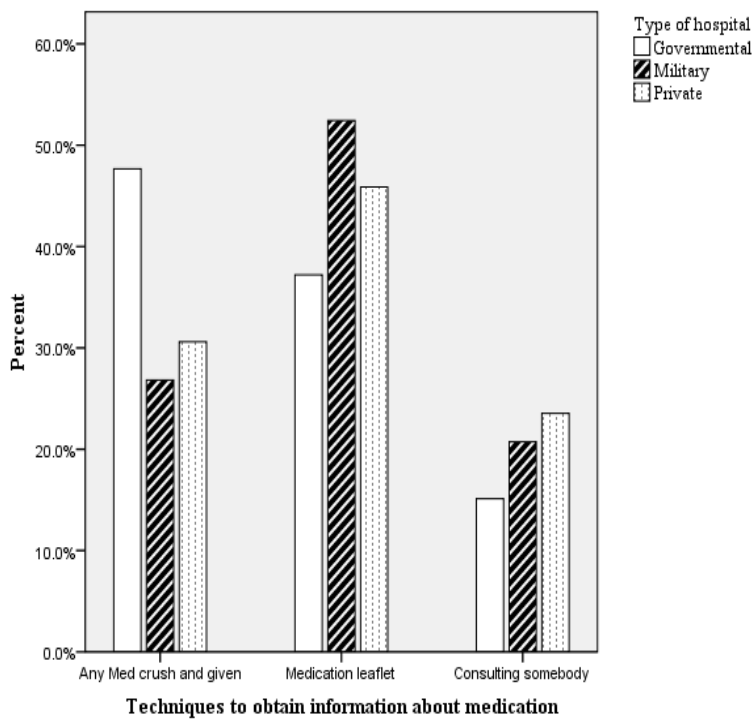


Figure 4.6: Comparing the three hospitals regarding the way of obtaining information about any medication given through tube.

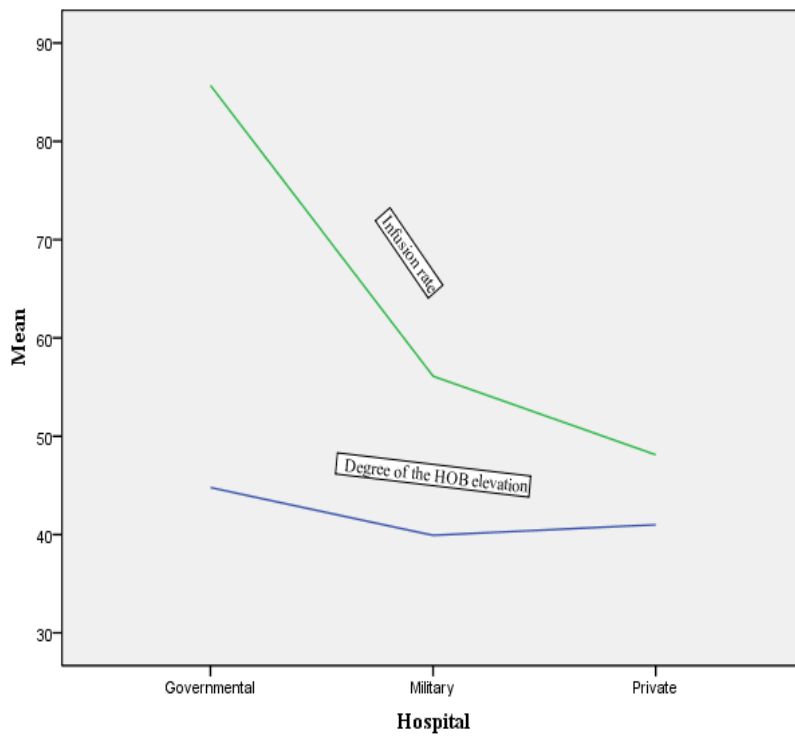


Figure 4.7: Comparing the three hospitals regarding the degree of bed elevation and feeding infusion rate

Table 4.5: Comparing nurses' EN interventions between the three sectors.

Sector EN intervention	Governmental		Military		Private		Total		Kruskal-Wallis test		Mann-Whitney U-test
	M	S.D.	M	S.D.	M	S.D.	M	S.D.	χ^2 test	p-value	
Flush tube before administration	3.60	1.43	3.60	1.37	3.67	1.38	2.62	1.39	0.121	0.941	
Flush tube after administration	4.16	1.32	4.28	1.07	4.41	1.03	4.28	1.15	1.695	0.428	
Daily inspection to nostrils	3.88	1.10	3.76	1.24	3.98	1.06	3.87	1.13	1.002	0.606	
Medications not to be crushed given in crushed form	2.80	1.45	2.46	1.46	2.31	1.41	2.53	1.45	5.732	0.057	
clean syringe after use	4.03	1.31	4.20	.90	4.16	1.00	4.13	1.08	0.033	0.984	
Using continuous feeding	2.40	1.50	3.72	1.36	3.29	1.34	3.13	1.50	32.863	<0.001	Gov. vs. Milt. (p<0.001), Milt. vs. Privt. (p=0.029), Gov. vs. Privt. (p<0.001)
Using bolus feeding	3.27	1.64	3.46	1.23	3.53	1.20	3.42	1.37	0.353	0.838	
Regular GRV checking	3.14	1.36	3.91	1.18	4.05	1.29	3.70	1.33	25.909	<0.001	Gov. vs. Milt. (p<0.001), Gov. vs. Privt. (p<0.001)
Feeding schedule allows for a night rest	2.87	1.43	2.88	1.40	3.48	1.24	3.08	1.38	10.599	0.005	Milt. vs. Privt. (p=0.005), Gov. vs. Privt. (p=0.005)
Using prokinetics to improve gastric emptying	2.48	1.32	2.67	1.30	3.28	1.03	2.81	1.27	18.243	<0.001	Milt. vs. Privt. (p=0.005), Gov. vs. Privt. (p<0.001)
Using feeding pump	1.74	1.08	3.56	1.35	3.33	1.27	2.87	1.47	75.475	<0.001	Gov. vs. Milt. (p<0.001), Gov. vs. Privt. (p<0.001)
Confirm tube position before each use	3.88	1.31	3.79	1.09	4.31	.93	4.00	1.14	10.176	0.006	Milt. vs. Privt. (p=0.001), Gov. vs. Privt. (p=0.052)
Checking the length of the inserted tube	3.51	1.33	3.69	1.09	3.59	1.18	3.59	1.20	0.300	0.861	
Changing giving set 24 hourly	3.53	1.34	4.24	1.12	3.76	.95	3.84	1.18	19.191	<0.001	Gov. vs. Milt. (p<0.001), Milt. vs. Privt. (p<0.001)
EN is preferred more than TPN	2.85	1.31	3.13	1.09	3.52	.95	3.17	1.16	12.488	0.002	Milt. vs. Privt. (p=0.029), Gov. vs. Privt. (p=0.001)

Scores range from 1 (never) to 5 (always).

4.1.1.6. EN complications

Nurses were asked to reveal their knowledge about the incidence of the most common EN complications in their departments. A list of the common complications was provided to show the extent of occurrence of each complication. It was evident that from all complications listed, diarrhoea was considered as the most frequent side effect resulting from EN (mean 3.36, SD 1.34). This result was accompanied with a significant difference between health sectors where the mean was higher in the military hospitals than in the governmental and private hospitals (χ^2 22.679, $p < 0.001$). Abdominal pain came secondly to record another common complication of EN (mean 2.85, SD 1.19) and it also revealed a significant difference between groups similar to that in diarrhoea in which the mean of the military hospitals was significantly higher than in the governmental and private hospitals (χ^2 20.493, $p < 0.001$).

Vomiting, nausea, hyper-hypo glycaemia, tube dislodgment and weight loss are another complications reported by nurses and their means were above the midpoint (>2.5), indicating their recurrences in the three sectors. Also, they showed some significant differences between groups (Table 4.6). Complications such as aspiration, high gastric aspirate, constipation, haemodynamic instability and nasopharynx injury were scored less by nurses from all sectors, considering a number of significant differences in some complications. However, these complications were below the midpoint, indicating their happening infrequently (Table 4.5).

Table 4.6: Comparing nurses' perception toward the incidence of complications in the three sectors.

Sector Complication type	Governmental		Military		Private		Total		Kruskal-Wallis test		Mann-Whitney U-test
	M	S.D.	M	S.D.	M	S.D.	M	S.D.	χ^2 test	p-value	
Aspiration	2.09	.89	2.35	1.04	2.14	1.03	2.19	.99	3.119	0.210	
Pneumonia	1.97	.89	2.32	1.04	1.79	.85	2.02	.95	12.472	0.002	Gov. vs. Milt. (p=0.025), Milt. vs. Privt. (p=0.001)
Tube dislodgment	2.34	1.17	2.76	1.06	2.68	1.07	2.59	1.12	7.311	0.026	Gov. vs. Milt. (p=0.012), Gov. vs. Privt. (p=0.039)
Diarrhoea	2.98	1.41	3.91	1.14	3.20	1.29	3.36	1.34	22.679	<0.001	Gov. vs. Milt. (p<0.001), Milt. vs. Privt. (p<0.001)
Constipation	2.16	1.11	2.55	1.11	2.15	1.16	2.28	1.14	7.616	0.022	Gov. vs. Milt. (p=0.025), Milt. vs. Privt. (p=0.011)
High gastric aspirate	2.06	1.08	2.27	1.10	2.24	.95	2.19	1.04	2.757	0.252	
Weight loss	2.85	1.24	2.32	1.03	2.54	1.04	2.57	1.13	8.110	0.017	Gov. vs. Milt. (p=0.006)
Weight gain	2.21	1.16	2.74	1.00	2.45	.85	2.47	1.03	13.754	0.001	Gov. vs. Milt. (p=0.001), Milt. vs. Privt. (p=0.012)
Hemodynamic instability	1.84	1.05	2.27	1.26	1.96	.92	2.02	1.09	5.194	0.074	
Sepsis	2.47	1.26	2.74	1.32	2.09	.97	2.43	1.22	9.722	0.008	Milt. vs. Privt. (p=0.002)
Naso-pharynx injury	2.31	1.19	2.72	.97	2.15	.98	2.39	1.08	13.158	0.001	Gov. vs. Milt. (p=0.010), Milt. vs. Privt. (p<0.001)
Hypo, hyper glycaemia	2.58	1.32	2.76	1.16	2.54	.83	2.62	1.12	1.566	0.457	
Abdominal pain	2.58	1.16	3.35	1.23	2.64	1.02	2.85	1.19	20.493	<0.001	Gov. vs. Milt. (p<0.001), Milt. vs. Privt. (p<0.001)
Nausea	2.40	1.21	3.05	1.16	2.45	.96	2.62	1.15	16.274	<0.001	Gov. vs. Milt. (p<0.001), Milt. vs. Privt. (p=0.001)
Vomiting	2.43	1.25	3.06	1.25	2.71	.88	2.73	1.17	10.812	0.004	Gov. vs. Milt. (p=0.002)

Scores range from 1 (to a very small extent) to 5 (very great extent).

4.1.1.7. EN evidence-based guidelines

In this section, nurses addressed their perceptions of the usefulness of using EBP in lowering the incidence of complications. Four interrelated items configured the evidence base, which substantially conveyed nursing adherence to EBP in respect to EN. The internal consistency for these items revealed higher reliability level (Cronbach's alpha= 0.86).

Regular checking for tube placement was regarded by nurses as the most effective evidence-based measure for reducing the incidence of complications (mean 3.48, SD 1.22). In addition, there was no significant difference found between groups regarding this measure. Frequent measuring of GRV was the second popular measure for lowering the incidence of complications (mean 3.34, SD 1.20) and it also revealed no significant difference between nurses in the three sectors. Nurses in the governmental hospitals perceived using aspiration reduction measures significantly higher than those in the military and private hospitals (χ^2 9.249, $p=0.010$). Aspiration reduction measures encompass frequent suctioning, elevation the HOB, controlling GRV, were more emphasised by nurses in the governmental hospitals than others (Table 4.7).

In general, nurses in both governmental and military hospitals confirmed the effectiveness of using EN protocols and guidelines significantly higher than those in the private hospital (χ^2 13.144, $p=0.001$). In particular, the importance of using these documentations was more notable among nurses in the military hospitals than others (Table 4.7). In addition, there was no significant difference between male and female nurses and between nurses in different age groups in terms of perceiving the effectiveness of these evidence-based items in reducing complications.

4.1.1.7.1. Complication rate

Nurses in all sectors were asked to reveal the expected current rate of complications in their departments. Different means of complication rates between these hospitals were raised, showing no significant differences between groups ($F=1.125$, $df=2$, $p=0.221$). Indeed, the mean of the current complication rates between these hospitals was 45.49 and SD 23.18 as appeared in Figure 4.8. Subsequently, nurses were asked to reveal their perceptions of the complication rates if the previous evidence-based measures were applied accurately in their institutions. The mean of the expected complication rates along with the evidence base was 22.79 and SD 17.03 with no significant difference found between groups regarding this inquiry ($F=0.213$, $df=2$, $p=0.809$). (Figure 4.8)

4.1.1.7.2. Relationship between complications and EBP

The scatter plot of the relationship between complication rates in the presence and absence of EBP suggested a linear positive relationship between both variables. There was a statistically significant relationship between the complication rates and the presence of EBP which is verified by the correlation coefficient ($\rho=0.73$, $df=251$, $p<0.001$). The complications of EN are less likely to occur in the presence of EBP than in lack of it. A linear regression revealed also that the increase in the evidence-based use entails reduction in the complication rates by 0.973 ($a=23.36$, $b=0.973$). The 95% confidence interval for this coefficient ranged between 0.855-1.091 ($F=261.86$, $Beta=0.715$, $p<0.001$). However, there were no significant differences between male and female nurses in comprehending this relationship ($F=1.138$, two tailed t-test, $p=0.260$), also no significant differences between different age groups regarding this issue ($F=0.931$, $df=4$, $p=0.447$).

Table 4.7: Comparing nurses' perception of the usefulness of evidence base in reducing complications in the three sectors.

Evidence base item	Governmental		Military		Private		Total		Kruskal-Wallis test		Mann-Whitney <i>U</i> -test
	M	S.D.	M	S.D.	M	S.D.	M	S.D.	χ^2 test	<i>p</i> -value	
EN protocols, guidelines and algorithms	3.26	1.16	3.39	1.17	2.75	1.20	3.13	1.21	13.144	0.001	Milt. vs. Privt. (p=0.001), Gov. vs. Privt. (p=0.008)
Aspiration reduction measures	3.59	.99	3.16	1.17	3.06	1.19	3.27	1.14	9.249	0.010	Gov. vs. Milt. (p=0.021), Gov. vs. Privt. (p=0.004)
Measuring GRVs frequently	3.19	1.07	3.51	1.28	3.34	1.23	3.34	1.20	4.157	0.125	
Checking tube placement frequently	3.49	1.10	3.67	1.20	3.29	1.33	3.48	1.22	3.739	0.154	

Scores range from 1 (to a very small extent) to 5 (very great extent).

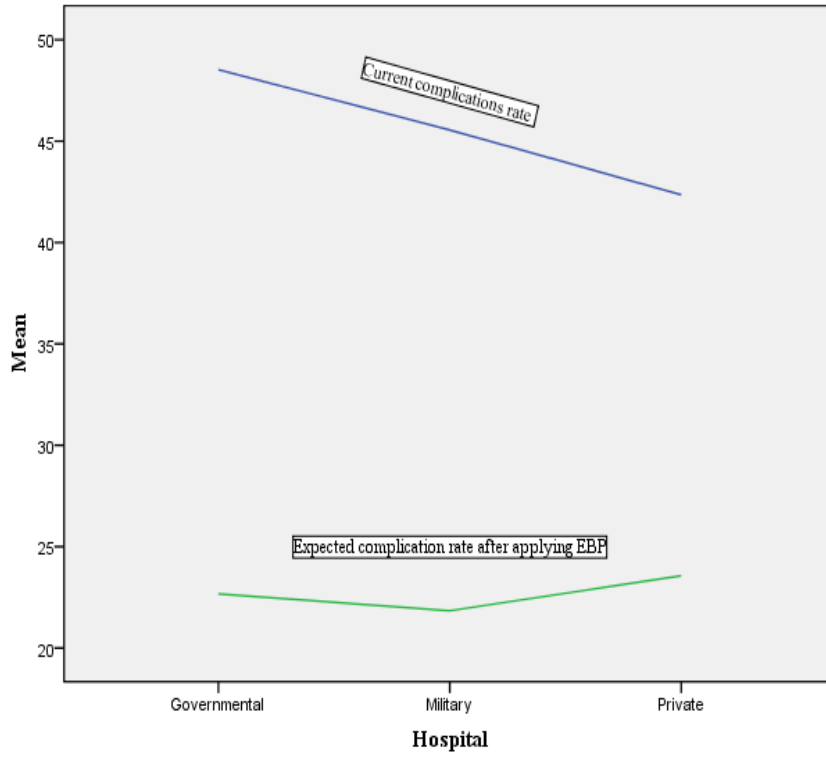


Figure 4.8: means of expected complication rates with and without applying evidence base

4.1.2. Bedside observation

This is the second part of the quantitative data analysis which represents the findings of data taken from patients via direct bedside observation. Fifty-five patients distributed equally on the MOH, military and the private hospitals (18, 18 and 19, respectively). Patients were observed for different clinical issues related to EN.

The small bore gastric tube was the most common tube used among the three sectors (52.7%). However, the wide bore tube was more frequently used in the private hospital than others (63.2%). Gastrostomy represents 20.0% of all observed cases so it has a minimal usage in overall.

Table 4.8 shows the differences between patients who were observed in the three sectors regarding some EN clinical issues. According to this table, the majority of patients (89.1%) had a tube securely fastened with tape and 67.3% of them showed no risk for damaging the eyes from tube placement. Similarly, 63.6% of all tubes were taped on undamaged skin and this was more notable in the private hospital. Adversely, only 26.4% of all tubes were fixed without straining the nose. However, the majority of patients in the private hospital (77.8%) had tubes fixed on the cheek, showing better tube fixation technique than other hospitals.

Of all observed patients, 50.9% were on infusion pumps. Nevertheless, feeding pumps were not labelled appropriately (25.5%) and only 38.2% of the administration sets were allocated for EN. When the feeding pump is not in place, feeding syringe is mostly the available device used for administration. Only 23.6% of patients on feeding syringe had labelled syringe indicating its use for feeding and only 16.4% of tubes were replaced

daily according to the date of label. However, 60.3% of the syringes in all hospitals were kept dry and preserved in a clean place to avoid any risk for contamination. Indeed, very minimal cases were detected with gurgling sounds heard during exhalation (7.3%) which is often appeared in poor suctioning or if any amount of gastric contents regurgitated into the respiratory system.

To ensure the accuracy of the given formulae, 56.5% of the hanging feeds were as prescribed, and 72.7% were at the correct rate as determined previously. Regarding patients' position and the HOB elevation while receiving EN, the majority of patients in the three sectors (76.4%) were placed in the supine position with a minimal use of right lateral and left lateral position (18.2% and 5.5% respectively). This result showed no significant difference between groups (χ^2 2.286, $p=0.683$). The degree of backrest elevation was significantly different in overall ($F= 16.771$, df 2, $p<0.001$). When Bonferroni adjustment was made of the number of comparisons, there was a significant difference between the mean of the governmental and military hospitals regarding the degree of backrest elevation ($t=4.384$, df 34, two-tailed $p<0.001$) where the mean in the governmental hospitals was significantly less than in the military hospitals (means: 29.72, 36.94, and SD: 4.36, 5.46 respectively). In addition, there was a significant difference in the mean of the governmental and private hospitals regarding the same issue ($t=5.770$, df 33.79, two-tailed $p<0.001$) whereby, the mean of the governmental hospitals was significantly less than in the private hospitals (means: 29.72, 39.21 and SD: 4.36, 5.59, respectively). There was no significant difference found in the means of HOB between patients in the private and military hospitals.

Table 4.8: Comparing bedside observation between patients in the three sectors regarding some EN clinical issues.

Item	Sector	Governmental	Military	Private	Total	Chi-square test	
		N. (%)	N. (%)	N. (%)	N. (%)	χ^2	P value
Feeding tube securely fastened with tape.		15 (83.3%)	15 (83.3%)	19 (100%)	49 (89.1%)	3.554	0.169
Feeding tube taped without risk of damaging the eye.		11 (61.1%)	9 (50.0%)	17 (89.5%)	37 (67.3%)	7.003	0.030
Feeding tube taped on undamaged skin.		8 (44.4%)	10 (55.6%)	17 (89.5%)	35 (63.6%)	8.854	0.012
Feeding tube fixed without straining the nose.		6 (33.3%)	4 (23.5%)	4 (22.2%)	14 (26.4%)		
Feeding tube fixed on the cheek.		8 (44.4%)	4 (23.5%)	14 (77.8%)	26 (49.1%)		
Feeding pump used.		11 (61.1%)	13 (72.2%)	4 (21.1%)	28 (50.9%)		
The administration set used is for EN.		8 (44.4%)	10 (55.6%)	3 (15.8%)	21 (38.2%)		
Feeding pump labeled.		4 (22.2%)	6 (33.3%)	4 (21.1%)	14 (25.5%)		
The syringe is labeled (only for feeding tube).		2 (11.1%)	5 (27.8%)	6 (31.6%)	13 (23.6%)		
The syringe is replaced daily according to date label.		4 (22.2%)	2 (11.1%)	3 (15.8%)	9 (16.4%)		
The syringe kept dry.		10 (55.6%)	11 (61.1%)	12 (63.2%)	33 (60.0%)	0.236	0.889
Gurgling sounds heard during exhalation.		1 (5.6%)	0 (.0%)	3 (15.8%)	4 (7.3%)		
The correct feed hanging as per prescription.		10 (55.6%)	14 (77.8%)	12 (63.2%)	36 (65.5%)	5.663	0.226
The correct feeding rate as per prescription.		8 (44.4%)	16 (88.9%)	16 (84.2%)	40 (72.7%)	10.893	0.004

4.1.3. Conclusion

This section presented the findings of the data obtained quantitatively from different resources; self-administered questionnaires and bedside observations. These findings demonstrate the level of knowledge, responsibility of critical care nurses regarding nutrition in general and EN in specific. The practical issues surrounding EN were examined to show the extent of using evidence-based guidelines in handling and administering EN.

Bedside observations gained sufficient knowledge about some practical elements in respect to tube feeding. These observations reflected the actual practical image that might contradict nurses' assertions in some issues in the survey. However, bedside observation provided also further explanation about the caring for feeding tube, considering the appropriate use of equipments in a safe and proper way and avoiding contaminations, in addition to the disposing procedures of used equipment in a regular manner.

The next section will present the findings gained from qualitative data analysis which, in turn, will be blended to these statistical findings in the integration phase.

4.2. Qualitative data findings

4.2.1. Introduction

This chapter represents the results of the qualitative data analysis including the explication of themes and subthemes emerged from this analysis. A total number of fourteen participants were involved in the interviews and selected according to their longer experience and higher position in their field of practice as explained in chapter 3. Table 4.9 shows the characteristics of all participants included in the interviews.

Four main themes emerged from the study along with 12 sub-themes in addition to a considerable number of codes. As shown in the following thematic map, some themes are overlapped with other themes in which each overlapping plays a significant role in illuminating that themes distinctly based on the intrinsic structure and to maintain a unique composition distinguished from other structures.

On the whole, each theme is elucidated in exhaustive way, introducing the structure of each and explaining the relationships associated and interacted between sub-themes to generate the final construct. Moreover, because the analysis was substantially based on the dataset, each explanation was provided with a sufficient number of excerpts taken directly from participants' perspectives.

Figure 4.9 shows the thematic framework of the interrelations between the emerged themes.

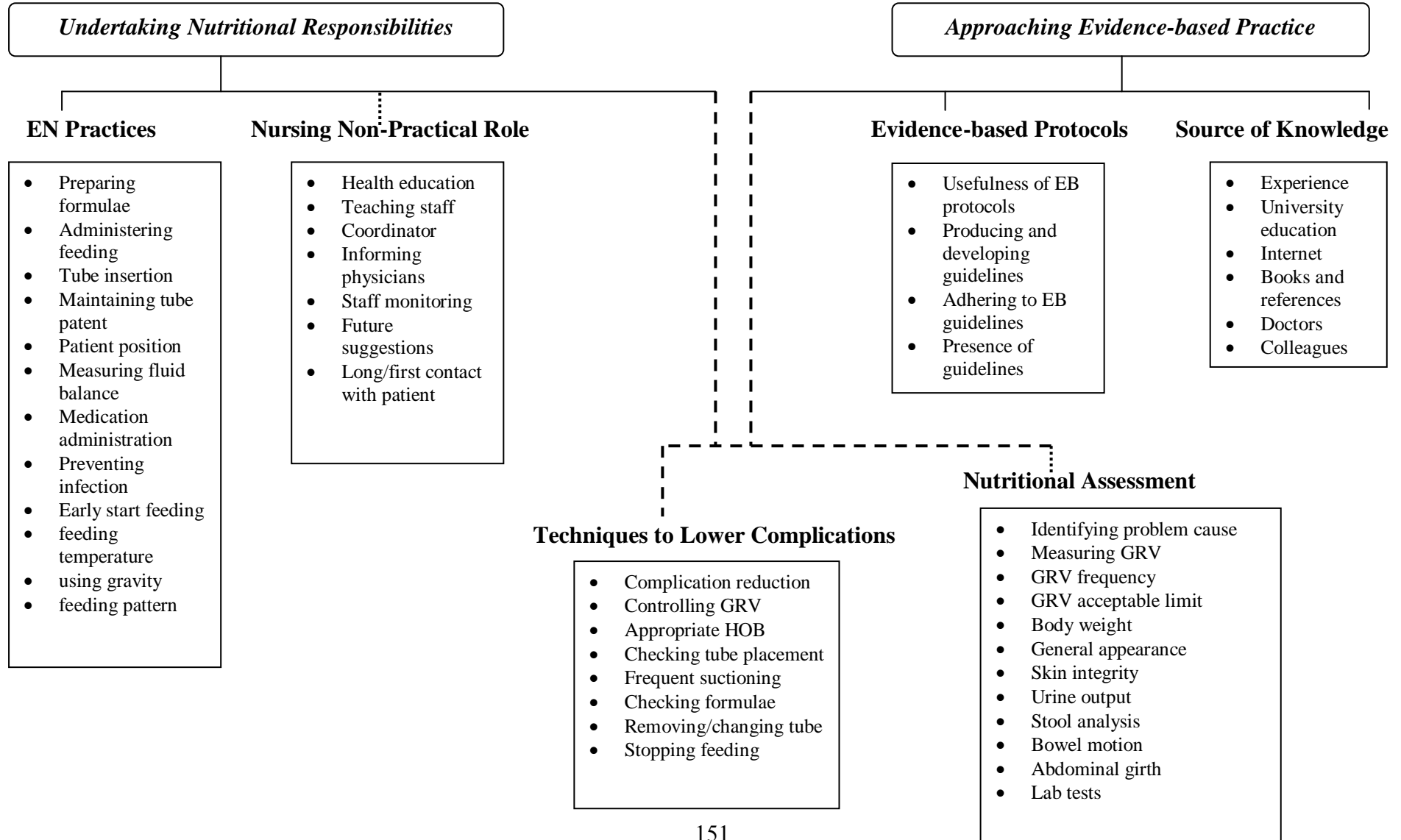
Table 4.9: Summary of the interviewees' current work experience.

Participant		<u>Health Sector</u>	<u>Department</u>	<u>Position</u>	<u>Years of Experience</u>
No.	Initial				
1	Miss MN	Governmental	ICU	RN/ Supervisor	8 Years
2	Miss NR	Governmental	ICU	RN	6 Years
3	Mr. AB	Governmental	ICU	RN	7 Years
4	Mr. AS	Private	ICU	RN/In-charge	13 Years
5	Mr. MO	Private	CCU	RN/ In-charge	11 Years
6	Mr. MS	Private	Neuro. ICU	RN	10 Years
7	Miss AN	Military	CCU	RN/In-charge	15 Years
8	Miss RB	Military	ICU	RN/Educator	6 Years
9	Mr. RA	Military	ICU	RN	6 Years
10	Miss RH	Military	CCU	RN/Supervisor	12 Years
11	Miss SZ	Military	ICU	RN/Educator	10 Years
12	Mr. HM	Governmental	ICU	RN/Head Nurse	18 Years
13	Miss KH	Governmental	ICU	RN	7 Years
14	Miss ZB	Governmental	ICU	RN/ Supervisor	14 Years

Thematic map

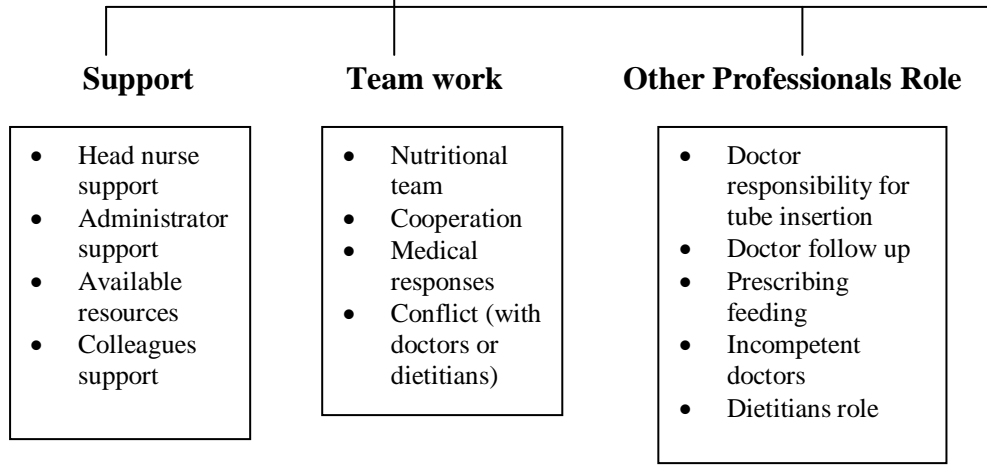
Theme 1

Theme 2



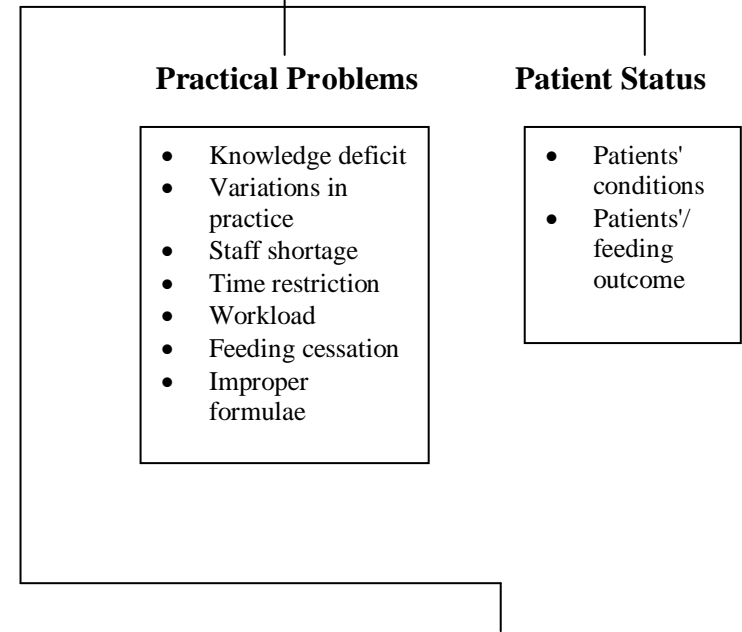
Theme 3

Multidisciplinary Team Working



Theme 4

Consequences of EN Care Deficits



Nursing Non-Practical Role

- Health education
- Teaching staff
- Coordinator
- Informing physicians
- Staff monitoring
- Future suggestions
- feeding
- Long/first contact with patient

EN Complications

- Aspiration
- Diarrhoea
- Feeding intolerance
- Tube displacement
- Complication rate

Figure 4.9: Thematic map of the Qualitative data findings

———— Linear Relationship
 - - - - - Overlapping Between Themes

4.2.2. Undertaking nutritional responsibilities

As one of the nursing roles, undertaking nutritional therapy is one of the practices that are being carried out by critical care nurses. Mainly, nurses are responsible for managing and assessing patients' nutritional requirements. This aspect is critically interrelated with the other themes because it considers nutritional responsibility as an integral part of clinical practice which encompasses both feeding delivery and the required assessment.

4.2.2.1. EN practices

Because the ICU nurses are responsible for initiating nutritional therapy for critically ill patients, different nutritional skills are undertaken by nurses to enhance greater nourishment. Clinical practice is a substantial part in the nutritional responsibility that all nurses should implement precisely and safely. This subtheme is associated with the other subthemes in explaining the nature of nutritional responsibilities which nurses are accountable for. The following excerpts are practical elements represent nursing responsibility for some tasks carried out before, during and after feeding initiation:

We are eligible to start EN to feed the patients. It is our responsibility; patients may differ in the type of given formulae, formulae strengthen, and the amount so we have to deal separately. (Participant 3)

We start feeding at low dose and then decide the patients' requirements. (Participant 8)

As nurses we prepare feeding and administer it, but if the patient needs special formulae the dietician will prepare it. (Participant 11)

Further, nurses indicated to their responsibility toward maintaining the patency of feeding tube and avoid any inadvertent blockage:

In addition, the feeding tube could be blocked, so to prevent that, we usually flush the feeding tube after each use. (Participant 4)

We should also care of NGT and the way of its fixation to the skin as well as flush it after each feeding by water. (Participant 13)

Although tube insertion is primarily a medical procedure, nurses can perform this procedure for stabilized patients, excluding patients with higher risk for injuries:

According to our policy, I'm responsible for inserting NGT, the patency of the NGT, and if it is inserted in the correct place at the time of administration. (Participant 7)

We usually insert the tube although it is doctor's responsibility, then we start "Ensure" feeding and evaluate patient's tolerance. (Participant 6)

One of our responsibilities is to insert feeding tube before administration. It is a medical procedure but we usually perform it in our unit except for patients with contraindications or at higher risk such as patients with head trauma. (Participant 8)

Other practices have emerged such as; administering feeding as early as possible and adjusting feeding in appropriate temperature and rate:

Our protocol, as I said, is to start feeding within 24 hours unless the patient is undergoing any investigation procedure such as abdominal CT scan, MRI, gastroscopy ...etc. then we start at low rate and suitable temperature then we increases the rate gradually until it reaches the desirable rate. (Participant 8)

The most important thing we focus on here is to start feeding as soon as possible within the second day of admission unless there are contraindications. (Participant 11)

These are a set of procedures that nurses can elaborate within that field of practice. They are, in general, preliminary requirements prior to start feeding. Therefore, other advanced tasks will be demonstrated and highlighted in the following explanations.

4.2.2.2. Nursing non-practical roles

In fact, nurses contributed to both direct and indirect patients' care in regard to nutrition in intensive care and they showed the greatest tendency to capture patients' nutritional needs. Obviously, the nurse is the first person in contact with the patients, who, in turn, is concerned with optimizing care for all patients. Therefore, Nurses spend a longer time for bedside monitoring and assessing patients' nutritional status as well as detecting therapeutic outcomes:

I have been 2 years in the ICU and I feel that the nurse is the closest person to the patient. (Participant 3)

Because nurses are the first person to contact with patient, they have the significant role because they are dealing with patient for 24 hours. (Participant 7)

Nurses have an important role because they are the first person to contact with patients and who deal with all issues about patients' care. (Participant 5)

Nurses claimed that they play the role of coordination between physicians and dietitians as a vital and important aspect in term of carrying out an accurate nutritional

care associated with minimal faults and variations. The following excerpts reflect nurses' intention of having a coordinator role:

I should inform physicians about any normal or abnormal progress of patient's status. For example, I tell them about the residual amount, and if the patient has diarrhoea what should we do? (Participant 13)

Our role is to coordinate with dietitians to prepare the formulae at the appropriate time. (Participant 14)

I am responsible for carrying out the physician's order regarding feeding and informing dietitians to prepare the formulae with specific type and amount based on the doctor's prescription. (Participant 7)

In addition to these non-practical roles, critical care nurses are encouraged to suggest any recommendations that would improve the strategy of nutrition in the future. The following suggestions were derived from nurses' perspectives in relation to developing the therapeutic plans:

To prescribe the appropriate feeding formulae I suggest studying each patient's condition. For example, people who are very close to the patient could tell what does this patient prefers to eat. (Participant 1)

I suggest using a clear guideline; I suggest also distributing a certain questionnaire to the staff to assess their knowledge, in addition to held continuous training programs. (Participant 6)

I believe that we have to focus on renal or hepatic patients. Also I would prefer using some kinds of formulae with different flavours that match patient's interest. (Participant 8)

Teaching and monitoring nursing staff is regarded as a core element of professional development. It is respected that knowledgeable and competent personnel become

responsible for developing other junior staff's professionalism whether formally or informally. Some nurses asserted that they are responsible for providing sufficient training and assistance for nursing staff:

We provide health education for the staff working with us and we teach them how to assess tube placement on the three shifts also, we have to follow up the process of administering formulae (Participant 1)

.... but for newly employed personnel, we provide a manual of procedures and explain and demonstrate each skill, then we observe them to evaluate if they are complied with these written guidelines. (Participant 4)

We have learned skills from our former colleagues and we also teach them to our newly employees here. (Participant 5)

Also, nurses are able to perform health education for patients and their families in order to improve their awareness of the current condition and explain any procedure being delivered:

If the patient is unconscious we inform his/her family about the procedure, or we explain the procedure for the patient if he/ she can understand. (Participant 2)

We offer trained personnel to train other staff and to do health education for patients and their families about the disease and its treatment. (Participant 1)

4.2.2.3. Nutritional assessment

Nutritional assessment is a continuing process carried out before, during, and after administering feeding so, it is also one of the essential requirements of patients' feeding. Generally, assessment is a prerequisite to the practice itself that is indispensable to eradicate unexpected outcomes and lower feeding complications.

Pre-administration assessment is necessary and encompasses both patients' and formulae checking. Miss Z indicated to different assessment tools that should be met before administering EN:

My role as a nurse is to assess the prescribed formula if it is ready to be given at the appropriate time, also to assess if the NGT is placed correctly before feeding administration. (Participant 14)

Measuring the GRV before and after administering feeding is considered as a pure nursing procedure so, nurses should be sufficiently skilful to measure that volume and to assess patients' digestive capabilities through assessing GRV's readings accurately:

We assess the colour and consistency of gastric content to see if it is normal. Also we measure the amount of GRV to evaluate patient's tolerance to the last amount of feeding, so we do regular check for GRV. (Participant 13)

Before we start feeding, we have to check the absorption of last given feeding. (Participant 10)

We assess GRV after one hour of administration and see if the amount becomes less, so we continue feeding and assess the outcome accordingly. (Participant 4)

Subsequent to the feeding administration, ICU nurse are responsible for assessing the consequences of feeding on patient's conditions. Various methods are used to obtain an inclusive view about patients' clinical feature and the effectiveness of current therapy such as assessing body weight and skin integrity through physical exam, and examination protein and albumin levels in the blood through lab investigations:

We assess patient's weight regularly; also we have to assess patient's skin integrity to detect dehydration. Bowel motion and the clinical appearance are also investigated. In addition to that, we check the albumin and protein levels in the blood. (Participant 4)

We assess patient's abdominal girth, if the patient developed abdominal distension that indicates a problem in absorption. We also measure the body weight; some beds in another ward have a digital measure for body weight that sometimes we can use. (Participant 11)

We look at the patient's body mass. Patients with poor nutrition have muscular atrophy, fat loss, and impaired skin integrity. (Participant 5)

Mr. RA confirmed the importance of nursing capability to assess, detect and identify defects in feeding process:

Every time we should re-evaluate the condition of patients and re-evaluate the nutritional strategy undertaken here and search for reasons and solutions for any problems. (Participant 9)

Nurses should implement their own techniques to identify the reasons of any problem inherent in tube feeding such as, gastric retention, diarrhoea and aspiration. In particular, these skills can be acquired over time and experience:

Sometimes, patient may develop diarrhoea so we have to search why diarrhoea has happened and what its relationship with feeding. (Participant 7)

We check the NGT for any block or occlusion that might cause aspiration. If that happened, I will search for the problem and solve it. (Participant 14)

If you have four patients and you prepared their formulas using the same process, and only one of them has developed a problem; this will indicate that the problem is resulting from the patient himself. (Participant 11)

If a patient received 210 ml over 4 hours and the GRV was more than 140, this indicates abnormal GRV. After that we may decide to withhold feeding to detect the reasons for high GRV. (Participant 6)

Generally, some of these measures are regularly used to assess patients' nutritional status in critical care units. However, nurses must be sufficiently trained to utilize each assessment method precisely and to differentiate between normal and abnormal values using their knowledge to interpret these measurements.

4.2.2.4. Techniques to lower complications

Minimizing the incidence of feeding complications is an intention of all nurses especially if the patient is at high risk to develop complications from EN. Some protective measures should be anticipated prior to feeding due to their effectiveness in eradicating common complications. Other measures are commonly used if the patient has developed certain problem from EN and the intention to decrease its effect on patient is approached. However, the majority of nurses undertake more than one strategy to preserve patients as nurses stressed on the urgency of avoiding these side effects whenever is possible. Therefore, it might be inevitable to use a number of these measures altogether:

When inserting the tube we try to minimize any complication that may happened as a result of abnormal nasal tract, so alternative way can be used such as 'PEG tube'. (Participant 8)

We intend to start weaning from NG feeding and to resume oral intake as early as patient can, because we know that NG feeding has many complications even from the tube itself. (Participant 5)

*Do you mean complications like diarrhoea, distension, and aspiration?
40% of these complications can be reduced. For distension it could be
treated, and for diarrhoea we give anti-diarrhoea drugs with feeding.
(Participant 10)*

Controlling GRV is regarded as an assessment and preventive measure used to assess patients' tolerance. It is more effective when measured in a regular manner. This technique can significantly lower the incidence of EN complications by maintaining gastric residues at normal limits:

*Because any overloaded amount could reach the patient's lungs and cause harmful effects this is an important point to check the GRV frequently.
(Participant 12)*

We prepare the milk to be infused over four hours, when it is finished we check the GRV. Also we have to check the NGT placement because both of them minimize the complications. (Participant 11)

We may continue feeding or give some medications to enhance gastric empty if there is abnormal GRV. (Participant 5)

Similarly, removing tube and shifting patient's position are additional effective techniques used to reduce the incidence of EN complications:

For example, if any patient has aspiration, then we should immediately remove the NGT, or put the patient in lateral position. (Participant 12)

Regarding aspiration and GRV, when we face high GRV we immediately stop feeding and put the patient in semi-fowler position then we inform doctor. (Participant 5)

*If the feeding tube blocked, we should remove it and insert a new one.
(Participant 9)*

If the NGT is placed inappropriately then, I have to reinsert it and I have to prepare the formula in the correct way. (Participant 11)

Frequent checking for tube placement is a further technique used to avoid many complications. If the tube is misplaced spontaneously into the lung or small intestine, it will cause aspiration or feeding intolerance:

We confirm that the tube is placed correctly and safely because sometime the tube is misplaced into the small bowel and makes major complications and intolerance. (Participant 8)

As I said, checking tube placement is a technique used when facing any tube feeding complication. (Participant 2)

In addition, placing the patient in an upright position and doing frequent suctioning contribute to avoiding tube displacement:

Rechecking the placement of the inserted tube, and placing the patient in an appropriate HOB can decrease the complications to a greater extent. (Participant 1)

Frequent suctioning, appropriate position, and keeping patient in upright position are needed to prevent complications. (Participant 9)

We keep patients in upright position to avoid tube displacement. (Participant 7)

Stopping feeding and rechecking the formulae are also used by the ICU nurses to limit the extensiveness of any potential complication during administering the formulae. Feeding cessation might be followed by changing the prescribed formulae:

If we gave feeding and the patient did not tolerate and has a high GRV or has diarrhoea, I would decide stopping feeding and re-evaluating the given feeding. (Participant 8)

When we detect an aspiration, we immediately stop feeding and perform oro-tracheal suctioning, later we detect if these problems associated with the kind of formulae, if so, we have to change it. (Participant 3)

We as nurses make formulae less concentrated to avoid diarrhoea. (Participant 12)

Many patients develop feeding intolerance so the prescribed formulae may need to be changed. (Participant 9)

Feeding intolerance is common here, so, we stop feeding for two days, and then the physicians have to change the type of formulae. (Participant 14)

The role of nursing in providing adequate nutrition is not carried out in a linear pathway. It is a mixture of nursing skills and abilities to, detect, analyse and resolve any EN problem associated with improper practicing. Therefore, the effectiveness of diagnostic measures is heavily relied on nurses' capacities to interpret different nutritional parameters successfully. The role of nurses in EN incorporates with the process of assessing patients' readiness to receive feeding and the subsequent outcomes of a delivered nutrition. Also, ICU nurses are concerned with developing staff professionalism and developing current clinical practice.

4.2.3. Approaching evidence-based practice

Evidence base is an essential concept that all nurses should adhere to. Nurses in all health sectors try to manipulate their own standard of care to achieve their scope of

practice based on the available resources and the hierarchal structure of their institution. This theme illustrates the efficiency of using EBP in clinical field and, in particular, for EN in intensive care. Several determinants were incorporated together to approach EBP as a contemporary professional requirement.

4.2.3.1. Evidence-based protocols

The optimal exploitation of evidence-based protocols can diminish the majority of complications resulted from EN and improve the state of poor absorption. The usefulness of these guidelines would be enhanced if they are revised and updated regularly, making them more efficient for applying in clinical practice:

The evidence based protocol is built based on previous studies that revised regularly. For example, if there is a problem with absorption and there is no tolerance; the protocol reveals that we should decrease the formulae's concentration. In addition, feeding protocol asserts that we should prepare the formulae in a clean and appropriate way. (Participant 11)

In my opinion, anything organized is better than none and to certain extent EBP would diminish any negative outcomes once it is organized. So, once the guideline is existed everything will be okay especially when they are updated regularly. (Participant 3)

It is very important to have here a documented protocol for EN built on evidence. (Participant 14)

Because of these guidelines, we monitor patient intensively and prevent the occurrence of some complications such as aspiration, also they save patients from contamination. (Participant 5)

Generally, nurses claimed that they inappropriately adhere to evidence-based guidelines for EN due to the dearth of these guidelines in their units. However, they

showed a greater tendency to undertake specific guidelines for EN to facilitate their role in administering feeding:

In general, it is not as we hope, our ambition is to move toward the best, we should have specific guidelines for EN that illustrate everything starting from feeding administration, techniques to prevent complications, and how to evaluate the patient's tolerance to feeding. (Participant 12)

I think we do not adhere to evidence-based guidelines in a very big extent. (Participant 9)

In the absence of guidelines, personal opinions can potentially be acceptable and influential on decision making than scientific justifications. Using evidence-based guidelines minimises discrepancies and variations in nursing practice through providing a unified clinical pathways:

We should impose feeding guidelines in order to avoid guessing; also to be more guided and to avoid any discrepancies between nurses in practice and to avoid using any old or out of date practices. (Participant 7)

Yes, evidence-based protocol can reduce complications, meaning that nurses can deal with patient better when they use protocols than personal opinions. If there is no guidance for nurses, we should not blame nurses but the majority of our practices will be based on personal opinions even it is correct. (Participant 13)

As a part of nursing role in developing practice, nurses contribute in establishing a new feeding protocols or developing an existing protocol, which is a core competency for nurses to keep ongoing education and development:

So we can contribute in developing a new guideline for feeding. (Participant 4)

Yes, we can and we have to suggest any new ideas if they improve our care. For example, we asked the hospital administration to supply us with a guide wire feeding tube which is easier for insertion than ordinary types. (Participant 5)

Surely, our policy allows us to improve any therapeutic strategies. However, we did not start changing EN strategy yet but, for example; we have created many protocols for different clinical issues such as DKA (Diabetic ketoacidosis) protocol. Therefore, we regularly meet and identify our suggestions and recommendations to improve our practice based on the scientific evidence. (Participant 3)

In conclusion, it is clear that nurses have insufficient adherence to the evidence-based guidelines because of the scarcity of specialized guideline for EN and poor concerns about developing the current practice. Indeed, they showed ‘low’ to ‘moderate’ levels of adherence to EN protocols despite the presence of these protocols in their departments in some circumstances that, in turn, lead to serious complication.

4.2.3.2. Source of knowledge

Critical care nurses acquire evidence-based guidelines from different resources. The source of knowledge that influences nurses’ background vary from person to another based on the availability of different resources. This subtheme is associated with the other subthemes in its ability to explain how nurses can approach EBP from a wide range of resources. Clinical experience is the first source of knowledge considered for obtaining evidence base:

We usually rely on our experience to determine the appropriate action, yes of course, now it depends on our personal experience because there is no guideline. (Participant 6)

Nurses here have a good experience of working with different disorders, so they are capable to deal with any new caring strategies over time.
(Participant 10)

Actually, it is based on experience. I worked previously in a private hospital so I apply here what I have learned in that hospital. Similarly, nurses who worked in governmental hospital are applying what they have learned here. Everyone works according to his/her previous experience.
(Participant 1)

University education is the second source of knowledge which comprises both theoretical and practical training designated in the curriculum. Although, it is sometime incomprehensive, nurses extensively trust their basic education and consider it a major source of knowledge:

We are applying here what we have learned in the university. (Participant 7)

Actually, not all of our practices are compatible with guidelines in the books, but for example, the newly graduate nurses start their practice based on what they have learned theoretically in the university but later they learn some practices from clinical experience. (Participant 5)

We just learned simple information about EN in the university but, still, we don't give it the right to be implemented in the appropriate way.
(Participant 13)

Nurses use also other sources of literature concerned with EN such as, the internet and medical textbooks. These resources were regarded by nurses as good sources of information if their reliability is proven:

Sometimes, we search the internet if we are interested in a specific topic as an individual effort to develop our self and to improve our clinical performance. (Participant 14)

We usually refer to some references such as medical & surgical nursing text books, critical care nursing or any relevant website. (Participant 4)

When there is no guideline for EN here, I can get information from the Internet, so if I face any new issue related to patient's condition, I prefer to use books and the Internet. (Participant 3)

Yes, we have written manual procedure that includes all practices here in the ICU. (Participant 11)

In addition to the former sources of knowledge, doctors and colleagues are acknowledged as an accessible reference for nurses who seek specific information. Colleagues with long clinical experience and competent doctors are alternative sources of knowledge especially in absence of documented resources or internet access:

I refer to the physician to obtain the appropriate action. (Participant 3)

We usually ask physicians about EBP because we don't have an internet access here to read about EN, formulas and complications. Further, the library here has old books and not updated, so we try to ask doctors if we have any enquiry. (Participant 14)

Everyone gives feeding according to his knowledge. If a nurse asks me to teach her about anything, I will do. Later, he/she will use the easiest way to give feeding and most of our nurses learn from each other. (Participant 1)

To certain extent it is good, we currently carrying out our practice based on what we get from our previous colleagues. (Participant 6)

All previous sources of knowledge are applicable when an ICU nurse has a query about any specific issue surrounding EN. However, nurses are able to critically appraise the reliability of each source based on their knowledge, education and experience in respect to the nutritional care in the critical care areas.

4.2.3.3. Techniques to lower complications and nutritional assessment

Linked to the previous theme ‘undertaking nutritional responsibilities’, these subthemes (techniques to lower complications and nutritional assessment) are heavily associated with the current theme in which both of these aspects contribute to complement establishing EBP. The majority of clinical guidelines are built on the basis of nutritional assessment and prevention of complications. Nurses follow the evidence-based guidelines of EN to reduce the complications rates. The following nursing actions exemplify how these evidence-based aspects lead to preventing some complications:

For aspiration, we put the patients in semi-setting position as long as possible along with regular checking for GRV and prevent doing any chest physiotherapy or changing position immediately after feeding. (Participant 6)

To prevent aspiration, for example, we never give feeding then do suction immediately, and we keep our patients in semi-setting position. These are examples of EN guidelines. (Participant 9)

If the GRV is considered high, the protocol says stop feeding and administer ‘Plasil’ (anti-emetic drug) to improve gastric emptying then we have to resume the feeding at lower rate. (Participant 8)

I stop the feeding for a short period of time to lower the incidence of regurgitation. (Participant 4)

To prevent aspiration, I must check the tube site and change feeding pattern to give more frequent feeds with less amount as guidelines recommend. (Participant 7)

Regarding nutritional assessment, nurses intend to have an evidence-based protocol to obtain a real picture about patients' nutritional status. The following excerpts demonstrate some measures and assessment tools undertaken by nurses to evaluate the effectiveness of EN during feeding administration:

The protocol shows that before any feeding administration, GRVs should be measured. (Participant 12)

We do complete assessment, we check the GRV, bowel sounds, and NGT placement before administering feeding. (Participant 11)

Physical exam is very important, but lab tests such as renal function profile and sodium level are also effective to detect dehydration. (Participant 3)

We also search for the causes of any problem arises, for example, if the tube's size is inappropriate, we may change it to gauge 16 and try to search for other solution as much as we can. (Participant 1)

In general, we use the general feature to assess patients' conditions. (Participant 2)

Nursing adherence to evidence-based guidelines and protocols in managing EN is one of the core elements that strengthen clinical practice. Through evidence base, nurses build their body of knowledge from different resources to find the appropriate strategy for assessing patients' progress along with lowering the incidence of potential complications. Thus, nurses are invited to apply thoroughly an evidence-based protocol that functions as clinical pathway for all nutritional tasks.

4.2.4. Multidisciplinary team working

It is trivial that nursing is a part of the whole in term of conducting therapeutic care, so, it is complementary to other professions' roles. The success of any multi-professional relationship primarily depends on the collaboration frame that enhances a greater interaction between members and providing an equal opportunity for sharing. The following subthemes introduce the identity of relationship between professionals, focusing on the nutritional care as a central concept of this discussion.

4.2.4.1. Extraneous support

Having support from institutional administrators, head nurses and colleagues can promote nursing practice. Head nurse and in-charge nurse are always at direct contact with ICU nursing staff, so, they can be more acceptable than others for receiving any suggestions or comments:

As I said, the issues that need to be changed are discussed with the head nurse who in turn will discuss these issues with the hospital administrators. (Participant 2)

Of course, we introduce any suggestion to the boss and they deal with it if there is a possibility to do that, in general, there is a chance for change. (Participant 4)

I think the expected response of our head nurse is very important. (Participant 3)

Hospital administrators play an indirect role in improving clinical practice and nursing satisfaction especially when nurses' suggestions are taken seriously into considerations. The following examples show the nurses' opinions regarding the responses of administrators:

If the suggestions will contribute to the patient's wellbeing, the institution will support us. (Participant 9)

Our hospital administrators are very cooperative; they would accept any opinions if they believe it will improve patients' health and wellbeing. (Participant 12)

They actually support us; the administrators here like changing to the best practice. (Participant 11)

In some instances, both in-charge nurses and the administrators are reluctant to meet nurses' expectations because of the restricted financial resources and budgets allocated for their institutions. The available resources supplied by the administration influence giving support for nurses to manipulate their roles:

The institution responds and supports any suggestions but within the available resources. For example, if I suggest establishing a small unit here for preparing EN, this will be difficult because the resources are limited. (Participant 14)

I can see that the administrator response is less than expectations because of the limited resources. (Participant 4)

The institution does not bring all types of milk so the patients' family brings what we ask, by this way we provide the best care and deliver the appropriate feed. (Participant 10)

Nurses revealed another source of support arises by colleagues. Colleagues can provide a friendly support which is usually acceptable because of the closed relationship that aggregates ICU nurses together in that field of working:

Also, the junior nurses seek help from us as we are able to solve any of their problems. (Participant 5)

However, support from colleagues is not effective all the time and has an adverse effect on staff communication and relationship:

I think one of our major problems in practice here is our relationship together as nursing staff, I feel that there is no effective cooperation between us especially when one introduces any suggestion for improvement, he/she will find many obstacles such as jealousy colleagues (Participant 13)

If the head nurse supports me, other staffs will not, staff here is very weak. (Participant 1)

Generally, our opinions are still ignorable because I think we don't have a good relationship as nurses. (Participant 6)

4.2.4.2. Team work

Multidisciplinary team working can be formally achieved if a nutritional team has been established. However, it would not be possible without a well-defined cooperation strategy between team members, considering a mutual interaction between all members equally. Nurses exhibited a positive impression towards establishing a nutritional team in their departments as it has a greater impact on patient nutritional status:

However, if there is multidisciplinary nutritional team, our practice will be better like chemotherapy team which includes nurses, physicians and technicians. (Participant 6)

Exactly, whether for gastrointestinal patients, diabetic patients or any other patients, we frequently need a nutritional team. (Participant 2)

You need people to work with you, not to be alone. You need a group of professionals who read, talk, and follow up; but if stay alone, you will never change anything. (Participant 11)

I suggest creating a nutritional team that perform a regular follow up for patients and see if the feeding is given appropriately. Also, they should contribute to improve feeding strategy, it is a good idea. (Participant 5)

Nurses addressed also that cooperation is an essential requirement to achieve effective team working. Cooperation is to be in a position to accept and respect other people's opinions and suggestions:

Everything is based on cooperation, we as nurses, complement each other. (Participant 1)

We arrange with dietitians to prepare the appropriate formulae for each patient. Patients with major problems need an intensive nutrition that should be done through arrangements between all parties. (Participant 8)

In my opinion, there is a good cooperation between professions. (Participant 4)

However, cooperation might be insufficient because of lacking nutritional team:

Actually, the cooperation here between health professions is not so effective because there is no specific nutritional team. (Participant 7)

Although, the physicians have the higher authority to prescribe, hold and resume feeding, medical responses to nurses' suggestions were highlighted to determine the extent of medical staff acceptance to nurses' contributions. Doctors may respond positively if they receive an evidence-based contribution:

Some physicians accept our opinion but not all of them. Sometimes, doctors concern with our suggestions, for example, they ask about the reasons of decreased urine output and then they ask to increase fluid intake. (Participant 13)

They respond well and they usually modify feeding order according to our notes if we provide enough rationales with scientific justifications for that suggestion. (Participant 9)

If my opinion is correct and scientific based that would improve patient's health and wellbeing, then the physician will accept it. But, if there is a debate on my point of view, then we will discuss that issue until reach a consensus on the appropriate decision. (Participant 14)

They trust our opinions, yes, especially if you are an ICU nurse, because they assume that you have previously dealt with similar cases, so you are capable to work with. (Participant 8)

On the contrary, when physicians or other professions do not regard nurses' involvement in care or devalued their contributions, a serious conflict between professions can be developed, causing frailty in working environment:

When I feel myself unmotivated or unsupported to do something new, this will prohibit my ambitions for developing our practice. (Participant 13)

So, I think there is a 'missed ring' which is lack of effective cooperation between us as expected. (Participant 3)

To be honest, sometimes the dietitians reject our opinion, for example, we advice them that this formulae has high calories over patient's needs; they respond to us negatively and say this is our work. (Participant 6)

4.2.4.3. Other professionals' roles

Professionals other than nursing have a substantial role toward promoting feeding plans. Physicians and dietitians are partners in managing EN therapy along with nurses. Nurses asserted that inserting feeding tube is a responsibility of doctors especially for patients with high risk in addition to adjusting feeding pattern:

For tube insertion in high risk patients, it is a responsibility of physicians not nurses. (Participant 2)

Of course, it should be inserted by physician who also determines the type of feeding formulae for patient. (Participant 14)

It is a medical procedure but we usually perform it in our unit, except for patient with contraindications or patients at high risks such as head trauma or basal skull fracture. (Participant 8)

Patient follow up is another medical responsibility along with prescribing the appropriate feed. Follow up is required to assess patients' progress after delivering such formulae:

Physicians must do a follow up to assess patients' condition and consequently modify the required feeding. (Participant 7)

Doctor have to continue following up patients' condition. (Participant 1)

When patients get benefits rapidly from feeding, we suggest doctors to initiate oral feeding according to patients' progress. (Participant 5)

The doctor prescribes feeding then follows up the patient's condition and check the fluid intake and output but the other things completely depend on the nurses themselves. (Participant 3)

However, doctors, in some instances, are incapable of dealing sufficiently with critical care patients due to the complexity of cases and lack of sufficient knowledge and experience in that field of care:

Physicians sometimes ask to start feeding regardless of patients' needs and without sufficient assessment before administration. (Participant 9)

Sometimes, physicians do not know the importance of EN. They do not update their knowledge and do not take feeding seriously. (Participant 13)

Usually, dietitians deal with formulae's preparation and administration according to the local policy. There is a relationship between dietitians, physicians and nurses. However, it would be more powerful if the dimensions of that relationship are consolidated and presented in a practical way:

Yes, the physician is responsible only for prescription, and the dietician is responsible only for preparation of feeding, but we (nurses) have to manage other things and administer feeding along with them. (Participant 12)

There is cooperation between physicians and nurses, but dietician just distributes feeding. There is no system at the hospital to determine the job description for dietician, they distribute feeding only. (Participant 2)

Mainly, we are trying to change the responsibility of dietitians from preparing the appropriate formulae to having sufficient interaction with other care providers who are being involved in nutritional responsibility. (Participant 10)

Nurses suggested that the role of dietitians is to be deeply interacted in the clinical practice. This gesture refers to the dietitians' body of knowledge and their ability to provide evidence-based suggestions or recommendations:

I prefer the dietitians to hold the responsibility for feeding more than doctors, because sometimes doctors ask us to initiate feeding "as usual" regardless patients' condition, so we will never be optimal as dietitians stand with us. (Participant 6)

I wish the dietitians have more effective role in feeding, because they know more about nutritional details more than us, for example, they know about

giving a specific formulae for hypertensive or diabetic patients or using a pre- prepared formulae. (Participant 8)

I would seek help from the dietitians, I need them as guidance for us to provide and explain any information we need about EN in the ICU. (Participant 4)

4.2.4.4. Nursing non-practical roles

Multidisciplinary team working requires of nurses to undertake other non-practical roles alongside practical elements such as teaching staff, coordination, staff monitoring...etc. This subtheme is being overlapped with the first theme 'Undertaking Nutritional Responsibilities'. At this point, some nursing non-practical roles are associated with the multidisciplinary team working in which each role reflects an actual collaboration between health care members:

I interfere directly when I see any malpractice existed here and report any wrong practice and guide the target person how to deal with this issue to be guidance for all. (Participant 4)

We coordinate with physicians. For example, if a patient has an elevated creatinine and BUN (Blood urea nitrogen) level in the blood, we decide whether to hold or to change feeding. (Participant 8)

Nursing role is directed toward staff supervision as nurses are at the first line of dealing with patients. (Participant 12)

We implement physicians' orders and prepare formulae through dietitians, so, our roles here are nested. (Participant 9)

I teach the staff the guidelines of EN, how to prepare, how to administer, how to check the residual volume, and how to insert the tube, and then we regularly follow up them. (Participant 11)

We explain the procedure of EN theoretically and practically for every new nurse or nurses who do not have an experience in that field.
(Participant 14)

The multidisciplinary team working is an influential issue concerned with establishing an effective relationship between health care providers in regard to clinical nutrition. It should be accompanied with a successful interaction between nurses and their seniors, administrators and colleagues from different professions to enhance an equal involvement of all parties in decision making and to promote the quality of nutritional care accordingly.

4.2.5. Consequences of EN care deficits

Despite the tremendous impact of using EN in the intensive care, many of harmful complications resulted from inappropriate tube management or inadequate assessment tools were revealed. This theme demonstrates the deficiency of nursing practice due to the malpractice or weak institutional policies that impede delivering an optimal nutrition and entails negative consequences. The following subthemes reflect factors associated with accelerating the likelihood of complications and nurses views of the incidences of different complications in their practical field.

4.2.5.1. Practical Problems

A number of practical issues have emerged to convey their effects on EN practice. Some personnel or administrative trends are associated with tube feeding complications. For instance, knowledge deficit among nursing professionals and the discrepancy in nursing practice elevate the possibility of complications as a result of delivering inconsistent care and poor comprehension of nutritional requirements:

Not all nurses know the complications of EN, there is misunderstanding of some procedures or lack of knowledge, I feel nurses just know only how to prepare and administer feeding, they believe in one type of formulae, regardless patients' conditions requirements. (Participant 8)

In particular these problems resulted from performing physiotherapy after giving formulae, or giving larger volumes of feeding by new nurses, but there is no complication occurred from poor practices. (Participant 6)

There is no good care because of fear from diarrhoea or because nurses don't have sufficient knowledge about the importance of EN here in addition to the absence of training programs and continuous education to improve nursing practice for some skills. (Participant 13)

I think the variation in practice occurs even in the presence of guidelines. We need to apply the same protocol for patient X, Y, Z...etc, so all patients are treated in the same manner and the differences should only be in the amount and the type of formulae, not the technique. (Participant 3)

Staff shortage and time restrictions are obstacles impede dealing efficiently with patients. Increasing staff workload restrains nurses' ability to provide an optimal care or to develop an existing protocol, considering that overloaded work environment has a negative impact on patients' care and patients' outcomes:

Head nurse do rotations on nurses' schedule to evaluate them on night shifts and morning shifts to rehabilitate and train them, but this is also difficult because there is a shortage in nursing staff. (Participant 1)

The problem here is that the majority of nurses are newly graduated. We have 25 nurses, only five or six of them are independent practitioner. (Participant 7)

We don't have enough time for training; I work as a clinical instructor but I have many other responsibilities. There is no nurse dedicated solely for developing guidelines, no one have enough time to do this. So the practice here is good but not excellent because of work overloading. (Participant 11)

Work overloading here does not help us to think about anything else. (Participant 9)

Moreover, another practical problem is inappropriate formulae preparation which makes the prospect of underfeeding higher. Using local preparation techniques is considered a problematic issue because of inaccurate measuring of calories based on patients' requirements:

I think sometimes, patients do not benefit from feeding because of inappropriate feeding types. (Participant 9)

Here, at the hospital's kitchen, formulae may be prepared in higher concentrations due to lack of accurate calculations of its components. So, in this case, what we have to do? To give the formulae, hold it or dilute it? (Participant 13)

The type of given formulae here is not suitable for all patients. (Participant 10)

4.2.5.2. Patient status

Nurses argued that EN complications are caused by other reasons than staff and institution itself. The complications can be influenced by patients' conditions and their response to the treatment. Patients' conditions are subject to improvement or deterioration based on the status of patients when they admitted to the intensive care and this absolutely influences the effectiveness of the treatment:

In general, we deal with fresh cases in our department, because this ward is allocated for acute cases most of the time, so feeding is often effective.
(Participant 10)

Honestly, EN is very important but it does not gain the greatest concern in our unit because most of our patients are unconscious and chronically ill.
(Participant 13)

One patient before was undergoing weaning from MV, the patient had muscle atrophy from poor nutrition therefore, weaning was unsuccessful.
(Participant 8)

I think some patients have problems in the gut or may become allergic to formulae itself. (Participant 4)

Most of our patients have CVA, malnutrition, and difficulty in swallowing.
(Participant 1)

Subsequently, patients' condition after receiving EN falls into two possible categories; successful, if EN was delivered in meticulous way or failed if the feeding was ineffective and below standard which manifested by weight loss, dehydration, delayed recovery and prolonged hospital stay:

Patients with poor nutrition are experiencing weight loss and risk of developing bedsores because feeding is ineffective and does not promote wound healing. (Participant 3)

If a patient develops weight loss or dehydration, it absolutely indicates to unsuccessful feeding. (Participant 5)

Some cases get benefits from feeding such as patients with CVA and they discharge from the hospital with good general conditions. (Participant 7)

Some patients stay hospitalized for 20 to 40 days without appropriate nutrition. You can assess them after 10 days or two weeks from admission to find that they are getting worse due to bad nutrition. (Participant 9)

Some patients on mechanical ventilation who need to start weaning are facing some difficulties in weaning due to muscle atrophy which is resulted from poor nutrition. (Participant 8)

4.2.5.3. EN complications

Linked to the previous subtheme which demonstrates some issues associated with failure of EN administration. This subtheme reflects the ultimate outcomes of poor practical performance, setting deficits and patient-related complication that are seen as undesirable outcomes. Firstly, nurses revealed that aspiration is one of the most crucial complications resulting from EN:

When a patient develops sudden aspiration, we initially check the placement of feeding tube because the tube may be displaced during suctioning or changing position. (Participant 8)

If the amount given is more than patient's needs, then aspiration will happen, also, infection might develop. (Participant 12)

GRV must be checked every 2-3 hours because patients on feeding pump usually develop aspiration especially with MV when the patient placed on supine position. (Participant 4)

Diarrhoea which is a result of either bacterial or non-bacterial source is at the second-rank of EN complications. Nurses recognise that diarrhoea leads to failure of administration and losing excessive water from the body so it becomes a competitive problem:

If any complications happened such as diarrhoea, I have to check the type of formulae given to the patient because diarrhoea might cause dehydration and malnutrition. (Participant 14)

We observe patient for diarrhoea and we can give anti-diarrhoeal formulae or give anti-diarrhoeal drugs (e.g. Motilium) without doctor order because it is a serious problem. (Participant 9)

The most common complications of EN are diarrhoea and distension and they occurred in 50% of adult patients. (Participant 10)

Further to the previous complications, feeding intolerance has become a prominent issue in ICU that warns staff of ineffective nutrition. Feeding intolerance might be a combined problem of GI intolerance with formulae deficits:

Some patients have frequent vomiting although, the physician calculated the amount and frequency of feeding accurately (250cc every 6 hours), but they may have a problem in GI system or they do not tolerate feeding. (Participant 13)

I have noted some cases of feeding intolerance; it might be resulted from patients' conditions or formulae itself. (Participant 4)

Finally, the incidence of complications has been translated into numbers. Nurses described the complications rates in a wider numerical range based on their perception of the complications' incidences in different departments:

The percentage of the occurrence of feeding complications is approximately 15-20% so it is relatively low. (Participant 4)

We have very minimal rate of intolerance or complications at 20% to 30%. (Participant 11)

The occurrence of complications is not too high, around 30-40%, because aspiration is under good control especially in the intubated patients.
(Participant 8)

We can say that 50% of our patients develop complications such as diarrhoea and other long term problems such as metabolic disturbances.
(Participant 3)

The rate of the incidences of diarrhoea is 70%, but aspiration is minimal.
(Participant 7)

These consequences of EN care deficits should be appraised as a poor nutritional care. Staff shortage and working overload may directly affects nursing performance and can also indirectly exacerbate patients' condition and produce fatal side effects. The majority of complications develop when nurses suffer from knowledge deficit and variations in practice, in addition to the absence of nutritional guidelines. Therefore, the ability of nurses to perform an appropriate care is that when they apt to be closer to the EBP.

4.2.6. Conclusion

All previous themes interact with each other to explicate professionals' attitudes and performance toward nutritional care in intensive care. Nurses adhere to all these concepts to achieve the goals of therapy. They alleged that nutritional care is one of their competencies that should be carefully considered, including better preparing, handling, and administering feeding. These practices should be carried out in a safe and expedient way along with frequent assessment of nutritional status until evaluating feeding outcomes. The contribution to minimizing complications is another approach carried out through developing an effective strategy of evidence-based to

lower the incidence of complications or to reduce the extensiveness of an existed complication. In parallel to these domains, evidence-based protocols should be attached to these practices, considering that clinical experience, basic education and literature or learning from others are different source of knowledge where nurse might acquire their evidence-based practice. Although the significance of EBP is adequately understood, nurses suffer from poor evidence-based resources which impact negatively on their role. However, they perceive the effect of evidence-based on each step of nursing process starting from preliminary assessment until later evaluation of the outcomes.

Multi-disciplinary team work is another approach that binds nursing practices with the evidence-based. The success of the nutritional team depends heavily on the cooperation between professionals which gives the impetus for nurses to be involved in making decisions. Nurses stressed on their ability to upheld nutritional strategy based on their experience and potentials which enhance sharing with physicians and dietitians to develop patients' nutritional care. This confidence emerged from their long experience in critical care that enables them to embrace all complexity of these cases.

Finally, EN has many problematic side effects appear when the assessment or preventive strategies of complications are below standard. The estimated complications rates of EN were unveiled by nurses based on their observation and perception. Indeed, they declared that the majority of these complications occurred when poor adherence to evidence-based guidelines is existed and the complications are less likely to happen if robust guidelines are processed.

At the end of presenting results gained from both qualitative and quantitative parts, and prior to start discussing these results, the next section will illustrate the mechanism of data integration of all previous methods and resources. The results obtained from the survey, bedside observations and the interviews will formulate the overall study themes which will be discussed later in one context.

4.3. Integrating the quantitative and qualitative findings

Using the Concurrent Embedded Mixed-methods strategy was anticipated earlier in this study. According to this strategy, data should be merged in the discussion stage, considering that one design will drive the flowing of another (Creswell, 2009). As mentioned previously, both designs had the equal weight but the quantitative design has driven the study progress and the qualitative design was used as a complementary strategy to enhance the richness of the data gained from the quantitative parts and to compensate for any deficiency inherent in using one design.

In this section, all data will be blended in a logical manner to generate understandable findings that will be used for discussion in the next chapter. The results obtained from the survey and bedside observations which are quantitatively-based will delineate the final construct of the discussion along with the themes which are qualitatively-based. Both are essential and given equal opportunity to build the overall study themes. This supports the premise that the data obtained from different sources are seen to enhance the validity of each other. In fact, this is the wisdom of using an embedded or triangulation strategy of mixing methods. However, the process of combining both

quantitative and qualitative data findings was explained in details in the integration section of the methodology chapter.

The following themes are the combination of study findings after considering all methods and resources. They revealed based on the congruence between results and whether support or contradict each other. However, the discussion will present the contribution of all results together, focusing on the most significant findings.

4.3.1. Knowledge of nutritional care in the critically ill

This section demonstrates the extent of nursing knowledge toward nutritional care in ICUs. Nurses' knowledge of nutritional care is addressed in both survey and interviews. Nurses in the survey were asked about the source of knowledge they used to obtain information about EN and the level of knowledge comprehension regarding each stage of the nursing process. In 'theme 2', nurses indicated the sources of knowledge, which were extensively similar to those in the questionnaires. Also, 'theme2' explained the extent of knowledge comprehension regarding nursing process in which the need for 'nutritional assessment' was discussed in details. In addition, this theme exhibits some familiar resources of gaining knowledge from facilities which are provided by institutions. Therefore, both results support each other in clarifying the defects in applying nursing process in the correct order.

4.3.2. Responsibility toward nutrition in the critically ill

Responsibility toward nutrition in intensive care was divided into two parts; responsibility of nurses for developing patients' nutritional care and responsibility of other health workers for supporting these nutritional plans. Both are presented simultaneously in the survey and in 'theme 1'. Nurses in the survey indicated to the

presence of a key person such as nurses, doctor or dietitians who is responsible for managing nutritional therapy at their institutions/departments. They also rated the extent of having responsibility for each stage of nursing process. In ‘theme 1’, the responsibility of nurses toward patients’ nutrition was extensively illustrated to be classified into practical and non practical roles. The practical roles includes the responsibility for handling EN, nutritional assessment, and lowering complication, whereas, non-practical roles include some elements such as staff training and monitoring, health education and coordination. The later was explicated only in the interviews. However, nurses’ perspectives taken from the interviews intersected with the information gained from the survey regarding the extent of nursing responsibility toward the stages of the nursing process. In fact, knowledge and responsibility toward nutrition do not differ in term of appraising the ‘nutritional assessment’ which is still being less concern among nurses in the ICU.

4.3.3. Practicing EN in intensive care

In the section entitled ‘EN interventions’ in the survey, nineteen clinical issues were investigated in regard to practicing EN in intensive care. In addition, the elements of bedside observation supported some of these elements and added other relevant issues. In the qualitative part, ‘theme 1’ and ‘theme 2’ shared equally by some subthemes the previous concepts to configure EN practice. The following aspects were constructed based on the convergences between both methods that formulate each practical issue individually. The routes and methods of administration which include early feeding administration and feeding pattern, was addressed in ‘theme 1’ as well as the relevant part in the survey. Aspiration reduction measurements which includes controlling GRV, detecting tube placement, HOB elevation and using

prokinetic agents were illustrated in the interventional section of the survey as well as the overlapping between 'theme 1' and 'theme 2' in subthemes entitled 'nutritional assessment' and 'lowering complications'. Medication administration was also detailed in 'theme 1' and some parts of the survey. Finally, caring for tube and avoiding infections were examined by the interventional section of the survey and in 'theme 1', in addition to a number of items in the bedside observation. The results obtained from bedside observations were combined with other findings related to some clinical issues. Bedside observations showed some contradictions to the results obtained from other resources. However, the results of clinical observation are reliably considered over other findings if the contradiction exists because the observation reflects the real field practice.

4.3.4. Establishing evidence-based practice

This section demonstrates issues surrounding nursing adherence to EBP. In the survey, the use of evidence-based guidelines was presented twice in two different forms;(a) in having support from documentations for conducting the nursing process, (b) in the section entitled 'Evidence-based-practice' in the questionnaire. The later also reflected the perception of nurses toward evidence based and its relation to the incidences of complications. In the qualitative part, 'theme 2' demonstrates the extent to which nurses realise the importance of EBP. Different subthemes joined together to support the results gained from the survey. However, 'theme 2' also showed the role of nurses in developing and adhering to such protocol as well as its significance to reducing the incidence of complications. Therefore, the results of both qualitative and quantitative methods depicted the state of optimal exploitation of evidence-based guidelines.

4.3.5. Multi-disciplinary team work

Teamwork is a pivotal concept in the nutritional care. This concept was only explored by ‘theme 3’ of the qualitative results. Multidisciplinary team working reflects some substantial elements associated with successful nutritional care. Establishing a nutritional team was acknowledged by nurses as a main source leading to successful nutrition in the critically ill. Collaboration between healthcare professionals is a devalued issue that nurses sought to be effectively activated instead of hold in abeyance. However, nurses disclosed their obtaining support from immediate managers, seniors and their colleagues which, in eventual, is able to accelerate their driving forces toward achieving goals.

4.3.6. Nutritional care deficits

This section represents the ultimate nutritional consequences of poor nutritional strategies. The section in the survey entitled ‘EN complications’ addressed all susceptible complications resulted from EN. Also, the overall complications rates were revealed by nurses in the presence and absence of evidence-based guidelines. Similarly, the qualitative part represented by ‘theme 4’ revealed the incidence of various complications as nurses indicated to, in addition to the overall complication rates in their departments. However, ‘theme 4’ went beyond that and explored some factors that lead to nutritional failure which is manifested by feeding intolerance and under-feeding. Work overload and staff shortage are issues function as obstacles to delivering an appropriate feeding delivery and associated with time restrictions that restrains nurses’ activity. Finally, the discrepancy in nursing practice which is appeared between individuals, departments and institutions due to lack of unified

evidence-based guidance was explored to show its role in magnifying nutritional failure and weakening nursing care.

4.3.7. Conclusion

An obvious integration between results was drawn from quantitative and qualitative methods and emerged to enhance better understanding of the scope of the study. This integration presented results in a systematic way that provides a thorough explanation of all aspects associated with nursing nutritional care in the critically ill. The next chapter will discuss these major themes in exhaustive way showing the relevance to literature and the theoretical context of each theme that referred to the Donabedian's model of quality assurance in health care.

Chapter Five: Discussion

5.1. Introduction

This study was designed to assess nurses' practice and perception of their knowledge, responsibility and documentation in relation to EN in the critically ill and to explore nurses' attitudes towards establishing EBP and teamwork in three health care sectors in Jordan. In mixed-methods study, the quantitative and qualitative findings should be nested in the interpretation stage. As explained in the previous chapter, both findings are either overlapped or complementary to each other. Therefore, it supports the early assumption that using both embedded and triangulation mixed-methods strategy is expected. In this chapter, all the emergent themes will be discussed in parallel to Donabedian's model which guided the study progress.

The hypothetical relationships between Structure, Process and Outcome provided the researcher with the conceptual guidance to elicit meaningful inferences from the study. Evidently, each final theme emerged from the study has a distinct role in advocating the usefulness of this model in developing a comprehensive meaning about nursing nutritional care. According to this, the overall study themes which were introduced in the previous chapter are now ascribed to the substrates of Donabedian's model and illustrated Table 5.1. This table demonstrates how far these integrated findings are congruent with Structure, Process and Outcome in light of nursing nutritional care in the critically ill.

Table 5.1: Adapting the theoretical framework to the study themes		
Structure	Process	Outcome
Knowledge of nutritional care in the critically ill		Nutritional Care Deficits
	Responsibility toward nutrition in the critically ill	
	Practicing EN in intensive care	
	Establishing EBP (EBP)	
Multi-disciplinary team work		

According to Table 5.1, six major themes were established after integrating the results of all methods as explained previously. In this chapter, all significant findings from all resources will be highlighted and discussed with relevant literature along with reviewing the theoretical relationship between Structure, Process and Outcome.

It is obvious that nurses tended to undertake patients' nutritional needs although most of them realized that nutritional therapy also falls under other professionals' responsibilities and nurses only play the secondary role. In term of knowledge and responsibility of EN in the nursing process, nurses showed more concerns about 'preventing complications' and 'evaluation' than 'assessment' and 'identifying goal'. However, female nurses showed concerns about 'assessment' and 'planning' more than male nurses.

The importance of measuring GRV is adequately perceived by nurses. However, there were inconsistent thoughts about the normal values, threshold and frequency of measuring GRV in intensive care. Tube placement is still confirmed via unreliable measures producing inaccurate evidence of tube location. Lab investigations such as blood protein and albumin levels are more usable in term of assessing nutritional status instead of using physical examination. Nurses acquired their knowledge from different sources; they mainly rely on their clinical experience, university education and the internet to obtain information about clinical nutrition. However, they asserted that they follow in the footsteps of their colleagues who provided them with the basic clinical guidance for nutritional care.

Evidence-based guidelines are adequately understood by nurses whereby the majority of complications are less likely to occur in the presence of guidelines. So, the significance of establishing and developing evidence-based protocol for EN was remarkable. Regarding EN complications, diarrhoea is considered the most problematic issue of EN followed by vomiting, tube dislodgment, weight loss and uncontrolled blood sugar. Patients may also suffer from under-feeding caused by these complications or feeding intolerance resulted from poor assessment strategies.

Regarding team work, nurses confirmed the need to establish a nutritional team from multidisciplinary professions that appears to hold all responsibilities toward patients feeding and follow up. However, nurses revealed that teamwork would not be successful without reinforcing effective cooperation between health care providers, considering that nurses have the mutual role in making decisions and formulating their own strategies of care.

5.2. Knowledge of nutritional care in the critically ill

Nutritional care is one of the core competencies of nursing profession. Nurses indicated to different aspects of gaining knowledge in regard to clinical nutrition. There is no ultimate description of how nurses can acquire their body of knowledge from different resources. However, because nursing is multifaceted, it interacts with various recourses, systems and professionals while providing nutritional care. This section illustrates nurses' knowledge of nutritional care in the ICU from different angles, including the sources of knowledge and the level of knowledge comprehension in nursing process.

5.2.1. Source of knowledge

The presence of a key person to consult in the hospital was evident in all hospitals. However, no person is dedicated specifically for intensive care, indicating that the majority of hospitals have no specialised nutritional team in their ICUs. Nurses indicated that establishing a nutritional team is one of the missing points that nurse looking forward to achieve. Various sources of knowledge were revealed by nurses from the survey and interviews. Nurses indicated that the internet is the most frequent and accessible way for obtaining information about any issue in clinical nutrition. University education and short courses in addition to the lectures and in-service training being hold in hospitals were also applicable for gaining knowledge. However, the most distinct source of knowledge embarked by nurses is the clinical experience. Clinical experience can be acquired from long clinical practice or from other people who have extended experience in that field. Nurses constitute their own experience based on their observation and medical judgments on other cases they dealt with. The interviewed nurses shared their peers who participated in the survey about using

university education, books and references to obtain information in addition to seek knowledge from doctors and colleagues who are also considered as a reliable source of knowledge. Persenius et al. (2006) confirmed that the previous sources of knowledge are the most common ways for developing the body of knowledge regarding nutrition in intensive care.

5.2.2. Knowledge of EN in the nursing process

Obviously, nurses showed a higher level of knowledge for the ‘advanced-stages’ of nursing process instead of the earlier stages. Knowledge of ‘preventing complications’ and ‘evaluation’ scored higher than ‘assessment’ and ‘identifying goal’ among nurses in all sectors. This means that nurses regard the outcomes of the therapy more than the preliminary assessment before, during and after delivering nutrition which contribute to successful therapy. This reinforces the assertion of Splett and Myers (2001) who stated that the role of nurses is more prominent in gathering and articulating patients’ data than determining nutritional goals. Likewise, the nurses claimed that they employ all facilities to manage EN tasks such as preparing formulae, tube insertion, maintain tube patency and administering feeding. However, the process of assessing nutritional status is more often undertaken in the instance of complications rather than in a regular basis. In other words, nutritional assessment skills, even though they are processed, do not reach the required level of satisfaction as nurses showed improper levels of knowledge comprehension regarding nutritional assessment comparing with detecting feeding complications and evaluating feeding outcomes. This supports the premise that the RNs’ autonomy is more notable in defining outcomes than reasons triggering these outcomes, meaning that nurses show less concerns about the pre-existing factors of complications and they usually tend to capture solutions of the

adverse outcomes if appeared (Williams and Leslie 2004, Persenius et al. 2006, Kennedy 1997, Fletcher and Carey 2011).

5.2.3. Theoretical context

As shown in Table 5.1 which reflects the relevance of 'knowledge' to the Donabedian's concepts, this theme is referred to as a part of Structure and Process altogether in which the institutional role of supplying accessible sources of knowledge, guidance, and consultation is related to Structure, whilst, nursing optimal exploitation of these resources and employing them in developing their body of knowledge is associated with Process (Donabedian 2003). In fact, this is a concrete relationship which links Structure with Process. Therefore, the institutional facilities and self-development are significantly triggering an appropriate knowledge background of nursing staff working in intensive care areas.

5.3. Responsibility toward nutrition in the critically ill

Linked to the previous section, responsibility toward nutrition refers to the responsibility of nurses for nutritional care in the ICU. The majority of nurses indicated that the clinical nutrition is not a mainstay of nursing profession. They claimed that other professions have to undertake that role with a partial responsibility of nurses. Nurses asserted that nutritional care is one of their direct responsibilities which comprise administering feeding and assessing patients' nutritional status and feeding outcomes. Similarly, former studies confirmed that critical care nurses are responsible for delivering prescribed nutrition, fluid, and medication in a safe and effective way (Adam and Batson 1997, Persenius et al. 2008, Jefferies et al. 2011). This reinforces the importance of nursing care in delivering nutrition. Woien and

Bjork (2006) stated that lack of responsibility for nutritional therapy lead to inadequate nutritional outcomes. Therefore, nurses should not be exempt from accountability, on the opposite; they are responsible and liable for undertaking nutritional care in a way that saves patients' integrity and precludes complications.

5.3.1. Responsibility for nutrition in nursing process

Responsibility for nutrition in nursing process is not far from the level of knowledge in nursing process; it is obvious that nurses exhibit a greater tendency to have responsibility for 'preventing complications' and 'evaluation' more than 'assessment' and 'identifying goal'. However, female nurses scored higher in having responsibility for 'assessment' and 'planning' than male nurses. This is logically associated with the precedent assertion that nurses still show more concerns about the outcomes of therapy more than the preliminary assessment needed prior to start EN. This might result from lack of knowledge about clinical nutrition in the critically ill. In a study by Persenius et al. (2006) RNs scored lower in having responsibility, having sufficient knowledge and having support from documentation in clinical nutrition compared with other nursing skills. However, nurses stressed on their responsibility toward nutrition as it is a multidimensional approach include the process of assessment, implementation, evaluation and lowering complications. In fact, there is no enough evidence to support the premise that nursing insufficiency in providing a good nutritional care in EN would directly affect the quality of care and patients' outcomes.

5.3.2. Roles of responsibility toward nutrition

There are many practical issues associated with EN in intensive care. Nurses are substantially responsible for the following aspects in provision of EN. Shuriquie et al.

(2008) claimed that 76% of Jordanian nurses believe in their responsibility for providing feeding through NG routes. As discussed in the previous chapter, this section is based on the first qualitative theme 'Undertaking Nutritional Responsibilities' and nutritional responsibility section in the survey.

5.3.2.1. Responsibility for handling EN

Nurses asserted that the initiation of artificial nutrition in general, and EN in specific, is one of their responsibilities which includes the process of preparing formulae (if applicable), checking the correct type, time and amount of feeding until assessing patients' outcomes. In some instances, nurses are entitled to insert feeding tube and contribute to start feeding as early as possible. However, the responsibility for inserting of a fine-bore NGT for EN falls mainly on highly skilled nurses (Dobson and Scott 2007). In a study by Shurique et al. (2008), 51% of Jordanian nurse claimed that they are capable to insert and remove NGT and 68% of them consider themselves able to assess patients' dietary intake.

The majority of nurses (80%) claimed that determining feeding type, amount and rate is often referred to the medical team. Nursing role in determining feeding rate was more notable in all sectors. Swanson and Winkelman (2002) stated that the critical care nurse is responsible for ascertaining EN volume and the quality of given formulae. However, dietitians gained insufficient considerations for these issues. Nurses suggested dietitians to have more visible role in preparing, initiating and delivering patients' nutrition along with other professions. Maintaining an appropriate feeding pattern should be carried out by gravity and at suitable formulae temperature

to decrease the sense of discomfort. Maintaining the patency of tube and preventing infections associated with feeding tube are another role of nurses as revealed by them.

5.3.2.2. Responsibility for nutritional assessment

Although insufficient knowledge and responsibility toward nutritional assessment was evident, nurses still intend to undertake nutritional assessment to examine the effectiveness of feeding. Joillet et al. (1998) reinforced the importance of nutritional assessment as the first step of EN. Based on how nurses perceived their role, they declared that identifying the reasons of any problem inherent in EN is one of their responsibility and they stressed on their capability to detect the reasons of any arising problem. A number of assessment techniques are used by ICU nurses such as measuring GRV, bio-physiological parameters such as body weight, abdominal girth, bowel exam, skin integrity, and urine and stool analysis in addition to some nutritional indicators such as serum protein level in the blood. Previous studies stressed on investigating weight, history of nutrition intake, severity of illness, and function of GIT prior to admission instead of measuring albumin and pre-albumin (McClave et al. 2009, Btaiche et al. 2010). The frequent assessment of BMI should also be measured by dividing weight in kilograms by the square of the height in meters (Normal range 19-25) (Elamin and Camporesi 2009). However, previous studies revealed that not all patients in intensive care have a regular nutritional assessment and the essential aspects of nutritional documentation are missed, also, there was no entire screening tool for evaluating nutritional outcomes (Persenius et al. 2008, Mirmiran et al. 2011). In general, all studies confirmed the significance of nutritional assessment, and the role of nursing in measuring patients' bio-physiological parameters.

5.3.2.3. Responsibility for lowering complications

Likewise, beside the role of assessment and surveillance, nurses alleged using a wide range of actions for preventing the occurrence of complications or inhibiting the exacerbation of an existing problem. Controlling GRV, checking tube placement, frequent suctioning, and maintaining an appropriate HOB are examples of nursing practices to avoid the incidence of aspiration. Furthermore, re-checking formulae, stopping feeding, and extubating feeding tube are examples of measures used to minimise the extensiveness of an existed problem. These measures will be discussed later in details under the title 'practicing EN in intensive care'.

5.3.3. Nursing responsibility for non-practical nutritional roles

A number of nursing non-practical roles emerged alongside the previous practical elements. Based on the first qualitative theme, nurses unveiled a set of non-practical issues that nurses are responsible for to complement their role in nutritional care. Regarding their roles toward staff, nurses provide teaching and monitoring for staff adherence to EBP in addition to develop clinical skills of those junior nurses to bridge the gap between theory and practice. Moreover, nurses intend to provide health education for patients and their families and they spend a considerable effort to make nutrition closer to the patients' preference that should also be discussed with the family (Stroud et al. 2003, Jefferies et al. 2011). In relation to communication with other professionals, nurses introduced themselves as coordinators between patients and physicians. For instance, nurses coordinate with doctors to manage any progress in patients' status due to the therapy; also, they are in a key position to communicate between physician and other health workers such as dietitians to solve any issue related to nutrition.

5.3.4. Theoretical context

Responsibility toward nutrition is regarded as a part of Process in Donabedian's model because it refers directly to nursing actions towards successful nutrition. An effective participation in caring strategy which also includes patient-practitioner interaction are a prerequisite to the '*quality of the Process of care*' as illustrated by Donabedian (Donabedian 2003). Therefore, nursing responsibility for nutrition provides an indicator of the quality of care in health care system where reflecting nursing recognition toward their practical and non-practical commitments is emphasized.

5.4. Practicing EN in intensive care

Artificial nutrition should be initiated in patients with critical illness if they failed to achieve a successful self-nourishment independently. EN is the method of choice that ICU nurses prepare, administer and monitor its outcomes. The following issues represent some practical elements of an effective EN including delivery and assessment. The following descriptions derived from the results of questionnaires, interviews and bedside observations as mentioned previously.

5.4.1. Routes and methods of administration

Various routes and methods of tube feeding are used according to the available resources and protocols. Regarding the routes of administration, gastric tube represented by NG route, is the most popular way used for feeding in all sectors. It is the simplest, fastest and easiest route that does not need specialised instruments and professionals. Nasal intubation is commonly used for gaining access into GIT; this method allows access to the stomach, duodenum and jejunum (Barrett et al. 2009,

McGinnis 2011). PEG is also popular but used less than NG feeding because it is often recommended for prolonged feeding plans or if the oro-nasal route is contraindicated. PEG tube is also indicated for patients with severe neurological or swallowing disorders such as CVA and cognitive impairment (Stroud et al. 2003). The post-pyloric routes are less used in all sectors and usually used for long term therapy especially for those patients with feeding intolerance. McMahon et al. (2005) stated that naso-duodenal-jejunal tube placement is used for patients with high risk of aspiration. Jejunal feeding requires continuous infusion and it limits patient mobility (McMahon et al. 2005). However, nurses did not realize that a post-pyloric route is recommended for patients with high gastric retention which prohibits using gastric route for feeding to minimize the risk for aspiration (Petros and Engelmann 2006).

Regarding the methods of administration, all hospitals showed higher popularity for bolus (intermittent) feeding more than continuous (infusion) methods. This method allows more ambulation when infusion pump is no longer used for administration (McMahon et al. 2005). Undoubtedly, using bolus feeding to that extent refers to the frequent use of gastric tube rather than other routes as mentioned before. However, using infusion feeding is still popular in the military and private sector more than the governmental sector, considering that is more recommended for the post-pyloric feeding.

5.4.1.1. Early start feeding

EN should be started as early as possible in critically ill patients who are unable to sustain oral intake within 24-48 hours of admission (McClave et al. 2009, Ridley and Davies 2011). Early start of EN is a robust evidence-based recommendation because it

impacts positively on patients' improvement, sepsis prevention and decrease LOS. Marik and Zaloga (2001), Woo et al. (2010) confirmed the effect of early EN in lowering infectious and non-infectious complications, LOS, and the incidence of pneumonia and mortality rate compared with late EN. Nurses affirmed that EN is initiated as early as possible on the second day of admission unless there is an evidence of contraindication or preparation for diagnostic procedures such as endoscopy, CT scan, MRI or any procedure affected by feeding (Cahill et al. 2011). Similarly, Miller et al. (2008) revealed that more than 66% of ICUs patients receive EN as early as possible within 48 hours of admission and the main reasons for delaying EN were haemodynamic instability such as cardiogenic-hypovolemic-vasogenic shock and gut dysfunction. Indeed, this reinforces the theory that early EN (within 24 to 48 hours of hospital admission) mitigates hypermetabolic response and that patients who fed earlier achieve caloric goal earlier than others (Marlan and Allen 1998, Doig et al. 2008, Ros et al. 2009, Btaiche et al. 2010).

5.4.1.2. Feeding rate

Feeding rate was significantly higher in the governmental hospitals than other sectors. Back to the methods of administration, this refers to the priority of using intermittent feeding over continuous feeding in the governmental hospitals that interprets using faster rates in a shorter time than using continuous feeding in slower rates. However, the infusion rate of feeding in both military and private sectors is less than 60 ml/hour- something considered acceptable for continuous feeding durations (Guenter 2010, Ireton-Jones 2011).

5.4.2. Aspiration reduction measures

The following preventive measures are indispensable for reducing the incidence of aspiration. Aspiration is the most common dangerous side effect resulting from EN. Each measure can be applied individually; however, most of them are usually combined simultaneously in the majority of protocols concerned with minimising pulmonary aspiration especially in enterally fed patients with MV. For instance, Bowman et al. (2005) established and implemented a new ‘evidence-based feeding protocol’ and an ‘aspiration reduction algorithm’ for enterally fed, mechanically ventilated patients in the ICUs. Also, Metheny et al. (2010) evaluated the effectiveness of using ‘Aspiration Risk-Reduction Protocol’ (ARRP) for enterally fed patients with mechanical ventilation.

5.4.2.1. Controlling GRV

The importance of controlling GRVs was adequately perceived by nurses as a protective measure to prevent exceeding GRV limit (Metheny et al. 2008, DeLegge 2011). Although the scores of measuring GRV in all sectors were above the middle point (>2.5), this technique was less understood by nurses in the governmental sector. Nurses indicated that GRV is regularly checked before feeding administration to assess the gastric residues that should not exceed 400-500 ml as a prerequisite to start feeding, or to assess the tolerance of last given feeds and detect if patients’ absorption and digestion are functionally intact. This conforms to the evidence-based recommendations that measuring GRV is an essential element in EN and should be maintained under the universal threshold of 200-500 ml (McClave et al. 2009). Nurses also defined GRV in different ways; it is a cut-off point of 30% of the last given amount remaining in the stomach, or it is the acceptable value of GRV at 200-250ml

before starting feeding or while administering feeding. The frequencies of measuring GRVs vary between departments. Some departments claimed measuring GRV every 2 hours, whilst others measure it every 4-6 hours and others asserted checking GRVs every shift or before each use (if intermittent feeding is only available). It is approved that detecting GRV should be every 4-6 hours if there is no sign of feeding intolerance which urges to measure it more frequent (Padula et al. 2004, Hsu et al. 2011). Nurses realised that GRV is the only risk for aspiration so it should be maintained at the threshold point. However, previous studies addressed that GRVs should not be taken into account for all potential risks for pulmonary aspiration, the evidence showed that many other factors should be considered along with GRVs to reduce the risk of aspiration such as trauma, head injury, using of sedation, and mental instability (McClave and Snider 2002). Therefore, excessive precautionary measures undertaken by nurses to reduce the risk for aspiration should be avoided. Instead, these measures should help them to maintain feeding rate at optimal levels making the possibility of increasing that rate gradually until meet the nutritional goal is applicable (Woien and Bjork 2006).

5.4.2.2. Detecting tube placement

Williams and Leslie (2005) stated that regular checking for tube position is strongly associated with low complication incidences. Nurses confirmed that the placement of feeding tube should be checked regularly before each feeding administration or at least every day using a reliable indicator such as radiographic confirmation (X-ray) which is still considered as a 'gold standard' (Burns et al. 2006, Lamont et al. 2011). They also affirmed that pH method is able to yield an accurate indication to the location of the tube tip. Previous studies confirmed that radiography is the most

reliable and preferred technique despite the risk of radiation exposure, but if not available, the analysis of aspirates by pH colour test can be applied (Jacobs et al. 1996, Sanko 2004, McClave et al. 2009, Turgay and Khorshid 2010). Unsatisfactorily, the majority of nurses in all sectors showed their reliance on the air bubbling technique which is carried out through detecting air exchange at the distal part of the tube to confirm its position. This technique is unreliable in terms of its accuracy and ineffective in guiding professionals to the tube location (Padula et al. 2004, Elpern et al. 2007, Tho et al. 2011). Auscultatory technique is also widely accepted and commonly used by nurses in all sectors due to its feasibility. However, there is no evidence to show its effectiveness at the same weight of radiographic and pH confirmation methods (Turgay and Khorshid 2010, Miller 2011). Therefore, using both X-ray and pH techniques are still below the required level in all sectors. This may be due to the limited budgets, scarce resources, poor knowledge or lack of qualified personnel for utilising these techniques accurately.

Nurses also suggested checking tube placement as a main requirement for detecting inadvertent gastric tube displacement into intestines which leads to feeding intolerance but they wrongly assume that detecting tube location is only needed when facing complications instead of checking tube placement in a regular basis. However, daily inspection of the nostrils and the length of the tube are adequately emphasised by nurses to detect any unintentional tube movement.

5.4.2.3. Suctioning and HOB elevation

Frequent oro-tracheal suctioning was introduced by Jordanian nurses as an effective strategy to lower the incidence of aspiration pneumonia and tracheal colonisation.

They recommended tracheal suctioning for all patients especially who are with gastro-oesophageal reflux (regurgitation). Bedside observations revealed very minimal cases with gurgling sounds heard during exhalation in all hospitals, indicating that appropriate suctioning strategies were undertaken by nurses. Nurses also asserted that suctioning is not effective without ascertaining the degree of HOB elevation. HOB elevation is a widely accepted method achieved through keeping backrest elevated at 30-45° degrees (Bourgault et al. 2007, McClave et al. 2009, Albertos et al. 2011). The mean of back rest elevation in the three sectors was approximately 42° which is absolutely optimal, because, the recommended HOB elevation is 40-45° unless there is a contraindication (Williams and Leslie 2004, Stroud et al. 2003). However, patients in governmental hospitals are still positioned on the lowest HOB degrees compared with patients in military and private hospitals, indicating that more attention should be paid to learn how to achieve an appropriate back rest elevation. Bedside observations also showed that the majority of patients were laid down on their back with a minimal use of right lateral or left lateral positions. In general, nurses confirmed that keeping frequent suctioning, appropriate HOB elevation, and putting patients on upright position are always helpful measures to prevent aspiration pneumonia and to avoid tube displacement. Miller et al. (2008) founded that only 4.9% of patients met the recommendation of maintaining HOB degree at 45°. The discrepancy in nursing practice toward HOB elevation was referred to insufficiency of nursing knowledge about the relationship between HOB elevation and the risk for VAP (Miller et al. 2008). Using prone position in patients with MV was not suggested by nurses although its impact on improving patient's oxygenation status and facilitating bronchial excretion (Reignier et al. 2010, Mueller et al. 2011).

5.4.2.4. Using prokinetic agents

In general, using prokinetic agents in the three sectors was above the midpoint (>2.5). However, their use was apparent in the private sector more than the other sectors. Prokinetics should be considered as a mainstay in EN. Evidence confirmed that using prokinetic agents in high gastric aspirates lowers the duration of MV, in-hospital mortality and LOS (Barr et al. 2004). Nurses believed that prokinetic agents are used only when GRV is above the normal limit. This is similar to a study by Nassaji et al. (2010) which found no effect of metoclopramide (prokinetic agent) on the incidence of pneumonia in the ICU. Some protocols advocate using these agents concurrently with EN and it is found that the episodes of gastric retention and pulmonary aspiration were less if prokinetics are given in a regular basis. For instance, Dobson and Scott (2007) established a new ‘nurse-led EN algorithm’ for the critically ill patients. This algorithm comprised solutions for higher GRV through using prokinetic agents with feeding at the same time. In addition, Pinilla et al. (2001) revealed that the incidence of feeding intolerance was significantly less among patients whose GRVs were adjusted at 250 ml along with regular using of prokinetic agents.

5.4.3. Medications administration through tube

Medications administration via feeding tube should be avoided whenever is possible. However, if a medication has no route other than feeding tube; it can be crushed and administered if its composition allow for this. Medications instructions should also be taken into consideration (e.g. enteric coated tablets should not be crushed and given through NGT) (Idzinga et al. 2009). The majority of nurses stated that medication information leaflets are the best guidance for obtaining information about certain medication instructions of administration. In addition, nurses showed a tendency to

accept counselling from other professionals regarding the ways of administering medications. However, the majority of nurses in the governmental hospitals believed that any medication given through oral route can be smashed and administered with feeding. This contradicts the premise of Guenter (2010) who asserted that medications should not be given with formulae and it should be delivered separately after stopping feeding and flushing the tube with at least 15ml water. Nurses indicated that crushed medications can lead to tube blockage. However, this can be avoided by flushing tube with 30 cc of water before and after use to avoid any precipitation of acids on the tube wall (Padula et al. 2004, Williams and Leslie 2005). In conclusion, nurses conformed to the common rules that crushing and dissolving medications are not always allowed and searching for alternative dosages options should be undertaken during preparation to avoid 'preparation error' (Stroud et al. 2003, Idzinga et al. 2009).

5.4.4. Caring for the tube and avoiding infections

Nurses of all sectors exhibited some concerns about preserving feeding tube and other related equipments in a clean and safe environment away from contaminations. Bedside observation also recorded these efforts as appeared by changing the giving sets on daily basis and this was notable in the military sector more than others. However, bedside observation reported very minimal tubes replaced on daily basis according to the date of labelling that might enhance the risk of contamination. Mathus-vliegen et al. (2006) found that the risk of developing pathogenic bacteria (e.g. Enterobacteriaceae and Pseudomonaceae) from endogenous source increased over the day and four subsequent days by 48% and this is called a retrograde growth. Similar to medication administration, nurses asserted that flushing the tube should be

carried out after feeding administration to avoid precipitations and clogging of the tube (Albertos et al. 2011). In case of intermittent feeding, nurses clean feeding syringe and keep it in a safe place after administration. According to the bedside observations, the majority of patients' tubes were securely fastened with tape, showing no risks of damaging eyes from tube position. However, most of them had a risk for straining nose from tube fastening. In addition, few of feeding syringes had been labelled, indicating their use only for feeding. Btaiche et al. (2010) confirmed the importance of keeping feeding syringe in a clean area and replaced daily to avoid transmission of exogenous bacteria into the feeding system.

Nurses asserted that the temperature of the formulae should be kept suitable and closer to the body temperature to avoid contaminations. Likewise, a study by Barrett et al. (2009) reinforced that the source of contamination might be endogenous. They alleged that the role of formulae temperature contributes to lowering the contamination rate when opened/partially-used quantities of formulae were kept in appropriate refrigeration. Also, formulae administration in temperature different from body core temperature may potentially causes abdominal pain and diarrhoea after administration (Barrett et al. 2009, Whelan and Schneider 2011).

5.4.5. Theoretical context

These practical elements of EN are associated with the Process in the Donabedian's model. Because these issues demonstrate nursing care toward best practice, they are heavily linked to patients' outcomes. This support the theory that Process is directly related to the Outcome more than the Structure and better able to identify small variations in quality of care more than Structure (Donabedian 2003). This postulated

relationship explicates how Process is tailored to generate such Outcomes based on the true picture gained directly from clinical field. Hence, it is assumed that best Process in term of appropriate EN interventions is a prerequisite to anchor better Outcome.

5.5. Establishing evidence-based practice

In all sectors, there was no clear image about using protocols for EN and whether there was a specific protocol. However, nurses indicated that clinical protocols might exist or be established at their institutions but are not actively implemented. Therefore, clinical guidelines are often missed in the clinical practice especially in the field of critical care. In a study by Marshall and West (2004), nursing knowledge in relation to EN may vary between institutions especially when there is no clear guideline. Broadly speaking, it is necessary to develop a standardized evidence-based framework for EN in critical care settings.

Nurses confirmed that EBP is a trend aims to unify clinical practice and curtail imparity associated with poor nursing adherence to evidence-based guidelines. Undertaking evidence-based protocol is required for attaining patients' nutritional goals much more smoothly than usual because it directs nursing care towards specific goals through tracking their practice in such clinical pathways (Adam and Batson 1997, Marshall and West 2006, Dobson and Scott 2007, Simpson et al. 2007).

Nurses stated that adhering to evidence-based recommendations is an integral part of successful nutritional care. The nurses claimed that using protocols concerned with confirming tube placement is the most important issue required to approximate

practice to the evidence base. By returning to the related section which revealed that nurses showing improper adherence to reliable measures for checking tube placement, it seems that nurses perceived their deficiency in meeting the recommendations of this task and therefore, they urged to adopt an evidence-based protocol to compensate this gap.

Using guidelines for controlling GRV was ranked in the second level in term of its importance for current practice. They believe that controlling GRV is essential and should be implemented within a specific pathway. Nurses stressed on the importance of managing GRV in a proper way using specific protocol for this. Nurses perceptions of these clinical issues conform to a study by Pancorbo et al. (2001) who revealed that nurses undertake the following actions to achieve the nutritional goal; frequent aspiration for NGT to measure GRV and checking tube placement (Pancorbo et al. 2001).

5.5.1. Developing and adhering to EN documentations

Participants reported that they are entitled to share in developing new guidelines for any nutritional aspect or improving and updating an existed guideline to accommodate with recent evidence based recommendations. However, this is not an absolute figure that reflects all nurses. Establishing guidelines basically depends on nurses' capacities, knowledge and experience to undertake such development. Although nurses showed their readiness to contribute to developing guidelines, their limited experience in that field of practice restricted their driving forces to accomplish that. Aari et al. (2008) signified that nursing competency is achieved when using

experiences, attitudes and skills to successfully establish clinical guidelines that can support their clinical performance in the meaning of EBP.

Participants showed a greater tendency to adhere to evidence-based guidelines for nutritional care. However, they complained about lack of guidelines in their departments that made obstacles to conduct an optimal care. A study by Adam and Batson (1997) described the effect of adopting protocols for feeding delivery in ICUs. Nurses in intensive care units with well-defined EN protocols have delivered the desired feeding volume more often than those without. Other studies revealed that nurses and other professionals do not always have a sufficient awareness of the significance of these guidelines (Briggs 1996, Kennedy 1997, Wentzel Persenius et al. 2009). Nurses described their adherence to evidence-based guidelines using percentages which revealed lower rates of attachment to evidence-based guidelines due to the insufficient sources of knowledge that is seen as a responsibility of the institution itself. As explained earlier in this chapter, nurses depend mainly on their clinical experience and other source of knowledge such as the university education, internet and references to gain knowledge about evidence-based recommendations. Therefore, the presence of specific guidelines for EN is the stepping stone to introduce an optimal exploitation of evidence based that could enhance lowering the discrepancy in practice and improve patients' outcomes. Higgins et al. (2006) strongly recommended establishing an appropriate documentation system to reduce discrepancies between physicians and dietitians orders in the clinical and to prohibit the episodes of under-nutrition and failure of administration. As such, changing nurses' and physicians' perceptions towards the importance of EN guidelines must be approached for two main reasons: to enhance using the guidelines and to eradicate

discrepancies in practice (Wood et al. 1997, Bourgault et al. 2007, Simpson et al. 2007, Ziegler 2011).

5.5.2. Theoretical context

Establishing EBP is one of the crucial steps that falls under Process in the theoretical model. Because Process is the activities that constituting health care, it includes the process of diagnosis, treatment and rehabilitation that must be approached in a standardized manner (Donabedian 2003). Evidence based care may appear to mean the moderation between nurses and their practice that provides the basis for legitimising nursing Process. Therefore, nurses have to regard evidence based care as an indicator for their care because evidence based care is analogous to medical standard and therefore it works in parallel with other systems to improve patients' Outcomes.

5.6. Multidisciplinary team work

The wisdom of establishing multifarious team working is that the nature of nutritional care which cannot be conducted by one profession. As illustrated previously, this section is entirely based on the third qualitative theme 'Multidisciplinary team working'.

In critical care, physicians hold the role of prescribing the amounts, types and rates of EN and they usually go beyond that to insert feeding tube and follow up patients' progress. Thereafter, nurses have to arrange with dietitians to prepare the formulae in specific composition. The nurses described the role of dietitians as controversial due to the vagueness of their job description in tasks other than preparing feeding. Nurses

declared that they endeavour to actively embrace all activities along with dietitians to physicians to achieve a thorough nutritional care in a systematic way. Braga et al. (2006) showed that enterally fed patients who followed dietitians' recommendations had significant weight gain, higher serum albumin level and also shorter LOS compared with those who were only fed by physicians' orders. In addition, Peterson et al. (2010) found that registered dietitians contribute positively to managing nutrition in ICU patients. Inappropriate use of PN was significantly decreased after applying dietitians' order and there was a significant reduction in the total use of PN. Moreover, undertaking dietitians' order-writing was associated with a 20% drop in the cost (Peterson et al. 2010). This reinforces nurses' desire to maximize the role of dietitians in providing nutritional support in the ICU.

In fact, nurses who stay longer beside the patients are committed to coordinate with other professionals and competent to assess the effectiveness of the delivered feeding whenever possible. Nevertheless, nurses claimed that some physicians are incompetent to hold the responsibility of nutrition in intensive care. They asserted that doctors who are specialized in critical care encounter some difficulties to capture the complexities of the critically ill patients that in eventual could lead to an inadequate nutritional support. Jones and Heyland (2008) indicated that many physicians may naively underestimate the complexity of implementing nutritional guidelines successfully. In addition, Peterson et al. (2010) revealed that registered dietitians usually disagree with physicians' order in prescribing EN and they consider it suboptimal and inadequate to provide sufficient nutritional support.

However, nurses revealed that their role would be more effective if there is a counterbalance in the relationships between professions. They envisage their role to be central to dietitians' recommendations and physicians' orders to provide a sufficient convergence for calculating nutritional requirement. However, former studies found that nursing role does not reflect an effective nursing involvement in decision making due to nurses limited capacity to assess feeding outcomes and manage complications effectively (McClave and Snider 2002, Williams and Leslie 2004, Marshall and West 2004, Higgins et al. 2006). Therefore, nurses suggested establishing a group of multi-professionals that includes dietitians, nurses, and physicians to manage the delivery of nutrition and to compensate the deficiency of nursing knowledge if exists. In addition they may extend to develop a unified clinical protocol, guidelines and educational programs to develop staff professionalism in that field (Kennedy 1997, Anderson 2000, Fulbrook et al. 2007, Ros et al. 2009, Fletcher and Carey 2011).

5.6.1. Collaboration between professionals

Nurses' perspectives shed the light on various pattern of medical responses to nursing suggestions and contributions. Whether positive or negative response, there is uncertainty in physicians' reaction to nurses roles. Nurses stated that some physicians accept their comments and go beyond that to modify the therapy based on nurses' observations. In contrast, some physicians are reluctant to accept any nurses' suggestions in respect to clinical nutrition and therefore, gaps between professions are increased because of the differences in authority. Lack of team cooperation is a dilemma of accomplishing EN goals, which also increases discrepancies in practice (Spain et al. 1999, Martin et al. 2004, Bourgault et al. 2007). Atwal and Caldwell

(2006) indicated that problems associated with poor interaction between professionals are resulted from differences in perceptions of teamwork, levels of professional skills and the dominance of medical power. Likewise, some studies asserted that nurses tend to cooperate with dietitians more than physicians (Williams and Leslie 2005). Away from discrimination, nurses showed unprecedented attitude toward approximating gaps between professions through inviting to a transparent relationship that clearly determines the role of each profession in joining nutritional care. Woien and Bjork (2006) stated that lack of responsibility for nutrition or the lack of teamwork may result in inconsistency in nursing care that entails insufficient nutrition in the ICU. In addition, the strategies of nutritional care would be efficiently developed if an effective cooperation between team members is established (Wood et al. 1997, McMahon et al. 2005, Fang and Delegge 2011).

5.6.2. Acquiring support

Alongside cooperation with other professionals participants revealed acquiring support from direct manager, in-charges and head nurses who facilitate tracking care. However, they declared that support gained from them is variable and, in some instances, does not meet their expectations. Some nurses feel incapable and unconfident to work efficiently within a team. Lack of effective support is considered a major obstacle to optimizing nutritional practice (Swanson and Winkelman 2002, Jefferies et al. 2011). Nurses asserted that not all their obsessions are taken seriously into considerations because of the limited resources or administrator prohibitions of ongoing development that appears when physicians are given the authority to legitimise practice, while, nurses' right to develop their own practice is degraded. In particular, nurses in the government sector are suffering from this, unlike military and

private nurses who indicated to a kind of cooperation between professionals and administrators in regard to the issues of continuous development and offering suitable working environment. On the other hand, nurses asserted that a multidisciplinary team work should be accompanied with colleagues' support represented by sharing in decision making, collaboration, and lowering discrepancy in practice. Nurses asserted that poor adherence to EBP refers to the inadequacy of interaction between nursing staff and their administrators and poor interaction with colleagues. Similarly, Jones and Hayland (2008) argued that the success or failure of implementing guidelines is largely associated with the interactions between several factors such as the type of the implemented practice, the nature of the institution, and staff respectability of reforming practice. Other studies stated that lack of co-operation in applying evidence-based guidelines is another obstacle to having successful nutrition. Nurses in poor cooperation systems feel incapable and less confidence to having successful interaction (Swanson and Winkelman 2002, McMahon et al. 2005, Atwal and Caldwell 2006).

5.6.3. Theoretical context

As shown in Table 5.1, multidisciplinary team work is a part of Structure in term of institutional role in developing nutritional team and a part of Process in term of nursing motivation for collaboration between professionals. This is another theoretical relationship that integrates Structure with Process which has also been illustrated by the Donabedian's model. Team working is a booster for nurses' roles because it supports their achievements when being delivered by different professions to enhance better outcomes. In fact, this relationship is less likely if there is no rapport and active collaboration between all parities. Consequently, the Outcome of care is subject to

failure unless effective cooperation between team members is introduced to enhance maximal beneficence.

5.7. Nutritional care deficits

EN can lead to a set of adverse consequences resulting from improper adherence to EBP, variations in practice, overloaded working environment and time restriction. This section combines the results of both quantitative and qualitative findings as explained in the previous chapter.

5.7.1. EN complications

It is evident that using EN in intensive care develops some complications. The most common complication occurs in intensive care is diarrhoea. Nurses in both survey and interviews confirmed that diarrhoea has the highest incidences compared with other complications in intensive care. They asserted that the cause of diarrhoea might be bacterial or non-bacterial, endogenous or exogenous. Padula et al. (2004) also addressed that the sources of contamination might be endogenous or exogenous, and the spread of infection can be prevented if nurses pay certain attention toward feeding preparation and administration. However, there was no consensus between nurses on the definition of diarrhoea in their practice. Whelan et al. (2003) showed no agreement between nursing staff in defining diarrhoea. For instance, stroke nurses consider faecal consistency as a strong indicator to defining diarrhoea, whereas, ICU nurses consider it the least important criteria.

Abdominal pain was ranked next as one of the most recurrent complications of EN. The interviewed nurses stated that abdominal distension and abdominal pain are

frequently occurred by EN, which also conforms to the result taken from the survey. Weight loss was also reported by nurses as a common complication. They stated that patients at risk for losing their body weight due to malnutrition which can be identified by comparing patients' weight before and after feeding administration. Persenius et al. (2008) asserted that malnutrition is one of the crucial issues that challenges critical care nurses when conducting nutritional therapy.

Fortunately, the most devastating side effect resulting from EN, which is aspiration, has shown one of the least incidences in all sectors. Both methods indicated that pneumonia resulting from aspiration scored lower compared to other common complications. This contradicts other studies which claimed that pulmonary aspiration demonstrates the most frequently occurring problem in intensive care from all tube feeding complications (Spain et al. 1999, Pancorbo et al. 2001, Williams and Leslie 2005). However, nurses asserted that some patients are more likely to have aspiration due to persistent vomiting which frequently occurred in enterally fed patients. This confirms that nurses should consider some other factors associated with increasing the risk of aspiration beside GRVs such as low level of consciousness, gastroesophageal reflux, head of the bed elevation, sedation and vomiting (Bourgault et al. 2007, Metheny et al. 2008). In addition, nurses assumed that shifting feeding pattern from intermittent to continuous infusion has a greater impact on preventing aspiration and diarrhoea especially in patients with MV because they usually placed on supine position and have a higher risk for developing VAP. Likewise, some clinical evidence recommended shifting feeding into continuous mode if diarrhoea is at higher risk and related to the method of administration, in this situation, intermittent feeding becomes less recommended (Btaiche et al. 2010). However, In risk of aspiration or feeding

intolerance, feeding tube should be placed into small bowel instead of stomach to enhance using a continuous feeding delivery (McClave et al. 2009).

Finally, other side effects were scored less in all sectors such as high gastric aspirates, haemodynamic instability, hyper-hypo glycaemia and naso-pharynx injury. These side effects were described as uncommon complications resulting from EN and they can be avoided if nurses pay more attentions toward assessment after delivering feeding. However, nurses showed some concerns about patients' nutritional status through investigating protein and albumins levels in the blood more than adopting physical examination for some essential bio-physiological parameters.

5.7.1.1. Incidences of complication

There was inconsistency in describing the incidences of complications between nurses in the interviews. Numbers were used to describe the rate of complications in the form of percentages. Some nurses revealed that 15-50% of cases in EN suffer from complications, and some of them went beyond that to claim 70% and above. However, the average of complications which is addressed in the survey is more informative than this in the interviews because of using larger and representative sample. Nurses disclosed the incidence of complications in their departments in the present time and if the evidence-based guidelines are applied. This revealed a strong relationship between EBP and the occurrence of complications, whereby, patients in evidence based are twice less likely to have complications than those without. Thus, nurses adequately understand the importance of EBP as an effective strategy of lowering the incidence of complications.

5.7.2. Feeding intolerance and under-feeding

Nurses realise that patients in EN might be at risk for under-feeding due to patients' conditions or the formulae itself, which is also acknowledged by the literature (Griffiths 1997, Bongers and Griffiths 2006). Specific factors accelerating the process of nutritional failure such as improper use of tube, feeding intolerance and gastric retention (Binnekade et al. 2005, Petros and Engelmann 2006). O'Meara et al. (2008) claimed that ICUs patients only receive 50% of the prescribed nutrition due to the frequent feeding interruptions (O'Meara et al. 2008). Nurses showed that frequent feeding cessation is usually triggered by patients' position, bathing or preparing for procedures. Adam and Batson (1997) found that the main causes of feeding interruption in the ICUs were gut dysfunction and procedures preparations. However, regardless the presence or absence of bowel motility, EN should be maintained and unnecessary cessation should be avoided (Marshall and West 2006, McClave et al. 2009). For procedures that require Trendelenburg position such as positioning, bathing and linen changes, nurses are encouraged to stop EN at least two hours before the procedure (Bourgault et al. 2007).

Nurses asserted that the discrepancy between required feeding and actual delivered feeding entails hypo-caloric nutrition. In a study by Jonghe et al. (2001), the overall prescribed and delivered nutrition in critically ill patients were less needs. Also, Heyland et al. (2003) found that there was a gap between current practice and ideal practice and most critically ill patients are considered under-fed because of the discrepancy between what is prescribed and what is tolerated. Nurses reported that there are signs of feeding intolerance including high gastric aspirate, abdominal distension and frequent vomiting. They also declared that feeding intolerance is

resulted from the formulae itself or sometime from the patients themselves. Lichtenberg (2010) suggested techniques to reduce the effect of malnutrition and caloric deficit due to frequent feeding interruption. The protocol aims to increase the infusion rate of the prescribed formulae to be delivered over 20 hours instead of 24 hours. The formulae used in intensive care is probably not compatible with patients requirements, meaning that the majority of patients are given the same kind of formulae regardless their nutritional needs which can be identified through lab investigations. Eschleman (1991) explained that selecting the type of formulae depends on several factors such as: patient ability to digest and absorb nutrients, the placement of tube (stomach versus intestine), the nutritional requirements, any fluid or electrolyte restriction, and individual tolerance (such as food allergies or lactose intolerance). In particular, some patients' formulae are prepared in hospital kitchens under dietitians' supervision. This might cause lack of accuracy and counterbalance in the ingredients and concentrations of components unlike the pre-prepared feeding packs. In the result, patients do not receive the maximum utility which is sought from feeding and serious complications might develop due to mismatching with patients' needs. Beattie and Anderton (2008) suggest using pre-prepared feeding packs to lower the incidence of feeding system contamination and to provide an accurate caloric index and avoid under-feeding (Kennedy 1997, Padula et al. 2004).

Nurses postulated that feeding intolerance can lead to muscle atrophy and generalised weaknesses that, in eventual, could affect the process of healing and weaning from mechanical ventilation. However, nurses did not show evidence of how feeding intolerance can be avoided using techniques other than changing formulae. For instance, avoiding inadvertent tube displacement from stomach to small bowel to

avoid feeding intolerance or preventing microbial transmission to prevent diarrhoea, vomiting and feeding intolerance (Mathus-Vliegen et al. 2006).

5.7.3. Workload and staff shortage

There is no doubt that increasing staff workload correlates negatively with employees' productivity. In intensive care, nurses are subject to many stressors related to the nature of their work. The interviewed nurses asserted that the quality of care may reduce and the risk for under-feeding may elevate when the time allocated for multidimensional therapy in critical care is restricted. In addition, restricted time can affect nurses' empowerment for developing and establishing evidence-based guidelines. Fulbrook et al. (2007) signified that nurses have limited involvement in establishing evidence-based protocols and evaluating existing guidelines for EN because of lacking sufficient background or time restrictions that reduce their confidence in developing practice. Another problem is that staff shortage which is a general trait of ICU nurses in Jordan and worldwide.

Nurses confirmed exerting their utmost effort to compensate for staff shortage in their units. Staff shortage might adversely affect patients' outcomes or exacerbate the conditions of those compromised patients due to their illnesses. The majority of senior nurses complained about higher nursing turnover because it disrupts the relationships between staff and makes working environment unstable. On the other hand, nursing turnover replaces highly experienced personnel with junior nurses who are novice in practice and incapable to burden a full responsibility for critically ill patients. Wentzel Persenius et al. (2009) found that nurses with former experience are able to anticipate patients' responses rapidly than those with limited experience. However, nurses with

limited knowledge were open-minded and created new approaches for treatment. In general, these are the major factors that weaken the practice in critical care in relation to staff and their working environment.

5.7.4. Discrepancies in nursing practice

Gaps in nursing practice are increased due to poor adherence to evidence-based guidelines (Aari et al. 2008, Braga et al. 2006). Nurses in all sectors ascribed the insufficiency of conducting a unified practice to the scarcity of evidence-based guidelines at their departments. They claimed that if the guidelines are available, the variations in nursing care will be less and nurses will perform a consistent care over all shifts and departments. Fulbrook et al. (2007) referred the discrepancy in nursing practice to the dearth of guidelines. Nurses in some clinical issues especially controversial issues, depend on their self-recognition instead of evidence based. Williams and Leslie (2004) concluded that many nursing guidelines and interventions are not primarily based on research, but on rituals and personal opinions. In particular, lack of nursing knowledge in regard to artificial nutrition in intensive care can prohibit accomplishing a unified nursing care and drive nurses to malpractice. Some studies found that the discrepancies in nursing practice is defined in term of the inadequacy of nursing strategies to manage complications and the frailty of using robust assessment techniques (Marshall and West 2004, Ros et al. 2009, Kenny and Goodman 2010). Therefore, Evidence-based protocols have the greatest impact on reducing these variations in clinical practice and promoting nutritional outcomes (Bourgault et al. 2007, Dobson and Scott 2007, Meyer et al. 2009).

5.7.5. Theoretical context

Nutritional care deficits reflect the Outcome in the theoretical model. In the Donabedian's model, Outcome is taken to mean changes, whether desirable or undesirable, in individuals and populations as a result of health care (Donabedian 2003). It is the consequences of nutritional care that is being determined by the Process of nursing care as well as Structure, considering that Process has a greater impact on the Outcome than Structure. This relationship clearly sets out the conceptual integrations between these elements and describes how nurses prioritise their practice in such a way that prevents shortcomings and irreversible damage. As the Outcome is influenced by the nature of nursing care, all issues discussed previously are substantially embedded in the quality of care and therefore, preventing complications would not be possible without employing sufficient resources and effective nursing strategies to achieve that goal.

5.8. Comparing health care sectors in Jordan

By perusal in all results, there are similarities and variances in some issues of nurses' practice between health sectors in Jordan. In overall, nurses in both military and private sectors may adhere to EBP more than nurses in the governmental sector. The availability of facilities in the military and private sectors encompassing equipped clinical settings and continuous training programmes are evident in both sectors and enable nurses to deliver care that is closer to the evidence based. However, nurses in the financially restricted system are not less important than their peers in term of formulating practice efficiently. Indeed, governmental nurses are still similar to their peers in their inclination to improve caring strategy despite the limitations in budgets which form obstacles to enhancing further improvements. No concrete gaps can be

inference from comparing nurses in all sectors regarding knowledge, responsibility and practicing of EN. However, there are different attitudes of nurses toward nutrition that can be seen to mean different perceptions or understanding of EBP.

The role of direct managers has a significant impact on enhancing better collaboration between personnel. Indeed, there were some variations between sectors in regard to this issue. Nurses showed variations in some clinical issues. Of course, it refers to the extensiveness of applying evidence-based recommendations that is the institutional responsibility for supplying the essential facilities. This supports the assumption that the institutional awareness of their staff level of knowledge and their needs in clinical field is substantial to determine positive points to strengthen using evidence-based solutions or negative points that weaken the use of it.

In conclusion, it is expected that the perception and performance of one is distinct, but his/her professional attitudes can be affected by the variations in policies and management, considering that nurses in well-defined monitoring and controlling systems are working more efficiently than nurses in poor supporting systems.

Chapter Six: Conclusion

6.1. Introduction

This chapter aims to highlight the main findings which emerged from the study, showing the implications of these findings for clinical practice and nursing research. It is acknowledged that the researcher addresses the limitations of the study including limitations in the design, the methods and the analysis strategies that might limit the generalisability of the findings. At the end of this chapter, a number of recommendations concerned with nursing practice and nursing research were provided, considering the contribution of administrators who are able to manipulate the track of nursing care in the critically ill.

6.2. Overall conclusions

The nutritional care in the critically ill has gained a higher priority among nurses in all health care sectors in Jordan. It is a nursing desire to maximise patients integrity, promote patients' improvement and minimise complications inherent in EN. Having a deep insight into nurses' perception toward their role, nurses have the intention to show more concerns about the outcome of EN more than factors that influence success or failure of the therapy. This means that the preliminary assessment tasks required before, during and after delivering EN are being missed and devalued in the area of clinical nutrition. Therefore, nurses should recognise the steps of primary prevention which precede nursing care and prevent the occurrence of problem before it exists instead of secondary and tertiary prevention which requires more efforts to inhibit the consequences of a problem when it exists.

Nursing nutritional assessment is still suboptimal to promote patients' successful nutrition. Measuring GRV is proven to be the best measure if appropriately understood. The impact of GRV on determining patients' status and detecting some complications such as aspiration pneumonia is well-known but nurses need to underpin their practical background with some evidence-based guidelines to manage this issue effectively. Thoroughness in ability to confirm tube placement is still deficient and needs further considerations to adopt other stronger indicators of tube placement instead of current unreliable techniques. Nurses also require understanding factors resulting in under-feeding and hypo-caloric nutrition through undertaking the previous assessment measures in the evidence base to prevent the occurrence of these episodes. A number of guidelines are recommended to help in accomplishing this such as avoiding inappropriate feeding cessation, using prokinetic agents with EN, keeping HOB elevated at 35-45°, increasing feeding rate in a constant manner and using pre-prepared feeding packs.

Multidisciplinary team work is one of the determinants of successful feeding. Nurses perceived the significance of establishing multi-professionals team for clinical nutrition as a good enhancement for better collaboration and interactions between professionals and for curtailing the disparity in practice. Likewise, nutritional teams should also consider an adequate involvement of nurses in decision making. Establishing EBP is a matter of all professions, and because nursing is a part of whole, nurses should be entitled to legitimise their practice and identify the frailty in the nursing process to compensate for along with other professions. According to the nurses' perspectives, institutional support is also essential for developing nursing care through acknowledging nurses' contributions and suggestions in that field.

Nurses regarded the practice of well-established evidence-based foundation. They vigorously appreciated the importance of establishing EBP at their units and the extent of how these guidelines attenuate the discrepancies in practice and eradicate poor nursing myths which are based on rituals and personal opinions. Particularly, nurses are serious to undertake EBP if their colleagues concur with them in tackling nutritional commitments in a way that reflect fairly professional demeanours.

Surprisingly, complications might occur in the presence or absence of evidence based guidelines. However, the capacity of nurses to anticipate complications is increased by the existence of evidence-based guidelines. Many of EN complications are foreseen and frequently occurred such as diarrhoea, feeding intolerance and tube displacement. The majority of complications can be precluded if robust protocols are being processed. These protocols should embrace techniques for controlling GRV and using prokinetic agent, confirming tube placement using accurate measures, detecting aspiration using reliable techniques, managing feeding pattern and selecting the appropriate route and method of administration, using the appropriate feeding type according to patients' nutritional needs and considering patients' preference, delivering and handling feeding system safely with less contaminations including appropriate temperature, rate, and minimal hanging time, providing an appropriate HOB elevation 35-45°, and initiating feeding gradually including carbohydrate and protein for malnourished patients to avoid re-feeding syndrome. The integration of all these issues enhances minimal incidences of complications and provides better nutritional outcomes as the majority of EN guidelines manage all these practical elements based on the recommendations of the evidence base.

6.3. Implications for clinical practice

This study provides an insight into nursing perceptions, attitudes and performance toward nutritional care and EN in the critically ill as a limited research work has been done in this area of practice in Jordan. The study inferences appear to assist nurses in tracking strength and weakness points of their practice. Nurses may subconsciously comprehend some of these issues but have difficulty in approaching all dimensions surrounding these issues. Consequently, critical care nurses should be able to understand factors influencing unexplained complications and other influential factors concerned with developing nutritional care based on image of nursing care gained from this study. This study constitutes the baseline of Jordanian nurses' practice in regard to nutritional care in the critically ill where EN was more emphasized. It approximates their current practice to the evidence-based guidelines to provide solution for the unjustified trends inherent in nursing care. The study reactivates the concept of multidisciplinary team work where the majority of nurses are less enthusiastic to disclose the identity of this concept. It also highlights the significance of collaboration between professions that helps to substitute poor conceptions with new cooperative team work and provide suitable working ambience for all.

6.4. Implications for nursing research

Because this study is the first attempt to approach nursing nutritional care in critical care in Jordan, it formulates the basis for future research which will be the basis of developing nursing care in this field of practice in Jordan. This study depicts the reality of nursing nutritional care in Jordanian critical care units based on the observations, interpretation and criticism of the study findings. Future research may either create a new protocol for EN or detecting the effect of such protocols on

patients' outcomes. Whatever the purpose of the future research, a real image about nursing practice in Jordan should be clear. Therefore, this study facilitates the researchers to find the point of continuum of their future research based on the description gained about the current practice in Jordan. Furthermore, this study can help to find the effect of implementing specific protocols or educational programs on nursing perceptions and performance in respect to clinical nutrition as the basis of these concepts are already determined in this study.

6.5. Limitations

Using mixed method strategies enhances study validity and compensates for any deficiency and bias associated with using one method because the study is polarised in two different methods in which the quantitative and qualitative data were complementary to each other and integrated later in one chapter. However, it might be powerful if the qualitative elements were collected using a specific qualitative design that falls into the typology of the qualitative paradigms such as grounded theory, because undertaking thematic analysis alone is associated with less philosophical underpinnings and intangible epistemological and ontological positions (Boyatzis 1998, Braun and Clarke 2006).

In relation to the sample size, the quantitative sampling strategy used for the survey was fairly sufficient to meet the anticipated power, remembering that each subject was selected randomly to achieve the highest representation. In bedside observation, the number of cases was limited due to the availability of patients in the ICUs who were fed enterally. Hence, the observation would be much more powerful if the sample was larger to provide sufficient power for conducting such comparisons between groups.

Regarding the sampling strategy used in the interviews, which assigned each participants purposively, the final construct of thematic analysis was accompanied with a distinctive level of data saturation which is an indicator of successful sampling that achieves a greater understanding of the intellectual puzzle (Mason 2002). However, using a larger sample to include a wider population would add richness to the description and enhance study credibility.

It was acknowledged that all data were aggregated by the principal investigator without involvement of any independent person. However, the reliability of bedside observations would be more powerful if the patients had been observed by different observer who would reach a consensus and meet the inter-rater reliability of observation. In addition, bedside observation was still at a risk of the Hawthorn effect which may violate the validity of observation when the intention of the observer is known by people under observation (Shuttleworth 2009, Nelson et al. 2010, Watson et al. 2010).

The study was conducted in different sectors in Jordan. Although all hospitals included in the study were educational, university hospitals should be compared with other sectors, expecting some differences in nursing practice due to the organizational structure and policy. The private hospital included in the study was sufficient to provide the required sample from the private sector. However, there is a potential bias in selecting one hospital from the whole sector and including other private hospitals would have helped to represent the private sector efficiently.

Overall, the study was conducted in Amman, the capital of Jordan and the largest city where the majority of health care centres are located, in addition to its highest population density and the availability of referral systems over other governorates. However, the nursing population present in Amman does not necessarily reflect nurses in other governorates which comprise the relevance of findings to other rural and urban health care facilities. It is well known that the quality of care can vary from one place to another. Therefore, future studies are invited to involve other geographical areas where nursing practice in critical care settings might differ and to avoid any unfair generalized judgment.

6.6. Recommendations

According to the study findings and inferences, the following recommendations, of particular concern, were launched to reinforce nursing practice in nutritional care. The following issues derived from the assumption that better adherence to the evidence-based guidelines and multidisciplinary team work generates new impetus for nursing professionals to undertake concrete strategies for nutritional improvement in intensive care. These recommendations can be presented and provided for Jordanian health care sectors as follow:

- Encouraging nurses to adopt an established evidence-based protocol for EN, in particular for managing some related issues such controlling GRV, using prokinetic agents, confirming tube placement, and determining the appropriate route and method of administration based on the available resources and the availability of special equipments in addition to staff qualifications.
- Inviting hospital administrators to establish a nutritional team that can bear the responsibility of patients' feeding in the intensive care. This team should consist

of medical staff, nurses and dietitians, considering mutual interactions between all members in an effective way. Moreover, this team can enhance cooperation between health care providers, improves nursing role, reduces variations in practice and mitigates conflict dilemma between professionals.

- Anticipating the steps of the nursing process consecutively, starting from the preliminary assessment until evaluating the delivered feeding. This is a reciprocal mission should be carried out by all professionals by continuous training and monitoring.
- Establishing an introductory course for junior nurses to shrink the gap between their limited experience and expected performance. Clinical training programs based on the shortfalls of nursing performance and background revealed in this study are required. These professional courses should enhance nursing development and promote nursing skills developing in line with the evidence base. In addition, it should be built on the collaborations between nurses and other professions involved in decision making.
- Using nutritional guidelines and nurses' education are necessary but not always sufficient to change the practice. Therefore, multidisciplinary roles are required.
- The study can influence decision makers to provide clinical settings featuring the necessary equipment, devices and counselling strategies to achieve nutritional goals.
- Using pre-prepared feeding packs instead of preparing formulae in hospitals kitchen. Also, patients' preference should be taken into consideration through using alternative feeding flavours.
- Some essential equipment should be provided by the administrators such as calorimetric pH strips to take the pH reading from the gut when confirming tube

placement, guide wire NG tube to facilitate determining the location of the tube by X-ray, digital infusion pumps that can be easily adjusted at specific volumes and rates, and closed feeding system than open system to minimise contaminations.

6.7. Communications of findings

- A copy of the results will be sent to the educational department of all hospitals involved in the study as follow: a copy for the MOH, RMS, and the private hospital.
- A copy of the results will also be sent to Mona Persenius who established the first version of the questionnaire upon her request.
- As the University of Sheffield rule permits, this study will be published either in full or in abridged form in specialised nursing journals.

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Appendices



الرقم
التاريخ
الموافق ٢٠١٠/٣/٢١

مدير عام مستشفى الأمير حمزة
مدير مستشفى الشيب
مدير مستشفى الدكتور جميل التوتنجي

تحية طيبة وبعد ،،،

ارفق طيبا كتاب رئيس لجنة اخلاقيات البحث العلمي رقم م ب ١/لجنة اخلاقيات/٤٧٤٣ تاريخ ٢٠١٠/٣/٢١ بخصوص الموافقة على السماح لطالب الدكتوراة في جامعة شيفيلد في المملكة المتحدة محمود طاهر الكلالدة على اجراء بحث بعنوان :-

(التغذية المعوية في أقسام العناية الحثيثة ، وأقع الاجراءات التمريضية وأثرها على فعالية العلاج)

وذلك عن طريق اجراء مقابلات شخصية وبطريقة اختيارية مع الممرضين القانونيين ذوي الخبرة الطويلة في أقسام العناية الحثيثة لتعينة الاستبيان المرفق ، وكذلك جمع بعض البيانات من المرضى الذين هم على التغذية المعوية .

ارجو التكرم بالاطلاع والايجاز لمن يلزم تسهيل مهمة الباحث المذكور في اجراء البحث اعلاه .

واقبلوا احترامي ،،،

مدير تطوير الموارد البشرية

الدكتور ايوب السيادة

نسخة / الملف

ROYAL MEDICAL SERVICES
Director of Professional Training
and Human Resources
Development
Amman – Jordan



الخدمات الطبية الملكية
مديرية التأهيل الفني وتنمية القوى البشرية
عمان – الأردن

Date: 5th June, 2010.

TO WHOM IT MAY CONCERN

We initiatively agree the student Mahmoud Taher Mahmoud Al- Kalaldehy, of Critical Care Nursing School/ University of Sheffield School of Nursing and Midwifery Sheffield - UK to handle a research on Enteral Nutrition in Intensive Care at the hospitals of the Royal Medical Services of the Jordan Armed Forces for two month .

Brig. Gen. Dr. Husam Makhamreh , MB.B.S. D.A (UK) FFARCSI
Senior Consultant in Anesthesia
Director of Professional Training and
Human Resources Deveoplment
Directorate of the Royal Medical Services



FAX: 962-6-5347485 TEL.: 5804804 EXT: 4341/ 4373 P.O. BOX: 122 Dahyat Al-Amir Rashid, Amman 11831 Jordan
فاكس : ٥٣٤٧٤٨٥ - ٦ - ٩٦٢٢ تلفون: ٥٨٠٤٨٠٤ فو ري ٤٣٤٢/٤٣٤١/٤٣٧٣ ص.ب ١٢٢ ضاحية الأمير راشد، عمان ١١٨٣١ الأردن



THE ISLAMIC HOSPITAL
Amman - Jordan

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P.O.Box: 2414 Amman 11181 Jordan
www.islamic-hospital.org



المستشفى الإسلامي
عمان - الأردن

تلفون : ٥١٠١٠١٠ - فاكس : ٥٦٦١٧٧٣
ص.ب : ٩٢٥٦٩٣ عمان ١١١٩٠ الأردن
ص.ب : ٢٤١٤ عمّان ١١١٨١ الأردن
e.mail: info@islamic-hospital.org

Ref :
Date :

الرقم : ١٢٩٤/٢٠١٠/٦١
التاريخ : ٠٧/٠٣/١٤٣١ هـ
الموافق : ٢٣/٠٣/٢٠١٠ م

الأخ محمود ظاهر الكلالدة - المحترم
هاتف : (٠٧٧٧٩٩٧٧٥٤)

الموضوع: عمل دراسة واستبيان

السلام عليكم ورحمة الله وبركاته

بناء على طلبك الخطي يسرني اعلامك بالموافقة على تسهيل مهمتك لعمل دراسة واستبيان بعنوان (التغذية المعوية في أقسام العناية الحثيثة ، واقع الإجراءات التمريضية وأثرها على فعالية العلاج) .
شريطة الالتزام بالانظمة والتعليمات المعمول بها في المستشفى والتنسيق المسبق مع قسم التعليم المستمر لدينا وتزويدنا بالنتائج بعد انتهاء الدراسة .

متمنيا لك التوفيق.

والسلام عليكم ورحمة الله وبركاته

المدير العام

الدكتور نائل العدوان

نسخة الى :
الملف العام
الأخ مدير دائرة التمريض
ب د/م ع

FROM:

- Lindsay Victoria Cooper

TO:

- mahmoud kalalkeh

Message flagged

Friday, November 20, 2009 9:43 AM

Message body

Dear Mahmoud

Thank you for this additional information, it is very helpful. Since the committee that will actually be approving your ethics application is Al-Basheer Hospital, which has already been judged to have a sufficiently robust ethics review procedure, you can now go ahead with seeking ethical approval for your project.

Once you have received approval from the ethics committee, please provide your departmental Ethics Administrator with a copy of the application form/documents and a copy of the confirmation of approval by the committee. You will then be able to go ahead with the project itself.

I hope this is clear, but if you have any questions, please let me know.

Kind regards
Lindsay

L.V.Cooper@sheffield.ac.uk

Manger letter sent to:

1. Minister of Health
2. Directorate of the Royal Medical Services
3. Manager of the Islamic Hospital

Roger Watson FSB FFMRC SI FRCN FAAN
Professor of Nursing
School of Nursing and Midwifery
The University of Sheffield
Herries Road
Sheffield S5 7AU / UK

Telephone: +44114 226 9624

Fax: +44114 226 9790

Email: roger.watson@sheffield.ac.uk

Dear Sir

Enteral Nutrition in the Critically Ill. A Mixed-Methods Study of Adherence to Evidence-Based Protocols, Nursing Responsibility and Teamwork

The School of Nursing and Midwifery University of Sheffield is one of the top rated nursing research centres in the United Kingdom. The School has an established international programme of research focusing on the development of new roles in the nursing professions and health care development. In addition to undertaking commissioned research in this field, we also have a number of doctoral students who are taking forward important research on new role development.

We are writing to you to seek your support and assistance for one of our post-graduate students from Jordan, Mahmoud Al kalalkeh. Mr Al kalalkeh's doctoral research involves nursing management of enteral nutrition in intensive care units, and nursing perceptions of enteral feeding guidelines and protocols. It is hoped that the findings from the study will help to develop a holistic view of the nature of nursing practice toward this issue and the aid in developing an appropriate clinical guidelines for enteral nutrition in the critically ill.

As part of the study we would like to undertake a survey questionnaire of nurses working in hospital settings who are in critical care units (enclosed). Subsequent stages of the study will involve interviewing nurses who have long clinical experience in enteral feeding practice. This will enable us to explore in more depth the perception and experience of enteral feeding current practice and it's related to the occurrence of certain common complications. In addition, we also plan to undertake, bedside observation of enteral feeding practice, although this will not involve direct patient contact or any change in patient care.

We intend to recruit up to 50 ICU nurses for the questionnaire survey and up to 7 ICU nurses for interview from your institution. We hope to be able to undertake the data collection in approximately 5 months time and would need your assistance in the process of accessing to the data.

The study will have ethical approval from both Sheffield and Jordan and we are happy to adhere to any ethical mechanism you may think necessary in your hospital. At the end of the study, a final report will be disseminated to you. The results and discussion will be in a generalized form and will not identify individual, staff, patient, or setting.

Thank you for considering this request. We look forward to hear from you.

Yours sincerely

Professor Roger Watson
The University of Sheffield

Mahmoud Al kalalkeh
(Doctoral Student)
Nrp09mta@sheffield.ac.uk

FROM:

- Mona Persenius

TO:

- 'mahmoud kalaldehy

Message flagged

Thursday, October 29, 2009 1:46 PM

Message body

Dear Mahmoud Taher Al kalaldehy

We are very glad to hear that you are interested in enteral nutrition and especially within intensive care. My co-authors and I grant you the right to use the questionnaire and the protocol in your study. Please refer to our article.

The questionnaire and the protocol used are in Swedish unfortunately, but a translation is enclosed with the article.

Attached you will find the appendix from the article, then you can make you own layout for the questionnaire and protocol. We would love to hear about the results when the research is completed.

Best regards,

Mona Wentzel Persenius

mona.wentzel@kau.se

FROM:

- Helen.Thacker@sth.nhs.uk

TO:

- kalaldehy82@yahoo.com

Message flagged

Monday, January 25, 2010 1:11 PM

Message body

Dear Mahmoud,

Please accept my apologies for my late reply regarding your study. You appear to have included all the relevant areas around enteral feeding lines in ICUs. Consequently there are only a couple of areas of practice to suggest for inclusion. On a daily basis we check the length the tube has been inserted to ensure there has been no movement and use pH rather than litmus paper to check for correct positioning. I have included the relevant policies and hope this is of use to you.

Good luck with your studies.

Regards

Helen Thacker

Clinical Educator

Critical Care

Sheffield Teaching Hospitals NHS Foundation Trust

Helen.Thacker@sth.nhs.uk

FROM: Frances.Allen@sth.nhs.uk

TO: kalaldehy82@yahoo.com

Message flagged Wednesday, January 20, 2010 11:13 AM

Message body

Hi Mahmoud,

Sorry for the delay in getting back to you but with Christmas, annual leave and the snow I've not been at work very much in the past 4 weeks. Hopefully Helen has responded more quickly. Having now had chance to look through the appendices I have the following thoughts/comments:

- Appendix A – all looks OK however it is very subjective way to measure knowledge level. I wonder whether you may be better to actually ask them specific questions about what they would do in certain scenarios e.g. if NG tube found to be in wrong place, if had a large gastric aspirate, if NG tube blocked etc etc. They would probably need to be multiple choice questions though to make analysis easier.

- Appendix B further questions you may want to include:
 - Is the correct feed hanging as per prescription?
 - Is the feed at the correct rate as per prescription?
 - Has the feed batch number/best before date been recorded anywhere?
 - Is the giving set changed every 24hrs for a NG/PEG feed?
 - Is the giving set changed every 12hrs for a post pyloric (Jejunal)feed?
 - Is the tube position confirmed every time before feed started or administering medications down the tube?

- Appendix B enteral nutrition complications – you have tube dislodgement but query whether you also need tube pulled out secondary to agitation/confusion. This is a big problem on our unit and could lead to suggestion of using nasal bridles/mittens (unless you use them already).
 - May also be useful to have high gastric aspirates as a problem.

Hope that's useful.

Kind Regards

Frances Allen

Specialist Dietitian for Critical Care & TPN

Frances.Allen@sth.nhs.uk

FROM: Nidal Eshah
TO: Mahmood Kalaldeh
Message flagged Sunday, January 3, 2010 11:01 AM

Message body

Dear Mahmoud,

Hoping that you are doing well.

Please find attached the two files that you sent for me. I provided me responses as simple comments on each file.

Dear Mahmoud, I suggest to rephrase the title to be clear and to include the independent variable, dependent variable, and the study population in it.

Research questions also need modification to include the previously mentioned elements. My advice to you is to keep your questions short and limited.

To provide you a judgment about the questionnaire's content validity; I need to understand the meaning of your dependent variable, plus the elements of this variable. Therefore it would be helpful to provide the reader with clear conceptual definition for your dependent variable. Personally, to send for you me comments regarding the content validity; I dealt with the dependent variable as having four elements (practical, responsibility, knowledge and documentation). My judgment regarding the content validity was based on Lawshe's method (1975). According to Lawshe the expert raters respond to the following question for each item: Is the skill or knowledge measured by this item (essential, useful but not essential, or not necessary) to the performance of the construct? According to Lawshe, if more than half the panelists indicate that an item is essential, that item has at least some content validity.

For me, I think this scale has content validity because it has a variety of questions that reflect the four proposed elements that constitute the study dependent variable.
Good luck.

Sincerely;

Nidal Farid Eshah - RN,MSN,CNS,PhD
Assistant professor-Faculty of Nursing
Zarqa Private University
P.O.Box 132222- Zarqa -13132- Jordan
Tel No:962-5-3821100; Ext. (1773)
E.mail: nidal2000jo@yahoo.com
nfareed@zpu.edu.jo

The University of Sheffield
School of Nursing and Midwifery

Invitation for participating in a survey

Research Title;

Enteral Nutrition in the Critically Ill. A Mixed-Methods Study of Adherence to Evidence-Based Protocols, Nursing Responsibility and Teamwork

My name is Mahmoud Al kalaldehy. I am writing to invite you to participate in a research study investigating nursing practice in relation to enteral nutrition in Jordanian intensive care units. The research is being conducted for a PhD study at the University of Sheffield - UK. The study has ethical approval from the University of Sheffield as well as permission from the hospital management to invite you to take part in the study.

Findings from the study will provide a greater understanding of the nature of nursing practice of enteral feeding and explore nurses' perceptions about this aspect of critical care. It is anticipated that the research findings will provide insight into how role of critical care nurses in ICUs might be further developed in Jordan.

The enclosed information sheet will provide you for further details about the survey. Please read it carefully to decide whether you are willing to participate in the study. If you decide to participate, please complete the enclosed questionnaire, which I estimate will take approximately 30 minutes of your time and then return it to the head of your department within 3 weeks of receipt. I would like to emphasise that you are under no obligation to join in the study, but your contribution would be much appreciated. If you have any enquiries about the study, please don't hesitate to contact me at my Email: nrp09mta@sheffield.ac.uk, Amman-Jordan, Tel: +962 777 997754, P.O Box 694-11592 Amman.

Thank you very much for considering my request, and I look forward to hear from you.

Yours sincerely

Mahmoud Al kalaldehy

The University of Sheffield
School of Nursing and Midwifery

Invitation for an Interview

Research Title;

Enteral Nutrition in the Critically Ill. A Mixed-Methods Study of Adherence to Evidence-Based Protocols, Nursing Responsibility and Teamwork

My name is Mahmoud Al kalaldehy. I am writing to invite you to participate in a research study investigating nursing practice in relation to enteral nutrition in Jordanian intensive care units. The research is being conducted for a PhD study at the University of Sheffield - UK. The study has ethical approval from the University of Sheffield as well as permission from the hospital management to invite you to take part in the study.

Findings from the study will provide a greater understanding of the nature of nursing practice of enteral feeding and explore nurses' perceptions about this aspect of critical care. It is anticipated that the research findings will provide insight into how role of critical care nurses in ICUs might be further developed in Jordan.

I would like to invite you for an interview with me in order to explore your views of the role of critical care nurse in delivering appropriate nutritional care in the ICU. I would like to emphasise that you are under no obligation to participate in the study; however, your contribution would be much appreciated. A copy of an information sheet which provides further details of the study is enclosed. Please read this in order to help you in deciding whether you wish to take part. If you have decided to participate in the study, please complete the enclosed consent form. For any enquiries about the study, please don't hesitate to contact me at my Email: nrp09mta@sheffield.ac.uk, Amman-Jordan, Tel: +962 777 997754, P.O Box 694-11592 Amman. I will telephone shortly to confirm your participation or answering any questions you may have.

Thank you very much for considering my request, and I look forward to hear from you.

Yours sincerely

Mahmoud Al kalaldehy

Enteral Nutrition in the Critically Ill. A Mixed-Methods Study of Adherence to Evidence-Based Protocols, Nursing Responsibility and Teamwork

You are being invited to take part in a research study. Before that, it is important for you to understand why the research is being conducted and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please contact me if there is anything that is not clear or if you require any further information. Take time to decide whether or not you wish to take part. Thank you for reading this.

What is the purpose of the project?

The aim of the study is to examine nursing management of enteral nutrition in intensive care units, and nursing perceptions of enteral feeding guidelines and protocols. Specifically, the study will describe:

1. ICU nurses' perception of their responsibility, knowledge and documentation focusing on enteral feeding in Jordan.
2. Nursing practice in relation to enteral nutrition in critical care units in Jordan.
3. The alternative strategies undertaken by ICU nurses for improving critically ill, enterally fed patient outcomes.
4. How do nurses perceive their current role in accomplishing of patient nutritional care?

Why I have been approached?

Your hospital has agreed to participate in the study. As a critical care nurse in any intensive care unit, you are invited to take part in this study because this study mainly focuses on the practice of ICUs nurses' in relation to enteral nutrition in different Jordanian health sectors.

Do I have to take part?

Participation is entirely voluntary. It is up to you to decide whether or not to take part. Your consent to participate in the study will be confirmed by returning the completed questionnaire.

What will happen to me if I take part?

You are invited to complete the survey questionnaire enclosed with this information sheet. The questionnaire seeks information about general aspects of enteral nutrition in intensive care, and it focuses on common issues that nurses' may encounter daily while performing their care. Therefore, your participation is merely enquiring about these issues. Eventually it will aid us to develop a new strategy of enteral feeding in Jordan. The questionnaire will take about 30 minutes to complete.

What other information will be collected in the study?

The study will comprise three concurrent process:

1. Survey questionnaire for ICU nurses’.
2. Semi-structured interviews with critical care nurses.
3. Bedside observation for predetermined items.

All of the three mechanisms will focus only on the practice of enteral nutrition in intensive care, and nursing perceptions of enteral feeding guidelines and protocols.

What are the possible disadvantages and risks of taking part?

No disadvantages or risks are anticipated as a result of completing the questionnaire.

What are the possible benefits of taking part?

It is not expected to have any direct benefits, but your contributions will provide us with valuable information about this aspect in the ICU, that probably could affect the management of overall practice.

What happens if the research study stops earlier than expected?

If the study stops earlier than expected the reasons will be explained to the participant.

What if something goes wrong?

It is unlikely that anything will go wrong as a result of taking part in the study. If you wish to raise a complaint please contact the supervisor, contact details are given at the bottom of this sheet. If you feel your complaint has not been handled to your satisfaction you can contact the University’s ‘Registrar and Secretary’. Or you can withdraw from the study at any time without any accountability.

Will my taking part in this project be kept confidential?

Yes. All information obtained from the survey will be treated as confidential and not disclosed to anyone. The reports and publications arising from the study will not identify any individual who participated. All questionnaires will be kept in a secure storage. The data collected will be coded so your responses remain anonymous.

What will happen to the results of the research project?

A summary of the main findings will be provided to each participating hospital and to the research participants if required. The research findings will also be disseminated through conference presentations and publications in both Jordan and the UK. The doctoral thesis arising from the study will available via the British Library and the University of Sheffield library for wider reference.

Who is organising and funding the project?

This research is part of a wider research programme at the University of Sheffield/United Kingdom. The research has been taken as part of a PhD study.

Who has ethically reviewed the project?

This project has been ethically approved via the Research Ethics Committee at the University of Sheffield in the United Kingdom, the Ethics Committee in each hospital.

What if have further questions

You can contact the research team if you have any further questions.

Researcher

Mahmoud Al kalaldehy, MSc, BSN, RN, Doctoral Student

School of Nursing and Midwifery, The University of Sheffield, United Kingdom

Email: nrp09mta@sheffield.ac.uk

Amman-Jordan P.O Box 694-11592, Mobile: +962 777 997754

Research Supervisors

✚ Roger Watson FSB FFMRCISI FRCN FAAN

Editor-in-Chief, Journal of Clinical Nursing

Professor of Nursing

School of Nursing and Midwifery

The University of Sheffield – United Kingdom

Tel: +44114 226 9624

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Reader in Nursing & Post Graduate Research Tutor

Associate Editor Journal of Clinical Nursing

School of Nursing and Midwifery

The University of Sheffield – United Kingdom

Tel +44 (0)114 226 9623

Email: M.Hayter@sheffield.ac.uk

Thank you for reading this information sheet. I hope it has answered any questions you may have.

Enteral Nutrition in the Critically Ill. A Mixed-Methods Study of Adherence to Evidence-Based Protocols, Nursing Responsibility and Teamwork

You are being invited to take part in a research study. Before that, it is important for you to understand why the research is being conducted and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please contact me if there is anything that is not clear or if you require any further information. Take time to decide whether or not you wish to take part. Thank you for reading this.

What is the purpose of the project?

The aim of the study is to examine nursing management of enteral nutrition in intensive care units, and nursing perceptions of enteral feeding guidelines and protocols. Specifically, the study will describe:

5. ICU nurses' perception of their responsibility, knowledge and documentation focusing on enteral feeding in Jordan.
6. Nursing practice in relation to enteral nutrition in critical care units in Jordan.
7. The alternative strategies undertaken by ICU nurses for improving critically ill, enterally fed patient outcomes.
8. How do nurses perceive their current role in accomplishing of patient nutritional care?

Why I have been approached?

Your hospital has agreed to participate in the study. As a critical care nurse in any intensive care unit, you are invited to take part in this study because this study mainly focuses on the practical issues of ICUs nurses' in relation to enteral nutrition in different Jordanian health sectors.

Do I have to take part?

Participation is entirely voluntary. It is up to you to decide whether or not to take part in the study. If you decide to take part you will be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time without giving any reason.

What will happen to me if I take part?

You will be interviewed by me. The interview will last approximately 30-45 min, and will be arranged for a mutually convenient time and a venue. The interview will be tape-recorded with your agreement, it will then be transcribed and analysed by me.

What other information will be collected in the study?

The study will comprise three concurrent process:

4. Survey questionnaire for ICU nurses’.
5. Semi-structured interviews with critical care nurses.
6. Bedside observation for predetermined items.

All of the three mechanisms will focus only on the practice of enteral nutrition in intensive care, and nursing perceptions of enteral feeding guidelines and protocols.

What are the possible disadvantages and risks of taking part?

No disadvantages or risks are anticipated as a result of completing the questionnaire.

What are the possible benefits of taking part?

It is not expected to have any direct benefits, but your contributions will provide us with valuable information about this aspect in the ICU, that probably could affect the management of overall practice.

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If the study stops earlier than expected the reasons will be explained to the participant.

What if something goes wrong?

It is unlikely that anything will go wrong as a result of taking part in the study. If you wish to raise a complaint please contact the supervisor, contact details are given at the bottom of this sheet. If you feel your complaint has not been handled to your satisfaction you can contact the University’s ‘Registrar and Secretary’. Or you can withdraw from the study at any time without any accountability.

Will my taking part in this project be kept confidential?

Yes. All information obtained from the study will be treated as confidential and not disclosed to anyone. The reports and publications arising from the study will not identify any individual who participated. The interview transcripts will not contain any information which could identify you, your colleagues or the hospital in which you work. Pseudonyms will be used where appropriate. Some short extracts from the transcripts may be used in the report and publications but these will remain anonymous.

What will happen to the results of the research project?

A summary of the main findings will be provided to each participating hospital and to research participants. The research findings will also be disseminated through conference presentations and publications in both Jordan and the UK. The doctoral thesis arising from the study will available via the British Library and the University of Sheffield library for wider reference.

Who is organizing and funding the project?

This research is part of a wider research program at the University of Sheffield/United Kingdom. The research has been taken as part of a PhD.

Who has ethically reviewed the project?

This project has been approved by the Research Ethics Committee at the University of Sheffield in the United Kingdom, and the Ethics Committee in each participating hospital.

What if have further questions

You can contact the research team if you have any further questions.

Researcher

Mahmoud Al kalaldehy, MSc, BSN, RN, Doctoral Student

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Thank you for reading this information sheet. I hope it has answered any questions you may have.

Project Title: Enteral Nutrition in the Critically Ill. A Mixed-Methods Study of Adherence to Evidence-Based Protocols, Nursing Responsibility and Teamwork

Participation in an interview – “Consent form”

Name of Researcher: Mahmoud Al kalalkeh

Participant Identification Number for this project:

Please tick the box

- | | |
|---|--------------------------|
| 1. I confirm that I have read and understand the information sheet/letter (delete as applicable) dated <i>[insert date]</i> for the above project and have had the opportunity to ask questions. | <input type="checkbox"/> |
| 2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. <i>Insert contact number here of lead researcher/member of research team (as appropriate).</i> | <input type="checkbox"/> |
| 3. I understand that my responses will be anonymised before analysis. I give permission for members of the research team to have access to my anonymised responses. | <input type="checkbox"/> |
| 4. I agree to take part in the above research project. | <input type="checkbox"/> |

Name of Participant <i>(or legal representative)</i>	Date	Signature

Name of person taking consent <i>(if different from lead researcher)</i> <i>To be signed and dated in presence of the participant</i>	Date	Signature

Lead Researcher <i>To be signed and dated in presence of the participant</i>	Date	Signature



Research Study

Enteral Nutrition in the Critically Ill. A Mixed-Methods Study of Adherence to Evidence-Based Protocols, Nursing Responsibility and Teamwork

This study is a part of PhD study which aims to describe nursing perception and their current practice of enteral nutrition at different critical care units in Jordan. All information will be treated confidentially without any indication for entities, character, or settings. Your contribution is appreciated and will help us to develop a holistic insight about enteral nutrition practice in Jordan.

*PhD student
Mahmoud Al kalalkeh*

PLEASE COMPLETE THE FOLLOWING QUESTIONNAIRE

- **Age:** _____
- **Sex:** a. Male b. Female
- **Total length of experience as a registered nurse (RN):** _____ year.
- **Total length of experience as a critical care nurse (CNS/NP):** _____ year.
- **Length of clinical working in this department:** _____ year.

Qualifications:

1. Diploma in nursing
2. Bachelor of nursing (BS)
3. Postgraduate diploma
4. Master degree (MSc)

Type of hospital:

1. Governmental (Ministry of Health)
2. Military (Royal Medical Services)
3. Private hospital

Working place:

1. General intensive/intermediate care unit (ICU)
2. Coronary care unit (CCU)
3. Surgical intensive care unit (SICU)
4. Any other specialized critical care unit (e.g. Stroke, Burn, Neurological, spinal cord injuries)

عزيزي المشارك، أرجو تعبئة الاستبيان بشكل دقيق مع مراعاة عدد الإجابات المطلوبة لكل سؤال حيث أن الرقم الذي يلي كل سؤال يوضح عدد الإجابات المطلوبة. في حال السؤال المتعدد الإجابات أرجو نقل رمز الإجابة بجانب

Important instructions prior starting answering:

- Please check the number of required answers for each section.
- Transfer your response beside each item as required.

Area of interest	Item	Response alternative
Knowledge of responsibility for nutrition	Are there any written guidelines regarding enteral nutrition on your ward? (1) هل يوجد أي بروتوكول للتغذية المعوية في قسمك؟	Yes, No, Don't know.
	Is there a nurse responsible for nutrition on your ward? (1) هل هنالك ممرض مسنونل عن ال غذية في قسم ؟	Yes, No, Don't know.
	Is there a nutritional team on your ward? (1) هل هنالك فر ق طبي مسنونل عن التغذية في قسمك؟	Yes, No, Don't know.
	Is there a nutritional team at the hospital? (1) هل هنالك فريق طبي مسنونل عن التغذية في المستشفى؟	Yes, No, Don't know.
	Are there other key persons to consult at the hospital? (1) هل هنالك خص آخر مسنونل عن استشارات التغذية؟	Yes, No, Don't know.
	Are there other key persons to consult outside the hospital? (1) هل هنالك شخص آخر مسنونل عن استشارا التغذية من خارج المستشفى؟	Yes, No, Don't know.
	Who prescribes the: (3) من المسنونل عن وصف الآتي في التغذية المعوية؟ **الإجابة لكل بند وعددها 3 <ul style="list-style-type: none"> • Amount: • Type: • Rate: of enteral nutrition?	Multiple choices for each item: 1. Physician 2. Nurse 3. Dietitian and enrolled nurse
Source of knowledge regarding enteral nutrition	To which extent have you obtained knowledge from: (9) إلى أي مدى تحصل على المعلومات من الجهات التالية؟ **الإجابة لكل بند وعددها 9 <ol style="list-style-type: none"> 1. Consulting colleagues; 2. In-service training; 3. Lectures; 4. Specialist education; 5. Scientific journal articles; 6. Other literature; 7. Nursing school; 8. Courses; 9. Internet; 	Scores could range from 1 to 5 for each item. 1 = to a very small extent 2 = small extent 3 = neither small nor great extent 4 = great extent 5 = very great extent
Responsibility	To what extent do you have responsibility regarding: (5) إلى أي مدى تتحمل المسنولية تجاه الآتي؟ ** الإجابة لكل بند وعددها 5 <ul style="list-style-type: none"> • Assessment of nutritional status; • Goal; • Planning and implementation of interventions; • Prevention of complications; • Evaluation; 	Scores could range from 1 to 5 for each item. 1 = to a very small extent 2 = small extent 3 = neither small nor great extent 4 = great extent 5 = very great extent
Knowledge	To what extent do you have satisfying knowledge regarding: (5) إلى أي مدى تشعر بثقتك بالمعلومات تجاه الآتي؟ **الإجابة لكل بند وعددها 5 <ul style="list-style-type: none"> • Assessment of nutritional status; • Goal; • Planning and implementation of interventions; • Prevention of complications; • Evaluation; 	Scores could range from 1 to 5 for each item. 1 = to a very small extent 2 = small extent 3 = neither small nor great extent 4 = great extent 5 = very great extent

<p>Documentation</p>	<p>To what extent do you have support from documentation regarding: (5)</p> <p>إلى أي مدى تشعر بالدعم من الإرشادات المكتوبة تجاه الآتي؟ **الإجابة لكل بند وعددها 5</p> <ul style="list-style-type: none"> • Assessment of nutritional status; • Goal; • Planning and implementation of interventions; • Prevention of complications; • Evaluation; 	<p>Scores could range from 1 to 5 for each item.</p> <p>1 = to a very small extent 2 = small extent 3 = neither small nor great extent 4 = great extent 5 = very great extent</p>
<p>Enteral feeding intervention</p>	<p>Most common used feeding tube: (4)</p> <p>إلى أي مدى تستخدم الأنواع التالية من التغذية المعوية في قسمك؟ **الإجابة لكل بند وعددها 4</p> <ul style="list-style-type: none"> • Gastric tube; • Doudenal tube (post pyloric); • Percutaneous endoscopic gastrostomy (PEG); • Needle catheter jejunostomy; 	<p>Scores could range from 1 to 5 for each item.</p> <p>1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always</p>
	<p>1. Is feeding tube flushed before administration of nutrients or medication? (1)</p> <p>هل تقوم بخض أنبوب التغذية بالماء قبل الاستخدام؟</p>	<p>Scores could range from 1 to 5.</p> <p>1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always</p>
	<p>2. Is feeding tube flushed after administration of nutrients or medication? (1)</p> <p>هل تقوم بخض أنبوب التغذية بالماء بعد الاستخدام؟</p>	<p>Scores could range from 1 to 5.</p> <p>1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always</p>
	<p>3. Do you do daily inspection to nostrils? (1)</p> <p>هل تقوم بالنظر إلى الفتحة الأنفية بشكل يومي؟</p>	<p>Scores could range from 1 to 5.</p> <p>1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always</p>
	<p>4. Are medications not to be crushed are administered in crushed form through feeding tube? (1)</p> <p>هل الأدوية الغير قابلة للسحق أو الطحن تعطى مع التغذية المعوية؟</p>	<p>Scores could range from 1 to 5.</p> <p>1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always</p>
	<p>5. Do you clean syringe after each use? (1)</p> <p>هل تقوم بتنظيف أدوات التغذية بعد الاستعمال؟</p>	<p>Scores could range from 1 to 5.</p> <p>1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always</p>
	<p>6. Is a 'continuous feeding' used in your department? (1)</p> <p>هل التغذية المستمرة عن طريق جهاز الضخ مستخدمة في قسمك؟</p>	<p>Scores could range from 1 to 5.</p> <p>1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always</p>
	<p>7. Is 'bolus feeding' used in your department? (1)</p> <p>هل التغذية عن طريق الجرعات المتعددة في اليوم مستخدمة في قسمك؟</p>	<p>Scores could range from 1 to 5.</p> <p>1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always</p>

Enteral feeding intervention	8. Do you perform a regular check for gastric residual? (1) هل تقوم بمراقبة كمية الغذاء المتبقية في المعدة بشكل منتظم؟	Scores could range from 1 to 5. 1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always
	9. Does feeding schedule allow for a night rest? (1) هل نظام التغذية في قسمك يسمح بإعطاء التغذية في الليل (أثناء النوم)؟	Scores could range from 1 to 5. 1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always
	10. Is prokinetic used to improve gastric empty (e.g.; meteclopromid (plasil), erythromycin)? (1) هل أدوية تحسين الهضم مثل " البلاسيل " تعطى لتحسين عملية تفريغ المعدة؟	Scores could range from 1 to 5 for each item. 1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always
	11. Is a feeding pump used in your department? (1) هل التغذية المستمرة تعطى عن طريق جهاز ضخ الكهروني؟	Scores could range from 1 to 5. 1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always
	12. Is the tube position confirmed every time before feeding or drug administration? (1) هل يتم التأكد من وضعية أنبوب التغذية داخل المريض قبل كل استخدام؟	Scores could range from 1 to 5. 1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always
	13. How do you check the position of feeding tube after insertion? (1or more) كيف يتم التأكد من وضعية أنبوب التغذية؟	Multiple choice question: 1. X-ray 2. Air bubbling 3. PH measure 4. Other;
	14. How do you know if a particular medication can be given through feeding tube? (1or more) كيف يمكنك أن تعرف ما إذا كان أحد العلاجات يمكن إعطائها من التغذية المعوية؟	Multiple choice question: 1. Any medication can be crushed and given 2. Medication leaflet 3. Consulting somebody
	15. Are patients placed in a specific position while receiving enteral feeding? (1) ما هي وضعية المريض المستخدمة أثناء إعطاء التغذية؟ (أرجو وضع الزاوية التقريبية لارتفاع رأس المريض)	Specify position (i.e. degree of head elevation);°
	16. What is the most common infusion rate (if use infusion pump) (1) ما هي السرعة المستخدمة في إعطاء التغذية عن طريق التغذية المستمرة؟ (اختر السرعة: ملل ساعة) ml/ hour
	17. Do you check the length of the inserted tube daily, to ensure there has no movement? (1) هل تقوم بقياس طول الأنبوب بشكل يومي للتأكد من عدم وجود إزاحة للأنبوب لأي سبب من الأسباب؟	Scores could range from 1 to 5. 1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always

	<p>18. Is the 'giving set' changed every 24 hours for NG feeding tube? (1)</p> <p>هل تقوم بتغيير أدوات الإغذاء الخارجية كل 24 ساعة؟</p>	<p>Scores could range from 1 to 5.</p> <p>1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always</p>
	<p>19. Is enteral nutrition is more preferred than parenteral nutrition in your department? (1)</p> <p>هل التغذية المعوية مفضلة في قسمك على التغذية الوريدية؟</p>	<p>Scores could range from 1 to 5.</p> <p>1 = never 2 = almost never 3 = neither never nor always 4 = almost always 5 = always</p>
Enteral Nutrition Complications	<p>To what extent do you report the following common feeding tube complications: (15)</p> <p>إلى أي مدى ترى حدوث المضاعفات التالية الناجمة عن التغذية المعوية في قسمك؟ ** الإجابة لكل بند وعددها 15</p> <ol style="list-style-type: none"> 1. Aspiration; 2. Pneumonia; 3. Tube dislodgement (e.g. secondary to agitation/confusion) 4. Diarrhea; 5. Constipation; 6. High gastric aspirate; 7. Weight loss; 8. Weight gain; 9. Hemodynamic instability; 10. Sepsis; 11. Naso-pharynx injury; 12. Hypo-hyperglycemia; 13. Abdominal pain (i.e. abdominal distention); 14. Nausea; 15. Vomiting; 	<p>Scores could range from 1 to 5 for each item.</p> <p>1 = to a very small extent 2 = small extent 3 = neither small nor great extent 4 = great extent 5 = very great extent</p>
	<p>What is the closest percentage of tube feeding complications in your department? (1)</p> <p>ما هي النسبة المتوقعة لحدوث المضاعفات الناجمة عن استخدام التغذية المعوية بشكل عام في قسمك؟</p>	<p>0 – 100 %</p> <p>.....</p>
Evidence-Based Guidelines	<p>To what extent do you believe that some/all these complications can happened if there is no: (4)</p> <p>إلى أي مدى ترى أن هذه المضاعفات قد تحدث بعدم وجود الاتي؟ ** الإجابة لكل بند وعددها 4</p> <ol style="list-style-type: none"> 1. Enteral feeding protocol, guideline and algorithm; 2. Aspiration reduction measurement; 3. Measuring gastric Residual Volume (GRVs) frequently; 4. Frequent checking for tube position; 	<p>Scores could range from 1 to 5 for each item.</p> <p>1 = to a very small extent 2 = small extent 3 = neither small nor great extent 4 = great extent 5 = very great extent</p>
	<p>What is the closest percentage of the complications you would expect if the previous evidence-based concepts have been applied?</p> <p>ما هي نسبة حدوث المضاعفات التي تتوقعها في حال تطبيق الآليات الأربعة السابقة؟</p>	<p>0 – 100 %</p> <p>.....</p>

Bedside observation

Area of interest	Item	Response alternative
Enteral feeding intervention	1. Is the feeding tube securely fastened with tape?	Yes/No
	2. Is the feeding tube taped without risk of damaging the eye*?	Yes/No
	3. Is the feeding tube taped on undamaged skin?	Yes/No
	4. Is the feeding tube fixed without straining the nose?	Yes/No
	5. Is the feeding tube fixed on the cheek?	Yes/No
	6. Is a feeding pump used?	Yes/No
	7. Is administration set for enteral feeding used?	Yes/No
	8. Is the feeding pump labeled?	Yes/No
	9. What kind of feeding tube is used?	Small bore/Wide bore jejunostomy / gastrostomy
	10. Is the syringe labelled (only for feeding tube)?	Yes/No/ Missing
	11. Is the syringe replaced daily according to date label?	Yes/No/ Missing
	12. Is the syringe kept dry?	Yes/No
	13. Patient position while receiving enteral nutrition?	Supine/Right lateral/Left lateral
	14. Can gurgling sounds be heard during exhalation?	Yes/ No/ Not applicable
	15. Backrest elevation?	Degrees;
	16. Is the correct feed hanging as per prescription?	Yes/No/ Missing
	17. Is the feeding at the correct rate as per prescription?	Yes/No

* The tape is not placed in the corner of the eye, not on the area closest to the eye and not with a long loose end that could damage the cornea.

Interviews Questions:

1. How do nurses perceive their role in enteral nutrition along with other professions?

Interview Questions:

- Tell me about what responsibilities you have in regard to enteral feeding in your unit
- What are your experiences of working with other professionals with patients receiving enteral feeding?
- How do other professionals respond when you voice your views on enteral feeding?

2. How do nurses describe barriers and facilities to successful exploiting of evidence-based protocols of EN?

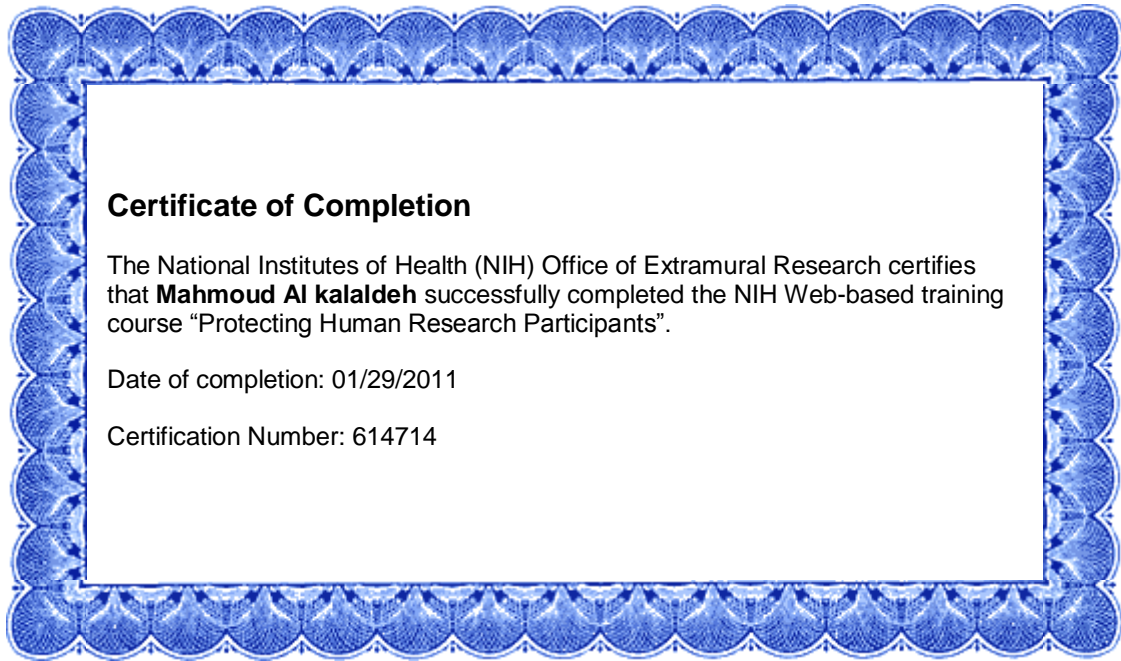
Interview Question

- Can you tell me about your contributions to producing any enteral feeding protocols in your department? What role do other nurses take with this?
- Can you tell me how much of the enteral feeding practice in your area, including protocols, are evidence based?
- How does your institution supports you if you want to improve patients' nutritional strategies?

3. How do nurses describe factors associated with tube feeding complication?

Interview Question

- What are your experiences of using an evidence-based protocol to reduction of feeding complications?
- What techniques do you employ when facing any tube feeding complications?
- How do you assess a patient's nutritional status and detect feeding intolerance in your unit?



Review Completed Quizzes

- Codes and Regulations - 6/6
- Respect for Persons - 6/6
- Beneficence - 5/5
- Justice - 4/4

