Healthcare Media Design for Low-literate Users

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Intellectual Property and Publication Statements

I confirm that the work submitted here is all my own except where jointly authored publications have been included. My own contribution to this work and that of other authors are explicitly indicated below. I confirm that appropriate credit has been given within the thesis where reference has been made to the work of others.

1. **Hung, Yah-ling & Stones, Catherine. (2014). Visual design in Healthcare for Low-literate Users – A Case Study of Healthcare Leaflets for New Immigrants in Taiwan. In Aaron Marcus (Ed). Design, User Experience, and Usability. User Experience Design for Everyday Life Applications and Services, 44-55. Publisher: Springer International Publishing.**

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Abstract

Low health literacy has been associated with poor outcomes in health care. Recent research suggests that good healthcare media can help to reduce the literacy barrier and enhance health outcomes. However, the majority of healthcare media are constructed for well-educated users rather than those with low literacy skills. This begs the question of whether or not various healthcare media have the same effect on low-literate users. Immigrant populations are vulnerable to serious health disparities, and language barriers and these may further exacerbate their limited health literacy in accessing health care information. Yet, ways to help low-literate parents to look after their children by applying healthcare media are still at an early stage of development. The aim of this study is to establish useful design strategies for Graphic and Information designers when planning and designing healthcare media for low-literate users. This research was implemented through four experiments, including a focus group interview and questionnaire survey, a pre-post knowledge test, a usability evaluation, and semi-structured interviews. The findings revealed the problems immigrant parents usually encounter in caring for their children's health. The results demonstrated that the influence of interventions by leaflets and websites on low-literate users is not significantly different. The findings also showed the criteria used by low-literate users to evaluate healthcare media and the visual factors of healthcare media that affect their satisfaction. An assessment checklist related to the design of health educational materials for low-literate users was also listed. This is an interdisciplinary research that integrates Design,

Communication and Public Health. It provides a holistic framework for improving health intervention using various methodologies, including development, experiment, observation, comparison, and analysis.

Keywords: Health Communication, Health Literacy, Healthcare Disparity, Visual Design, Healthcare Media, Usability Evaluation

Table of Contents

Intellectual Property and Publication Statements ..... **II**

Acknowledgements ..... **IV**

Abstract ..... **V**

Table of Contents ..... **VII**

List of Figures ..... **XI**

List of Tables ..... **XII**

Chapter 1 Introduction **1**

1.1 Research Background 1

1.2 Past Research 3

1.3 The Questions and Objectives of this Study 7

1.4 The Framework of this Study 9

1.5 Overview of Chapters 11

Chapter 2 Health Communication with Immigrant Populations **14**

2.1 Health Communication 14

2.1.1 Health Intervention 16

2.1.2 Doctor-patient Communication 18

2.2 Health Communication with Minority Ethnic Populations 20

2.2.1 Racial/ethnic and Cultural Disparities 20

2.2.2 Language and Literacy Barriers 21

2.2.3 Reducing Healthcare Disparities 23

2.3 Immigrants' Healthcare in Taiwan 25

2.3.1 Immigrants' Mothers in Taiwan 25

2.3.2 Immigrants' Children in Taiwan 26

2.3.3 Children's Allergies in Taiwan 28

2.4 Chapter Summary 29

Chapter 3 Development and Assessment of Healthcare Media.....31

3.1 The Fundamental Concerns for Designing Healthcare 31

3.1.1 Health Information Technology 32

3.1.2 Visual Appeal in Healthcare.....35

3.1.3 Visual Factors of Healthcare Media.....38

3.2 The Evaluation Categories for Assessing Healthcare.....42

3.3 Paper-based Healthcare Media & Web-based Healthcare Media.....45

3.4 Comparative Analysis of Various Types of Healthcare Media.....49

3.4.1 Leaflets VS. Websites.....50

3.4.2 Leaflet VS. Video.....52

3.4.3 Single-media VS. Multimedia.....53

3.5 Chapter Summary.....55

Chapter 4 Low-literate Health Education 59

4.1 Health Literacy.....59

4.2 The Problem of Parental Health Literacy.....61

4.3 Higher Literacy Users VS. Lower Literacy Users.....64

4.4 Development and Evaluation of Healthcare Media for Low-literate Users.....68

4.5 Low-literate Healthcare Media Design 72

4.5.1 User-centred Healthcare Design.....72

4.5.2 Understand Target Audience.....73

4.5.3 Design Issues of Low-literate Healthcare Media.....77

4.5.3.1 Content Design.....77

4.5.3.2 Appearance Design.....81

4.5.3.3 Usability Design.....86

4.6 Chapter Summary.....89

Chapter 5 Methodology **91**
5.1 The Structure of Methodology in This Study 91
5.2 Sample 95
5.3 The Reliability and Validity Test of Questionnaire 97
5.4 Statistical Analysis in this study 99
5.5 Ethical Approval Application 102
Chapter 6 Focus Group Interviews & Questionnaire Survey **104**
6.1 Methods 104
6.2 Data Analysis of Questionnaire Survey 107
6.3 Key Findings and Discussion 111
Chapter 7 Pre-post Knowledge Testing **114**
7.1 Methods 114
7.1.1 Development of Testing Media 114
7.1.2 Pre-post Knowledge Testing 118
7.2 Data Analysis of Pre-post Knowledge Test 120
7.2.1 Leaflet Group VS. Website Group 120
7.2.2 Demographic Factors and Educational Effect 122
7.3 Key Findings and Discussion 129
Chapter 8 Usability Evaluation **132**
8.1 Methods 132
8.2 Data Analysis of Usability Evaluation 132
8.3 Key Findings and Discussion 135
Chapter 9 Semi-Structured In-depth Interviews **139**
9.1 Methods 139
9.2 Data Analysis of Semi-Structured In-depth Interviews 142
9.3 Key Findings and Discussion 154
Chapter 10 Conclusions **166**
10.1 Contribution to Research Process 167
10.2 Contribution to Knowledge 169

10.2.1 Different Criteria Used by Immigrants to Evaluate Healthcare Media 169

10.2.2 The Design Strategies and Guidelines of Healthcare Media for Low-literate Users.....173

10.3 Limitations of the Study and Future Directions for Research.....181

10.3.1 Limitations of the Study 181

10.3.2 Future Directions for Research 183

List of References.....185

Appendices 201

Appendix A: Questionnaire Design.....201

Appendix B: The Content of Testing Media.....205

Appendix C: Testing Pictures for Semi-Structure Interviews 214

List of Figures

Figure 1: Past studies related to this research

Figure 2: The framework of this study

Figure 3: Health disparities of immigrant population

Figure 4: Develop, implement, and assess the health information technology

Figure 5: The flowchart of healthcare media design

Figure 6: The evaluation criteria of healthcare media

Figure 7: Causes and results of low health literacy

Figure 8: The current strategies used in the design of healthcare media for low-literate users

Figure 9: An interdisciplinary research

Figure 10: The design strategies of healthcare media

List of Tables

Table 1: Leaflet VS. Website

Table 2: Leaflet VS. Video

Table 3: Single-media VS. Multimedia

Table 4: The different reading behaviour and managing ability between skilled readers and poor readers

Table 5: The contrast between the reading experience and navigating behaviour of skilled readers and less skilled readers

Table 6: The differences between the online information-seeking behavioural strategies of lower and higher literacy users

Table 7: The structure of methodology in this study

Table 8: Baseline characteristics of participants enrolled in the study

Table 9: Statistical analysis in this study

Table 10: Testing media design / Leaflet VS. Website

Table 11: The criteria used by low-literate users to evaluate healthcare media

Table 12: The justification of test pictures for semi-structured interviews

Table 13: The major transcript of semi-structured interviews

Table 14: The key terms used by immigrant mothers to evaluate healthcare leaflet

Table 15: The key terms used by immigrant mothers to describe visual design

Table 16: The visual design strategies of healthcare media for low-literate immigrants

Table 17: The design guidelines of healthcare media for users with low literacy

Chapter 1 Introduction

1.1 Research Background

Low health literacy has been associated with poor outcomes in health care, which include higher health care costs, a worse assessment of one's own degree of health, and less success in managing chronic diseases (National Institute of Health, 2002). Recent research suggests that good healthcare media can help to reduce the literacy barrier and enhance health outcome. They can help modify attitudes, shape positive behaviours, and improve patients' self-prevention (Andersen *et al.*, 2008; Atkinson *et al.*, 2009; Choi & Bakken, 2010). However, the majority of healthcare media are constructed for well-educated users rather than those with low literacy skills (Plimpton & Root, 1994; Doak *et al.*, 1996; Olives *et al.*, 2010). This begs the question of whether or not various healthcare media have the same effect on low-literate users.

Immigrant populations are vulnerable to serious health disparities, and language barriers may further exacerbate their limited health literacy in accessing health care information. This research considers a specific group of immigrant mothers who come from Southeast Asia in Taiwan, most of whom have low levels of education and have married into poor families. Their children therefore are at risk, receiving poor health care because of parents'

low socio-economic status in Taiwan. According to Taiwan's Ministry of the Interior, the number of new immigrants reached 490,000 in 2013 and the number of their children reached 230,000 in the same year. Recent surveys indicate that more than 20 per cent of children in Taiwan suffer from allergies (Zhou & Wu, 2012). Children with chronic diseases are highly dependent on their parents in the management of their health care. Yet, ways to help low-literate parents to look after their children by applying healthcare media are still at an early stage of development (Mackert *et al.*, 2009; Sabo & Lorenzen, 2011).

Taiwan's health care system, known as National Health Insurance (NHI), was introduced in 1995 and it provides comprehensive healthcare coverage for more than 99% of the 23 million-strong population. Taiwan spent 6.7 percent of its GDP on health care in 2012, and although this represented record growth, its share in terms of % to GDP was still rather low compared to other developed countries, like the US (17.7%), the UK (9.2%), and Japan (9.6%) (Global Data, 2013). There has been an increasing trend to improve Taiwan's healthcare facilities over the past decade, as well as those in other developed countries. Healthcare engineers and architects have proposed stylish and innovative concepts for the development of medical devices, aesthetic clinics and care homes (Lin, 2013). Unlike the highly acclaimed improvement in healthcare facilities, the quality of healthcare media in Taiwan has been criticised for being under-developed and amateurish. This is because the annual budget for developing healthcare media is allocated to advertising companies through price competition rather than considering professionals'

concerns (Hung & Li, 2012). Successful healthcare media needs to be developed in three stages, namely planning, testing, and reviewing. (The Ministry of Health of New Zealand, 2002; the Western Cheshire Primary Care Trust in the UK, 2007; Maine Health, 2010); however, the supervision of the NHI for developing healthcare media in Taiwan is not as rigorous as that in other developed countries. Most healthcare media in Taiwan simply focus on content and distribution, but are seldom concerned about appropriateness and effectiveness (National Health Insurance Administration, 2014). The lack of consultation and expertise means that the proliferation of health leaflets, videos and websites are largely ignored by audiences, although they account for much of the government's annual budget for health education.

1.2 Past Research

A systematic review was undertaken to screen related publications between 2000 and 2013 in order to survey the current strategies, methodologies and tools to design health information for low-literate users, as detailed in Figure 1. The databases searched included ‘Pub Med’, ‘Engineering Village’, and ‘Google Scholar’ and the three targeted journals were ‘Patient Education and Counselling’, ‘International Journal of Medical Informatics’, and ‘Journal of Medical Internet Research’. Combined terms, such as parent literacy & children’s health & intervention design, health intervention effects & low-literate patients, health intervention & chronic diseases & behavioural changes, health information technology & impact evaluation, visual aids &

health medication and cultural factor & information system were entered to search for related articles.

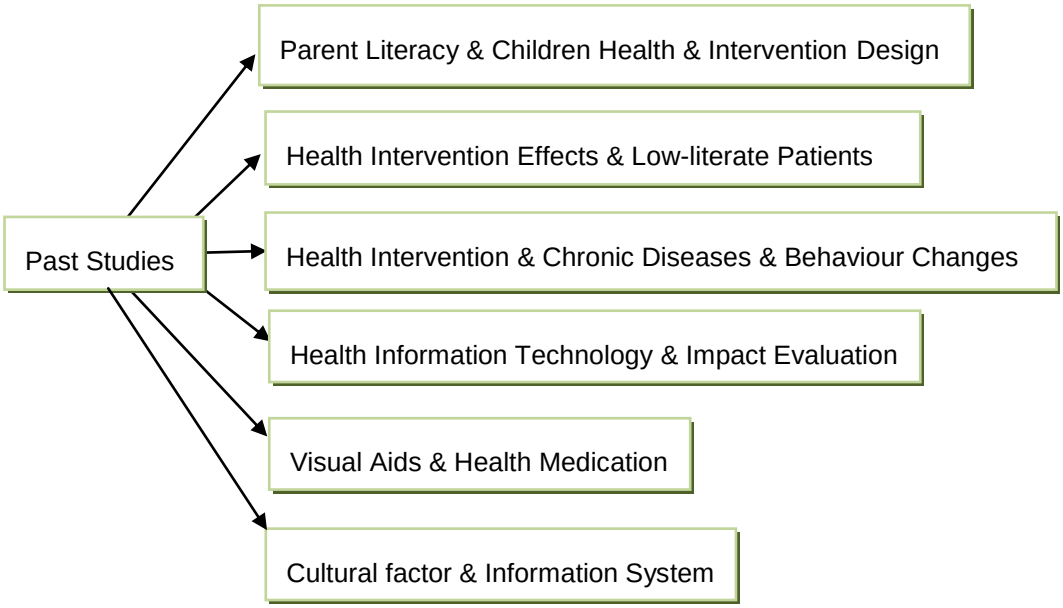


Figure 1 Past studies related to this research

The result showed that there has been a great proliferation of research into low literacy health communication over the past decade, such as the impact of health literacy (Nair & Cienkowski, 2010; Gill *et al.*, 2012; Rowlands *et al.*, 2013), the problem of parental health literacy (Macy *et al.*, 2011; Knapp *et al.*, 2011; Yin *et al.*, 2013), the racial and ethnic disparities in healthcare (Sentell & Braun, 2012; Shaw *et al.*, 2012; Sperber *et al.*, 2013), and low-literate health education (Andersen *et al.*, 2008; Mackert *et al.*, 2009; Negarandeh *et al.*, 2013).

What past studies have neglected and what further study needs to be implemented

DeWalt & Hink (2009) conducted a systematic review of 4182 new titles and abstracts published between 1980 and 2008 to determine the relationship between parents' literacy and child health outcomes and interventions designed to improve the health outcome of children with parents with low literacy skills. The results showed that 24 articles met the inclusion criteria, but few of them had examined the impact of knowledge-related interventions, evaluated the relationship between caregivers or child literacy and health service use or health outcomes, or even focused on interventions to improve child health outcomes for parents with low literacy. Sheridan *et al.* (2011) conducted a systematic review to screen publications related to health literacy between 2003 and 2010 to identify articles on interventions that authors reported to be specifically designed to mitigate the effects of low health literacy. 26 studies met their inclusion criteria. They suggest that some important untested interventions need to be implemented in future, such as those that increase the motivation to process information, those that work around the problem of low health literacy, and those that change physicians' behaviour, practice structure, or the existing health policy. Taggart *et al*. (2012) conducted a systematic review to screen publications about intervention studies between 1985 and 2009 to evaluate the effectiveness of interventions used in primary care to improve the healthcare outcome of patients who are suffering from a chronic disease. 52 articles were found to demonstrate that a great many health interventions are associated with

change in behavioural risk factors related to smoking, nutrition, alcohol, physical activity and weight, while analyses of the functional health literacy or components of interactive and critical health literacy (i.e. health knowledge, self-efficacy, patient motivation, confidence and social support) are comparatively rare. Katz *et al.* (2006) conducted a MEDLINE search for articles published between 1966 and 2005 to examine the effect of pictorial aids in medication instructions on medication recall, comprehension, and adherence. The findings showed that pictorial aids have proven to enhance patients' recall, comprehension, and adherence to their medication regimen. Unfortunately, not all picture-based interventions have successful results because some symbolic icons have been found to be too complex to understand. Thus, it is suggested that patients learn the meanings of pictorial aids used in medication instructions before doing any picture-based intervention.

When taking a comprehensive view of the above findings, the majority of past studies were focused on investigating the effectiveness of health promotional platforms from the perspective of information providers and consumers, while analyses of the educational effectiveness of various media for low-literate users from the perspective of designers are comparatively rare. Recent studies indicate that visual design might service as a powerful means for the delivery of health information because vivid information combined with visual elements seems to affect both affective and cognitive processes to maximize comprehension. For example, the use of visual attributes, images, information graphics, diagrams, and animations to convey and absorb information can

provide techniques and tools to help patients gain situational awareness of medical information. Simplifying large data sets and accelerating communication may aid users' decisions more quickly (Rajwan & Kim, 2010). Since a visual cue may aid comprehension when people have difficulty understanding the text and aid information recall when people understand the text, the use of visual cues enhances satisfaction with the information presented on website and it attracts more attention from older adults than from younger adults (Weert *et al.*, 2011). At this time, visual design plays an important role in bridging the gap between the healthcare information provider and the consumer. Nevertheless, ways to apply visual appeal into healthcare media for immigrant populations to improve their health behavioural outcomes are still under investigation.

1.3 The Questions and Objectives of this Study

The successful transmission of information is vital for parents whose children require immediate care. However, the cultural disparities and literacy barriers may be an obstacle for immigrant mothers to manage their children's health. Healthcare medium might be an effective communication platform to offer an innovative professional care system in a diversified society. Yet, how to develop a more accessible, applicable and affordable health educational platform for low-literate immigrants remains a challenge. The following are the main questions addressed in this study;

- What kind of problems do low-literate immigrant mothers encounter in terms of health communication?
- What are the technical obstacles that impede low-literate users' ability to access information via healthcare media?
- Do different kinds of healthcare media have the same impact on low-literate users?
- How to compare the educational effectiveness of different media to deliver health knowledge to users with low literacy?
- Do the demographic characteristics of the immigrant population influence their ability to access health information?
- What are the criteria used by low-literate users to evaluate healthcare media?
- What kind of visual factors affect low-literate users' satisfaction with healthcare media?

The aim of this study is to establish useful design strategies for Graphic and Information designers when planning and designing healthcare media for low-literate users. Several objectives have been met to achieve this aim, and these are listed below.

- To survey current strategies and methodologies used in the design of health information for low-literate users.
- To establish applicable testing methods to compare the Influence of healthcare media for particular low-literate users.

- To identify key problems usually encountered by immigrant mothers when caring for their children's health.
- To compare the educational effectiveness of leaflet and website to deliver health knowledge to users with low literacy.
- To explore the criteria used by immigrant mothers to evaluate healthcare media.
- To identify the visual factors of healthcare media which affect low-literate users' satisfaction.
- To set up design strategies and guidelines of healthcare media for users with low literacy.

1.4 The Framework of this Study

The study was implemented in seven stages, as shown in Fig 2, the first of which reviewed existing literature in order to identify the current strategies and methodologies used to design healthcare media for low-literate users. Second, a focus group interview was conducted with 10 Vietnamese volunteer interpreters to prepare a questionnaire to ask other immigrant mothers about the problems experienced in terms of health communication and their use of media. Third, a leaflet and a website were developed relating to healthcare information of children's allergy. Fourth, a reliability and validity test was conducted with a paediatric allergy doctor, a paediatric clinical nurse, a Vietnamese interpreter, an immigrant mother who achieved primary education, and an immigrant mother who achieved middle education to

ensure that all the questions in the questionnaire were clear and useful to measure the important variables in this study. Fifth, a pre-post knowledge test was conducted with 70 immigrant mothers, who were randomly placed into two groups to explore the educational effectiveness of a leaflet and website respectively. A usability evaluation survey, which measured the content quality, appearance quality, and usability quality of the testing media was then undertaken to assess the user' satisfaction of the participants. Finally, semi-structured interviews were conducted with 10 Vietnamese participants separately, who had a lower educational level and attended the pre-post knowledge test and usability evaluation survey, to identify the visual factors of healthcare media that affect low-literate users' satisfaction.

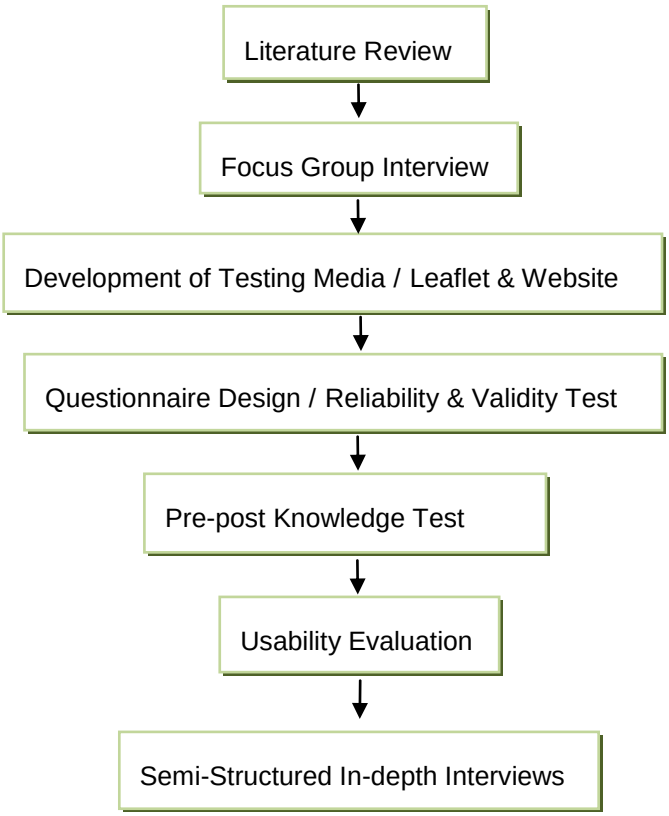


Figure 2 The framework of this study

1.5 Overview of Chapters

The research background and research themes of this study are clarified in Chapter 1, which begins with an introduction to the problems involved in designing healthcare media for low-literate immigrants. The key literature related to this study is then examined to determine what past studies have neglected and what further study needs to be implemented. Subsequently, the motivations and purposes of the research are explained before moving on to introduce the framework of the study. The chapter ends with an overview that aims to show the whole picture of this thesis.

The aim of Chapter 2 is to explore the problems involved in health communication among members of immigrant populations. It begins with an overview of the developing history and important studies related to health communication, and this is followed by the key tasks and appropriate expertise to improve health interventions. A description of the common obstacles to doctor-patient communication and some strategies are then proposed to improve the clinician-patient relationship. Subsequently, the cultural disparities and language barriers of a vulnerable population are then explored with a discussion of how these disparities can be reduced. The remainder of the chapter focuses on the healthcare problems of immigrant populations in Taiwan.

The aim of Chapter 3 is to investigate the development and assessment of

healthcare media. The fundamental concerns of designing healthcare media are firstly addressed, to show how both health information technology and visual appeal play important roles in the transfer of information and healthcare delivery. The evaluation categories used by past studies are then examined to assess whether healthcare media is a success or failure before moving on to explore how the authors develop and evaluate paper-based media and web-based media. The remainder of the chapter focuses on comparative analyses of the influence of design interventions made by various forms of media, such as leaflets vs. websites, leaflets vs. videos, and single-media vs. multimedia.

The aim of Chapter 4 is to explore the problem of low health literacy and the current strategies used in the design of healthcare media for low-literate users. It firstly addressed the problem of health literacy and how this affects patients' ability to obtain, process, and understand health information. It then investigates the problem of parental health literacy and how this affects low-literate parents whose children have chronic diseases. The great contrast between higher literacy users and lower literacy users when searching for health information is then summarised before exploring the way in which healthcare media for low-literate users has been developed and evaluated in the past decade. The rest of the chapter focused on low-literate users' special need for healthcare and how this affects the strategies, media, and forms of healthcare media.

The aim of Chapter 5 is to establish the appropriate methods for experiments and describe the applied methods for data analysis in this study. The structure

of the methodology is firstly discussed before providing the basic characteristics of the participants enrolled in the study. Subsequently, the reliability and validity of the questionnaire is tested before moving on the statistical data analyses that were conducted in this study. The remainder of the chapter focuses on the application of ethical approval for this study.

The five chapters following this introductory chapter contain a description of the methodological approach taken in this study and then a conclusion is drawn in the final chapter. The problems experienced by immigrant mothers in terms of health communication are revealed in Chapter 6; the influence of health intervention of a leaflet and website on users with low literacy is compared in Chapter 7; the criteria used by low-literate users to assess healthcare media are identified in Chapter 8; the visual factors of healthcare media that affect users' satisfaction are examined in Chapter 9. The study is concluded in Chapter 10 with a list of its contributions to current knowledge before discussing the limitations of the study and suggesting the direction for further research in this field.

Chapter 2 Health Communication with Immigrant Populations

2.1 Health Communication

What is health communication? “Health communication is the study and use of communication strategies to inform and influence individual and community decisions that affect health. It links the fields of communication and health and is increasingly recognized as a necessary element of efforts to improve personal and public health” (Health.gov, 2013). The field of health communication started with the creation of the Health Communication Division of the International Communication Association in 1975, and this subsequently became a division under the same name at the National Communication Association in 1985. Then, computer-tailored health education and behavioral change programs were developed and tested by researchers at several universities, health care organizations, and government agencies throughout the 1990s. There is no doubt that health communication has grown dramatically in the past twenty-five years (Thompson, 2003; Krueger *et al.*, 2010). The role of health communication, was identified by the US national Cancer Institute as follows: to increase the intended audience’s knowledge and awareness of health issues, problems, or solutions; to influence perceptions, beliefs, and attitudes that may change social norms; to prompt action; to demonstrate or illustrate healthy skills; to reinforce knowledge, attitudes, or behaviour; to show the benefit of behaviour

change; advocate a position on a health issue or policy; to increase demand or support for health services; to refute myths and misconceptions; and to strengthen organizational relationships (Green & Tones, 2010).

Effective health communication relies on timely, reliable, evidence-based, and appropriate information. How do we assess whether health communication is a success or failure? Neuhauser & Kreps (2010) propose that health communication is more effective when people can relate it to their social or life context. Tailored communication is more effective than generic messages and interactive communication is more effectual than one-way communication. Furthermore, Wurzbach (2004) identifies four methods to evaluate community health education and promotion, the first of which involves using 'Formative Evaluation' to maximise the chance of programme success before starting the activity. The second is using a 'Process Evaluation' to examine the procedures and tasks involved in implementing the programme, while the third involves using an 'Outcome Evaluation' to obtain the descriptive data for the project, and the fourth and final method entails the use of an 'Impact Evaluation' to focus on the resulting improvement in the health status. In addition, Dansky *et al*. (2006) identify different dimensions of eHealth evaluation that need to be considered, such as design methods, technical challenges, processing environment, administrative concerns and evaluation methodology. When taking a comprehensive view of the above scholars' opinions, it would appear that an effective mode of health communication focuses on the purpose of the application, technical requirements, target audience, evaluation methodology, and intervention outcome. All of these

concerns will be integrated into this research to provide a holistic framework for the design and implementation of healthcare projects.

2.1.1 Health Intervention

What is health intervention? Rychetnik *et al.* (2002) indicate that an intervention is defined as a set of actions with a coherent objective to bring about change or produce identifiable outcomes. These actions may include policy, regulatory initiatives, single strategy projects or multicomponent programmes. The important contextual characteristics of public health intervention might include factors in the political and organisational environment and socioeconomic or demographic features of the population. What are the objectives of health intervention? Sheridan *et al*. (2011) emphasise certain objectives of health intervention for low-literate patients, namely to improve the use of healthcare services, to improve health outcomes, to decrease the cost of care, and to reduce the disparity in the use of healthcare services and/or health outcomes among different racial, ethnic, cultural, or age groups .

How can the influence of health intervention be improved? Campbell et al. (2007) provide some key tasks for optimising health intervention as follows: identify the key processes and outcomes of intervention; identify mechanisms by which intervention will lead to an improved outcome; identify barriers to the application of intervention; quantify the potential benefit and estimate the likely

effect of size; refine the target group to take account of its likelihood of responding to the intervention; consider the best achievable combination of intervention components and intensities. Glasziou *et al.* (2010) also provide some study protocols with appropriate expertise to improve health intervention: examine the “contents” including all the constituent components, materials, resources and their quality; observe the people who delivered the intervention, including their expertise, additional training, and support; note where the intervention was delivered, namely, the setting; note how and when the intervention was delivered, such as the intensity, frequency, and duration of schedule, and the interaction with users; examine the degree of flexibility permitted, including options and decision points.

Most past studies have examined the effect of intervention on health knowledge or behavioural change, whereas few have explored various types of intervention, such as brochures, videotapes, computerised tools, or oral presentation. No research to date has investigated if interventions can affect health care costs or health disparities based on race, ethnicity, culture, or age (DeWalt *et al.*, 2004). Thousands of health interventions fail to go beyond the trial stage because the published report of the intervention trial often focuses on the results, but fails to describe the intervention in sufficient detail (Glasziou, *et al.*, 2008; Chalmers & Glasziou, 2009). This is unnecessary waste and can be systematically remedied. In order to determine the types of intervention that may be most effective for users with low literacy, this study provides a holistic framework for improving health intervention using various methodologies, including development, experiment, observation, comparison,

and analysis.

2.1.2 Doctor-patient Communication

Good doctor–patient communication is critical for the successful treatment and care of patients. Nevertheless, some common obstacles to hamper doctor-patient communication need to be cleared. For example, Hubley & Copeman (2008) indicate that one-to-one communication can easily break down when it is enacted in a noisy place. The patient may not really trust the health educator, the doctor may use medical jargon and give too much information, or the health educator may give advice that is irrelevant or impossible to put into practice. Schillinger (2001) also mentions that the communication barriers between physicians and low-literate patients includes the providers have no follow-up plan to check the maintenance of mediation, the patients lack of timeliness of visit in relation to disease-specific problem, the variation in providers' communication content and styles, and the complexity of patients' recall and reporting of fluctuations in their health status. Sufficient time to understand different culture, perceptions, beliefs and values is the key to result in successful doctor-patient communication.

What are the basic concerns to improve the doctor-patient relationship? Alsos *et al.* (2012) mention that successful collaboration and communication between physicians and patients has three components, namely, face-to-face communication, non-verbal communication and visible action. Ni *et al.* (2011,

p3338) also point out three components of problem-solving counselling need to be considered as follows (1) Information-seeking: where doctors collect information to establish a diagnosis; (2) Documentation: where doctors record symptoms, diagnosis and treatment decisions; and (3) Patient education: where doctors impart medical information to the patient. To date, the way to increase the quality of doctor-patient communication can be carried out through a video or an audio recording in order to understand patients' true inner thoughts, and scholars could verify the realism and results of the simulation by means of individual in-depth interviews and a qualitative analysis of the conversation around clinics.

However, during face-to-face consultations in clinics, low-literate patients often have difficulty in recalling the information and explanations given by doctors. Therefore, Doak *et al.* (1998, p162) suggest some strategies to improve clinician-patient communication in clinic as follows: "(1) Verbal patient communication strategies, such as providing an agenda, limiting new information to the key points needed now, focusing on behaviour and actions, dividing long lists, presenting the context before the new information, using examples with pictures, sketches, models and visuals, and obtaining feedback from the patient to verify comprehension; (2) Written patient communication strategies, such as writing the patient's name on the cover, underlining the key points, tailoring the message according to the content, structure and specific image to individuals' characteristics, referring to illustrations to reinforce written information, and asking questions to verify patients' comprehension." In order to explore the problems usually encountered by immigrant mothers in

the clinic, a focus group interview and questionnaire survey will be conducted in chapter6. Identifying these problems and incorporating solutions may effectively improve the doctor-patient relationship within immigrant populations.

2.2 Health Communication with Minority Ethnic Populations

2.2.1 Racial/ethnic and Cultural Disparities

Healthcare disparities based on race and ethnicity still exist in many developed countries. For example, African American men and Latinos frequently have serious comorbidities, such as cardiovascular disease, diabetes mellitus, and metabolic syndrome. The variability of race/ethnicity, socioeconomic status, language, healthcare-seeking behaviours, and cultural beliefs and practices influence the treatment resulting in unequal treatment or inferior quality of health care (Martinez *et al.*, 2008). Immigrants disproportionately suffer from heart attacks, cancer, diabetes, strokes, HIV/AIDS, and many other serious diseases. These health risks demand effective health communication to help immigrants recognize, minimize, and respond effectively to potential health problems. Yet, immigrants often have significant language and health literacy difficulties, which are further exacerbated by cultural barriers and economic challenges to accessing and making sense of relevant health information (Kreps & Sparks, 2008). At these times, healthcare media plays an important role in bridging the gap between physicians and patients if it succeeds in providing the appropriate culturally-

sensitive practices to meet the needs of immigrant populations.

How can the cross-cultural communication between physicians and patients be improved? Campos (2006) conducted a comprehensive literature review to explore the ways to improve health outcomes for specific patients with diabetes mellitus (DM) from Hispanic/Latino populations. The findings showed that a better understanding of cultural differences and their impact on health care could influence how clinicians treat their minority patients with DM, leading to effective interventions that may help patients better manage their DM and narrow the cultural divide in DM care. Moreover, Jones-Caballero *et al.* (2007) stress that social and cultural factors such as body image, educational level, fears, general family integration and support, health literary, language, myths, and nutritional preferences, among others, might affect the success of the physician patient relationship and influence patients' adherence to treatment. Specific strategies to enable clinicians to communicate with culturally-diverse populations may include being aware of patients' educational level, asking questions about their personal goals, ascertaining what behaviour they have adopted from mainstream culture, and understanding the strength of family ties.

2.2.2 Language and Literacy Barriers

Language barriers may supersede the limited health literacy of a minority ethnic population in impeding their interactive communication with physicians.

For example, Sudore *et al.* (2009) attempted to explore whether the effect of health literacy (HL) on patient–physician communication varies with patient–physician language concordance and communication type. Three types of patient–physician communication, such as receptive communication (physician to patient); proactive communication (patient to physician); and interactive, bidirectional communication were rated by 771 participants. The result showed that poor patient–physician communication, due to HL and language barriers, contributed to poor healthcare quality and health disparities. Furthermore, Neuhauser & Kreps (2008) examined whether online cancer communication met the literacy, cultural, and linguistic needs of non-English-speaking populations. They conducted a comprehensive review of English-language online literature, selected books and policy documents related to literacy, cultural, and linguistic factors in health and cancer communication. The negative results showed that health providers should guide vulnerable patients to better websites, and supplement that information with oral and tailored communication.

To date, there are some websites which deliver medical and health information on a wide range of subjects with links especially aimed at low literacy audiences, such as “Medline Plus” which contains some materials for low-literate audiences, such as “Easy to read”, “Interactive Tutorials”, and “Low Vision”, but there is no online indication of the reading level. On the other hand, several websites are attempting to adapt current computer-based programmes tailored for low literacy ethnic minority populations. For example, “Ethnomed” provides health information in a variety of languages aimed at

specific ethnic groups, such as Spanish, Chinese, Russian, Japanese, and Cambodian, but text occupies almost the whole layout, which may increase users' cognition load and mislead patients' treatment decisions.

2.2.3 Reducing Healthcare Disparities

Rapidly shifting immigration trends pose a real challenge for healthcare. Numbers of new immigrants are forced to seek health information in a non-native language and navigate significant culture barriers. What are the healthcare disparities of race/ethnicity of minority ethnic populations? Institute of Medicine (2002) advocate these vulnerable populations are often confused and misinformed about health care services, early detection guidelines, disease prevention practices, treatment strategies and the correct use of prescription drugs. Bierman *et al.* (1998) mention three issues to be considered for reducing healthcare disparities of minority ethnic populations as follows: the problems to access health care system, the structural barriers within the system, and the ability of the provider to address patients' needs. Smaje (1995) proposed three key issues related to the healthcare of minority ethnic populations required more sustained analytical attention: namely, a theoretically-informed empirical research to understand their difficulties and needs; a need to disentangle the various mechanisms underlying ethnic patterns in health experience; and a wider discussion about appropriate policies to improve their health and consider how such policies can be systematically implemented.

What are the effective ways to help these vulnerable populations to improve their health? Cooper *et al.* (2002) suggest that improving cross-cultural communication between primary care physicians and patients and providing patients with access to a diverse group of physicians may lead to more patient involvement in care, higher levels of patient satisfaction, and better health outcomes. Campos (2006) declares that many Hispanic/Latino individuals with diabetes mellitus lacked access to adequate health care because of their cultural divide. They recommend that providing interpreters, hiring bilingual staff members, and becoming more familiar with the cultural factors could reduce racial and ethnic disparities. Johnson *et al.* (2004) indicate that racial and ethnic minority respondents are more likely to perceive bias and lack of cultural competence when seeking treatment in the health care system than whites. Future studies should use validated measures of providers and health system cultural competences that incorporate patients' perspective. Coffman (2010) points out that improving the health literacy of immigrants, enhancing the cultural competence of clinicians, and increasing knowledge about minority health issues can help avoid ineffective non-traditional methods of treatment.

When taking a comprehensive view of the above scholars' opinions, the healthcare disparities of immigrant population include low literacy and language barriers to communicate with clinicians, poor ability to access health care media, and poor skills to navigate the health care information. Low literacy is more than just the inability to read and write. Individuals' health

literacy skills and capacities are mediated by their gender, age, education, income, residence, race, ethnicity, culture, religion, etc. (Andersen, 2008). The way to help immigrants with low literacy to improve their health might include enhancing the cultural competence of clinicians, improving the health literacy of immigrants, providing interpreters during face-to-face consultation and the most important way is improving the quality of healthcare media.

2.3 Immigrants' Healthcare in Taiwan

2.3.1 Immigrants' Mothers in Taiwan

Most of the immigrant mothers in Taiwan come from Southeast Asia, and 90% of them are Vietnamese and Chinese (Lin & Xiao, 2007). Problems involving these immigrant mothers in Taiwan have increased in recent years. These include social maladjustment, marital discord, domestic violence, and child-rearing difficulties. In particular, low literacy is associated with a variety of adverse social problems among immigrant populations (Xia, 2003). In order to cater for these immigrant mothers' health, the Taipei City Government set up a 'Eugenics and Health Services Centre for brides from Foreign Countries and Mainland China' at Taipei Municipal Women and Children's Hospital in 2003, while Taichung City Government also established 'Designated Outpatient Services for Pregnant Immigrants' at Taichung Municipal Hospital in 2005. Due to the growing importance of immigrant mothers, recent years have seen increased attention being given to healthcare issues. Not only do service centres provide educational leaflets in different language editions, such as

Vietnamese, Thai, and Indonesian, but they also recruit volunteer interpreters who have lived in Taiwan for years to provide a translation service for immigrant mothers consulting physicians. Yet, these considerate policies do not seem to be practicable for a minority of new immigrants, racks of health information leaflets in clinics are often ignored and it is proving hard to implement a training programme for volunteer interpreters (Chen *et al.*, 2007).

2.3.2 Immigrants' Children in Taiwan

According to the Ministry of Education in Taiwan, the number of immigrant children is growing by 10% every year and it is estimated that, by 2014, one in seven students in elementary school will be the child of an immigrant mother. Since their mothers are almost all new immigrants from south-east Asia, they are called 'New Taiwanese Sons'. These children mainly come from low-income families, and usually their fathers are burdened by disease and low social status, while their mothers have a low level of education and suffer from the language barrier (Hung, 2005).

Due to the growing importance of 'New Taiwanese Sons', there has recently been an increase in the research devoted to this population. For example, Wu (2005) indicates that immigrant women tend to have a greater number of underweight births than non-immigrant women. Low birth weight (LBW) is the most significant determinant of neonatal mortality and morbidity, and this may continue throughout life. Hung (2005) investigated whether or not the father's health status was significantly associated with that of the child, and found that

moderately ill Taiwanese men are more likely to marry women from Southeast Asia, while seriously ill men are more likely to find their spouses in Mainland China. Children of ill fathers relatively tend to suffer from delayed development, disability and critical illnesses. Jhuang (2008) conducted a cross-sectional research to survey a total of 7,574 immigrant mothers with children under 12 years old in terms of the children's injuries, and the results showed that falls (46.67%) were the leading cause of the unintentional injury of foreign spouses' children, followed by trauma (38.32%), choking (3.35%), and drowning or poisoning (0.69%). Fu (2009) tried to understand the nutritional condition, diet and of the children of immigrant mothers. He conducted face-to-face interviews with 60 families with mothers from Mainland China and Southeast Asia and children between the ages of 4 and 6 living in southern areas of Taiwan. The study found that the children's gender, their parents' educational background, and the father's age all had an apparent influence on the amount of nutrients the children took. The frequency of food intake, the father's educational background and age, the mother's age, and the family income all caused apparent differences in the children's diet. In addition, Chen *et al.* (2009) explored the medical services and social supporting network for immigrant mothers in Taizhong and Yunlin County, and found that many immigrant mothers were in dire need of health education. They suggest that the entire process of health education should include pregnancy, childbirth, and the nursing of the baby. Low literacy also significantly affects the effectiveness of health education, so it would be better to provide immigrant mothers with a graphic explanation rather than a literal description.

2.3.3 Children's Allergies in Taiwan

Recent surveys indicate that more than 20% of children in Taiwan suffer from allergies. Atopic dermatitis, allergic rhinitis, and bronchial asthma are the most common child allergic diseases in Taiwan (Zhou & Wu, 2012).Therefore; this study will focus on the transfer of healthcare information related to these three diseases. Atopy is one of the most common immune disorders underlying atopic dermatitis (AD), allergic conjunctivitis (AC), allergic rhinitis (AR), and bronchial asthma (BA) (Tomida *et al.*, 2002). Among these prevalent allergic diseases, literature related to healthcare information about AD and BA is much represented. AD is a chronic inflammatory skin disease which occurs mainly in childhood, and it is a pervasive health problem in developed countries. Even though it has been reported that the incidence of AD in children is closely linked to the prevalence of AD in their parents, in fact, a variety of environmental factors, such as environmental pollutants and microbial infection, are also implicated in the increased occurrence of AD (Abramowitz, 2005; Von Mutius, 2000). On the other hand, asthma is a chronic disease that causes coughing, wheezing, and breathlessness resulting from a complex interplay between environmental exposure and genetics. It has been reported that there are more than 22 million asthmatics in the US, 30% of them are children. It is the most common reason for childhood hospitalisation which affects an estimated 5-10% of children at ages 0-18. Especially, the national prevalence rate of asthma has exceeded 20% in certain low-income populations (Clark *et al.*, 2002; Wu *et al.*, 2007; Hong,

2010).

A quarter of low-income children in the United States are members of immigrant families, and these children are in worse physical health than those from non-immigrant families and use healthcare services significantly less frequently. This is because children from lower income families are more than 5 times likely than children from higher income families to lack health insurance coverage and are almost twice as likely to lack the usual sources of sick care (Huang *et al.*, 2006). Children with chronic diseases are highly dependent on their parents for the management of their health care. However, ways to design effective children's health promotional platform to enhance parents' cognition, promote their active processing, and increase their frequency of interaction, is still at an early stage of development.

2.4 Chapter Summary

The healthcare disparities of immigrant populations can be discussed via three aspects of concern that require more sustained analytical attention. These can be classified as being the problem of low literacy, the impact of cultural disparities, and the effect of language barriers, as detailed in Figure 3. The problems caused by low literacy include the capacity to obtain, process, understand and apply health information. Family, language, education, religion, wealth, image, metaphors, myths and nutritional preferences may be culturally sensitive factors for an immigrant population. Language barriers

have been associated with poor doctor-patient communication, poor description interpretation, poor medication instruction, and poor self-management, which have resulted in poor health-related outcomes, such as frequent hospitalisation, poor adherence, medication errors, preventive failure, and weak navigation. Identifying the characteristics of low-literate users that influence their ability to learn about health information and incorporating solutions into a health education intervention may help to bridge the learning gap related to their level of literacy.

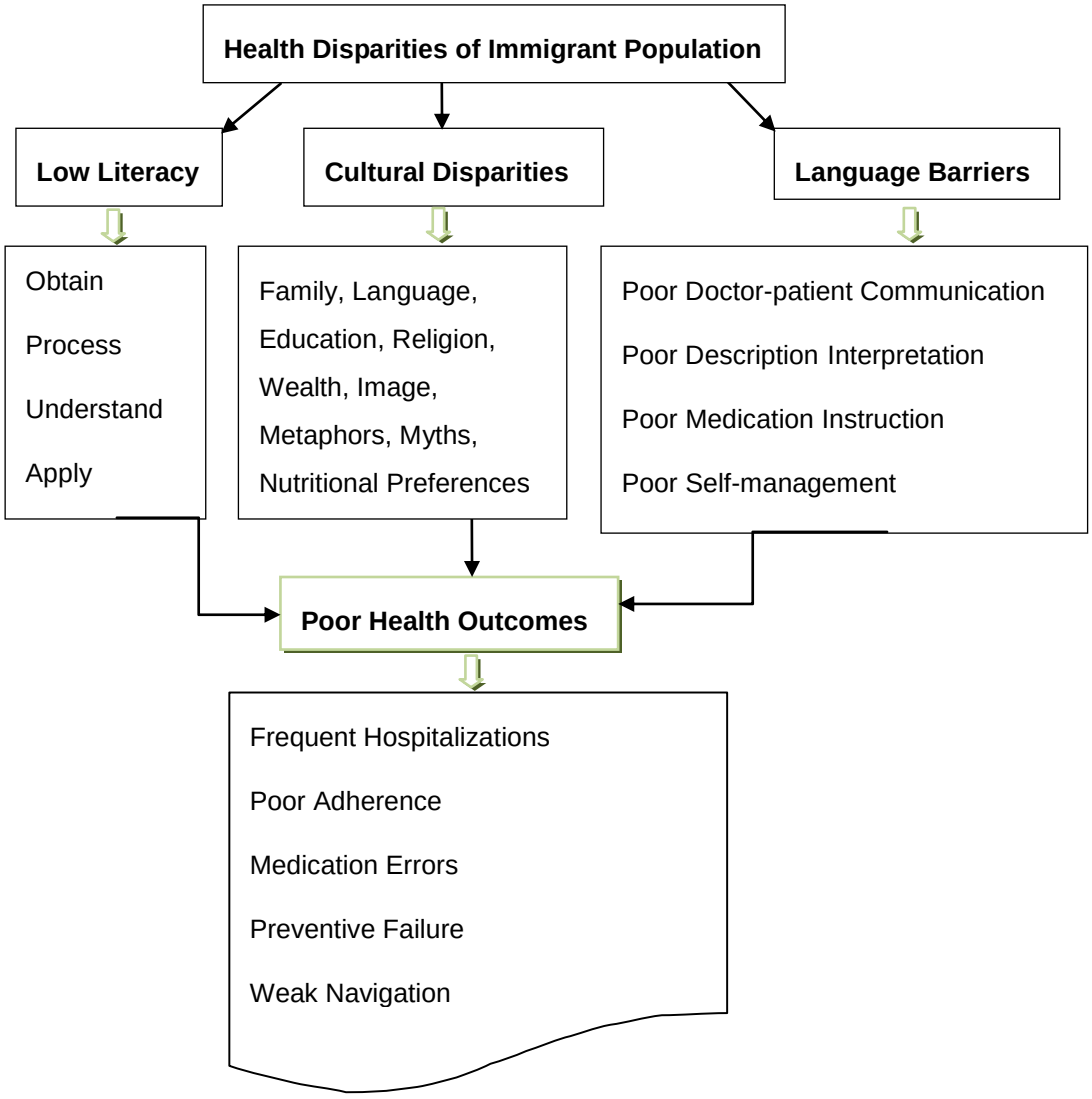


Figure 3 Health disparities of immigrant population

Chapter 3 Development and Assessment of Healthcare Media

3.1 The Fundamental Concerns for Designing Healthcare

The development of successful healthcare media needs to undergo three procedures, namely, planning, testing, and reviewing. At the planning stage, developers need to determine the purpose, decide the material, identify the audience, plan the distribution, and develop a timeline for the project (Maine Health, 2010). Developers also need to determine the need for a health education resource, determine the type of resource, establish appropriate content and design characteristics, and develop a distribution and marketing plan (The Ministry of Health of New Zealand, 2002). At the testing stage, developers need to adopt guidelines from the planning stage to develop the material, obtain feedback from clinicians, consult with the marketing/community relations department, and test materials with consumers (Maine Health, 2010). Developers also need to check the national and local policies, examine the technical accuracy, explore the educational appropriateness, check for cultural appropriateness, and considerate the advertising standards codes (The Ministry of Health of New Zealand, 2002). At reviewing stage, developers have to submit the material to the appropriate committee for review and recommendations, send material to marketing/community relations department for review and proofreading (Maine Health, 2010). Developers also need to plan the pre-test of the draft

version of the resource, send a preproduction copy of the resource to the Ministry of Health to ask approval, commence distribution and marketing undertake the level of evaluation appropriate to the resource, and write a report on the development, production and distribution of the resource (The Ministry of Health of New Zealand, 2002).The above is an organisational framework for effective healthcare material design, which proposes the fundamental concerns and sequential key steps that incorporate the planning, financial, cultural and practical issues that need to be considered when developing healthcare media.

3.1.1 Health Information Technology

What is health information technology (HIT)? The Robert Woods Johnson Foundation (2006) interprets HIT as being the use of a variety of electronic methods for managing information about the health and medical care of individuals and groups of patients, which could improve the quality and delivery of care. Bisantz *et al.* (2011) indicate that HIT tasks include disease registries, clinical support, computerised order entry, electronic health records, electronic prescriptions, exchange of health information, personal health records, interoperability, and telehealth. Fotheringham et al. (2000) point out that HIT can be used to relay information, enable informed decision-making, promote healthy behaviours including preventive screening, promote emotional or social support, promote self-care and risk reduction, manage demand for health services, and facilitate communication. In brief, HIT is a

powerful means to improve the health care system by reducing costs, increasing patient safety and improving quality of care.

The success of the HIT is the guarantee of an effective healthcare medium. However, how to assess health information technology (HIT) in health communication a success or a failure? Skinner *et al.* (1997) indicate the fundamental concerns to combine information technology in promoting health-related behaviour change effectively as follows: the nature of the target health problem, the processes of behaviour change, the interactive computer technologies and communication strategies, and how to combine them to create an effective health promotion program for the population of internet. Moreover, Rippen *et al.* (2012) depict five evaluation phases of HIT, which include implementation, process evaluation, impact evaluation, system evaluation, and outcome evaluation. Yusof *et al.* (2008, p392) also address some evaluation criteria for health information systems as follows: “(1) System quality: data accuracy, data currency, database contents, ease of use, ease of learning, availability, usefulness of system features and functions, flexibility, reliability, technical support, security, efficiency, resource utilization, response time and turnaround time; (2) Information quality: importance, relevance, usefulness, legibility, format, accuracy, conciseness, completeness, reliability, timeliness and data entry methods; (3) service quality: quick responsiveness, assurance, empathy, follow up service and technical support.”

Health information technology can act as a translator to bridge the gap between the doctors and patients. However, significant numbers of people

have been excluded from the benefits of digital technology, such as older and disabled people and other minority groups, because they are either scared of it and/or do not think they will ever be able to use it. This has been called the 'Digital Divide' (Newell, 2011). To date, HIT is increasingly being used and studied for its role in information transfer and healthcare delivery for paediatric patients in community and home care settings. A good developing model of children's health could reduce health care costs and improve the quality of life across children's life span. Yet, ways to help patients with low literacy and digital divide to look after their children by applying healthcare media are at early stage.

Development, Implementation and Assessment of Health Information Technology

With the advent of the digital age, methods of transmitting health information have changed from being passive to interactive and even with patients taking the initiative. Past studies related to health information technology were more concerned with issues related to development, implementation and assessment (Skinner *et al*., 1997; Rippen *et al*., 2012; Yusof *et al*., 2008), which are summarised in Figure 4. From the perspective of development, the key issues emphasised by former researchers included four procedures, namely, system design, content design, interface design, and process design. From the perspective of implementation, the methods previous researchers used for practical prototypes may have been a combination of experimental methodology, analytical methodology, before-after observation, and pre-post

comparison. From the perspective of assessment, the evaluation phases of health information technology may have been derived from four areas, namely, technological evaluation, organisation evaluation, environmental evaluation, and outcome evaluation.

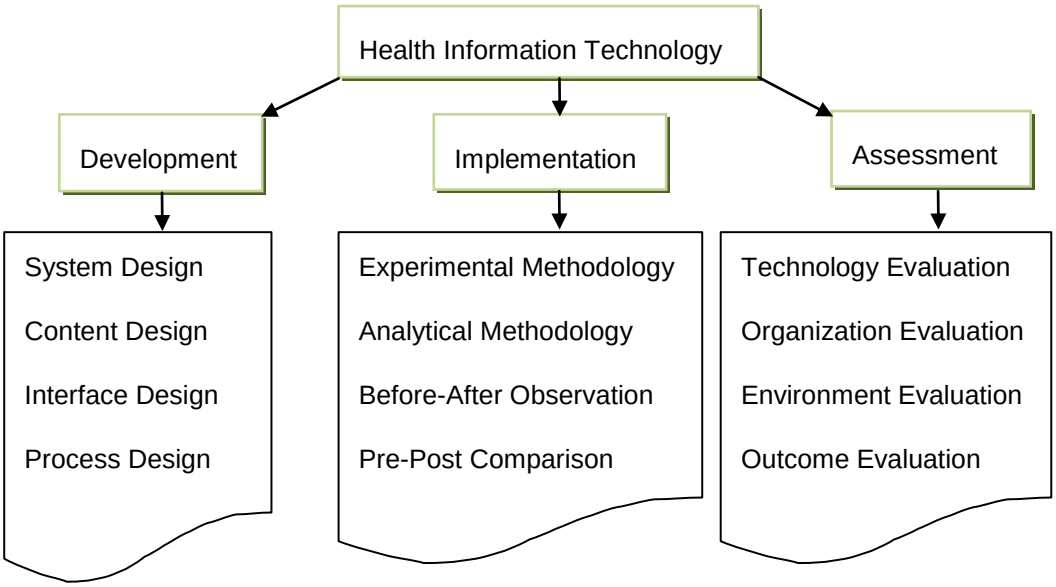


Figure 4 Develop, implement, and assess the health information technology

3.1.2 Visual Appeal in Healthcare

Recent studies indicate that visual appeal might serve as a powerful method for the delivery of health information. For example, Doak *et al.* (1996) investigated whether a message showed with visuals and graphics is better than a message showed with sound. The results showed that the memory systems in the brain favour visual storage and visual presentations have been shown to be 43 per cent more persuasive than unaided presentations. Furthermore, Brotherstone *et al.* (2006) explored the effectiveness of visual

illustrations in improving people's understanding of the preventive aim of Flexible Sigmoidoscopy (FS) screening. They recruited 318 older people to attend FS screening and randomly allocated them to receive written information alone, or written information plus illustrations. The findings confirmed that pictorial illustrations resulted in significantly better understanding. In addition, Schapira & Nattinger (2006) evaluated the effect of elements of commonly used graphic formats on perceptions of risk magnitude and perceive truth of data. They administered face to face survey with 254 female patients who were diverse in race, education, and income. The findings depicted that elements of graphic format might have unintended yet predictable effects on the interpretation of likelihood information. The use of numeric terms and graphic displays may increase the specificity of information provided but also may introduce format effects on risk perceptions.

Low-literate users may have different preferences from high-literate users in terms of visualisation, what are the underlying factors of visual design that need to be considered for users with lower literacy? Houts *et al.* (2006) reviewed the journals in health education, psychology, education, and marketing to assess how information combining pictures with spoken or written text affects health communication. Four aspects of health communication including attention, comprehension, recall, and intention/adherence were discussed. The findings showed that pictures provided significant benefits with all patients, but patients with low literacy skills are especially likely to benefit. Because pictures could increase their attention; pictures can improve their comprehension and pictures could

change their adherence to health instructions. Moreover, Choi & Bakken (2010) indicate that using concrete and realistic pictures and pictographs with clear captions will maximise the benefit of visuals. Nevertheless, one emerging theme is simplicity in design (e.g., limited use of colours, one font type and size), content (e.g., avoid lengthy text), and technical features (e.g., limited use of pop-ups).They also suggest that future designs of low-literacy interfaces should include a careful selection of icons and visual images. These should be more realistic than abstracts, and closely resemble the intended meaning of the visuals. In addition, Rajwan & Kim (2010) indicate the following perspectives to make use of visualisation to support patient-provider health communication, which includes physical and biological aspects of the participants; language, literacy, numeracy, and graphic encoding and decoding; shared mental models and common ground; concordance in the understanding by the participants. They also suggest some consideration for supporting patient cognition regarding medical decisions, such as the patient's ability to use visualisation techniques and tools, the patient's ability to perceive, encode and decode information as it is presented, the patient's ability to interpret visualised information in a way that is correct and consistent with care goals, and the patient's ability to make decisions based on interpreted data in an informed fashion.

On the contrary, Newell (2011) didn't agree with the visual contribution for learning and declares that the very high level of abandonment of assistive technology products may provide poor aesthetics for presentation. Because he believes older and disabled people are entirely motivated by the

functionality of products and have little or no aesthetic sense. Therefore, novel and beautiful concepts need not be considered when designing for older and disabled people, and the design team can exclusively focus on the ergonomic and technical aspects of the product. Moreover, Liu *et al.* (2009) used methods of eye-tracking to compare how young and older adults read and comprehended healthcare texts with illustrations or without illustrations. Young and older adults were randomly assigned to read health-related texts alone or texts accompanied by explanatory illustrations. The results showed that neither young nor older adults appear to benefit from explanatory illustrations accompanying health-related texts. However, older adults appear to have difficulty understanding the illustrations as well as integrating the illustrations with the text. They declared that health practitioners, writers, and editors should not assume that illustrations will increase older adults' comprehension of health information. Previous studies appear to have found contradictory results in terms of the visual appeal of healthcare materials; therefore, additional studies are needed to identify the visual factors that most influence audiences' ability to learn about health information. Identifying these factors and incorporating solutions into a health intervention may help to bridge the gap between health information providers and receivers.

3.1.3 Visual Factors of Healthcare Media

What are the visual factors of healthcare media that might affect users' satisfaction? Frascara (2004) indicates that "graphic design" as a term is more

descriptive and appropriate than “visual communication”, because it encompasses various creative aspects related to the following issues: perceptual message, cultural recognition, source collection, publication organisation, aesthetic styles, broadcasting media, technical quality, and written and spoken language. Arntson (2003) also suggests that designers should apply the following principles of visual perception to practice visual communication: information perception, a dynamic balance, good gestalt, usage of text types, layout styles, illustration and photography in design, advertising design, and designing with colour. Ambrose & Harris (2009) stress that graphic design is a multidisciplinary process that draws on many creative sources, including industrialisation, technology, typography, consumerism, identity and branding, social responsibility, modernism and post-modernism, nostalgia and rhetoric, semiotics, and the vernacular. Dabner *et al.* (2010) points out that the fundamental components of graphic design are positive and negative space, form & space, symmetry & asymmetry, basic principles of layout, style of layout, pace and contrast, size and format, coordination and identity, and photography and illustration. When taking a comprehensive view of the above scholars’ opinions, it would appear that the fundamental components of graphic design within healthcare materials cover diverse disciplines ranging from message presentation to aesthetic style, creative concept, layout arrangement, typography design, colour contrast, cultural recognition, advertising strategy and photography and illustration.

In terms of aesthetic styles, various graphic design styles have changed with the development of the industrial civilisation and commercial art from the

Victorian era to the present. These include Victorian, Arts and Crafts, Art Nouveau, Early Modern, Art Deco, American kitchen, Late modern, Late Modern, Swiss/ International, Psychedelia, Contemporary, Post-Modern and Digital (Heller & Chwast, 2011). In terms of creative concepts, although advertising strategies involve a constant search for a new and innovative way to express sales appeal, there are also some creative formats that have worked over the years; for example, creative concepts that involve straightforward approaches, comparison, scene from daily life, humour, and celebrity may attract attention, stimulate interest, and foster audiences' positive mood (Altstiel & Grow, 2010; Moriarty *et al.*, 2012; Fill *et al.*, 2013). In terms of layout design, a good arrangement of graphic elements, such as headlines, sub-headings, pictures, branding, etc. will achieve a smooth flow of information and eye movement for maximum effectiveness or impact. A visual structure of repetition, rhythm, pattern, series, sequence, balance, symmetry, and movement are probably the most common layout arrangements (Frascara, 2004); In terms of typography design, a typeface has aesthetically powerful impacts and is varied in colour, form, and spacing. It is better to use a suitable font size to improve the readability of the content and different styles and forms of typeface to organise the content better and make it easier to understand (Ambrose & Harris, 2009; Dabner *et al.*, 2010). Furthermore, according to Yee (2008, pp. 98-99), the global skills of typography represent four communication functions, and each category highlights a different set of skills and knowledge related to each of those functions, as follows: (1) Typographic Form: the visual appearance and aesthetic quality of letter form and type; (2) Typographic Content: the various ways type is used for different

purposes; (3) Typographic Expression: how typography is used to generate and communicate phonetic and ideographic meanings; (4) Typographic Context: the internal and external context of typography. The aforementioned visual factors were considered for higher literacy users rather than lower literacy users. Whether low-literate users have different preference for visual design will be explored through further experiments.

In terms of colour scheme, it is crucial for designers to remember that bright colours are excellent for attracting attention; contrast value is the key to legibility. The psychology of colour may evoke emotional feeling, and the symbolic meanings of colours provoke an immediate association with synaesthesia. (Dabner *et al.*, 2010; Sherin, 2012); In terms of illustrations, there are many ways to visually represent an idea, object, person, or place can be used to evoke audiences' interesting, but the picture has to be well-composed, with a fashionable concept, designed in a good tonal range, and matching the aims of the title (Dabner, 2010; Sherin, 2012). In terms of the cultural issue, how can the gap of cross-cultural communication be bridged in order to appropriately deliver the desired message to the audience? Liquori (2011) indicates that designers need to consider a wide range of features, such as language, symbol, image, colours, and navigational ways of reading. Since each culture has its own unique way of constructing sentences, sharing icons, matching images, associating colours and navigating reading, how can culturally-competent interventions be incorporated into the delivery of healthcare information? Bernal *et al.* (1995) maintain that linguistically-appropriate, individual backgrounds, incorporating symbols, culture-specific

knowledge, research goals, specific procedures, and health problems may be the culturally sensitive factors that need to be considered when designing treatment interventions. All the aforementioned visual factors were considered in order to justify the choice of a sample as a test scenario for further semi-structured interviews to identify the visual factors of healthcare media that affect low-literate users' satisfaction.

3.2 The Evaluation Categories for Assessing Healthcare

How can healthcare media be assessed as being a success or failure? What kinds of evaluation categories are applicable for assessing the quality of healthcare media? From the perspective of content design, the Health On the Net Foundation (HON, 2011) indicate that the qualifications of the authors and the attribution should be clearly cited, the personal data submitted to the site by the visitor should be kept completely confidential and the advertising should be clearly distinguishable from editorial content. Doak *et al.* (1994) propose that the purpose should be explicitly stated in the title, on the cover, or in the introduction; the contents should aim at desirable reader behaviour rather than simply quoting facts; the scope should be limited to essential information that patients can reasonably learn in the time allowed; the text reading level should be 5th-grade or lower; the writing style should be conversational with a service voice; the vocabulary should consist of common words whereas words of technical, conceptual, categorical and value judgement must be explained with examples; and the logic, language, and

experience should be similar to the target culture. Kerr *et al.* (2008) maintain that the content should provide comprehensive and wide-ranging information; the quantity and depth of the data should be managed to include up-to-date and accurate information; and the external links should provide sufficient and trustworthy information without commercial advertising. Hung & Stones (2011) stress that articles published in healthcare media should clearly denote the authoritative organisation and advertising should be clearly distinguishable from the editorial content. They also believe that users can learn more effectively from divided sections rather than complete information and can also learn more effectively when the words are presented in a conversational rather than a formal style.

From the perspective of the appearance of the design, Doak *et al.* (1994) suggest that the illustrations should be simple, familiar, and appropriate to present key messages to adults; the images and examples presented in the instructions should be realistic and positive; lists, tables, graphs, charts and geometric forms should be accompanied by an explanation; the layout should be designed with adequate white space and a high contrast between the typeface and paper; the type size should be at least 12 point and the number of fonts should be limited to aid the reading. Kerr *et al.* (2008) recommend making services easier to distinguish from each other visually; using more pictures to break up the sections of text; showing all the main topics at a glance and only listing the most relevant documents of any one topic; and re-designing the home-page with a simplified layout and matching images could make the presentation more appealing. Hung & Stones (2011) point out that

the appearance of the website should be aesthetic to attract the attention of potential users and the style of the subject, colour and background of a page should be designed consistently to avoid users getting lost. They also believe that users learn more effectively from metaphorical signs rather than explanatory text and they also learn more effectively when printed words are placed near to corresponding pictures.

From the perspective of the usability of the design, Doak *et al.* (1994) stress that viewers should be asked to resolve problems, make choices, demonstrate through interaction; that the desired behavioural patterns should be modelled with familiar instances; and readers' motivation should be enhanced by being somewhat successful in understanding or resolving a problem. Kerr *et al.* (2008) suggest that improving the sensitivity of the search function, enhancing the book-marking service to more easily return to the information, using the topic structure and keywords to help users to find specific information rather than embedding hyperlinks in sections of text to make navigation easy, and displaying dictionary definitions under topic names before listing relevant information could make it easier to find the relevant content. Hsu & Chang (2007) observe that user-friendliness, clear links, fast feedback, easy interactive function, an easy to control, multi-search path and reduction of search time are the basic concerns of an operating interface. Hung & Stones (2011) claim that the link buttons should be clearly presented to guide users, the content should download quickly and recover efficiently after users' interaction, the website should provide a discussion area for users to communicate with each other, and the website should cooperate with the

related medical institutions or hospitals to provide professional health consultations on-line. All the aforementioned concerns about healthcare media design will serve as a reference to design further usability testing media.

3.3 Paper-based Healthcare Media & Web-based Healthcare Media

Paper-based Healthcare Media

Leaflets are probably the most popular educational materials, because they are relatively inexpensive to create and easy to carry. For example, Frederikson & Bull (1995) investigated whether or not the impact of leaflets really encouraged patients to adopt a more thoughtful and prepared approach toward consulting their doctor. 80 patients consulting a single doctor at normal surgeries were randomly divided into two groups. Patients in the experimental group were given specific leaflets before the consultation, while those in the control group consulted the doctor directly. The results showed that there were clear differences between the control and experimental groups in terms of the proportion of consultations being perceived as containing good, average and poor communication. However, the sample size was relatively small and the use of a single doctor seriously limited the generalisability of the findings. Moreover, Steele *et al.* (2011) developed and evaluated health information leaflets to promote public awareness of the link between lifestyle and cancer. They made use of feedback from the general public, healthcare

practitioners and design professionals by means of focus groups, questionnaires and semi-structured interviews to design newly-developed leaflets. Therefore, they conducted usability surveys and awareness tests to compare the attractiveness and effectiveness of the newly-developed leaflets and existing standard leaflets. The result showed that both of the leaflets increased awareness of the link between lifestyle and cancer but participants expected the healthcare leaflets to be more usable as well as legible and comprehensible.

Printed health education resources have been identified as being one of the most influential media for improving the quality of healthcare. Patients can bring them home and reread them to remind themselves of key points if they are too shy to ask in the clinic. The use of paper-based media to promote health in developed countries is widespread. (Paul & Redman, 1997; Frazer & Smith, 1997; Harvey, *et al.*, 2000). However, they provide no feedback only one-way communication and are nor tailored for specific audience. Racks of health information brochures in clinics are still ignored by patients and these account for much of the government's annual budget for health promotion (Kreuter *et al.*, 2010).

Web-based Healthcare Media

What is eHealth? *"e-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related*

*technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology." (*Eysenbach, 2001) "The term of e-health describes a range of information and communication technologies that are used to provide healthcare, such as Internet or computer-based technologies, telemedicine, remote patient monitoring, electronic health records, and videoconferencing." (Morrison *et al.*, 2012, p137)

A recent telephone survey by Pew Research Centre found that 61% of American internet users search for health information online, and 60% say the information found online affect a decision about how to treat an illness or condition (Fox & Jones, 2009). What are the motivations for people to search health information online? The Pew Internet & American life Project carried out a survey of 500 internet users who go for healthcare information and the results are detailed below: 93% look for information about a particular illness or condition, 65% look for information about nutrition, exercise, or weight control, 64% looked for information about prescription drugs, 55% gather information before visiting a doctor, 48% look for information about alternative or experimental treatments or medicines, 39% look for information about a mental health issue such as depression or anxiety, 33% look for information about a sensitive health topic that is difficult to talk about, and 32% look for information about a particular doctor or hospital (Fox and Rainie, 2001). Websites, which can combine text, pictures, audio, and video, seem to be

easier to enhance the interest of audience, but whether or not their versatile presentations affect low-literate patients' health knowledge is not yet known.

Indeed, navigating health information online leads users to look for a second opinion or ask their physician new questions, which leads to new dialogue and improved shared decision-making between patients and physicians. Nevertheless, could eHealth really alter patients' health behaviour and even change their treatment decisions? Jan *et al.* (2007) attempted to explore the different healthcare outcome between an Internet-based asthma monitoring program and a traditional clinic-based patient educational program. 164 paediatric patients with persistent asthma were enrolled and randomized into two study groups for a 12-week controlled trial. The intervention groups were taught to monitor their peak expiratory flows and asthma symptoms daily on the Internet, whereas the control group received a traditional asthma care plan consisting of a written asthma diary supplemented with instructions for self-management. The results showed that the intervention group performed significantly better than the control group. Moreover, Strecher *et al.* (2008) tried to determine whether engagement in web-based smoking cessation program content influence long-term outcomes and explore what particular components of a web-based smoking cessation program influence engagement. They used a randomized trial to recruit 1866 smokers to examine the efficacy of different treatment components on a web-based smoking cessation intervention, such as high-versus low-personalized message source, high-versus low-tailored outcome expectation, efficacy expectation, and success story messages. The findings showed participants

who are younger, male, or have less formal education are more unlikely to engage in web-based program, particularly when the program sections are delivered sequentially over time. This study is a reminder that knowledge about the source of the message, the degree of message tailoring and the timing of exposure are all important factors that influence online intervention.

In particular, individuals with chronic diseases make relatively high use of the internet to obtain health information for self-management. Especially, population in poorer health and in lower income need to use the Internet for social networking and for obtaining health care support (Rice, 2006; Atkinson *et al.*, 2009; Kerr *et al.*, 2010). To date, a plenty of eHealth had been created for helping patients' self-management of chronic diseases. However, despite the fact that eHealth has several advantages, including low cost, a wide reach, potential for targeting audiences, the ability to be tailored to individuals, and the capability to improve the relationship between patient and physician, low-income, low-literacy, and technologically-challenged populations cannot really benefit from it, since most of them suffer from a digital divide. Thus, the challenge is how to provide the right people with the right knowledge in the right form and at the right time via an accessible, applicable and affordable web-based self-management programme.

3.4 Comparative Analysis of Various Types of Healthcare Media

3.4.1 Leaflets VS. Websites

There has been much research undertaken in health-based media interventions in the past decade, most of which focused on the educational effectiveness of paper-based and web-based media. For example, Jan *et al.* (2007) attempted to determine whether or not a web-based multimedia asthma educational and monitoring programme would improve the knowledge and health status of children and caregivers. The results showed that the adherence rates of therapeutic and diagnostic monitoring, the global assessment of asthma control, the knowledge of asthma self-management, and the quality of life of caregivers were all significantly higher in the intervention group. Moreover, Yardley *et al.* (2010) conducted two in-depth qualitative studies to compare the effectiveness of paper-media and web-based media for providing medical care for flu. The results showed that users often felt overwhelmed by the quantity of information provided in paper-based media, and they wanted to have greater control of how information is accessed in web-based media. Since paper-based media are typically created for the general population, they do not really consider the specific characteristics of prospective consumers. On the contrary, web-based media is based upon the principle of “market segmentation” which aims to find a specific group of consumers for a particular product or service (Richards *et al.*, 1998) Indeed, targeted information is well suited to meet the needs of targeted populations. Compared to the function of one-size-fits-all paper-based media, web-based media can tailor information which applies to people

with similar characteristics, allowing interventions to effectively target high-risk groups (Ahern *et al.*, 2010).

With the advancement of IT technology, can computer-based media completely replace paper-based media on the work processes in daily clinical care? Even though simple medium-portability can be achieved through contemporary handheld computer devices such as mobile phones, PDAs, tablets, etc., paper-based media still seem to play an essential role in clinical work. Paper based patient records help form cognitive tools that reduce clinicians' reliance on memory, and support joint attention and collaboration (Bang & Timpka, 2003; Bardram & Bossen, 2005; Dahl & Svanas, 2008). Paper might also reduce extraneous processing and promote germane processing compared with dynamic animations, whereas web-based media might split the attention, increase the cognitive load, and reduce the transfer of learning compared with static illustration (Jan *et al.*, 2007; Yardley et al., 2010). However, most health care educators hold the same view, which is to simplify the descriptive text within healthcare media and increase visual elements (Rajwan & Kim, 2010; Choi & Bakken, 2010). The advantages and disadvantages of using a leaflet or website to promote healthcare are discussed below.

	Leaflet	**Website**
1	Static Media	Dynamic media
2	Portable	Portable but expensive (smart phone)
3	Initially inexpensive	Initially expensive

4	One-way communication	Interactive communication
5	One-size-fits-all	Tailor target users
6	General population	Market segmentation
7	No IT skills needed	Basic skills needed
8	No feedback	Allow feedback

Table 1 Leaflet VS. Website

3.4.2 Leaflet VS. Video

Leaflets with static pictures can be used to facilitate patients' understanding of health information, whereas a video with active images can be used to attract more patients' attention. For example, Meade *et al.* (1994) investigated whether printed or videotaped information was more effective in enhancing the healthcare knowledge of colon cancer among individuals with limited reading skills. The findings showed that there was no significant difference between the influence of the design intervention made by the booklet and videotape, as well as the demographic information, such as age, race, and sex. Furthermore, Leiner *et al.* (2004) compared the educational effectiveness of a non-illustrated leaflet and a video tape of animated cartoons for transmitting a health message for polio vaccinations. The results showed that using marketing and advertising techniques to design an animated cartoon was more effective in delivering the message than the same information provided in written instructions. In addition, Hung & Li (2012) compared the influence of leaflets and videos which were designed to deliver knowledge to low-literate mothers about taking care of their new-born babies, and the findings showed that the performance of the video group was much worse

than that of the leaflet group. This was because the video tended to divide the audiences' attention and increase their cognitive load so that they lost the key message.

Compared with dynamic videos, the advantages of leaflets are easy to read repeatedly, easy to carry home, cheap to make at the start and the user can control the speed. However, the benefit of its one-size-fits-all approach varies from person to person. On the contrary, video which combine audio and visual effect and convey information through brief narration, which may somewhat reduce the anxiety levels and enhance the interest of audience, but whether or not their versatile presentations affect low-literacy patients' health-related behaviour is not yet known. The advantages and disadvantages of using a leaflet or video to promote healthcare are further discussed below.

	Leaflet	**Video**
1	Static images	Active images
2	Visual elements	Audio and visual effect
3	Long text content	Brief narration
4	Easy to read repeatedly	Shown too quickly
5	A clear column type	Narration is difficult to understand
6	User's own control	Without user's own control
7	No facilities needed	Basic facilities needed
8	Cheap to make at the start	Expensive to start

Table 2 Leaflet VS. Video

3.4.3 Single-media VS. Multimedia

With multimedia technology, the media presentation can be produced in a very interesting, entertaining, and lifelike manner. However, does multimedia perform better than one single-media on knowledge learning? Schär & Kaiser (2006) compared the effect of single-media and multimedia presentations on the knowledge of audiences. They investigated the learning principles of multimedia by measuring acquired knowledge and tested the effect of cognitive load induced by various media combinations. Finally, they suggested that the effect of multimedia must be evaluated with regard to the learning goals rather than depending on the representation with verbal and visual media. Furthermore, Bhowmick *et al.* (2007) evaluated the effectiveness of different multimedia combinations, namely: text; audio and synchronized text; audio, video and synchronized text, for procedural-based tasks to support web-based learning for a senior-level production, planning and control course. Data were collected on performance, process and subjective measures. The findings showed that an easy-to-use system did not imply an efficient learning system, because user performance was dependent on the type of multimedia combination and the type of learning task in terms of complexity. The above observation showed that multimedia itself is not necessarily for either performance or process efficiency. Multimedia may perform better than a single medium for delivering knowledge to high-literate users, but whether multimedia has the same impact on low-literate users is questionable. The advantages and disadvantages of using a single medium or multimedia to promote healthcare are discussed below.

	Single-media	**Multimedia**
1	Basic facilities	High functionality

2	Low cost	High cost
3	Simple presentation	Potentially complicated presentation
4	One path learning	Multi-way learning
5	Sensory limited	Sensory vividness
6	Easily portable	Not easily portable (Except smart phone)
7	Single way	Interactive way
8	Easy to access	Difficulty to access

Table 3 Single-media VS. Multimedia

3.5 Chapter Summary

When designers develop a healthcare medium, they focus on certain concerns; for example, what health information needs to be included in the content? How can they deliver and present the health information? Where can patients obtain the information they need? Who is the target audience? How can health intervention be assessed as being a success or failure? Generally speaking, the causation, symptoms, treatment and prevention of various kinds of diseases are the most popular content of healthcare media. The written, spoken, and visual forms are discussed for information presentation, and paper-based media, video-based media, and web-based media are considered for information transmission in the early stages of design. Demographic factors, health literacy, and access to technology are the key factors that need to be identified, whereas health knowledge, behavioural change, and health outcomes are the key evaluating criteria to assess the achievement of health intervention. The above broad range of issues provides a framework for healthcare media design, as shown in Figure 5.

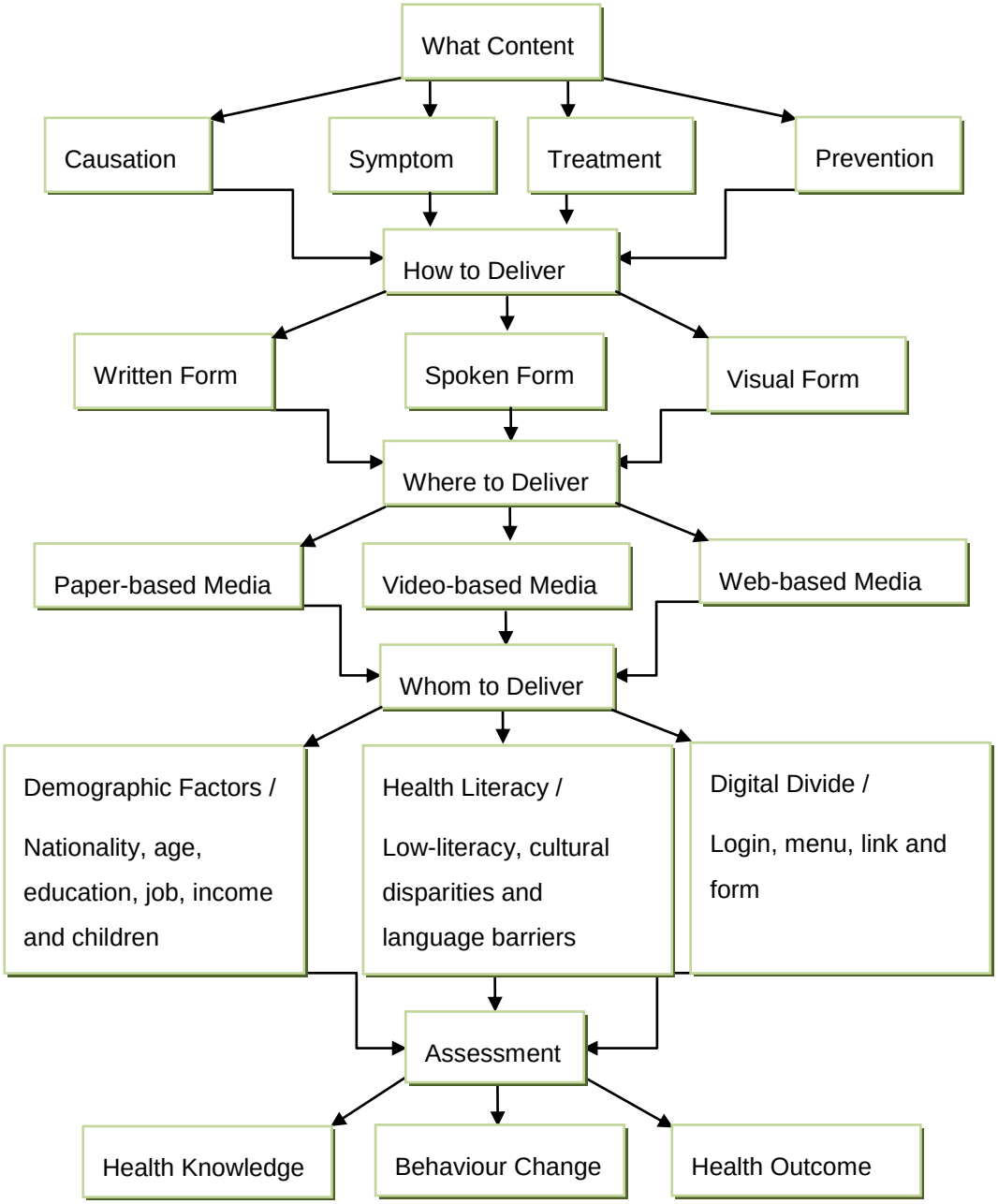


Figure 5 The flowchart of healthcare media design

When audiences access a healthcare medium, they always have some concerns such as, is the delivery platform accessible? Is the health information credible? Is the text understandable? Is the operating interface applicable? Is the media affordable? Past studies related to the evaluation criteria of healthcare media can be analysed in terms of four categories,

namely formative evaluation, process evaluation, outcome evaluation and impact evaluation, which are summarised in Figure 6. A formative evaluation is used to investigate the criteria of target audience, attractive appearance, useful information, clear appeal, readable content, maintenance management, advertising policy, and cultural competence. A process evaluation is used to examine the criteria of easy navigation, user-friendly interface, user control, consistency and standards, recovery from errors, media effect, cognitive load, clear links, and fast feedback, while an outcome evaluation is undertaken to explore the criteria of increased health knowledge, change in healthcare behaviour, and improved health outcomes, and an impact evaluation assesses the criteria of arranging follow-up, reaffirming action, reducing hospitalisation rates, strong adherence, successful medication, and successful prevention. What is achieved from the above will serve as a reference for evaluating successful healthcare media.

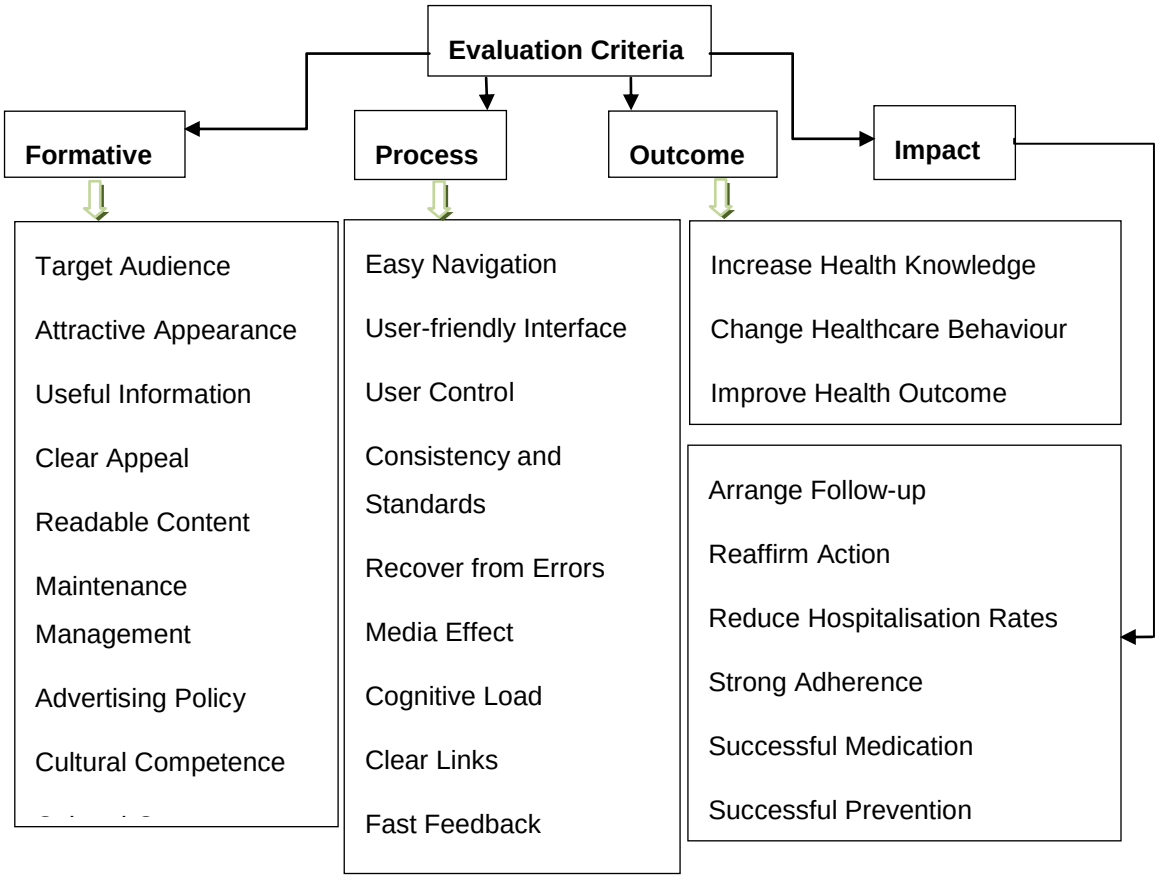


Figure 6 The evaluation criteria of healthcare media (based on Wurzbach, 2004; Hung & Stones, 2011)

Chapter 4 Low-literate Health Education

4.1 Health Literacy

What is Health Literacy?

What is health Literacy? “Health literacy is the individuals’ capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions and follow instructions for treatment” (Institute of Medicine, 2004). “Health literacy is the ability to use complex literacy skills in health-related circumstances and environments to help prevent, manage and treat health conditions” (American Medical Association Foundation, 2008). “Health literacy is the ability to understand and interpret the meaning of health information in written, spoken or digital form and how this motivates people to embrace or disregard actions relating to health”(Adams *et al.*, 2009). “Health literacy is the degree to which individuals have the capacity to read and comprehend health-related print material, identify and interpret information presented in graphical format (charts, graphs and tables), and perform arithmetic operations in order to make appropriate health and care decisions” (Yost *et al.*, 2009).

What problems does low literacy cause? Sudore *et al.* (2009) point out patients with limited health literacy always show their poor comprehension of physicians’ instructions, they are shy to ask questions within the clinical

encounter, and more often report poor satisfaction with patient–physician communication. Bankson (2009) mentions that low health literacy has been associated with poor health-related outcomes, which include higher hospitalization rates, poor adherence to prescribed treatment and self-care regimens, and increase medication or treatment errors. Choi & Bakken (2010) stress that low-literate users fail to seek preventive care, and they lack the skills needed to navigate the health care system. They have disproportionately high rates of diseases and mortality and increased use of emergency rooms for primary care. Olives *et al.* (2010) declare that people with low literacy skills understand less healthcare advice and are less likely to take timely action to reduce their health risks. Understanding patients' health literacy in relation to behavioural risk factors is an important goal in the prevention and detection of chronic diseases.

There are numerous people with low health literacy in the world. For example, Elliott *et al.* (2007) indicates that more than 90 million people have a literacy level rated as 'basic' or 'below basic'. Sudore *et al.* (2009) indicate that 90 million Americans have limited literacy and 21 million have limited English proficiency. Kodagoda *et al.* (2012) stress that 16% (5.2 million) of the population were classified as low-literate in the United Kingdom, which is defined as having reading and comprehension levels that are below secondary school level. The vulnerable populations of older people, immigrants, those who with limited education, and unstable housing were associated with limited health literacy. However, ways to help various populations with low literacy to improve their health outcome are still at an

early stage of development. Past studies related to the causes and results of low health literacy are summarised in Figure 7.

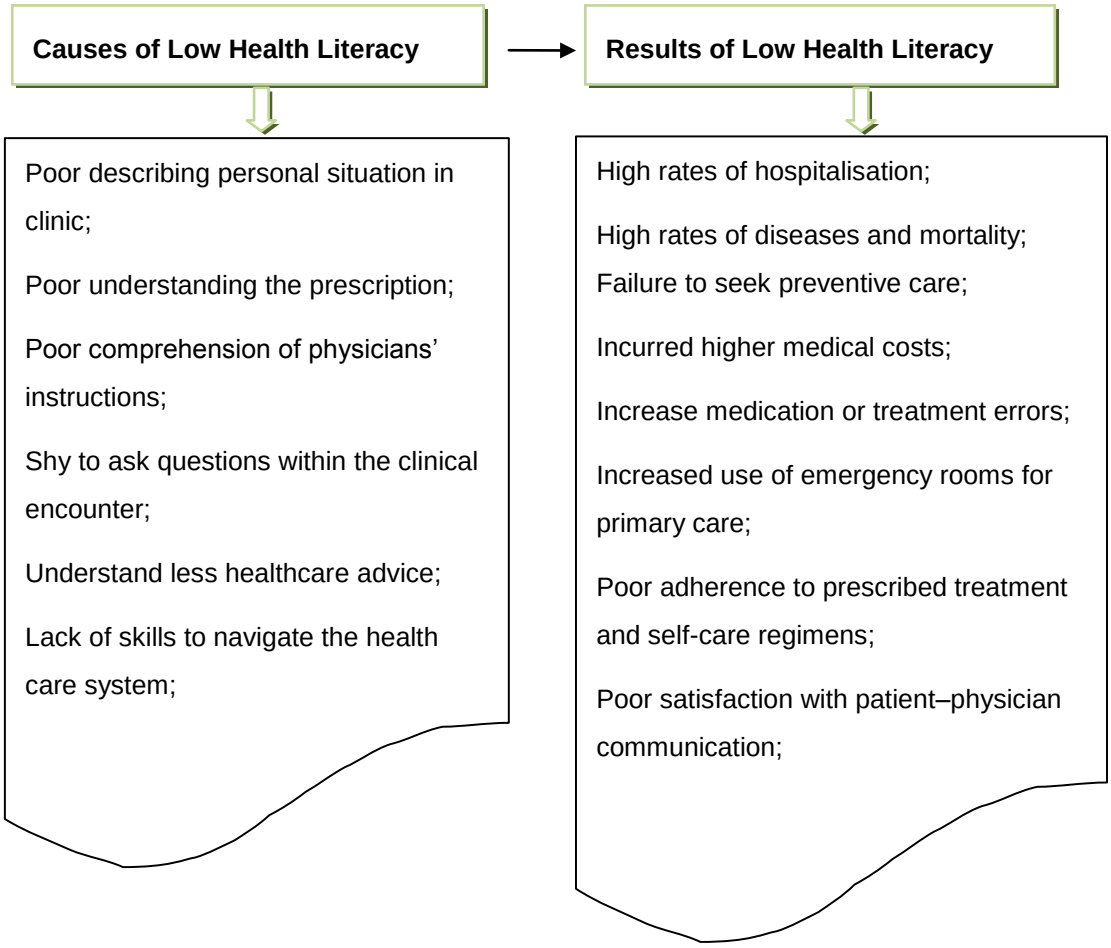


Figure 7 Causes and results of low health literacy

4.2 The Problem of Parental Health Literacy

The problems of health literacy might be the obstacle for parents to manage their children's health. For example, DeWalt *et al.* (2007) tried to determine whether or not parental literacy is related to emergency department visits, hospitalisations, and days of school missed for children with asthma. They performed a retrospective cohort study at a university paediatric clinic and

enrolled 150 children who were diagnosed with asthma, and their parents. The results show that parents with low literacy have less asthma-related knowledge, and their children are more likely to have moderate or severe persistent asthma and had greater use of rescue medications. Furthermore, Shone *et al.* (2009) explored the role of parent health literacy among urban children with asthma. They found that parents with limited health literacy worried more and perceived a greater overall burden from the child's asthma, even though reported health care use did not vary. They also suggest that enhancing parents' understanding and providing parents with information about child asthma can reduce the parent-perceived asthma burden, alleviate parents' worry, and improve their quality of life. In addition, Kumar *et al.* (2010) developed and validated a new parental health literacy scale, the Parental Health Literacy Activities Test (PHLAT) to assess parental health literacy and numeracy skills in understanding instructions for infants caring with182 caregivers. The results showed that many parents did not understand common health information required caring for their infants, and the PHLAT had good reliability and validity to serve as useful tools for identifying parents who need better communication of health-related instructions.

Parents are increasingly making use of e-Health to look after their children. However, do existing health websites provide readable and reliable information they need? Mackert *et al.* (2009) conducted a series of focus groups interview with low literacy and culturally diverse parents to learn more about the challenges low-health-literate parents face with eHealth. The findings showed that some of them avoided .edu or .gov websites because

such websites were viewed as too complex and that some parents had expressed a lack of trust in government websites. To explore the Internet access and use patterns among low-income parents whose children have special health care needs, Knapp *et al.* (2011) performed an across-sectional telephone survey of 2371 low-income parents whose children with special health care needs. The results showed that parents who were African American, non-English speaking, older, and not college graduates were less likely to use the Internet than their referent groups. About 74% of Internet users reported that they knew how to find health information for their children. However, 50% of these parents reported that they were unable to distinguish between high and low quality information and were not confident in using information accessed online to make health decisions. Sabo & Lorenzen (2008) believe the barriers to parents to access e-Health include wide variability in Web site quality, low health literacy, and literacy levels, and a growing number of immigrants who did not speak English. They reviewed recent studies and surveyed existing websites to discuss the advantages of providing parents with filtered Web sites. Finally, they provided an annotated list of websites on health aspects of autism and recommended that librarians and health professionals should provide readable and reliable health care information through trustworthy websites from government, health organizations, and autism-related groups.

How to help low-health-literate parents to look after their allergic children by applying healthcare media? In order to educate asthmatic children and their parents about the triggers that may cause asthma attacks or worsen the

symptoms, Hong *et al.* (2010) aimed to create an interactive adventure game for tracking asthma triggers to improve the self-management skills of paediatric asthma. By interviewing healthcare workers and families with asthmatic children, they proposed the following developing concern: help community health workers to provide education and support for behavioural change and resources to effectively control triggers; help parents to control environmental asthma triggers and minimise children's exposure to indoor triggers; support children's experimental learning about asthma triggers in real-world environments. The results demonstrated that computer game could be a fun activity to improve children's learning of healthcare knowledge because most children today have grown up in the midst of computers and gaming. Parents of children with special health care needs are likely to have a greater impetus to seek health information compared with those whose children do not have special health care needs. Quality of care in paediatrics is vital for many children from families with a low socio-economic status.

4.3 Higher Literacy Users VS. Lower Literacy Users

Studies which compare the difference between higher literacy users and lower literacy users in health communication have been comparatively rare during the past decade. There has only been sporadic research into comparative studies of the different behaviour of higher literacy users and lower literacy users in searching for information, such as the difference between the reading and navigational strategies of high literacy users and those with lower literacy

skills (Summers and Summers, 2005; Meyanathan *et al.*, 2012), and the differences in information-seeking behavioural strategies between low and high literacy users (Kodagoda & Wong, 2008 ; Kodagoda *et al.*, 2009).

Unlike their higher literacy counterparts, lower literacy readers may read most or all of the words in an instruction and still understand few points or derive no meaning from the text. Doak *et al.* (1996) explored the difference between the reading behaviour and managing ability of skilled and poor readers and suggested the following strategies to help health practitioners to manage these literacy problems:

Skilled Readers	Poor Readers	Manage the Problems
Interpret meanings	Take words literally	Explain the meaning
Read with fluency	Read slowly, missing the meaning	Use common words and examples
Get help for uncommon words	Skip over the words	Use examples, review
Grasp the context	Misunderstand the context	Explain context first using visuals
Persistent readers	Tire quickly	Shore segments, easy layout

Table 4 The different reading behaviour and managing ability between skilled readers and poor readers (Doak *et al.*, 1996, p4)

The skill in searching for information is significantly different between higher literacy and lower literacy users. Skilled readers scan the relevant information quickly and resume the search task, whereas poor readers read word-for-word slowly and tend to give up searching in a short time. Meyanathan *et al.* (2012) summarised the great contrast between the reading experience and

navigating behaviour of skilled readers and less skilled readers in the following table:

	Skilled Readers	**Less Skilled Readers**
Reading Web Pages	Can quickly scan text and visuals to find essential ideas.	Re-read each word carefully or skip over most information and visuals, especially if the website offers lengthy navigation options.
Scrolling	Can scan and scroll through text and go below the "fold" to the next page or computer screen.	Find it difficult to scan the text. Can lose visual concentration when scrolling down.
Searching	Can enter search words accurately and make sense of search results, including those that present shortened or chopped text.	Have difficulty spelling search words and interpreting search results.
Attention Span	Attention span is sufficiently long to scan, scroll, and search text	Shorter attention span, leading to a quick decision to stop reading and close the page.

Table 5 The contrast between the reading experience and navigating behaviour of skilled readers and less skilled readers (Meyanathan *et al.*, 2012, p4)

What are the weaknesses of low literacy that hinder users when searching for information? Lower literacy users took eight times longer than higher literacy users to complete an information search task, spent one-third more time on a web page than higher literacy users, visited eight times more web pages in total than higher literacy users in their search for the specific information they needed, used the browser's back button 13 times more frequently than higher literacy users, and were 13 times more likely to become lost than higher literacy users (Kodagoda & Wong, 2008). Moreover, Kodagoda *et al.* (2009)

investigated the differences between the information-seeking behavioural strategies of lower and higher literacy users of an on-line social service system. Ten volunteers enrolled in the study, five of whom were classified as having high literacy, while the other five were classified as having low literacy. All the participants were asked to think aloud while undertaking the information search using the “Advice guide” website. The following table shows the results of the investigation:

	High- Literate Users	**Low-literate Users**
Verification	Had 100% verification for medium and difficult levels	Did not verify the correctness of the information found
Reading	Performed a 100% scan of information on easy and medium-difficult levels	Did not scan information at all, but read it word by word
Recovery	Identified incorrect or irrelevant information at medium and difficult levels, and were able to recover from a mistake.	Were unable to identify incorrect or irrelevant information in the easy and medium levels, and were unable to recover from a mistake.
Trajectories	Presented 100% similar trajectories at the easy level	Showed dissimilar trajectories, except for only 40% of the time if the task was easy.
Abandon	Did not abandon their search. Were able to find the necessary information	Showed a higher tendency to give up the search. Were unable to find the necessary information

Table 6: The differences between the online information-seeking behavioural strategies of lower and higher literacy users (based on Kodagoda *et al.*, 2009)

Based on a review of relevant literature, the reading strategies, information-seeking behaviour, and interface design needs of higher and lower literacy

users are significantly different. It is essential to train health providers to deliver care information which is sensitive to the needs of diverse individuals with varying degrees of health literacy. However, most past studies seem to have two major limitations, one of which is the use of small probability sampling, while the other is the literacy level of participants. It was difficult to recruit participants because of the long duration of testing, while some feedback from the questionnaire may have been distorted because of literacy issues. Any small change in the data may have influenced the results because of the small sample size. Thus, it is important to analyse and validate a larger sample size. Future studies need to recruit a larger sample size and incorporate solutions to literacy issues in order to effectively optimise health intervention.

4.4 Development and Evaluation of Healthcare Media for Low-literate Users

The research related to the development and evaluation of healthcare media for low-literate users has grown dramatically in the past decade. In term of paper-based media, Kripalani *et al.* (2007) conducted a randomised controlled trial to explore the difficulties and needs of low-literate patient in healthcare materials. The results showed that almost all the patients declare that it was difficult to understand prescription drug labels and other medication instructions and considered an illustrated medication schedule might be a useful and easily understood tool to assist with medication management.

Furthermore, Shaw (2009) recruited 321 patients at an in-patient cardiology unit to examine the readability of healthcare leaflet. The findings showed that 22% of the patients interviewed were found to have a low level of literacy. Many of them felt that the health information on the leaflets should be written in plain language. There is a broad gap between patients and leaflets, because most of the existing educational leaflets do not consider both internal content and external presentation.

In terms of video-based Media, Ross *et al.* (2010) evaluated the applicability of a video intervention to promote informed decision-making for prostate cancer screening. By means of a pre-post knowledge test across participants' demographic and health literacy characteristics, the result showed that the video intervention had a positive outcome among African American men intervention. Moreover, Maxwell *et al.* (2010) evaluated the feasibility of video intervention to deliver breast health education for Chinese American women. The findings show that the video intervention increased their healthcare knowledge and positively influenced their attitudes and cultural beliefs regarding mammographic screening, because 44 per cent of the participants reported having received a mammogram within 6 months after the video intervention. In addition, Banda *et al.* (2012) developed and evaluated a culturally-targeted video designed to impact six specific attitudes of African American cancer patients toward therapeutic trials. The study showed that changing a patient's intention or willingness to participate in a trial is a crucial step toward improving healthcare behaviour. Indeed, the preference for visual processing and learning approaches has been noted as being a contributory

factor to the success of video interventions. However, whether voice-over instructions or narration hinder or enhance video intervention for low-literate immigrants is a question still to be answered.

In terms of web-based media, Houston *et al.* (2006) developed and evaluated an easy-to-use interface website for training community health advisors (CHAs), who were identified as having come from low income, ethnic minority communities. After 12 months of follow-up focus groups and pre-post surveys, they found that the curriculum helped low-literate users to access the Internet, search for health information, and evaluate the quality of online health information; however, the CHAs reported that the threshold of a digital-divide and lack of portability prevented them from successfully accessing web-based healthcare media. Andersen *et al.* (2008) created an adaptive web-based kiosk system to deliver appropriate information about stopping smoking to low-literate Hispanics (Mexican- Americans), and the results verified that simplicity was the key to eHealth design and cultural and linguistic healthcare information magnified the impact of poor health practices on this population. Robinson & Graham (2010) investigated whether a brief computer and Internet eHealth class could improve health outcomes, which they measured by increased medication adherence rates and the reduced use of emergency services. The findings showed that the confidence of HIV-positive participants with limited computer experience significantly improved in terms of finding and using Internet health information resources. These low-income users may have benefitted from learning what health resources were available on the Internet, where to find health resources on the Internet, and how to

incorporate the new information into their existing knowledge base. When taking a comprehensive view of the aforementioned scholars' opinions, it is evident that the inadequate readability of educational material and the digital-divide prevented low-literate patients from searching for healthcare information via online healthcare media.

In terms of Mobile Devices, Mackert *et al.* (2009) created mobile devices to test the efficacy of mobile-device-based health interventions as a delivery model for low-literate audiences. The results showed that delivering cheaper mobiles loaded with health interventions intended for lower literate audiences could provide crucial health education to developing countries. Furthermore, Medhi *et al.* (2011) developed and tested three prototypes of mobile phone with a text-free interface, such as a spoken dialogue system, a graphical interface, and a live operator. The results showed a live operator was up to ten times more accurate than a text-based interface, and a spoken dialogue system could be used by those who felt more comfortable and familiar with speech. Undoubtedly, smart phone becomes the most potential platform for delivering health information in developing countries. Nevertheless, usability remains a major hurdle for novice and low literacy populations.

4.5 Low-literate Healthcare Media Design

4.5.1 User-centred Healthcare Design

User-centred system design (UCSD) is a design concept that focuses on whether the usability through the entire process meets the end-user's need. Several proposals related to UCSD over the past few years were adopted in this study. For example, Nielson (1993) indicates that representative users should be invited to participate in the entire development process; while Kyng (1995) stresses that the interface design must be easy for target users to understand. Gould *et al*. (1997) point out that an evaluation system should focus on being both interactive and incremental, and ISO (1999) stipulates that the development process should be performed by effective multidisciplinary teams.

"Health message design is an audience-centred process; it is designed primarily to respond to the needs and situation of the target audience, rather than to the needs and situation of the message designers or sponsoring organisations." (Maibach & Parrott, 1995, p.167).

User-centred healthcare design (UCHD) is a kind of co-design, because it is a way of developing and promoting healthcare technologies and services that gives patients control and choice, as well as providing the services they need. UCHD harnesses the creative skills and techniques used by professional designers to help build a healthcare service whereby patients can act as co-producers of their own healthcare (Wright, 2009). The concept of UCHD was applied in this study to drive innovation and improvement in the delivery of

healthcare services to low-literate users, as follows;

4.5.2 Understand Target Audience

Poor Doctor-patient Communication

It is widely recognised that good doctor–patient communication is critical for the successful treatment and care of patients. However, during face-to-face consultations in clinics, patients often have difficulty in recalling the information and explanations given by doctors. Even when supplying written information with quality write-ups, it cannot be guaranteed that the patient will read the material provided (Shaw, 2009; Raiwan & Kim, 2010). Low-literate patients have more problems than high-literate patients in doctor–patient communication. Because they may struggle to describe personal health status, comprehend physicians' instructions, understand medicine prescription and execute mediation administration. This may increase high frequency of using emergency rooms for primary care, disproportionately high rates of diseases and mortality, and poor adherence to prescribed treatment and self-care regimens (Schillinger, 2001; Bankson, 2009; Choi & Bakken, 2010).

Lower Reading Level

Designing lower readability of health educational material to meet specified patients' needs is likely to result in better health outcomes. It seems most health information was written for a reading level beyond 10th grade comprehension. However, 30-50 per cent of the target audience cannot read at this level (Plimpton & Root, 1994). Half the U.S. population reads at the

9th-grade level or lower, but most current health-care instructions are above that level. Even worse, about one in five adult Americans read below the fifth grade level (Doak *et al.*, 1996). According to the first US national health literacy survey by National Center for Education Statistics in 2003, only 12% of the American adult population was able to comprehend all the medical information being provided for prevention and treatment of medical conditions. There is an enormous gap between the reading comprehension level of patients and the readability of patient educational materials.

Different Information-seeking Behaviour

What critical characteristics do low-literate users demonstrate when searching and retrieving information online? They read word-for-word, have a narrow field of focus, skip chunks of text, are easily satisfied by information, skip from link to link, and avoid searching since this requires them to spell (Summers & Summers, 2005). Most of the time, they assume that the information they are looking for is unavailable and abandon the search at an early stage; they never verify the information they find to confirm its correctness and abandon the search early due to being easily satisfied; they are easily confused by long dense pages with anchor links; they have a perception of where information should be on the website, and if it is not, they immediately abandon the search assuming the information is not available (Kodagoda, *et al.*, 2009). These behavioural patterns provoke low-literate users to use different search paths or trajectories. Therefore, a future interface design for low-literate user needs to consider how to reduce their cognition load, extend their searching attention, and improve their use of digital technology.

Different Preferences for Educational Materials

Identifying the different preferences of lower-literate user will help designer to develop more effective health educational materials. Therefore, what underlying factors of design need to be considered for low-literate users? Doak *et al.* (1996, p22) state that “Limiting the objective to what the majority of the target population needs, emphasizing the change of health behaviours and skills rather than facts and examples, presenting the framework or purpose or of the new information before presenting it, dividing instruction into a number of easy-to-understand parts, and making an interaction to lead patient to, write, tell, show, or select something in response to the instruction” Furthermore, Kutner *et al.* (2006) reveal that low-literate adults prefer visual or audio-based health information rather than written text-based sources, such as newspapers, magazines, books or brochures. Burnham (2008) suggests that video tapes and oral communication are recommended for those who fall below the high school reading level. Andersen *et al.* (2008) found out that low-literacy patients prefer images of real people to cartoons and illustrations and dislike the over-use of religious imagery, particularly an inclusion of an image of the God. They recommend developing a dynamic content presentation to provide age-tailored content and to slow users down such as adding sound and animation in the future.

Different Culture-sensitive Factors

Cultural competency is an emerging field in medical practice; however, what are the cultural factors that need to be considered in the adoption and

implementation of health communication? Bernal *et al.* (1995) advocate that language, persons, metaphors, content, concepts, goals, methods, and context may be culturally-sensitive factors that need to be considered when designing treatment interventions. Moreover, Jones-Caballero *et al.* (2007) stress the social and cultural factors, such as body image, educational level, fears, general family integration and support, health literacy, language, myths, and nutritional preferences may influence the success of the doctor-patient communication. In addition, Balasubramanian (2011, p. 71) also identifies four major factors of values and beliefs that have an impact on individuals' healthcare decisions: "(1) age versus wisdom; (2) gender and role expectations; (3) collective versus individual ownership of assets; and (4) belief in end versus means." All the aforementioned cultural factors will be considered to become the coding category for further semi-structured interviews.

Accessibility and the Digital-divide

Removing the technical obstacle for low-literate users to acquire health information will result in better communication. Therefore, what problems are caused by the digital-divide that prevents lower literacy users from accessing healthcare media? Summer *et al.* (2006) indicate the recurring problems when low-literate users interacting with health-related websites includes the inability to begin the login process, the difficulty to generate usernames and passwords, the difficulty to complete forms in the designed order, the difficulties to use dropdown menus, the confusion to recognise field labels, and the tricked feeling over privacy and consent issues. Ishibashi & Nakajima

(2004) believe rather than providing highly valuable telemedicine systems to support high income doctors, a low valuable public health courseware will be far more cost-effective to engage in a project targeting on preventing infectious diseases. Reducing the threshold of digital-divide might enhance the effectiveness of health intervention within public health.

4.5.3 Design Issues of Low-literate Healthcare Media

4.5.3.1 Content Design

Some specific factors of content design that help low-literate audiences to learn best were considered in past studies, the first of which is the use of common words and short sentences in the context. For example, Doak *et al.* (1996) propose that little or no technical jargon in printed healthcare materials would reduce audiences' level of anxiety. Plimpton & Root (2000) stress that too many long words, complex sentences, and technical language or jargon in the content would force audiences to stop reading, while Paul *et al.* (2003) suggests that using more common words and phrases and expressing the content in simple, straightforward language would be welcomed by readers. Summers and Summers (2003) indicate that using short, familiar words and simple sentence structures to provide short, focused annotations for each result would make printed healthcare materials more acceptable to low-literate audiences. The Ministry of Health of New Zealand (2002) also emphasises that using short words and sentences and concrete, not abstract terms, in the content would help audiences to make further inroads into a case, while the

Health Literacy Now Web, a leader in delivering online health literacy information suggests using common words rather than medical jargon to explain complex medical terms to avoid scaring away low-literate audiences.

The second factor of content design is that it should consider the reading comprehension level of patients and the readability of patient educational materials when producing healthcare information. For example, Plimpton & Root (2000) suggest that the designer should identify the characteristics of easy-to-read material and further identify the learning difficulties of poor readers. The Western Cheshire Primary Care Trust in the UK (2007) also suggests that the language should be patient-friendly and the content should be easy to read in order to increase the rate of exposure of printed material. Summers & Summers (2005) suggest that the text should be written at a 6-8th grade reading level with a simple sentence structure to meet low-literate users' specific needs. The Institute of Medicine recommends that health-related information is written at a 6th grade level or below. Davies *et al.* (2011) observe that the average reading comprehension of the general public is 5-6th grade, but there is an enormous gap between the readability of educational media and users' level of comprehension.

The third factor of content design is that the content should describe a specific objective and convey a limited amount of information. For example, Doak *et al.* (1996) maintain that if no more than three to four main points are presented in the contents, this could reduce audiences' cognitive load.

Plimpton & Root (2000) believe that the typical problems in health materials are complex concepts, an overload of information, and an unclear core message. Paul *et al.* (2003) indicates that reducing the amount of text and restricting the information to key points could improve the quality of the content of printed health promotion materials. The Ministry of Health of New Zealand (2002) also emphasises that using direct, strongly worded messages and more concise language and sentences would aid audiences' understanding. Kodagoda *et al.* (2012) point out that the health information on each topic is neither extensive nor does it provide answers to every aspect of the disease entity, thus to prevent users with low-literacy from getting overwhelmed with too much information.

The fourth factor of content design is to put the most important information first in the context. For example, Summers & Summers (2005) indicate that low-literate audiences tend to give up searching in a short time. They suggest putting the most important information first in the context in case low-literate readers give up after reading only part of the text. Meyanathan *et al.* (2012) also express a similar concern and recommend presenting the most important information first when developing printed materials for low-literate patients in e-newsletters or on websites.

The fifth factor of content design is that the content should adopts a vivid and friendly tone and be written in a conversational style, For example, Doak *et al.* (1996) observe that, if the text is vivid and interesting and the writing is in a

conversational style, this makes the materials friendlier. According to Plimpton & Root (2000), an uninviting tone and inappropriate culture or language would be other problem with printed health materials for target audiences. The Ministry of Health of New Zealand (2002) suggests using the active voice and familiar words in the content to attract audiences' attention, while Steele *et al.* (2011) would like to see information presented in sections with a question and answer approach to cause interaction between the media and the audience.

The sixth factor of content design is that desired behavioural changes should be clearly specified. For example, Doak *et al.* (1996) stress that "need to know" information and a summary of "what to do" should be included in the content to anticipate patients' change in behaviour. Plimpton & Root (2000) declare that emphasising the desired behaviour is the most important task for health materials, but this is often ignored by some typical health materials. The Ministry of Health of New Zealand (2002) indicates that providing specific, accurate information about the health risk and emphasising the positive results of preventive behaviour would result in a better outcome.

The seventh factor of content design is that authority and attribution are clearly recorded. For example, Paul *et al.* (2003) indicates that producing supplementary referenced information and providing a contact number for further information could gain audiences' trust. The Ministry of Health of New Zealand (2002) maintains that using an expert, a representative from the target group, or a celebrity to endorse the message would enhance the credibility of the media. The Western Cheshire Primary Care Trust in the UK

(2007) provides a check list to meet the NHS Litigation Authority Risk Management Standards as follows: the NHS logo should be situated at the top right-hand corner of the front page, the title of the leaflet should be displayed on the front page, the department of origin should also be shown on the front page, the web address of the Trust should be on the back page, the date of publication must also be shown on the back page, as well as the copyright notification of the organisation.

The eighth factor of content design is cultural appropriateness. Doak *et al.* (1996) indicate that the material should be culturally, gender, and age-appropriate and should closely match the logic, language, and experience of the intended audience. Plimpton & Root (2000) suggest that designers should consider the applicability of the information to culturally-diverse populations and tailor it to apply to people with similar characteristics. Meyanathan *et al.* (2012) point out that colours used in printed material, e-newsletters, or websites should be culturally appropriate to grab low-literate users' attention, but this is often ignored by some typical health educational media.

4.5.3.2 Appearance Design

Some specific factors of appearance design that help low-literate audiences to learn best were considered by past studies, the first of which is an attractive cover. For example, Doak *et al.* (1996) contend that the cover graphic should be friendly, attracts attention, and clearly portrays the purpose of the leaflet, while Steele *et al.* (2011) suggest that a modern style and eye-catching

colours should be considered when designing a cover for paper-based healthcare. Paul *et al.* (2003) also emphasises that the first task of a good graphic designer of printed materials is to make the cover eye-catching to ensure that people pick them up.

The second issue of appearance design is the use of suitable font size and limited typefaces to improve the readability of the content. For example, Doak *et al.* (1996) mention that font size used on some health care materials are only suitable for those with good eyesight, and they suggest that designers use lower-case letters, a 12-point print size, and no large or stylised initial letters to improve the readability of the content. The Ministry of Health of New Zealand (2002) advise designers to use a simple, easily readable, plain typeface, use less than three different typefaces, and avoid blocks of italics and blocks of uppercase and lower case text for headlines. Summers & Summer (2005) indicate that using a large text size to increase legibility, i.e. 14 pts for a 5-inch text column and using simple page titles in a larger type size can stimulate readers to pay attention to the information of interest. The Western Cheshire Primary Care Trust in the UK (2007) believes that text must be of a 12-point size and an Arial font and blocks of capitalised lettering should not be used for the typeface. Meyanathan *et al.* (2012) suggest that the font size should be at least 12 points, and upper case letters should never be adopted in the context to avoid readers getting lost during reading.

The third issue of appearance design is to use bright colours and adopt a high degree of contrast between the print and the paper. For example, The Ministry of Health of New Zealand (2002) emphasises the importance of using colour rather than just black and white, and using a highly contrasting colour between the print and the background. Steele *et al.* (2011) believe that the lack of colour or even a dull colour scheme will ruin the potentiality of printed material. Doak *et al.* (1996) indicate that some materials have hues of artistic appeal which provide poor contrast to make reading difficult. There should be a high degree of contrast between the print and the paper to increase the readability. Anderson *et al.* (2008) advocate that people with low literacy prefer highly contrasting combinations, particularly black text on a white background. They also suggest that adopting a high degree of contrast between the print and the paper will result in a better outcome.

The fourth issue of appearance design is the use of appropriate visual aids to deliver healthcare information written in unfamiliar terms or complex phrases. For example, Doak *et al.* (1996) mention that most poor readers rely on visuals and the spoken word rather than text, and he recommended designers using simple illustrations, preferably line drawings, to amplify the text. Plimpton & Root (2000) believe that solid print with no illustrations, illustrations that do not fit the message, or cartoon body parts will result in bad feedback from audiences. The Ministry of Health of New Zealand (2002) asks designers to consider using relevant and realistic illustrations and placing them near the relevant text and the Western Cheshire Primary Care Trust in the UK (2007) also stresses that diagrams/pictures should be used to

illustrate concepts where necessary, but the use of clipart should be avoided. Summers & Summers (2005) declare that using information graphics and animations to illustrate processes and relationships are brief concerns for the graphic issue of low-literate healthcare materials. Meyanathan *et al.* (2012) suggest that the visuals should be simple, realistic, and reflect users' local context, that each visual should convey only one message, and the symbols and images used should be familiar to the reader and easily understood.

The fifth issue of appearance design is the use of realistic pictures to assist the audience to recognise the content. For example, Houts *et al.* (2006) stress that pictures can increase low-literate patients' attention, comprehension, recall, and adherence within health communication. However, health educators should minimise the use of distracting details in pictures, but use simple language in conjunction with pictures, and closely link pictures to text and/or captions. Choi & Bakken (2010) mention that low-literate users prefer photographs to clip art because these give more realistic images. They suggest that using concrete and realistic pictures and pictographs with clear captions and in bite-size steps will maximise the benefit of visuals. Anderson *et al.* (2008) point out that most low-literate adults prefer images of real people to cartoons and illustrations in the design of health educational materials. However, they dislike the overt use of religious imagery, particularly the inclusion of an image of the Virgin Mary. Steele *et al.* (2011) believe there should be a minimal use of relevant images; also, negative features such as a high word count and old-fashioned images that split audiences' attention should be avoided.

The sixth issue of appearance design is conveying limited information and using lots of white space in the layout design. For example, Doak et al (1996) indicate that the pages or sections should appear to be uncluttered and have ample white spaces. Paul *et al.* (2003) expects the size of printed health materials to be bigger to gain more space for the layout. Summer & Summer (2003) suggest that sharply limiting the number of results displayed on a page and maintaining a lot of white space will enhance the reader's interest in reading. The Ministry of Health of New Zealand (2002) considers using margins of blank space around text and paragraphs rather than one block of text to avoid vertigo and chaos in the layout. The Western Cheshire Primary Care Trust in the UK (2007) also stresses that text should be in small blocks and there should be some white space in the layout to reduce the reading pressure. Kodagoda *et al.* (2009) point out that a good layout design should reduce lower-literate users' memory load and maintain their attention by presenting less textual information. Meyanathan *et al.* (2012) also consider the layout of health educational materials and suggest that the text and pictures should have "room to breathe", with only a few choices provided in the navigation pane and few links on the page.

The seventh issue of appearance design is that the layout is organised in a clear and logical manner. For example, Doak *et al.* (1996) maintain that providing headers and summaries to show the organisation of the layout and repeating the message would help audiences to understand the whole story. Plimpton & Root (2000) indicate that general problems with the layout include

pages cluttered with too many graphic devices and the organisation of the content not clarified with titles and subtitles. Summer & Summer (2005) indicate that basing the information architecture on “linear information paths” will reduce low-literate users’ cognitive load. The Ministry of Health of New Zealand (2002) suggests using one paragraph per topic, providing headings for paragraphs, using bullet points to break up the text, and number signalling to show the sequential order, while the Western Cheshire Primary Care Trust in the UK (2007) declare that bullet points should be used where necessary and all text should be lined up to the left of the page to provide a logical layout. Choi & Bakken (2010) recommend limiting the interface design to 3 key topics per screen and giving it an ordered format, including steps and lists (bullets). Meyanathan *et al.* (2012) contend that maintaining a sequential logical order and ensuring that the steps are numbered in the context is helpful for low-literate audiences to process information.

4.5.3.3 Usability Design

Past researchers have considered some specific factors of usability design that helps low-literate audiences to learn best, the first of which is a user-friendly interface. Kodagoda *et al.* (2009) point out that a user-friendly interface may help lower-literate users to easily access health educational media and check it frequently. Cassell *et al.* (2010) also indicate that a user-friendly interface is the key requirement of successful e-Health, since it maintains readers’ attention and interest for longer periods.

The second factor of usability design is the use of simple digital technology. For example, Andersen *et al.* (2008) advocate that simplicity is the key to successfully deliver health information about stopping smoking to low-literate populations. Choi & Bakken (2010) recommend avoiding mouse drag, scrollbars, drop-down menus, and multiple windows to maintain design simplicity, because too many pop-ups or hypertext links distract users and reduce their focus. Cassell *et al.* (2010) indicate that the Internet with simple technology has the potential to reach those with low computer and reading literacy levels with a wide array of visual and audible cues.

The third factor of usability design is that interaction is invited via questions, responses, and suggested actions. For example, Doak *et al.* (1994) suggested using question-and answer format to discuss problems and solutions. Summer *et al.* (2006) recommend providing feedback for each question as soon as the user answers it in a quiz or health assessment to help low-literate users to interact with medical forms online. The Health Literacy Now Web is used by many different healthcare providers and health organisations suggests that the information online should be provided in a conversational style in order to bridge the patient-provider communication gap.

Having screened the related literature from the past decade, a host of design strategies that are currently used in the design of health information for low-

literate users are summarised below. These could be applied to further test the development of healthcare media to see if they can really help low-literate users to access healthcare information.

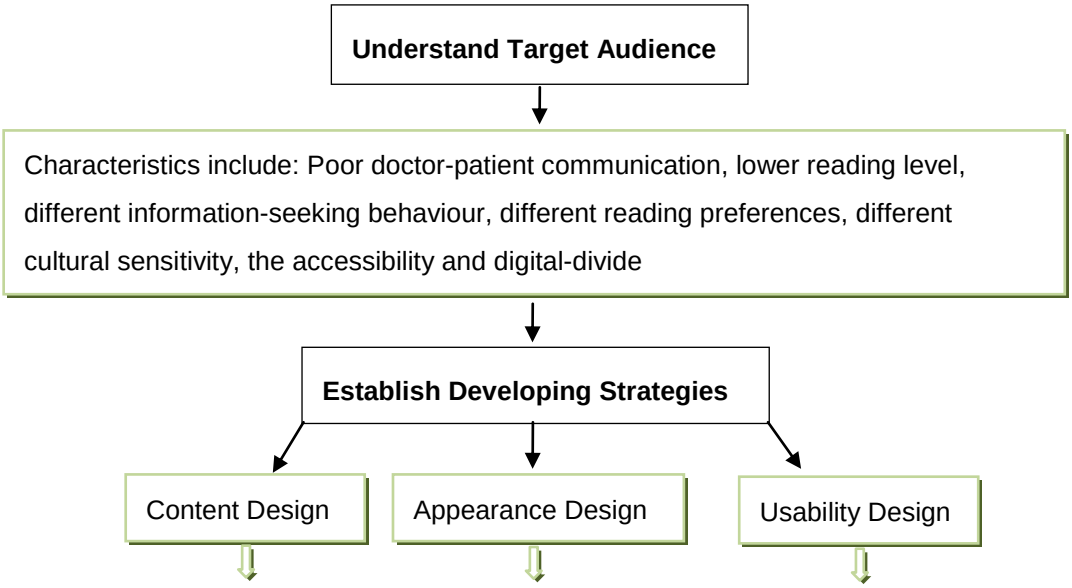
Content design: (1) Use of common words and short sentences; (2) Consider the reading comprehension level of patients and the readability of patient educational materials; (3) Describe a specific objective and convey a limited amount of information; (4) Put the most important information first in the context; (5) Adopt a vivid and friendly tone and be written in a conversational style; (6) Specify desired behavioural changes; (7) The authority and attribution are clearly recorded; (8) Match the culture of target users;

Appearance design: (1) Ensure the cover is attractive; (2) Use suitable font size and limited typefaces; (3) Adopt a high degree of contrast between the print and the paper; (4) Use appropriate visual aids to deliver healthcare information written in unfamiliar terms or complex phrases; (5) Use realistic photos to assist audience to recognize the content; (6) Adopt plenty of white spaces in layout design; (7) Organize a clear and logical manner in layout design;

Usability design: (1) Design user-friendly interfaces; (2) Adopt simple digital technology; (3) Interaction is invited via questions and answers;

4.6 Chapter Summary

The current strategies used in the design of healthcare media for low-literate users can be discussed through two aspects of concern, namely, understanding the target audience and establishing development strategies, as shown in Figure 8. From the perspective of understanding the target audience, same key concerns are analysed in the diagram, including understanding key difference of a low-literate audience. From the perspective of establishing development strategies, content design, appearance design, and usability design are the key themes for optimising low-literate health education. Identifying the characteristics of low-literate users and incorporating solutions into the related design strategies may help to bridge the gap between healthcare provider and the consumer.



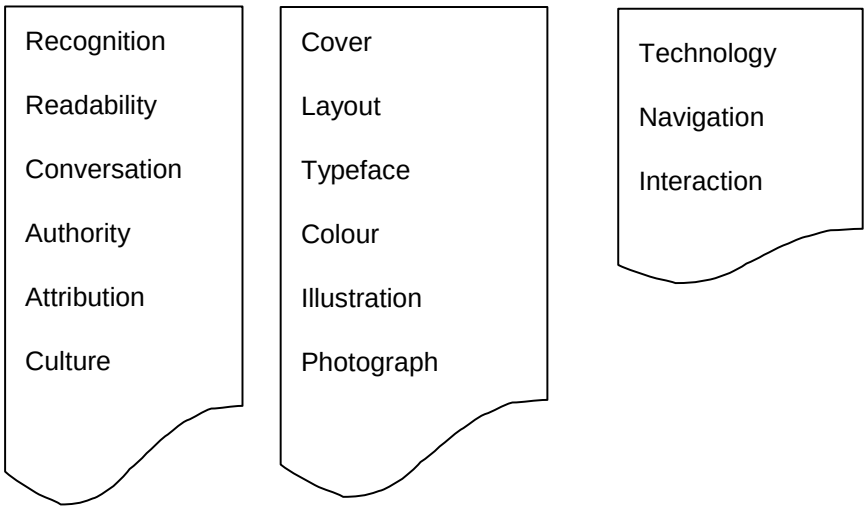


Figure 8: The current strategies used in the design of healthcare media for low-literate users

Chapter 5 Methodology

5.1 The Structure of Methodology in This Study

According to the previous studies mentioned in sections 3.3, 3.4 and 4.4, the appropriate testing methods to access the efficiency of healthcare media might include focus group interviews, questionnaires, pre-post knowledge tests, usability evaluation and in-depth interviews. Focus group interviews have proved to be a useful approach to data collection in both lay settings and health service settings (Green & Thorogood, 2004). They are ideal tools to investigate participants' initial perceptions, views, and beliefs, since some sensitive issues may be more easily discussed in a group by people with similar local cultural values (Stewart, *et al.*, 2007). Therefore, a focus group interview was conducted with 10 Vietnamese volunteer interpreters to prepare questionnaire to ask other immigrant mothers the problems experienced in terms of health communication. However, focus group methodology has its limitations. For example, the small sample size may be inadequate to represent the population at large, group discussions may be difficult to steer and control in terms of relevant topics, the respondents may feel peer pressure to give similar answers to the moderator's questions, and the moderator's skill in phrasing questions, along with the setting, can affect the responses (Temkin, 2013). To reduce the bias in a focus group, the moderator should remain as neutral as possible in both tone and body language, rephrase or remove potentially biased questions and encourage the participants to express their honest and personal opinions about the topic

(Leung & Savithiri, 2009). Every effort was made in this study to reduce any possible errors and bias in the focus group in order to obtain valid and meaningful results.

Randomised controlled trial (RCT) in healthcare is recognised as being a useful method to assess patient satisfaction after using various kinds of health intervention. The strength of RCT is its random allocation of participants and its feature of being blind or double-blinded reduces the chance of bias and eliminates the potential impact of factors other than the intervention (Davies & Newman, 2011). To avoid biased results caused by the potential incorrect allocation of participants, 70 immigrant mothers from Vietnam and China were randomly placed into two groups to undertake the pre-post knowledge tests respectively. 35 of them were shown the leaflet and the other 35, the website. Since the minimal requirement for the number of participants for an SPSS analysis is 30 for each group, ten additional participants were recruited for the pre-post knowledge test to make up for the discarded samples.

Usability evaluation can be defined as being a measure of the learnable effectiveness as to whether or not a technological product fits the specified goals of users (Lewis 2002; Miller, 2005). The aim of usability testing is to identify and eliminate barriers to easy, safe and efficient use by target users, and to establish user acceptability and satisfaction with the intervention (Hinchliffe *et al.*, 2008). Therefore, a usability evaluation was conducted with the same 70 participants after the post-test to explore the criteria used by

immigrant mothers to evaluate healthcare media. Likert scales are used when respondents are required to evaluate a statement related to any kind of subjective or objective criteria. Four, five, six, seven, eight or nine-point Likert scales are widely used in various fields of research. A recent empirical study (Dawes, 2008) found that a 5- or 7- point scale may generate slightly higher mean scores relative to the highest possible attainable score, compared to those produced from a 10-point scale, and this difference is statistically significant. Therefore, a five-point Likert Scale was used in this study for the usability evaluation test to explore the criteria used by immigrant mothers to assess healthcare media.

Based on the orientation of the data collection, in-depth interviews can be classified in a variety of ways including formal, less formal and informal; structured, semi-structured and unstructured; focused or non-directive; and informant interviews versus respondent interviews. However, semi-structured interviews are more suitable for obtaining people's opinions; furthermore, they guarantee good coverage and enable the interviewer to probe for answers (Drever, 2003). Successful semi-structured interviews require much more advanced preparation and investigation than fully structured interviews, as well as more discipline and more creativity during the actual interviews, and more time for analysing and interpreting the results (Wengraf, 2001). Therefore, semi-structured interviews were conducted with 10 Vietnamese immigrant mothers who had been educated to a primary level to identify the visual factors of healthcare media that affect low-literate users' satisfaction.

Finally, both quantitative and qualitative methods were adopted in this study to test appropriateness, as shown below.

	Methods	**Objectives**
Focus Group Interviews + Questionnaire Survey	A focus group interview was conducted with 10 Vietnamese volunteer interpreters for two hours.	To prepare questionnaire to ask other immigrant mothers the problems experienced in terms of health communication and their use of media.
	A questionnaire survey was conducted with 70 immigrant mothers before the pre-test	To identify key problems that immigrant parents usually encounter when caring for their children's' health.
Pre-post Knowledge Testing	A leaflet and a website were developed as the testing media	To introduce health care information relating to the causation, symptoms, and prevention of children's allergies
	A pre-post knowledge test was conducted with 70 immigrant mothers, who were randomly placed into two groups to explore the educational effectiveness of leaflet and website respectively.	To compare the educational effectiveness of leaflet and website to deliver health knowledge to immigrant mothers
Usability Evaluation	70 participants were asked to complete a questionnaire to evaluate the usability of the presented media after the post-test.	To explore the criteria used by immigrant mothers to evaluate healthcare media

Semi-structured In-depth Interviews	Semi-structured interviews were conducted with 10 participants who been educated to a primary level and had taken the pre-post knowledge test and usability evaluation survey.	To identify the visual factors of healthcare media which affect low-literate users' satisfaction

Table 7 The Structure of Methodology in this Study

5.2 Sample

10 Vietnamese volunteer interpreters were recruited for focus group interview to prepare a questionnaire to ask other immigrant mothers about the problems experienced in terms of health communication and their use of media. These volunteers have lived in Taiwan for years and provide a translation service at outpatient clinics. Since they have similar local cultural values and local sociological issues as those experienced by immigrant mothers on a regular basis, their feedback related to general healthcare problems within the immigrant population can be regarded as being useful for preliminary primary research.

70 immigrant mothers from Vietnam and China were recruited for the questionnaire survey, pre-post knowledge test and usability evaluation. After discarding some inappropriate samples, such as those with identical answers due to the mutual discussion of the participants or samples with important values missing, there were still 64 valid samples. Moreover, 10 Vietnamese immigrant mothers who had been educated to a primary level and had

attended aforementioned experiments were recruited for semi-structured interviews.

Baseline Characteristics of Participants Enrolled in the Study

66% (n=42) of the participants were from Vietnam and 34% (n=22) from mainland China. The majority of them were less than 40 years old (66%, n=42), while the remainder were older than 40 (34%, n=22). 63% (n=40) of the participants had been educated to a lower level of primary or middle education, whereas 37% (n=24) of them had completed high school or undergraduate education. The majority of the participants were housewives (63%, n=40) with only a few having a full-time job (20%, n=13). Most of the participants' family income was below £600 per month (86%, n=55), less than the average personal monthly income of £800 in Taiwan. 59% (n=38) of the participants had only one child, whereas 13% (n=8) of them had 3 or more children; 47% (n=30) of them had an allergic child at home, whereas 38% (n=24) had no idea if their children had any allergies. 28% (n=9) of the participants were familiar with surfing the web, while 27% (n=17) did not know how to surf online.

Characteristics	**Findings**
Nationality (n=64)	Vietnam (42); Mainland China (22)
Age (n=64)	20–30 (18); 30–40 (24); 40 or above (22)
Educational Level (n=64)	Primary (grade 1-6) (13); Middle School (grade 7-9) (27); High School (grade 10-12); (20); Undergraduate or above (4)
Job (n=64)	Full-time (13); Part-time (11); Housekeeping (40)

Family Monthly Income (n=64)	Less than £400 (28); £400 –£600 (20); £600–£800 (7); More than £800 (9)
Number of Children (n=64)	1 (38); 2 (18); 3 or above (8)
Allergic Child at Home (n=64)	Yes (30); No (10); No idea (24)
Web-surfing Frequency (n=32)	Once a day (9); Once a week (5); Once a month (1); Do not know how (17)

Table 8 Baseline characteristics of participants enrolled in the study

5.3 The Reliability and Validity Test of Questionnaire

The majority of immigrant mothers in Taiwan are Vietnamese and Chinese, who had been educated to a lower level of primary and middle education (Xia, 2003; Lin&Xiao,2007). The average reading comprehension of the general public is sixth to eighth grade level (Summers & Summers, 2005; Davies *et al.*, 2011); therefore, all the content and questionnaires for this research were try to create to meet the standard of immigrant mothers' readability, and they were made available in the Chinese and Vietnamese languages. The questions were asked in a yes/no or a multiple-choice format, and a qualitative and quantitative analysis had been performed concurrently with the data collection at a later stage. In order to make sure that all of the questions in the questionnaire were good indicators to measure the important variables in this study, a reliability and validity test was conducted with a paediatric allergy doctor, a paediatric clinical nurse, a Vietnamese interpreter, an immigrant mother who achieved primary education and an immigrant

mother who achieved middle education.

A 5-point Likert-type scale of response options ranging from strongly disagree to strongly agree was used to elicit relative endorsement of a particular statement. The rating scale for measuring the appropriateness of the questionnaire was scored from 1= strongly disagree, 2=disagree, 3=no opinion, 4=agree, 5= strongly agree. Then, the questions with higher scores, which indicated greater appropriateness, were retained, while the questions with lower scores, which indicated lower appropriateness, were discarded. All of the questionnaire design for this study is shown in Appendix A.

As for questionnaire survey, the test-takers agreed with most of the questions in the questionnaire, marking them 4.8 out of 5. However, they still had some concerns with 2 questions, marking them below 4 out of 5. Since the immigrant mothers declared that they did not know if their children had an allergic disease, they suggested adding an optional answer of ‘no idea’. The option, ‘I will learn through mass media’, was rated lower by the Vietnamese interpreter, who suggested adding brochures, television, and the internet to explain the meaning of ‘mass media’.

As for pre-post Knowledge test, the results showed that the test-takers agreed with most of the questions in the questionnaire because they marked them with 4.8 out of 5. However, they still had some concerns with 3 questions, marking them below 4 out of 5. 24 questions in the questionnaire related to the healthcare knowledge of children’s allergies were set up at beginning.

Since the paediatric allergy doctor and the paediatric clinical nurse declared that questions ‘taking medicines for bronchial asthma over a long period of time will do harm to both the liver and the kidneys’, ‘when children have yellow excretions on the skin and skin inflammation, their skin may well be infected, and need to be treated with antibiotics’ and ‘children can continually use nasal decongestants to improve nasal congestion for a long time’, which related to the treatment, were difficult to understand, they were discarded and only 21 questions were retained in the questionnaire.

As for usability evaluation, the results showed that the test-takers agreed or strongly agreed with most of the questions in the questionnaire because they marked them with 4.8 out of 5. However, they still had some concerns with 3 questions, marking them below 4 out of 5. Since, the options, ‘whether it offers clear links’, ‘whether it limits use of pop-ups’, and ‘whether it provides a discussing room’ were reworded as ‘whether the content is easy for navigation’, ‘whether it adopts simple digital technology’ and ‘whether it provides others’ experience’. It seems that the technical terms for website design, such as embedding hyperlinks, pop-ups screen, fast feedback and recover errors were not recognised by the Vietnamese interpreter and the immigrant mothers.

5.4 Statistical Analysis in this study

All the data obtained via questionnaires was checked and coded into the

computer. Range checking and consistency checking were conducted to clean the data. Descriptive and inference statistics were applied to analyse the distribution and the effectiveness of the media by using SPSS for Windows v. 20. Some statistical data analyses were conducted, including a pair t-test was adopted to test the differences between pre-test and post-test knowledge within each intervention group (Pair t-test is used to compare the means for the same group of people on two different occasions.). An independent sample t-test was adopted to test the effectiveness of different media on the knowledge of participants (Independent sample t-test is used to compare the means between two unrelated groups on the same continuous, dependent variable.). A one-way ANOVA was adopted to determine if there were significant differences between the educational effect and the demographic variables (One-way ANOVA is used when it had one independent variable with three or more levels and one continuous, dependent variable.). Descriptive Frequencies were used to describe the features of healthcare issues that immigrant mothers showed most concern over and to explore the criteria used by immigrant mothers to evaluate healthcare media (Descriptive Frequencies is used to describe the characteristic of the sample and show the number of occurrences of each response chosen by the respondents.). Multiple Crosstabs were employed to examine the different ways and media that low-literate immigrant mothers and high-literate immigrant mothers usually applied to acquire healthcare information (Multiple Crosstabs is used to explore the relationship between one continuous, dependent variable and a number of independent variables or predictors.).

Methods	Purposes
Paired-sample t-test	● To examine whether there were significant differences between the results shown in the pre-test and the post-test of using the leaflet ● To examine whether there were significant differences between the results shown in the pre-test and the post-test of using the website
Independent-sample t-test	● To examine whether there were significant differences between the effectiveness of health intervention made by the leaflet and by the website ● To examine if there were significant differences between the educational effect and the user's 'nationality'
One-way ANOVA	● To examine whether there were significant differences between the educational effect and the user's 'educational level', 'web-surfing frequency', ' monthly income', 'age', 'job', 'number of children' and ' allergic child at home'
Descriptive Frequencies	● To determine the problems immigrant mothers usually encountered in the clinic ● To determine the paediatric information immigrant mothers most need when their children are sick ● To determine the ways used by immigrant mothers to acquire healthcare information ● To determine the media immigrant mothers usually access to acquire healthcare information ● To explore the criteria used by immigrant mothers to evaluate healthcare media
Multiple Crosstabs	● To explore the relationship between 'the ways used by immigrant mothers to acquire healthcare information' and their 'educational level' ● To explore the relationship between 'the media immigrant mothers usually access to acquire information' and their 'educational level'

Table 9 Statistical analysis in this study

5.5 Ethical Approval Application

The main ethical issues with the research is that 70 immigrant mothers who had come to Taiwan from Vietnam and China had been recruited as research participants, most of them had low levels of education and had married into poor families. The research was undertaken in the New Immigrants' Hall, which had been established by the Taipei City Government to assist immigrant populations with their immediate problems (regarding marriage, family, work, and everyday life). To ensure that the immigrant mothers were fairly recruited and did not feel that they were being coerced to participate in the research, the recruitment posters and consent forms were placed at the entrance of the New Immigrants' Hall a month before the test. Immigrant mothers who were willing to participate in the activity were invited to register by telephone, fax, mail or text messages. To cover their travelling expenses to participate in the research, every participant received £10 compensation as an incentive to take part.

There were two ethical issues that could have possibly embarrassed and upset the participants during the study. First, educational level was a sensitive issue, since some participants did not want to mention their educational level in a public setting. Therefore, the recruitment posters had to reassure them that the purpose of this experiment was not to test their educational level, but to explore the problems they perceive when accessing healthcare media. Second, children's health was also a sensitive area since the participants may have been reluctant to discuss their children's diseases or perhaps would

have found the subject upsetting. Therefore, the conditions chosen were carefully presented to avoid causing alarm and were written in a positive tone. To ensure that participants were not upset by the result of knowledge testing, it had been clearly explained that the project was not about advising them on health matters. Participants were able to withdraw from the study at any time without being obliged to give a reason. In addition, to enable the researcher to ensure the confidentiality and security of personal data, all the data was anonymised, transferred and encrypted electronically, and other manual files were appropriately filed and stored securely in the school office until the research had ended. Before commencing the primary research, ethics approval was granted by Fu Jen Catholic University and the University of Leeds.

Chapter 6 Focus Group Interviews & Questionnaire Survey

6.1 Methods

The approximate size of a focus group should be six to eight people, who are brought together to discuss a particular issue in a non-threatening and non-evaluative environment in which they can freely express their opinions. The discussion should be guided by a skilled moderator and last between one and two hours (Kreuger & Casey, 2000). A focus group interview was conducted with 10 Vietnamese volunteer interpreters to prepare a questionnaire to ask other immigrant mothers about the problems experienced in terms of health communication and their use of media. A wide range of issues were discussed including the problems immigrant mothers usually encountered in the clinic, the paediatric information immigrant mothers most need when their children are sick, the ways used by immigrant mothers to acquire knowledge of their children's healthcare, and the kinds of media immigrant mothers usually access to acquire healthcare information. The duration of this focus group interview at the Taipei Immigrant Hall was two hours and it was recorded on recording pen. To avoid the whole discussion to be dominated by a few people thus resulting in biased output, all the participants were encouraged to express themselves openly without being concerned about others' opinion. Their feedback served as a reference for the further questionnaire survey and the development of usability testing media.

According to the volunteer interpreters, the problems immigrant mothers usually encounter in clinics include the following:

- They cannot understand what the medical staffs says;
- They cannot understand prescriptions;
- The medical staff speak too quickly for them to understand;
- The medical staff cannot understand what they says;
- They are too shy to ask the medical staff any questions;
- They cannot explain their health condition;
- They do not know which doctor to see;
- They feel unsafe when they see unfamiliar faces and scenes in clinics;
- They feel embarrassed when they have to describe a personal situation;
- They feel ashamed when they ask consulting physicians for a translation service;

Since the issues of ‘I cannot understand what the doctor is saying’, ‘the doctor cannot understand what I am saying’, ‘I cannot understand the prescription’, ‘I am too shy to ask questions’, and ‘I do not know which doctor to see’ were said most often in the focus group, they were applied to a further questionnaire survey of other immigrant mothers.

Besides, the paediatric information immigrant mothers most need when their children are sick is as follows:

- What are the factors that trigger this disease?
- What are the common symptoms of this disease?

- What are the common medication and treatment for this disease?
- Will there be any side effect if my child takes the medicine for a long period?
- When should I take my child to see a doctor?
- How can I take care of a child with this disease?
- How can I prevent my child from succumbing to this disease?
- How can I help my child to control the illness?
- Can my child lead a normal life, i.e. attend school, take exercise, and enjoy travel?

Since the issues of ‘trigger factors’, ‘common symptoms’, ‘side effects’, ‘how to give care’, and ‘when to see a doctor’ were said most often in the focus group, these were applied to the further development of usability testing media and questionnaire survey of other immigrant mothers.

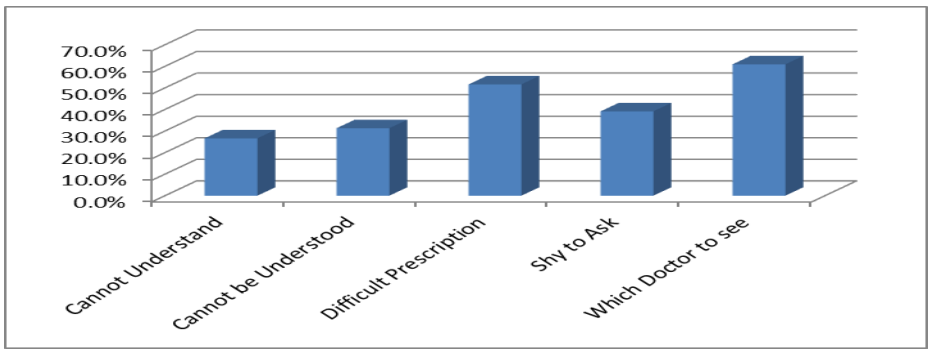
In addition, the ways used by immigrant mothers to acquire knowledge of their children’s healthcare were also explored as follows: They consult a doctor; they consult a nurse; they consult their family members; they consult their friends; they search for information via the mass media. In addition, the kinds of media immigrant mothers usually access to acquire information about their children’s healthcare are leaflets, books, television, the internet, and CD-ROM. The key finding from above helped to form the questions in questionnaire for testing with the other immigrant mothers. This is described below.

6.2 Data Analysis of Questionnaire Survey

The questionnaire survey was conducted with 70 immigrant mothers at Taipei New Immigrant Hall. Each participant was asked to complete a questionnaire before the pre-post knowledge test. In order to examine the difficulties and needs of child healthcare for immigrant mothers, Descriptive Statistics / Frequencies tests were used for data analysis as follows:

1. The problems that immigrant mothers most encountered in the clinic are ‘which doctor to see’ and ‘I cannot understand the prescription’, which got more than 50% of the participants agree upon. Chart 6.2.1 shows the results.

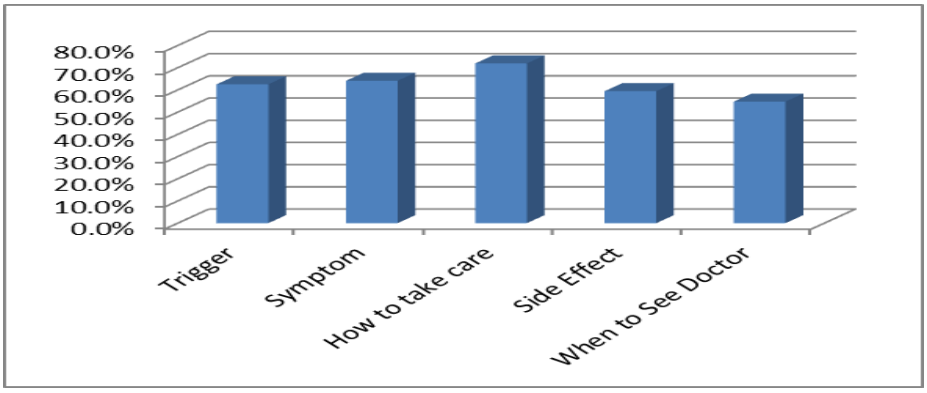
Chart 6.2.1 The problems immigrant mothers usually encountered in the



2. The paediatric information immigrant mothers most need when their children are sick is the knowledge related to how to take care rather than trigger factors, symptom, and side effect. This reminds us health information is designed primarily to respond to the needs and situation of the consumers rather than to the needs and situation of providers.

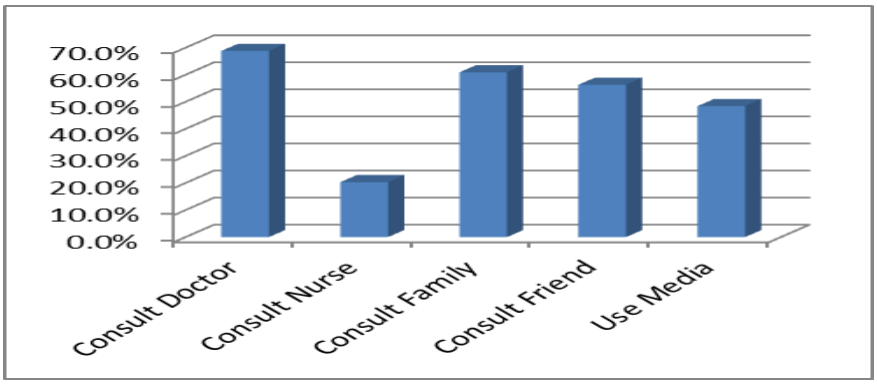
Chart 6.2.2 shows the results.

Chart 6.2.2 The paediatric information immigrant mothers most need when their children are sick



3. Most of the immigrant mothers would ask their doctors, families and friends about the information of children's healthcare, and only 48% of them indicated that they would make use of healthcare media. This reminds us to explore the problems that prevent low-literate users from accessing health educational platform. Chart 6.2.3 shows the results.

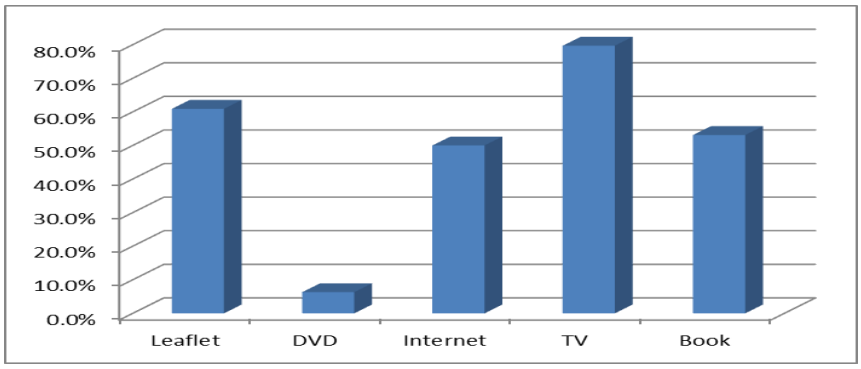
Chart 6.2.3 The ways used by immigrant mothers to acquire healthcare information



4. The media immigrant mothers usually access to acquire healthcare information is ranked as television, leaflets, books, internet, and CD-ROM respectively. It was surprising to find that television was the

winner, with highest frequency of use reaching 79.7%, whereas CD-ROM was not as welcomed as other media, with the worst support of 6.3%. Chart 6.2.4 shows the results.

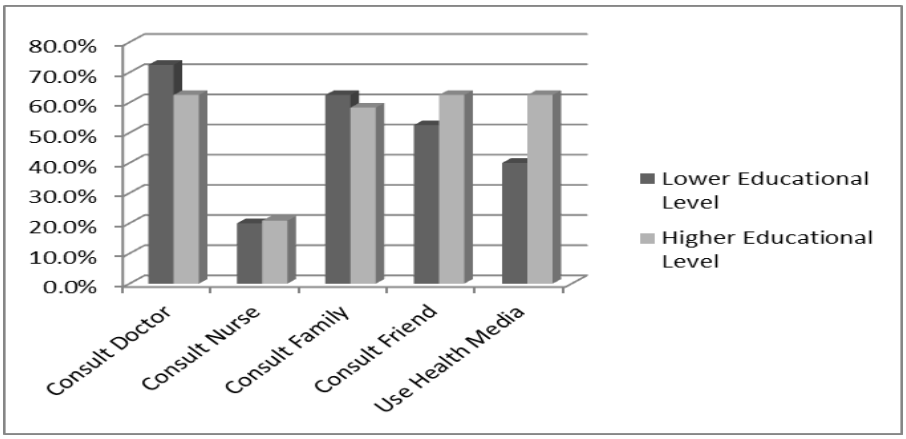
Chart 6.2.4 The media immigrant mothers usually access to acquire



In order to examine the different ways that immigrant mothers with lower educational level and immigrant mothers high-literate usually applied to acquire healthcare information, Multiple Response / Crosstabs tests were used for data analysis as follows:

1. The favourable ways used by immigrant mothers with a lower educational level to acquire healthcare information were ‘consult doctor’ and ‘consult family’, which were well-supported by 72.5% and 62.5% of the participants respectively, whereas the favourable ways used by immigrant mothers with a higher level of education to acquire healthcare information were ‘consult doctor’, ‘consult friend’ and ‘use healthcare media’, which were well-supported by 62.5% of the participants. Chart 6.2.5 showed the results.

Chart 6.2.5 The relationship between ‘the ways used by immigrant mothers to acquire healthcare information’ and their ‘educational level’

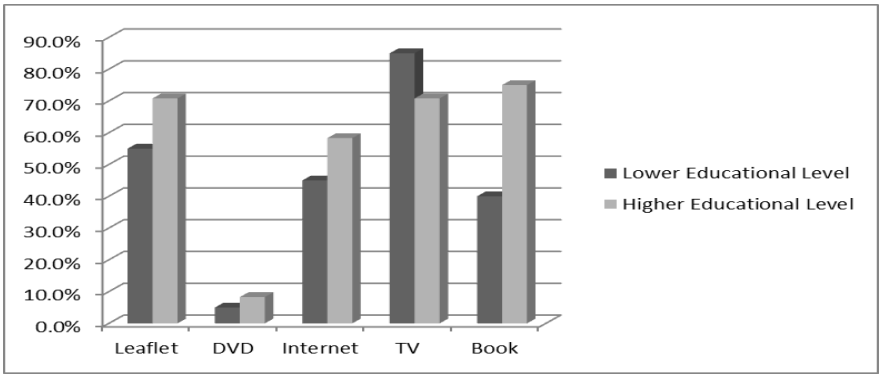


Note: Lower educational level: primary and middle education

Higher educational level: high school and undergraduate education

2. The favorable media for the users with lower educational levels could be ranked as television, leaflets, internet, books and CD-ROM, whereas the favorable media for the users with higher educational levels could be ranked as books, televisions, leaflets, internet and CD-ROM. Chart 6.2.6 showed the results:

Chart 6.2.6 The relationship between 'the media immigrant mothers usually access to acquire information' and their 'educational level'



Note: Lower educational level: primary and middle education

Higher educational level: high school and undergraduate education

6.3 Key Findings and Discussion

The results show that the key problems generally encountered by immigrant mothers when caring for their children's health relate to five factors, namely language, knowledge, culture, how to take care, and the use of healthcare media. From the perspective of language, the finding is similar to that of previous studies mentioned in Section 2.4.2, that low-literate patients often find it difficult to recall the information and explanation given by medical staff during face-to-face consultations in clinics.

From the perspective of knowledge, the medical information that appeared to be of most interest to immigrant mothers ranges from the trigger factors, symptoms, medication and treatment to side effects of different diseases. It is suggested that these should be included in the content of healthcare media. However, it is strongly recommended that all the information should be created at middle school level or lower to meet the standard of immigrant mothers' reading ability. In terms of culture, immigrant mothers' cultural beliefs and practices have a huge influence on them, which results in unequal treatment or inferior health care. This result is also similar to that of previous research (Martinez *et al.*, 2008; Jones-Caballero *et al.*, 2007). It is important for health educators to adopt racial/ethnic considerations and culturally sensitive communication practices to reach and influence diverse members of the populations.

The paediatric information immigrant mothers most need is how to care for their children's health includes looking for doctors, preventing disease, and care during illness. A good healthcare model for children's health could reduce health care costs and improve the quality of life across a child's life span. To date, a large volume of information related to various diseases has been transmitted on various kinds of media. However, the more information that is provided, the lower the proportion of information is remembered by audiences. Targeted information is more suited to meet the needs of audiences (Plimpton & Root, 1994). Thus, it is strongly recommended that healthcare media provides simple topics with clear instructions rather than complex issues with professional suggestions.

From the perspective of the use of healthcare media, the media immigrant mothers usually like to acquire information from about their child's healthcare are ranked in the following order: television, leaflets, books, internet, and CD-ROM respectively. This is probably because it is easy to approach healthcare information on television and in leaflets, whereas special digital knowledge is required in order to access healthcare information on a computer or video. Exploring the problems caused by the digital-divide and removing the technical obstacle for them to acquire health information will result in better communication.

There was 25% difference between users with higher educational level and users with lower educational level in acquiring healthcare information in terms

of accessing media, whereas there was 10% difference between users with higher educational level and users with lower educational level in acquiring healthcare information in respect of consulting a doctor. It does appear that both groups agreed that the best way to acquire health information is to consult a doctor, but 'using healthcare media' was welcomed more by users with higher educational level than lower educational level ones.

The percentage of users with higher educational level was significantly higher than that of users with lower educational level in terms of reading books to acquire health information, with different frequency of use reaching 35%. The percentage of users with lower educational level was significantly higher than that of users with higher educational level in terms of watching TV to obtain health information, with different frequency of use reaching 15%. This result is similar to that of past studies (Kutner *et al.*, 2006; Burnham, 2008) who believe that video tapes and oral communication are recommended for low-literate audiences because they prefer visual or audio-based health information rather than written text-based sources.

Chapter 7 Pre-post Knowledge Testing

7.1 Methods

7.1.1 Development of Testing Media

Computer-assisted patient education tools are increasingly being designed with the capability of being adapted to the needs of individual users. The fundamental concerns for creating information content online included predicting symptom and condition, processing treatment and medication, guiding day–to-day living, offering local services and resources, providing in-depth scientific information or new research, sharing other people's experience, and reminding care information for family members (Kerr *et al.*, 2008). A leaflet and a website were developed as the testing media to introduce the same healthcare issues relating to the causation, symptoms, and prevention of children's allergy. All of the developing strategies were informed by the literature review and references collected from former focus group interviews. All of the design tasks in the testing media were integrated and converted using the computer software, Photoshop, Illustration, Flash and Dreamweaver, a combination of Adobe multimedia-development application systems. The content of the testing media is shown in Appendix B and the major design is described below.

In order to ensure that the leaflet and website were equally designed, the same design concept for content, appearance and usability was applied to these two testing media. However, there are still two major differences between these two testing media, one of which is ‘interface design’ and the other is ‘navigation design’. In terms of interface design, firstly, the static image on the leaflet is different from the animated illustration on the website. Secondly, the blank layout on the leaflet is different from the full layout on the website. Thirdly, the pictures on the leaflet are placed near the relevant text, whereas there is not enough space to place the photograph next to the related text on the website. In terms of navigation design, firstly, the one path learning on the leaflet is different from the multi-way learning on the website. Secondly, the visual appeal of the leaflet is different from the audio and visual effect of the website. Thirdly, the one-way communication on the leaflet is different from the website’s interactive communication.

<table>
<tr><td colspan="2">Cover (homepage)</td></tr>
<tr><td>Leaflet</td><td>Website</td></tr>
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<tr><td colspan="2">Catalog</td></tr>
<tr><td>Leaflet</td><td>Website</td></tr>
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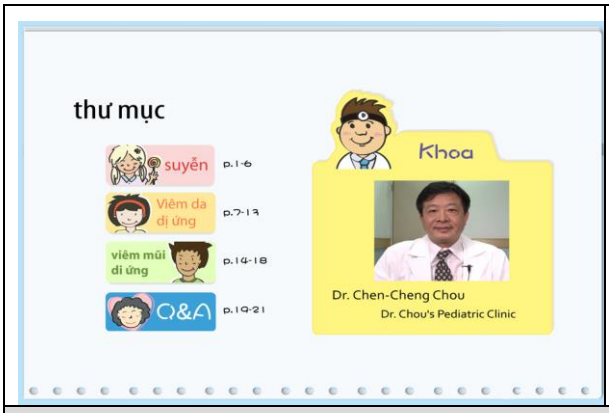
<tr><td> 
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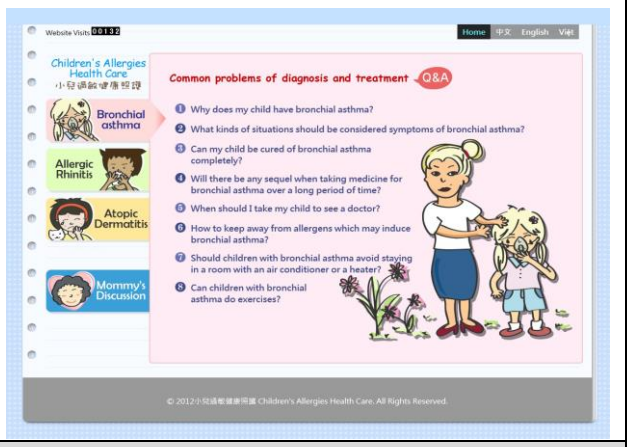
</td><td> 
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<tr><td>Leaflet</td><td>Website</td></tr>
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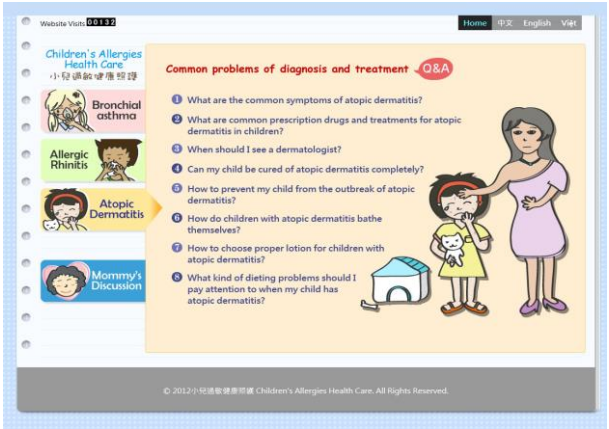
</td><td> 
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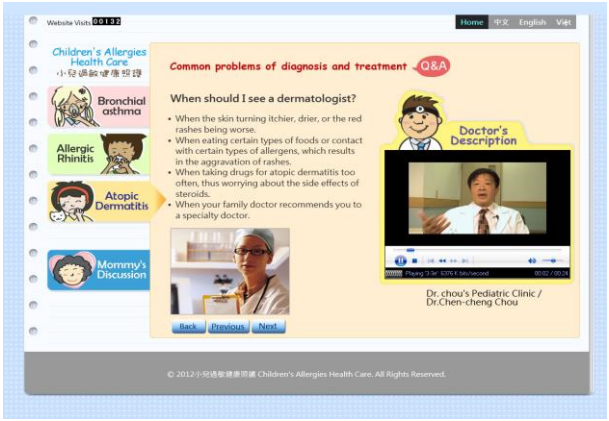
</td><td> 
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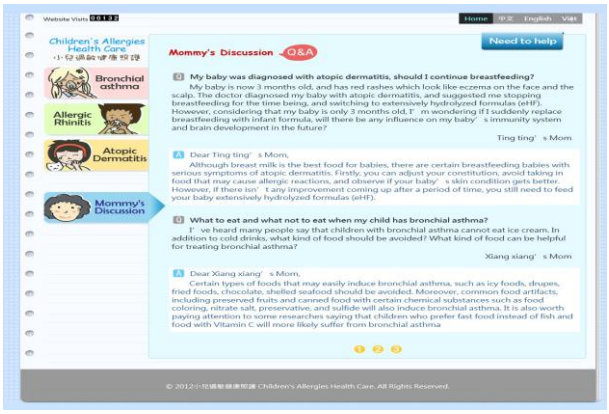
</td><td> 
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Table 10 Testing Media Design / Leaflet VS. Website

7.1.2 Pre-post Knowledge Testing

The typical processes of RCT involve recruiting a specific sample, excluding ineligible participants, randomising participants to intervention or control groups, receiving intervention or normal care separately, and a follow-up measurement (Kendall, 2003). Therefore, 70 immigrant mothers from Vietnam and China were randomly placed into two groups to explore the educational effectiveness of leaflets and websites respectively; that is, when one

participant was organized into the leaflet group, and the next one was organized into the website group. 35 were shown the leaflet, and 35 were presented with the website. All of the groups were asked to fill out the knowledge testing questionnaire before and after the trial. Thus, this research could measure their comprehension of the presented media. Before the test, the assistant simply demonstrated how to operate the testing media, and then allowed all the participants to operate it themselves. According to the test-takers' opinion in the reliability and validity test, this best duration of a test for immigrant mothers is no more than an hour. Every participant had 20 minutes to fill in a pre-test questionnaire, 20 minutes to view the media, and 20 minutes to fill in a post-test questionnaire. Participants could raise their hands to ask questions at any time when they were filling in the questionnaires and viewing the media.

Andersen *et al.* (2008) used a performance test, a post-task questionnaire, and a post-test questionnaire to test the health effects of a web-based kiosk system for low-literacy users. They conducted a comparative analysis of comprehension performance based on the number of right answers in response to a post-knowledge test. The rating scale for measuring the performance of the post-knowledge testing is follows: 1-3=bad, 4-8=average, 9-11=good. Since there were 21 questions in the questionnaire for pre-and-post knowledge test, therefore, this research supposes that, if there are no more 5 right answers, this means the performance of the participant is bad; if there are between 6 and 10 right answers, this means the performance of the participant is OK; if there are between 11 and 15 right answers, this means

the performance of the participant is good; if there are between 16 and 21 right answers, this means the performance of the participant is excellent (1-5=bad, 6-10=ok, 11-15=good, 16-21=excellent, Items=21). The evaluation criteria which were achieved from the above were also applied to following pre-post knowledge test.

7.2 Data Analysis of Pre-post Knowledge Test

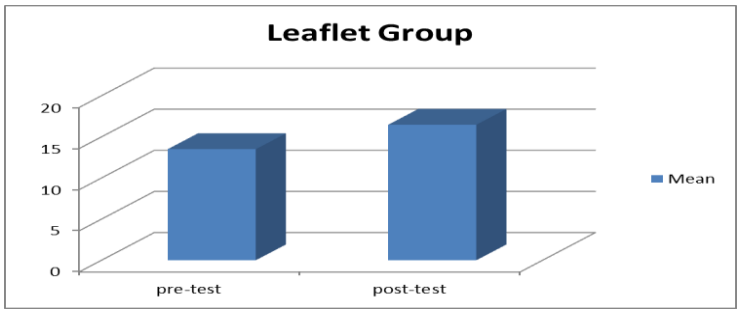
7.2.1 Leaflet Group VS. Website Group

1. In order to examine whether there were significant differences between the results shown in the pre-test and the post-test of using the leaflet, a pair t-test was applied. Table 7.2.1 shows the results. The findings show that there were significant differences between the pre-test and post-test of using leaflets as media (t-value = 11.259, $p < .001$). Since the average right answers for measuring the performance of the post-knowledge testing in leaflet group was 16, which was between 16 and 21 right answers, this means the performance of the participant in leaflet group is excellent.

Table 7.2.1 Pair T-test (Leaflet)

		Mean	Mean Difference	t-value
Leaflet Group	Pre-test	13.50	2.97	11.259***
	Post-test	16.47		

Chart 7.2.1 The differences between the pre-test and the post-test in leaflet

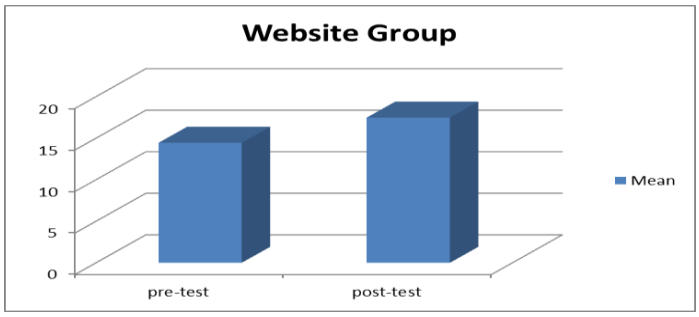


2. In order to examine whether there were significant differences between the results shown in the pre-test and the post-test of using the website, a pair t-test was applied. Table 7.2.2 shows the results. There were significant differences between the pre-test and post-test of using websites as media (t-value = 9.063, $p < .001$). Since the average right answers for measuring the performance of the post-knowledge testing in website group was 17, which was between 16 and 21 right answers, this means the performance of the participant in website group is also excellent.

Table 7.2.2 Pair T-test (Website)

		Mean	Mean Difference	t-value
Website Group	Pre-test	14.44	3.03	9.063***
	Post-test	17.47		

Chart 7.2.2 The differences between the pre-test and the post-test in



3. In order to examine whether there were significant differences between the effectiveness of health intervention made by the leaflet and by the website, an independent sample t-test was applied. Table 7.2.3 shows the results. There was no significant difference between the effectiveness of health intervention by means of leaflets or websites (t-value=.147, p>.05). However, the average mean of website group was marginally higher than the average mean of leaflet group.

Table 7.2.3 Independent Sample t-test (Leaflet VS. Website)

	Media	N	Mean	Std Deviation	Sig	t-value
Educational Effect	Leaflet	32	2.97	1.49	.884	.147
	Website	32	3.03	1.89		

7.2.2 Demographic Factors and Educational Effect

Significant Difference

1. In order to examine whether there were significant differences between the educational effect and the user's 'educational level', one-way ANOVA test

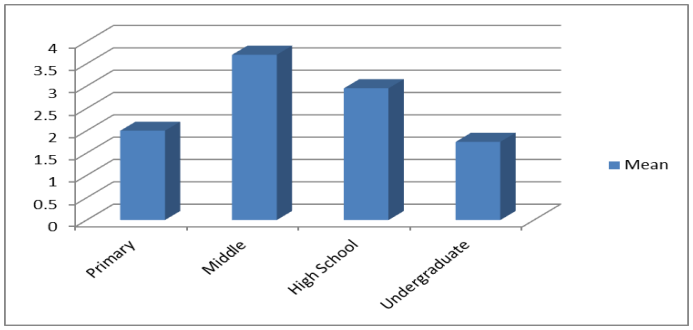
was used. Table 7.2.4 shows the results. There were significant differences between the educational effect and the user's 'educational level' (F=4.435, P<.01). By using the Scheffe multiple-comparison test, we can see only those who achieved primary education and those who achieved middle education show the significant differences (P<.05)

Table 7.2.4 Educational Effect VS Education Level

	1	2	3	4	F	Sig.	Scheffee Post Hoc Comparison
Mean	2.00	3.70	2.95	1.75	4.435	.007*	(1,2)*

Note: 1: Primary (grade 1-6), 2: Middle (grade 7-9), 3: High school (grade 10-12), 4: Undergraduate

Chart 7.2.4 The differences between the educational effect and the user's 'educational level'



Multiple Comparisons

Dependent Variable: EducationalEffect

Scheffe

(I) Education	(J) Education	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00▶	2.00	-1.70370*	.52899	.022	-3.2253	-.1821
	3.00	-.95000	.55826	.415	-2.5558	.6558
	4.00	.25000	.89597	.994	-2.3272	2.8272
2.00▶	1.00	1.70370*	.52899	.022	.1821	3.2253
	3.00	.75370	.46230	.454	-.5761	2.0835
	4.00	1.95370	.83953	.156	-.4612	4.3686

3.00►	1.00	.95000	.55826	.415	-.6558	2.5558
	2.00	-.75370	.46230	.454	-2.0835	.5761
	4.00	1.20000	.85828	.585	-1.2688	3.6688
4.00►	1.00	-.25000	.89597	.994	-2.8272	2.3272
	2.00	-1.95370	.83953	.156	-4.3686	.4612
	3.00	-1.20000	.85828	.585	-3.6688	1.2688

*. The mean difference is significant at the 0.05 level.

Marginal Significant Difference

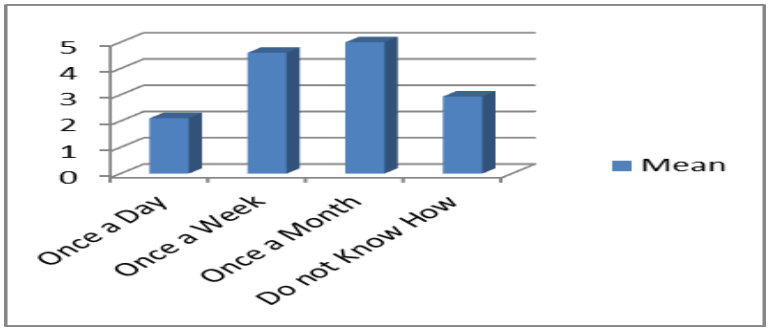
1. In order to examine if there were significant differences between the educational effect and the user's 'web-surfing frequency', one-way ANOVA test was used. Table 7.2.5 shows the results. There was marginal significant difference between the educational effect and the user's web-surfing frequency (F=2.57, .1>P>.05). The users who surfed the web once a week or a month are marginal significant different from those who surfed the web once a day or do not know how to use internet.

Table 7.2.5 Educational Effect VS Web-surfing Frequency

	1	2	3	4	F	Sig.	Scheffe Post Hoc Comparison
Mean	2.11	4.60	5.00	2.94	2.57	.074	Not Sig.

Note: 1: Surfing the web once a day, 2: Surfing the web once a week, 3: Surfing the web once a month, 4: Do not know how to use internet.

Chart 7.2.5 The differences between the educational effect and the user's 'web-surfing frequency'



No Significant Difference

1. In order to examine if there were significant differences between the educational effect and the user's 'nationality', an independent sample t-test was applied. Table 7.2.6 shows the results. There was no significant difference between the educational effect and the user's 'nationality' (t=.154, p>.05). Although Chinese participants had been predicted to perform better than their Vietnamese counterparts, surprisingly, there was not much difference between the performances of both groups. This is probably because the content of test media and the questions in questionnaires were made available in the Chinese and Vietnamese languages.

Table 7.2.6 Educational Effect VS. Nationality

	Nationality	N	Mean	Std. Deviation	Sig.	t-value
Educational Effect	Vietnamese	42	3.02	1.77	.445	.154
	Chinese	22	2.95	1.56		

2. In order to examine if there were significant differences between the educational effect and the user's 'age', one-way ANOVA test was used.

Table 7.2.7 shows the results. There was no significant difference between the educational effect and the user's 'age', (F=.016, p>.05). The younger immigrant mothers were predicted to perform better than the older immigrant mothers, surprisingly; there was not much difference between the performances of both groups. This was probably because the older immigrant mothers who have longer residential period in Taiwan had the advantage of more fluent language when they asked questions, while the younger immigrant mothers had the disadvantage of language barriers because of their shorter stays and they were shy to raise their hands to ask questions.

Table 7.2.7 Educational Effect VS. Age

	1	2	3	F	Sig.	Scheffe Post Hoc Comparison
Mean	2.94	3.04	3.00	.016	.984	Not Sig.

Note: 1: 20-30, 2: 30-40, 3: 40 or above.

3. In order to examine if there were significant differences between the educational effect and the user's 'job', one-way ANOVA test was used. Table 7.2.8 shows the results. There was no significant difference between the educational effect and the user's 'job', (F=1.72, P>.05). The full-time users were predicted to perform better than housekeeping users since they had a comparative advantage in using social networks. On the contrary, it was surprising to find that the housekeeping users performed better than those who had a part-time job and even those in full-time employment, which shown that the testing media was well-designed for

different groups of participants.

Table 7.2.8 Educational Effect VS Job

	1	2	3	F	Sig.	Scheffe Post Hoc Comparison
Mean	2.30	2.81	3.28	1.72	.187	Not Sig.

Note: 1: Full Time, 2: Part Time, 3: Housekeeping.

4. In order to examine if there were significant differences between the educational effect and the user's 'monthly income', one-way ANOVA test was used. Table 7.2.9 shows the results. There was no significant difference between the educational effect and the user's 'monthly income' (F=1.374, P>.05). However, users who had the highest monthly income with the average mean of 4, which performed marginally better than those who had the lowest monthly income with the average mean of 2.79. This was probably because the users with a higher monthly income also had a higher level of education, as well as more opportunity to access healthcare media.

Table 7.2.9 Educational Effect VS Income

	1	2	3	4	F	Sig.	Scheffe Post Hoc Comparison
Mean	2.79	3.00	2.57	4.00	1.374	.259	Not Sig.

Note: 1: Less than £400, 2: £400 –£600, 3: £600 – £800, 4: More than £800.

5. In order to examine if there were significant differences between the educational effect and the user's 'number of children', one-way ANOVA test was used. Table 7.2.10 shows the results. There was no significant difference between the educational effect and the user's 'number of

children', (F=.014, P>.05). The users that had numerous children were predicted to perform better those who only had one child. However, we were surprised to find that users who had more care experience with more children didn't perform better than those who had less care experience.

Table 7.2.10 Educational Effect VS. Numbers of Children

	1	2	3	F	Sig.	Scheffe PostHoc Comparison
Mean	3.03	2.94	3.00	.014	.986	Not Sig.

Note: 1: 1 child, 2: 2 children, 3: 3 children.

6. In order to examine if there were significant differences between the educational effect and the user's 'allergic child at home', one-way ANOVA test was used. Table 7.2.11 shows the results. There was no significant difference between the educational effect and the user's 'allergic child at home' (F=.957, P>.05). Users with an allergic child at home were predicted to perform better than those without an allergic child. However, it was surprising to find that users who may have had knowledge of children's allergy did not perform better than those who may not have had similar knowledge. This is probably the users with an allergic child at home might have answered more correctly during the pre-test. However, the users who didn't know if their children have allergies performed the worst.

Table 7.2.11 Educational Effect VS. Allergic Children at Home

	1	2	3	F	Sig.	Scheffe Post Hoc Comparison
Mean	3.2	3.3	2.63	.957	.390	Not Sig.

Note: 1: Yes, I have allergic child at home 2: No, I don't have allergic child at home, 3: No

idea: I don’t know if my child has allergy.

7.3 Key Findings and Discussion

The result showed that both the leaflet and website intervention had positive outcomes. The result for the website group was marginally better than the result for the leaflet group. However, there was no significant difference between the influence of the intervention made by the leaflet and by the website. Why two healthcare media has so many different features, but have the similar educational effectiveness on the low-literate audiences. There are two possible reasons to cause the phenomenon as follows: First, they were made with same content; second, they were applied with simple technology. According to previous studies (Richards *et al.*, 1998; Yardley *et al.*, 2010; Ahern *et al.*, 2010) web-based media include advantages such as self-controlled navigation, interactive communication and market segmentation, which make health interventions effective for targeting high-risk groups. However, the aforementioned studies focus on higher-literacy rather than lower-literacy users without considering that low-literacy users may have different preferences of healthcare media characteristics that could be provided by paper-based media, such as static presentation, portability, and requiring no IT skills.

Most of the demographic factors did not have an impact on the educational effectiveness, apart from the user’s ‘educational level’ and user’s ‘web-surfing frequency’. Previous research (Doak *et al.*,1996; Kodagoda, *et al.*, 2010) have

suggested that lower literacy users always possess a lower level of reading comprehension and employ weaker information-seeking strategies than their higher literacy counterparts. However, it was surprising to find that low-literate users performed significantly better than high-literate ones, which suggests that these two testing media had been well-designed for low-literate users and well-accepted by them. It is also probably because the users with high literacy are not as compliant as the users with low literacy to receive any advice from healthcare media. According to past studies (Houston *et al.*, 2006; Summer *et al.*, 2006), the lack of opportunity and the digital-divide prevents low-literate users from accessing healthcare media. Users in the website group who surfed the net more often were predicted to perform better than those who seldom surfed the net. However, it was surprising to find that users in the website group who were not familiar with web-surfing performed marginally better than those who were good at it, which suggests that eHealth could become a more effective educational platform for the low-literate users if they had been developed well to meet target audience's need. This could also have resulted because the less experienced web users were more direct in their approach to and use of information.

Results of the observation suggested that some of the participants in the leaflet group apparently lacked patience to read the text content but depended on the illustrations and photographs to understand the healthcare information. However, the participants who had allergic children in the leaflet group appeared more concentrated on the text content rather than illustrated content. More than half of the participants in the leaflet group found the leaflet

very useful, and asked if they could take it home as a backup reference for their allergic children. On the other hand, some of the participants in the website group indicated that some text on content on the website was difficult to understand, so they directly watched the video-clip and listened to the voice-over, whereas some of them indicated that the speed of video narration was so slow and disturbed their reading process, and that’s why they liked to read the text content directly.

Chapter 8 Usability Evaluation

8.1 Methods

To establish guidelines for the design of healthcare media for users with low literacy, a usability evaluation test was conducted with the same 70 participants after the post-test to explore the criteria used by immigrant mothers to assess healthcare media. Each participant was asked to complete a questionnaire to evaluate the usability of the presented media after the post-test. This consisted of 22-25 items of evaluation criteria, including the quality of content, appearance, and process of the media in question. A five-point Likert Scale was used for every question, with higher scores indicating the higher appropriateness. The rating scale for measuring the appropriateness of the questionnaire was scored from 1= very unimportant, 2=unimportant, 3=neutral, 4=important, 5=very important. All of the questionnaire design for this study is shown in Appendix A.

8.2 Data Analysis of Usability Evaluation

In order to examine the criteria used by immigrant mothers to evaluate healthcare media, Descriptive Statistics/Frequencies tests were used to identify the criteria used by immigrant mothers to evaluate healthcare media.

In terms of the quality of the content, 98.4% of the participants thought that ‘authoritative attribution’ was an important factor, since they rated this as 4 or 5 on the five-point Likert Scale. However, only 70% of the participants thought that ‘limited information’ and the ‘latest information’ were important, since around 20% of them expressed a neutral attitude toward these factors.

In terms of the quality of the appearance, 98.5% of the participants thought that ‘real photos’ were important, since they rated this factor as 4 or 5 on the five-point Likert Scale, while ‘consistent style’ was only deemed to be important by 62.6% and ‘high contrast’ by 64% of the participants, since they always rated these factors as 3 or 4 on the five-point Likert Scale.

As for the quality of the usability, ‘easy navigation’ and ‘user friendly interface’ were the most advocated criteria, since more than 90% of the participants thought that they were important and rated them as 4 or 5 on the five-point Likert Scale. On the other hand, ‘simple digital technology’ was ranked first by the website group since 93.7% of them marked this as being an important factor and rated it as 4 or 5 on the five-point Likert Scale.

In brief, most of the criteria were advocated by more than 70% of the participants, indicating that all the immigrant mothers agreed that most of the criteria were important. However, only about 73.4% of them thought that the quality of the appearance was critical, which was significantly lower than the 89.3% who thought the quality of the content was important; while around 85% thought that the quality of the usability was significant.

Chart 8.2.1 Content Evaluation

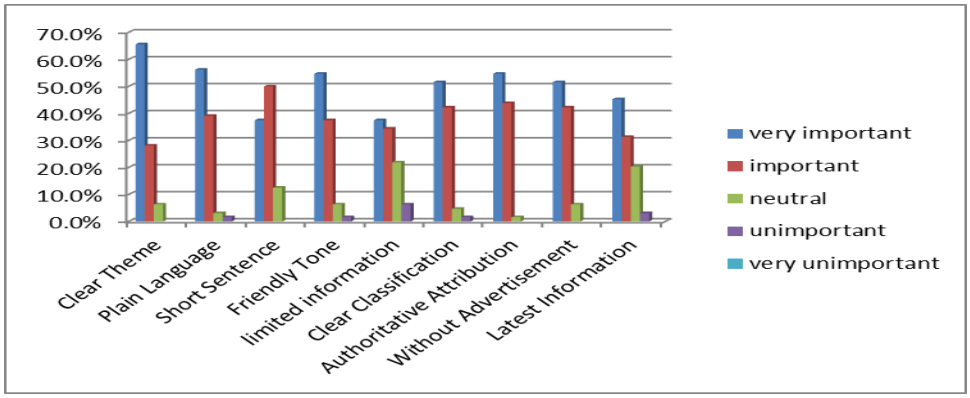


Chart 8.2.2 Appearance Evaluation

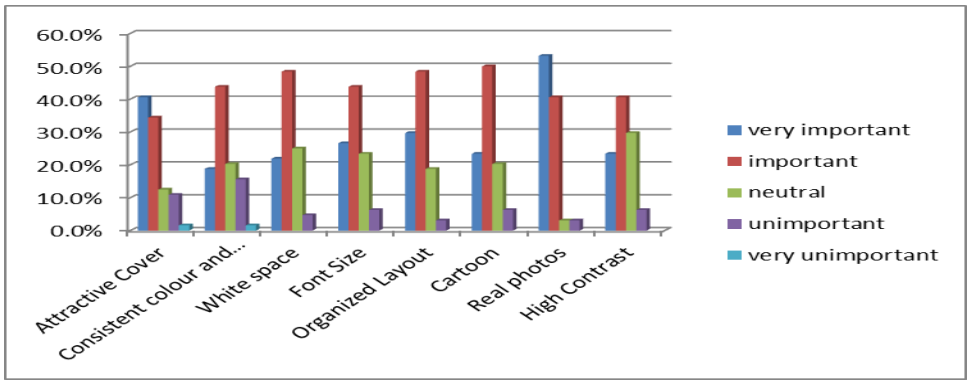


Chart 8.2.3 Usability Evaluation

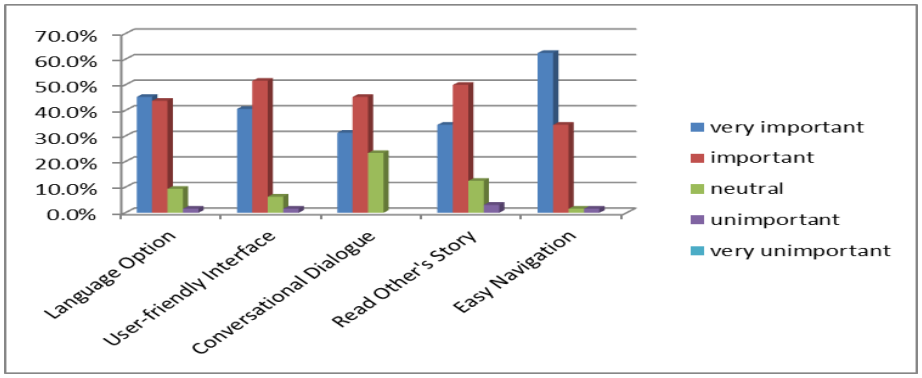
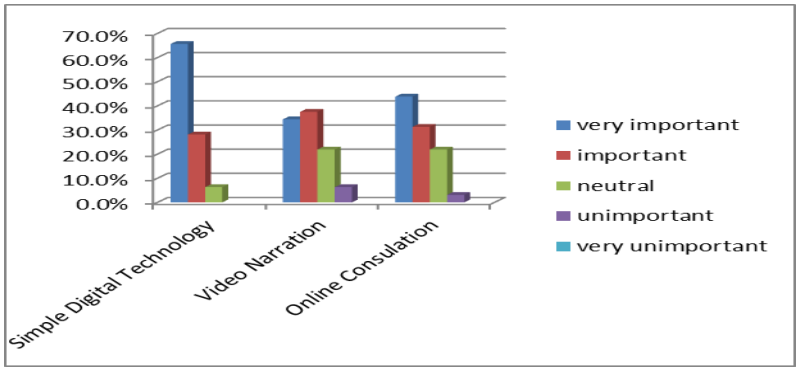


Chart 8.2.4 Usability Evaluation for Website Only



8.3 Key Findings and Discussion

The criteria used by immigrant mothers to evaluate healthcare media could be analysed in terms of the quality of content, appearance, and usability. Most of the participants agreed that the quality of content and usability was marginal important than the quality of appearance in healthcare media. In terms of the content design, both of the past and new findings agreed with certain evaluation criteria for low-literate health media, such as a clear theme is described; plain language is used; short sentences is adopted; a vivid and friendly tone is adopted; information is divided into several unique classifications; and the authority and attribution is clearly recorded. This study advocates two more criteria that were recommended for higher literacy users in previous studies. The first is that the source of the content should be up to date, which was mentioned by Kerr *et al.* (2008) and the second is that advertising should be clearly distinguished from content, which was stressed by HON (2011).

In terms of the appearance design, both of the past and new findings agreed with certain evaluation criteria, such as attractive cover is designed; plenty of empty white space is adopted; suitable font size is used; layout is designed in a logical manner; related pictures are placed near relevant text; and a high degree of contrast between the print and the paper is adopted. This study proposes one more criterion than was recommended for higher literacy users in previous studies, which is designing the colour and background consistently to help audiences to recognise the chapter they are reading, as mentioned by Hung & Stones (2011). On the otherhand, both of the past and new findings had some different views in appearance design. For example, Anderson *et al.* (2008) point out that most low-literate adults prefer images of real people rather than cartoons and illustrations in the design of health educational materials, whereas this study found that both cartoons and photographs are welcomed by low-literate immigrants. Therefore, this study suggests that designers should use photographs to interpret the text and cartoons to attract low-literate users' attention.

In terms of the usability design, both of the past and new findings agreed with certain evaluation criteria, such as a user-friendly interface is designed; information is represented in a way of dialogues; content is easy for navigation; and simple digital technology is adopted. This study also proposes four further criteria that are recommended for higher literacy users in previous studies. The first is the provision of video narration to reduce the pressure of reading, mentioned by Chen *et al.* (2005), while the second involves offering online consultancy to support patients' self-management, advocated by Hung

& Stones (2011). The third relates to illustrating others' experience of healthcare to reduce the level of anxiety of those suffering from a similar disease, as suggested by Jan *et al.* (2007). The fourth is providing the option for low-literate immigrants to select a specific language. All of the contents of testing media were made available in the Vietnamese, Chinese and English. The criteria used by immigrant mothers to evaluate healthcare media are detailed in Table 11 according to their importance. It could be a standard for the development of strategies related to low-literate healthcare media.

Categories	**Elements**
Content Design	1 Whether the information of hospital or doctor is contained. 2 Whether it uses plain language. 3 Whether information is divided into several classifications. 4 Whether the advertisement and content are obviously compartmentalised 5 Whether it conveys clear themes. 6 Whether it is written in a friendly Tone. 7 Whether it uses short sentences. 8 Whether it presents the latest information. 9 Whether it shows limited information.

Appearance Design	1	Whether related pictures are placed near relevant text.
	2	Whether it has organized layout.
	3	Whether it has an attractive coverage.
	4	Whether it has cartoons.
	5	Whether the font size is suitable for reading.
	6	Whether it adopts plenty of white spaces.
	7	Whether it adopts a high degree of contrast between the print and the paper
	8	Whether the colour and background are designed consistently.
Usability Design	1	Whether the content is easy for navigation.
	2	Whether a user-friendly interface is designed.
	3	Whether it provides the option for user to select a specific language
	4	Whether it provides others' experience.
	5	Whether it represents information in a way of dialogues.
	Website only	
	1	Whether it adopts simple digital technology.
	2	Whether it offers online consultancy.
	3	Whether it offers video narration.

Table 11 The criteria used by immigrant mothers to evaluate healthcare media

Chapter 9 Semi-Structured In-depth Interviews

9.1 Methods

In order to identify the visual factors of healthcare media that affect low-literate users' satisfaction, semi-structured interviews were conducted with 10 Vietnamese immigrant mothers who had been educated to a primary level. The main questions for the semi-structured interviews were planned in advance to create the overall structure and what was said during interviews was recorded to be analysed and interpreted later. According to previous studies mentioned in section 3.13 and participants' feedback from the usability evaluation, the visual factors of healthcare media that affect low-literate users' satisfaction include concept design, design layout of cover, design layout of content, typeface design, colour scheme, pictorial illustrations, realistic photographs and cultural factors. These were used to select a diverse range of leaflet and visual style for testing. After searching the leaflets related to health education in Taiwan, some inappropriate issues were discarded, while some appropriate issues were retained to be applied to this research. 32 pictures from existing health educational materials in Taiwan were collected and divided into 8 categories based on the above-mentioned issues. All of the testing pictures for this study are shown in Appendix C. The justification for choosing these samples as test pictures is as follows:

Categories	The justification of test pictures

Concept	Straightforward concept; Shocked concept; Humored concept ; Celebrity-based Concept;
Design Layout of Cover	Use plenty of white space; Use contrasting scheme; Use rhythmic composition; Use symmetrical arrangement;
Design Layout of Content	Use segmentation; One topic per page; Use of bullet points; One picture per question;
Typeface Design	Use a variety of styles of typeface; Use suitable font size; Use lists, charts and graphs; Use graphic devices;
Colour Scheme	Use bright colours & familiar ad colours; Use monochrome scheme; Use colour for different genders; Use ethnic colours;
Pictorial Illustrations	Apply with line drawings; Apply with digital cartoons; Apply with paintings; Apply with abstract forms;
Realistic Photographs	Use daily life; Use medical specialisation; Use symptoms of a disease; Use general medical equipment;
Cultural Factors	Include religious references; Include living habits; Include hometown festivals; Include hometown landscape;

Table 12 The justification of test pictures for semi-structured interviews

Each category consisted of four test pictures and several corresponding interview questions, as follows:

- What do you see in these pictures?
- What do they mean to you?
- What emotions do you feel as you look at this?
- Which are your favourite pictures?
- Why are they your favourites?
- Which pictures do you dislike?
- Why do you dislike them?

These interviews were conducted separately to avoid individual participants' statements affecting others' opinions. These interviews were also processed accompanied by a Vietnamese interpreter to reduce their stress and create a safe environment for these low-literate participants. During the face-to-face interviews, some fundamental descriptions of graphic design were interpreted to help them to express the factors that affected their satisfaction. All the predicted answers were listed in a questionnaire format to ensure that the responses of the interviewees followed the structure of questionnaire, while all the unpredictable answers were recorded in an open text box. The duration of each interview was an hour and interview data was recorded either by hand-written notes or by audio taping. What they said was used as data to analyse the evaluation process.

How large did my sample size have to be? An extremely large number of articles, book chapters, and books that recommend guidance and suggestions with anywhere from 5 to 50 participants is adequate (Dworkin, 2012). Most scholars argue that the concept of saturation is the most important factor to

consider when thinking about sample sizes in qualitative research (Mason, 2010). Based on the data set involving sixty in-depth interviews, Guest et al. (2006) found out that saturation occurred within the first twelve interviews and basic elements of themes were present as early as the first six. This depended on practical issues that included assessing the research aims and objectives, validity within epistemic communities and the available time and resources (Morse, 2000). In-depth interviews are not as concerned with making generalisations to a larger population of interest, but are rather more inductive and emergent in their process. I stopped at the 10th interview because participants were beginning to repeat each other. I felt that the point of saturation had occurred, and I felt enough quality data to work with.

9.2 Data Analysis of Semi-Structured In-depth Interviews

A qualitative content analysis is one of many ways to analyse textual data. It focuses on reducing it into manageable segments by the application of inductive and/or deductive codes, and reorganising it to allow for the drawing and verification of conclusions (Miles & Huberman, 1994). This study employed the method of content analysis to describe the results of semi-structured interviews. Once above processes have taken place, the audio taped data from entire interviews was transcribed, the ticked answers on questionnaire format was collected and the hand-written notes was decoded. Since the transcription was faithfully picked up incomplete sentences, half-finished thoughts, piece of words, and odd phrases, the author sometimes

have to fill in gaps and missing words. Once the transcription is finished, a classification system for major topics was developed and material in the transcript related to each topic was identified. Colour-coded brackets were then used to mark the different topics within the text. The phrases used by the immigrant mothers to evaluate healthcare material are highlighted in light grey, whereas the phrases they used to describe the visual design are highlighted in dark grey in Table 13. These key phrases served as a basis for decoding the transcription. Having completed the decoding process, the coded copy of the transcription was dissected and sorted into relevant categories.

Concept	**Transcripts**
Concept of being straightforward	*'Motherly pictures make me feel warm.'* *'The meaning is expressed very clearly so that I don't need to spend time reading the text.'* *'Blue sky makes people feel refreshed.'* *'It's easy to distinguish the red title from the blue background.'* *'The theme is clearer when the subject is placed in the middle.'* *'I get very embarrassed by breastfeeding pictures.'* *'It's culturally inappropriate to use improper photos, such as lovers kissing each other or naked bodies in healthcare material.'* *'The idea of straightforward is too simple.'*

Concept of shocked	*'When you see that the whole lung is black, you know it's a smoking ad.'* *'It's too dark to exude an air of mystery and horror.'* *'The subject is too vague; I cannot tell what it is.'* *'It looks like someone doing something immoral at night.'* *'I don't like a black and white design; it depresses me.'* *'Realistic photos help me to understand the content, but they are shocking.'* *'I cannot understand the implication of the design.'* *'Why is the title written in English rather than Chinese?'* *'I don't like a presentation that combines overlapping pictures and text, because I can't distinguish the text on the upper layer from the image on the lower one.*
Concept of humour	*'The little boy looks handsome.'* *'There is a strong contrast between the red and the green.'* *'I couldn't understand the story until I read the text.'* *"I couldn't understand the meaning of the title.'* *'It's funny, but superficial.'* *'Why use a photo of a bespectacled boy to promote the prevention of myopia?'* *'It's better to let the boy actually wear glasses than drawing glasses on his face.'*
Concept of celebrity	*'I would not pick it up because it's too sad.'* *'I don't like to feel intimidated to change my living habits.'* *'The anti-smoking icon clearly tells me it is an anti-smoking advertisement.'* *'I have more confidence in celebrity endorsements.'* *'I like a slogan to be presented by an international movie star.'* *'I prefer a Vietnamese celebrity to promote healthcare.'* *'I couldn't identify Taiwanese celebrities.'* *'I wouldn't be convinced by a sick and skinny celebrity.'* *'I believe that the use of miserable photos may have a negative effect.'* *'I can't accept photos that tell a miserable story in educational materials.'*
Design Layout of Cover	**Transcription**

Use of plenty of empty white space	*'The page is neatly designed.'* *'It showed a peaceful mode by using a blue and boundless sky.'* *'I could immediately distinguish the subjects from the background.'* *'The artistic font of the text was beautiful but it was hollow so it appeared to be vague.'* *'There was too much white space.'* *'The subject was too tiny.'* *'I couldn't read the English title.'* *'I didn't even know it was a poster to promote anti-smoking; I wondered if it was about the fate of the story because of the clover pattern.'*
Use of contrasting scheme	*'The contrast between yellow and black is very strong.'* *'The ladder design makes people feel like climbing up.'* *'Highlighting the title makes it very prominent.'* *'The text is very clear because only two colours are used.'* *'I don't like the silhouette design, because it looks like a dummy.'* *'I don't like content with highly contrasting colours that affect my vision.'*
Use of a rhythmic composition	*'Boundless sky gives a feeling of peace.'* *"If too many photos are placed together, the picture looks very crowded.'* *'The title is not clear because it is a similar colour to the background.'* *'I don't understand landscape photos are used to promote anti-smoking'* *'I don't like to see an unstable composition.'* *'I don't like an irregular arrangement with small pictures on the cover.'* *'I don't like a rhythmic design with dynamically arranged subjects that negatively affect my vision.'*
Use of symmetrical arrangement	*'The text is arranged very neatly.'* *'The picture is designed in a balanced way.'* *'The outlines of the kidney are symmetrically arranged.'* *'I don't like the techniques of combination.'* *'The photos arranged within the kidney shape are difficult to identify'*
Design Layout of Content	**Transcription**

Scheme of segmentation	*'The title is very prominent.'* *'The cartoons are beautifully drawn.'* *'The composition is lively.'* *'I get the idea by looking at the picture rather than reading the text.'* *'I prefer the content to have lots of pictures but little text.'* *'I like the use of numbers to show the order.'* *'I prefer divided sections rather than complete information.'* *'It looks too busy when several themes are presented at the same time.'* *'Too many pictures affect my vision.'*
One topic per page	*'A monochrome design makes people feel comfortable.'* *'I like the idea of one topic per page.'* *'I prefer a composition that contains the appropriate amount of white space.'* *'I prefer a limited amount of text.'* *'I don't think this painting is good.'* *'This painting has nothing to do with the subject.'* *'I don't like black and white pictures that give me a quiet feeling.* *'I don't like dull pictures that give me the feeling of sloppiness.'*
Scheme of bullet points	*'I like the use of bullet points and numbering to show the order.'* *'The use of numbering would be better than bullets.'* *'I don't like to read content with text and pictures but without any white space.'* *'I don't like the text to be placed around a picture, because I can't find the beginning and end of the content.'*
Illustration of one picture per question	*'I prefer divided sections rather than complete information.'* *'I prefer the pictures to be placed near the relevant text.'* *'I prefer every question to be accompanied by an interpretive photo.'* *'I prefer every question is accompanied by an interpretive photo to reduce my anxiety in reading.'* *'There is too much information to read.'* *'I don't like to read content with text and pictures but no white space'* *'It looks like a general flyer; it does not convince me.'*
Typeface Design	**Transcription**

Use of a variety of styles of typeface	*'I prefer an eye-catching title.'* *'The underlined text is easy to read.'* *'I like the use of headings and subheadings to guide passages.'* *'I like to see the title, heading, subheading, and context presented in a variety of styles.'* *'I don't like the typeface with graphic devices because it is incomprehensible and abstract.'* *'It's better not to use more than three kinds of fonts for the context.'*
Use of suitable font size	*I prefer the text to be designed in a simple style.'* *'I like to see the title and text in different fonts.'* *'I prefer the use of a suitable font size to increase the legibility.'* *'I don't like a monochrome title.'* *'I don't like the use of a smaller font size to show the content.'* *'It looks confusing when the title and text are the same colour.'* *'It's hard to find the key point in an article when the same style is used for the title and content of a section.'*
Use of list, charts and graphs	*'I prefer a title to be designed in an artistic style.'* *'I prefer an artistic headings accompanied by the monochrome text.'* *'I don't understand what the purpose of the charts is.'* *' I get confused when I see math'* *'I am not interested in reading the data.'*
Use of graphic devices to highlight key messages	*'The decorative cartoons are very lively and beautiful.'* *'I like the use of numbering to show the order.'* *'The use of various colours to design the text makes me feel dizzy.'* *'It's difficult to identify most of the coloured text with the artistic style of the content.'* *'I don't like the use of graphic devices to highlight key messages; it makes the articles difficult to read.'*
Colour Scheme	**Transcription**

Using bright colours & familiar ad colours	*'It uses live colours.'* *'I like to see a bright colour scheme.'* *'I prefer a highly contrasting design to generate an active feeling.'* *'A well-known advertisement colour makes me remember the content at first glance.'* *'The breastfeeding picture makes me feel embarrassed.'* *'It looks like an imitation of an advertising flyer, so I do not want to read it.'* *'I believe that the use of a high degree of contrast is a kind of shallow idea; for example, a highly contrasting design in red and green generates a vulgar feeling.'*
Using monochrome colour	*'Black and white pictures show no vitality.'* *The use of monochrome colour makes the content look quiet.'* *'A low contrasting design in white and grey is boring.'* *'A dull colour scheme makes me feel depress because it is kind of blurred.'* *'It's not good for subjects and background to have a similar colour.'* *'I prefer colourful pictures to monochrome ones.'* *'It is a general design without a creative idea.'*
Using colour for different genders	*'I couldn't tell the theme from an abstract form.'* *'I didn't understand the story until I saw the title.'* *'I am not familiar with the system that warm colours are always regarded as being feminine colours, whereas cold colours are always regarded as being masculine colours.'* *'I am more concerned about male healthcare because our husbands are generally older and needed home cares.'*
Using ethnic colours	*'It uses a soft colour scheme.'* *'The Vietnamese title is very prominent.'* *'The cartoon images are too naïve to present a pregnant theme.'* *'I don't know which colours represent Vietnam.'* *'I don't agree that natural colours can represent Vietnam.'* *'I don't like the use of Vietnamese text because I have no confidence in the translation.'*
Pictorial Illustrations	**Transcription**

Applied with line drawings	*'The use of line drawings makes the picture look very neat.'* *'The theme is easy to recognise, even if only the outline of the subject is illustrated.'* *'I don't like line drawing because it gives me a feeling of being done hastily.'* *'It looks like an unfinished painting.'* *' I cannot convinced by line drawings'*
Applied with digital cartoons	*'I prefer a lively cartoon with cute characters.'* *'I prefer more realistic cartoon'* *'I love to see a picture of a happy family life.'* *'I couldn't be convinced by a fake cartoon that delivers healthcare information.'*
Applied with painting	*'It looks like an artistic drawing.'* *'It was painted carefully.'* *'It is easy to see a colourful title placed on a white background.'* *'I prefer the use of paintings to sketch the natural world.'* *'I prefer a scene of three generations because it implies happiness.'* *'I couldn't identify the subjects because the outline illustrated by watercolours was too vague.'*
Applied with abstract forms	*'It gives me a clean impression.'* *'It gives me a trendy impression.'* *'The shapes have a very modern design.'* *'The font is beautifully designed.'* *'The presentation of the earth is very three-dimensional.'* *'The picture is too tiny to see clearly.'* *'Why is there so much empty space? It's a waste'* *'It's too abstract to understand; I didn't know what the story was about until I saw the cigarette.'*
Realistic Photography	**Transcription**

Using daily life	*'I love to see photos of couple; they give me a warm feeling.'* *'I prefer to see familiar faces and scenes in pictures since this makes me feel safe.'* *'The content reminds me to take exercise regularly'* *'The title use of a high degree of contrast'* *'The people on the screen should be healthy and beautiful to present a positive vision.'* *'The park in the picture reminds me of the park nearby my house.'*
Using photo of a doctor	*'I believe the use of photo of a doctor can express professionalism.'* *'I think the use of a doctor's picture can attract patients' trust.'* *I can't understand the meaning of medical supplies presented in healthcare materials.'* *'Professional medical photos make me feel that the content of the article is hard to read.'* *'The doctor seems to be saying something about surgery, but how can I understand the content?'* *'The photos of outpatients remind me that I can't understand what the doctor says in the clinic.'*
Using symptoms of a disease	*'I like photos of symptoms. They can help me to recognise the disease because my kids suffer from allergies.'* *'I can't accept the use of realistic treatment to show the need for behavioural change.'* *'Detailed symptoms of diseases make me uncomfortable.'* *'Realistic descriptions of treatment scare me.'* *'I believe that realistic photos are depressing.'* *'Why use a photo of a foreign baby rather than a Taiwanese one?'*
Using general medical equipment	*'I refuse to see healthcare materials designed with photos of hospitals and medicine.'* *'Seeing too many medical materials together depresses me.'* *'I'm not sure whether the story is about medication, vaccinations, or seeing a doctor.'* *'I am not impressed by popular images, because similar images and backgrounds are boring.'* *'I don't like unrelated photos only used for decorative purposes, because I feel cheated if I depend on them to decide whether to read the content or not.'*
Cultural Factors	**Transcription**

Adopting the factor of religion	*'We don't have religious beliefs apart from respecting our ancestors.'* *'Religious beliefs were not allowed in the communist era.'* *'Buddhism can't represent Vietnam, because there are other religions there.'* *'I don't like metaphorical signs because I couldn't understand the implication of the design.'* *'I don't like the use of serious religion to represent the relaxed lifestyle in Vietnam.'* *'Our Chinese is not good enough to understand the ancient text.'*
Adopting the factor of living habits	*'The arrangement of the main course is very neat and the decoration of the side dish is very beautiful.'* *'I prefer the use of unique Vietnamese food to represent Vietnam.'* *'I prefer the use of a delicious home-made meal to represent Vietnam.'* *'This kind of food is also popular in other Southeast Asian countries.'* *'I'm afraid we will be overlooked if such simple ingredients are used to represent Vietnam.'*
Adopting the factor of hometown festivals	*'I get a warm glow when I see traditional Vietnamese costumes.'* *'Festive activities give us the impression of a family reunion.'* *'The unique props, costumes and dances show that they are Vietnamese.'* *'Scenes of Vietnamese culture make me feel as if the Taiwanese respect us.'* *'The arrangement of the people dancing is wrong. It would be better if a woman wearing a blue dress was followed by a woman wearing a red dress.'* *'You can see similar activities in rural areas of Taiwan.'* *'It is hard to identify them because each region holds different events and activities.'*

Adopting the factor of hometown landscape	*'The beautiful scenery of Halong Bay is a familiar Vietnamese scene.'* *'I like to see slim pretty Vietnamese girls in healthcare materials.'* *'The images of costumes and boats remind people of Vietnam.'* *'A hometown landscape makes me feel homesick but I am still pleased to see it.'* *' I couldn't accept a description of a lower standard of living which made them feel being discriminated'* *'When I first came to Taiwan, I felt that emphasising the Vietnamese image was discriminatory, but I don't think that anymore.'* *'I like the subject placed in the middle.'* *'I am not impressed by the picture because it is too common.'* *'A specific country landscape can't represent the whole of Vietnam.'* *' I believe that scenery without people lacks vitality.'*

Table 13 The major transcript of semi-structured interviews

In brief, the phrases used by immigrant mothers to evaluate healthcare material can be analysed in terms of comprehension, criticism, emotion, preference, standard and trust, as detailed in Table 14. The phrases, 'believe', 'wonder' and 'afraid' were the most frequently-used by immigrant mothers when commenting on the health leaflet, whereas the phrases, 'should', 'refuse', and 'stand' were less frequently-used. It does appear that immigrant mothers prefer to use flexible words rather than powerful ones to express their feelings. This indicates that immigrants lack confidence to evaluate healthcare material in this respect. Furthermore, the phrases, 'like', 'good' and 'beautiful' were the most frequently-used by immigrant mothers when referring to the health leaflet, whereas the phrases, 'difficult', 'boring' and 'waste' were less frequently-used. This also illustrates that immigrant mothers prefer to use positive rather than negative words to criticise healthcare material, and this

indicates their humble attitude toward life in this respect.

Encoded Category	Phrases
Comprehension	know, understand, think, tell, identify, distinguish, recognise, remind, remember
Criticism	very, too, good, easy, hard, simple, clear, funny, beautiful, lively, bright, general, appropriate, difficult, strong, prominent, positive, negative
Emotion	Sad, worm, worry, scare, concern, dizzy, depress, boring, shocking, horror, mystery, confusing, embarrassed, comfortable, impression, intimidate, miserable
Preference	Like, love, prefer, interest, impress
Standard	Can, should, better, clear, more, stand, allow, accept, agree, waste
Trust	Believe, convince, confidence, wonder, sure, cheated, refuse, afraid, familiar

Table 14: The key terms used by immigrant mothers to evaluate healthcare leaflet

In brief, the phrases used by immigrant mothers to describe visual design can be analysed in terms of concept, layout, typeface, colour, illustration, photographs and culture, as detailed in Table 15. Words like ‘idea’, ‘story’, ‘meaning’ and ‘theme’ were most frequently used by immigrant mothers when referring to the concept of health leaflets; words like ‘page’, ‘space’, ‘order’, ‘arrangement’ and ‘background’ were most frequently used by immigrant mothers when commenting on the layout of health leaflets; words like ‘text’, ‘title’, ‘heading’ and ‘font’ were most frequently used by immigrant mothers when referring to the typeface of health leaflets; words like ‘contrast’, ‘bright’ and ‘colour’ were most frequently used by immigrant mothers when commenting on the colour of health leaflets; words like ‘cartoon’, ‘painting’ and ‘drawing’ were most frequently used by immigrant mothers when referring to

the illustration of health leaflets; words like ‘photo’, ‘picture’ and ‘image’ were most frequently used by immigrant mothers when referring to the photographs in health leaflets; and words like ‘belief’, ‘religion’ and ‘metaphor’ were most frequently used by immigrant mothers when reflecting the culture of health leaflets.

Encoded Category	Phrases
Concept	idea, story, content, theme, scheme, meaning, message, implication
Layout	page, space, order, layer, arrangement, background, middle, balance, rhythmic, symmetrical, composition
Typeface	text, title, heading, font, style
Colour	contrast, bright, monochrome, colour
Illustration	icon, cartoon, painting, drawing, scene, pattern, sketch, illustration
Photographs	photo, picture, image
Culture	culture, belief, religion, metaphor, mystery, superficial, immoral, overlook, discriminatory, nationality

Table 15: The key terms used by immigrant mothers to describe visual design

9.3 Key Findings and Discussion

It is clear from the transcript presented in Table 13 that the concept, layout and cultural factors raised the low-literate immigrant mothers’ emotions the most, because they provided more feedback about these three issues than others. Design is not an exact science and designs need to be extensively tested. Despite a low sample number, the in-depth interviews that emerged enabled visual design strategies of healthcare media for immigrant mothers to

be recommended below. The recommendations below were agreed by the majority of the participants (There were 10 participants and more than seven of them indicated that these were important factors.).

Concept	
Suggest	**Avoid**
● **Use the concept of straightforward** Low-literate users prefer that designers inform them of the main theme directly rather than describing a long story in detail. ● **Use the concept of humour** Funny stories make low-literate users sufficiently relaxed to absorb new information. ● **Use the concept of celebrity** Low-literate users expect a slogan presented by a familiar idol, to enhance the credibility of healthcare media. ● **Applied cultural elements** The adoption of motherland culture can deepen low-literate audience's impression of identity.	● **Avoid using the idea of intimidation** Low-literate users may not appreciate being forced to change their behaviours due to religion or illness. ● **Avoid using the idea of metaphor** Low-literate users may not comprehend content that includes metaphors and implications. ● **Avoid using idea of infamous celebrity** Low-literate users don't know the celebrity and question the commercial intention. ● **Avoid using culturally inappropriate scheme** Low-literate users may have a simple and traditional morality rather than a complex and open one. ● **Avoid using Hi-tech Techniques** Low-literate users may perceive hi-tech healthcare materials to be unfriendly.

Layout Design	
Suggest	**Avoid**

• **Use plenty of empty white space** Low-literate users expect a limited content presented on a layout that contains the appropriate amount of white space. • **Use symmetrical arrangement** Low-literate users expect a balanced design with a symmetrical arrangement on a layout. • **Use the scheme of segmentation** Low-literate users prefer learn from divided sections rather than the complete information. • **Use number signalling** Low-literate users prefer the use of numbering to show the order rather than bullet points. • **Use one topic per page** Low-literate users dislike the idea of too much information on the same page and several themes presented at the same time.	• **Avoiding using tiny subjects shown in a wide white layout** Low-literate users may not identify themes described by a tiny subject shown in a wide white layout • **Avoid using unbalance composition** Low-literate users don't like to see unstable compositions which make them feel uncomfortable. • **Avoid using the scheme of full layout** Low-literate users don't like to read content with text and pictures but without any white space.

Typeface Design	
Suggest	**Avoid**

• **Use an eye-catching title** Low-literate users wanted to determine whether or not the specific theme met their needs at first glance. • **Use suitable font size** Low-literate users expect for the use of suitable font size to increase legibility. • **Use a variety of styles of typeface** Low-literate users prefer to see the title, heading, subheading, and context presented in a variety of styles. • **Use graphical headings and corresponding monochrome text** Low-literate users expect for a conspicuous title accompanied by the clear text to present the content clearly.	• **Avoid using monochrome text for whole section** Low-literate users may believe it sometimes looked dull when a monochrome text with a simple style was used for whole section. • **Avoid using same style for title and content** Low-literate users may believe it was hard to find the key point in an article when the same style was used for title and content of a section. • **Avoid using of graphic devices to highlight key messages** Low-literate users may believe the use of graphic devices to highlight key messages made the articles difficult to read.

Colour Design	
Suggest	**Avoid**

• **Use bright colours** Low-literate users prefer a highly contrasting design to generate an active feeling. • **Use well-known advertising colours in the long term** A well-known advertisement colour makes low-literate users remember the content at first glance. • **Use contrasting scheme** Low-literate users expect the subjects could be distinguished from the background immediately.	• **Avoid using ethnic colours** Low-literate users don't know which colours can represent their identity or nationality. • **Avoid using scheme of black and white** Low-literate users disliked a quiet and dull background because it gave them the feeling of sloppiness. • **Avoid using scheme of similar colours for subjects and background** Low-literate users may not distinguish the subjects from the background because of the use of similar colours.

Illustration Design	
Suggest	**Avoid**
• **Applied with painting** Low-literate users prefer artistic drawings that make them feel the material has been carefully designed • **Applied with cartoons** Low-literate users prefer cartoons used for decorative purposes. • **Applied with realistic sketches** Low-literate users believe the use of realistic sketches gives an impression of professionalism and is convincing. • **Use the subject of three generations** Low-literate users believe that a scene of three generations implies optimism and happiness.	• **Avoid applying line drawing in draft** Low-literate users may believe that the use of line drawing shows that the designer was in a hurry to finish it. • **Avoid using abstract forms** Low-literate users may not comprehend the meaning of abstract forms and simplified terms. • **Avoid applying negative vision.** Low-literate users may prefer a positive theme rather than a negative one.

Photograph Design	
Suggest	**Avoid**
• **Use daily life** Low-literate users prefer to see familiar faces and scenes in pictures since this makes them feel safe. • **Use photograph of a doctor** Low-literate users prefer the use of a photo of a doctor to represent professionalism • **Use photograph of symptoms** Low-literate users believe the photos of symptoms which can help them to recognise the disease when their children are sick. • **Use one photograph per question** Low-literate users prefer that every question is accompanied by an interpretive photograph to reduce the pressure of reading.	• **Avoid using intimidating photographs** Low-literate users don't like the use of detailed of diseases and treatment to show the desire for their behavioural change. • **Avoid using embarrassing photographs** Low-literate users may feel embarrassed to see the photos of breastfeeding, lovers kissing, or naked bodies. • **Avoid using the photograph of medical specialising** This may make low-literate users feel that the content of the article will be difficult to read. • **Avoid using photos unrelated to the theme** Low-literate users may dislike the use of unrelated photos that were only used for decorative purposes which make them feel deceived.

Cultural Design	
Suggest	**Avoid**

• **Adopt the factor of hometown landscape** Low-literate immigrants agree that a familiar scene would remind immigrants of their origin. • **Adopt the factor of hometown festivals** Low-literate immigrants prefer to see specific props, costumes, dances and festive activities to give the impression of a family reunion. • **Adopt the factor of living habits** Low-literate immigrants feel being respected by local people who have observed scenes of their original hometown.	• **Avoid using religious image** Low-literate immigrants may not accept a design with a superstitious theme. • **Avoid adopting unfamiliar living style** Low-literate immigrants may not agree with the idea that the style of everyday living was not nationwide. • **Avoid adopting the factor of a lower standard of living** Low-literate immigrants may feel being discriminated if poor scenes are used to represent their life.

Table 16 The visual design strategies of healthcare media for low-literate immigrants

In terms of concept, both the past and new findings agree with certain evaluation criteria. For example, Andersen et al. (2008) maintain that low-literate users dislike the overt use of religious imagery, particularly an inclusion of an image of the God. This study also found out that low-literate patients disliked the concept of intimidation because they might not appreciate being forced to change their behaviours due to religion or illness. Moreover, Altstiel & Grow (2010) suggest that the concepts of humour and celebrity might be applied in advertising to grab audiences' attention. The results of this study also recommend that a slogan presented by an idol can enhance credibility, but warns against using ridiculous humour and celebrities who are unfamiliar to immigrant communities because they may cause a negative effect. However, some new findings about the concept scheme for health

materials have also emerged from this study, such as using the concept of being straightforward rather than the idea of metaphor to inform low-literate user the main theme, and applying cultural elements rather than digital effect techniques to grab low-literate immigrants' attention.

In terms of the layout, Meyanathan *et* al. (2012) propose that maintaining ample white spaces will enhance readers' interest, and this study also recommends limited content shown in a wide white layout but warns against using tiny subjects on a wide white layout because low-literate users will struggle to identify the theme. Moreover, Summer & Summer (2003) suggest limiting the results displayed on a page to reduce the pressure of reading. This study also recommends that limited information presented at the same time to reduce low-literate users' memory load and the concept of one topic per page might be a more useful way to maintain their attention. In addition, the Ministry of Health of New Zealand (2002) suggests using bullet points to break up the text and number signalling to show the sequential order, whereas this study recommends designers to use numbering rather than bullet points because they are easier to be recognised by low-literate users.

In terms of typeface, both the past and new findings agree with certain evaluation criteria. For example, Summers & Summers (2005) suggest that the use of 14 points for a 5-inch text column and simple page titles in a larger type size can stimulate readers to pay attention to important information, and this study also advocates the use of larger text to increase legibility. Moreover, Dabner (2010) advocates the use of different styles and forms of

typeface to better organise the content, and this study also proposes the use of a variety of typeface styles applied to the title, heading and context to make article easier to read. However, Doak *et al.* (1996) indicate that the use of six or more types of fonts and sizes on a page confuses the appearance and makes the focus uncertain, and the Ministry of Health of New Zealand (2012) recommends that designers should use a simple and plain typeface and less than three different typefaces for headlines. Therefore, this study proposes the use of artistic headings and corresponding monochrome text to present whole context might be a more useful typeface scheme.

With respect to colour, both the past and new findings agree with certain evaluation criteria. For example, Doak *et al.* (1996) suggest that designers should use a high degree of contrast between the print and the paper to increase the readability, and the results of this study also found that low-literate users could not distinguish the subjects from the background if similar colours were used. Steele *et al.* (2011) believe that a lack of colour, or even a dull colour scheme, will ruin the potential of printed materials, and the findings of this study showed that low-literate users disliked a quiet and dull background because it gave them the feeling of sloppiness. Therefore, this study advises designers to avoid using black and white as a colour scheme unless this is the colour of the theme, such as in Chinese calligraphy. However, some new findings about the colour scheme for health materials have also emerged from this study, such as using familiar advertising colours to evoke low-literate memories, and avoid using ethnic colours to highlight their identity or nationality.

In terms of illustration, both the past and new findings agree with certain evaluation criteria. For example, Steele *et al.* (2011) advise designers not to use negative features, such as a high word count and old-fashioned images to split audiences' attention, and this study also suggests that designers should avoid using draft drawings or negative vision. However, some past studies found contradictory results; for example, Doak *et al.* (1996) suggest that designers should use line drawings to promote realism without including distracting details for low-literate users, whereas the Western Cheshire Primary Care Trust in the UK (2007) recommends avoiding the use of clipart for general patients. However, the findings of this study showed that low-literate users preferred designers to illustrate details with realistic sketches rather than clipart. Furthermore, some unexpected findings have also emerged; for example, low-literate users prefer illustrations with artistic paintings rather than abstract forms and they also prefer images showing three generations rather than a single individual.

With respect to photographs, both the past and new findings agree with certain evaluation criteria. For example, The Ministry of Health of New Zealand (2002) advocates that placing of illustrations near the relevant text to help readers to understand unfamiliar terms or complex phrases, and this study also found that every question accompanied by an interpretive photograph might be a more useful way in to reduce the pressure of understanding. Sherin (2012) suggests that illustrations should match the aim of the title, and this study also warns against using irrelevant pictures with no

connection to the theme. A great many helpful concepts related to photograph design have emerged from this study, such as using photographs of daily life to reduce anxiety caused by unfamiliarity, using photographs of symptoms to help to recognise diseases, and using a photograph of a doctor to represent professional care. However, the use of improper photographs and detailed photographs of diseases and treatment should be avoided because they make low-literate users feel embarrassed and uncomfortable. This study also warns against adopting the photographs that include special equipment or complex medical data. This may make low-literate users feel that the content of the article will be difficult to read and even may remind them that they struggle to understand the doctor says in the clinic.

As for cultural design, both the past and new findings agree for certain evaluation criteria. For example, Doak *et al.* (1996) suggest that designers should use similar logic, language, and experience to match the target culture. Liquori (2011) suggests that culturally-sensitive factors, such as language, symbols, images and colours need to be incorporated into cross-cultural communication. This study also recommends using cultural elements to remind immigrants of their origin but warns against highlighting ethnic and cultural differences because low-literate immigrants worry about being discriminated against. Furthermore, this study has highlighted some other concerns in terms of representing culture. Firstly, scenes that denote a lower standard of living in their home countries should be avoided because it makes low-literate immigrants feel discriminated against; secondly, serious scenes that relate to religion should be avoided because low-literate immigrants could

feel threatened; and thirdly, the creative theme must imply appropriate morals, which will enable low-literate immigrants to feel virtuous.

Chapter 10 Conclusions

The objectives of the study were explained in Section 1.3 of the introduction and these can now be examined to determine their level of achievement. The key findings in this study are as followed: (1) The key problems usually encountered by low-health-literate immigrant mothers when caring for their children's health relate to five factors of concern, namely language, knowledge, culture, how to take care, and the use of healthcare media; (2) There was no significant difference between the influence of the intervention made by the leaflet and by the website; most of the demographic factors did not have an impact on the educational effectiveness, apart from the user's 'educational level' and user's 'web-surfing frequency'; (3) The criteria used by low-health-literate users to evaluate healthcare media could be analysed in terms of the quality of content, appearance, and process; Most of the participants agreed that the quality of content and usability was marginal important than the quality of appearance in healthcare media; (4) The visual factors of healthcare media that affect low-literate users' satisfaction include concept design, design layout of cover, design layout of content, typeface design, colour design, pictorial illustrations, realistic photographs and cultural factors. The concept, layout and cultural factors raised the low-literate immigrant mothers' emotions the most. The study can be said to have contributed to several domains, as illustrated below.

10.1 Contribution to Research Process

An interdisciplinary research

This is an interdisciplinary research that integrates Design, Communication and Public Health; it discusses various topic related to visual design, health information technology, usability evaluation, health communication, health intervention, doctor-patient communication, health literacy, healthcare disparity, and immigrant populations. Successful health communication depends on the health information properly coded by the providers and correctly decoded by the consumers. The development of healthcare media would be more effective if the ideas of providers, designers, caregivers, and users could be practically adopted and implemented.

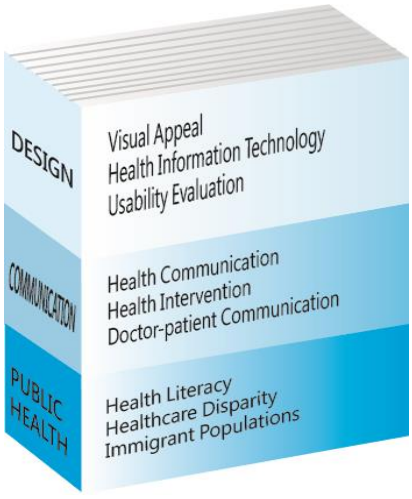


Figure 9 An interdisciplinary research

Leaflet VS. Website for Low-literate Users

This is the first research study that compares the educational effectiveness of leaflets and websites for low-literate users. The majority of past researches were focused on developing and evaluating the feasibility of healthcare media for well-educated users. Comparative analyses of the influence of various forms of media on low-literate users are rare. Specific strategies, methods, and tools were determined to design, implement, and evaluate specific healthcare media to meet the needs of low-literate users in this study.

A Holistic Framework of Methods

Thousands of health interventions fail to go beyond the trial stage, because the broad range of the available usability testing methods makes it difficult to choose the best plan to assess the efficiency of the intervention. However, this study uses a combination of quantitative and qualitative methods to explore more internal and external problem of healthcare material. It provides a holistic framework for improving health intervention using various methodologies, including development, experiment, observation, comparison, and analysis. The research module conducted in this study may be able to be applied into different chronic diseases, such as such as diabetes, cancer, allergy and heart disease to meet the users' needs of different groups of vulnerable populations such as new immigrant, low-income, low educational level and elder people.

Practical Health Educational Platform for Low-literate Immigrants

This is also the first experiment that focuses on the transfer of healthcare information related to paediatric allergies to low-literate immigrants. A number

of intervention studies have used healthcare media for various low-literacy populations, including pregnant smokers, cancer patients, allergic children, and low income family with positive results. There is no comprehensive research focusing on improving healthcare knowledge related to paediatric allergies for low-literate immigrants. This study cooperated with paediatric allergy specialists to develop and evaluate a practical health educational platform, which provides healthcare knowledge related to atopic dermatitis, allergic rhinitis, and bronchial asthma to help low-literate immigrants to take care of their children.

10.2 Contribution to Knowledge

10.2.1 Different Criteria Used by Immigrants to Evaluate Healthcare Media

Different Favourite Healthcare Media

This study found that most of the immigrant mothers would ask their doctors, families and friends about the information of children's healthcare, and only 48% of them indicated that they would make use of health educational materials. The above findings show that immigrant mothers prefer to have consultations with real people, to ask questions and receive answers, rather than using the non-interactive method of obtaining information from health educational materials. No wonder racks of health educational materials are

ignored in hospitals, clinics and community health centres (Kreuter *et al.*, 2010). However, we were encouraged to discover that television is the most frequently-used media for healthcare by immigrant population. The combination of audio and visual elements of TV appeared to be effective 80% of low-literate users in the sample. Actually, TV programmes on health care have flourished in Taiwan in recent years. TV producers invite celebrities to ask questions about healthcare problems, which are answered by medical experts during the programme. The topics discussed relate to different kinds of healthcare and the contents of the conversation are easy to understand. The medical jargon is explained using visual aids and the interaction invited via questions, responses, and suggested actions, which is why low-literate immigrants prefer to watch these programs rather than using other media to acquire healthcare information. The findings provide evidence of the need to include video content in healthcare resources, as well as the need to commission more programmers.

Different Preference for Hi-Tech Techniques

Another finding was that most of the participants expressed a dislike for the use of overt digital effects. For example, a design that contained overlapping pictures was disliked because they found it difficult to distinguish text amongst the pictures. Dislike of this digital effect then was due to its negative effect on comprehension. Participants also expressed dislike for overt highlighting of key message with graphical effects, again finding it hard to distinguish between elements and read coloured text which was dominated by a graphic

filter or effect. Designers should not assume that digital manipulation or digital effects are the panacea for successful healthcare material.

Different Evaluating Visual System

Most low-literate users seem to be unfamiliar with a visual system that is regarded as being common by their high-literate counterparts. For example, warm colours are always regarded as being feminine colours, whereas cold colours are always regarded as being masculine. Therefore, pink and orange colours are used to promote women's health, while blue and green colours are used to promote men's health. Low-literate users seem to ignore above-mentioned visual system when choosing healthcare media; for example, the reason they pick up healthcare materials related to men's health is simply because their husbands are generally older and need home care. Moreover, while creative formats that involve metaphorical approaches to express innovative appeal have worked over the years, low-literate users sometimes fail to understand the designer's intention because they cannot comprehend the metaphor and implication in content correctly. In addition, the use of monochrome colours to represent the value of a product and imply an artistic appeal is very popular in advertising design. However, some participants stressed that they preferred a lively topic to be accompanied by a colourful drawing rather than a subdued subject accompanied by monotonous pictures because it give them the feeling of sloppiness. These findings are a reminder that simplicity is the key to successfully delivering healthcare information to low-literate users. Designers are advised to adopt straightforward concepts

rather than complicate strategies in the visual design of low-literate healthcare materials.

Different Culture-sensitive Factors

Cultural factors seem to be the biggest barrier to delivering healthcare for immigrant populations. Values and beliefs must be carefully analysed to identify the key factors that have a major impact on their decision-making. According to previous studies mentioned in section 4.5.1, the culturally sensitive factors that have an impact on individuals' healthcare decisions can be identified as follows: family, language, education, religion, wealth, image, metaphors, myths, and nutritional preferences. This study indicates that the cultural issues that need to be considered when transmitting health information to immigrant populations relate to seven factors, namely ethnicity, customs, habits, trust, fears, metaphors, and family. In terms of ethnicity, this study warns against the use of an ethnic scheme to stimulate low-literate immigrants to fight for their identity, because highlighting ethnic differences makes new immigrants feel they are being discriminated against. In terms of custom, this study advises designers to avoid using improper photos that may embarrass low-literate immigrants (e.g. clear photos of breastfeeding, lovers kissing, or naked bodies). In terms of habits, this study suggests that unfamiliar faces and scenes should not be adopted because they make low-literate immigrants feel unsafe. In terms of trust, it warns that a scheme with unrelated picture should be avoided because low-literate immigrants feel deceived when unrelated photos are used for decorative purposes but have no connection with the subject. In terms of fears, designers are advised not to

use the idea of intimidation to motivate a behavioural change, because low-literate immigrants feel uncomfortable when diseases and treatment are described in detail. In terms of metaphors, this study warns against using metaphorical schemes in the content because low-literate immigrants feel frustrated when trying to recognise metaphorical signs. In terms of family, it is recommended that a scene depicting three generations of healthy could be used for illustration because it implies optimism and happiness. Cultural factors play an important role in decision-making and subsequent actions. Enhancing the cultural competency of clinicians and healthcare systems may be the solution to reduce ethnic disparities in healthcare.

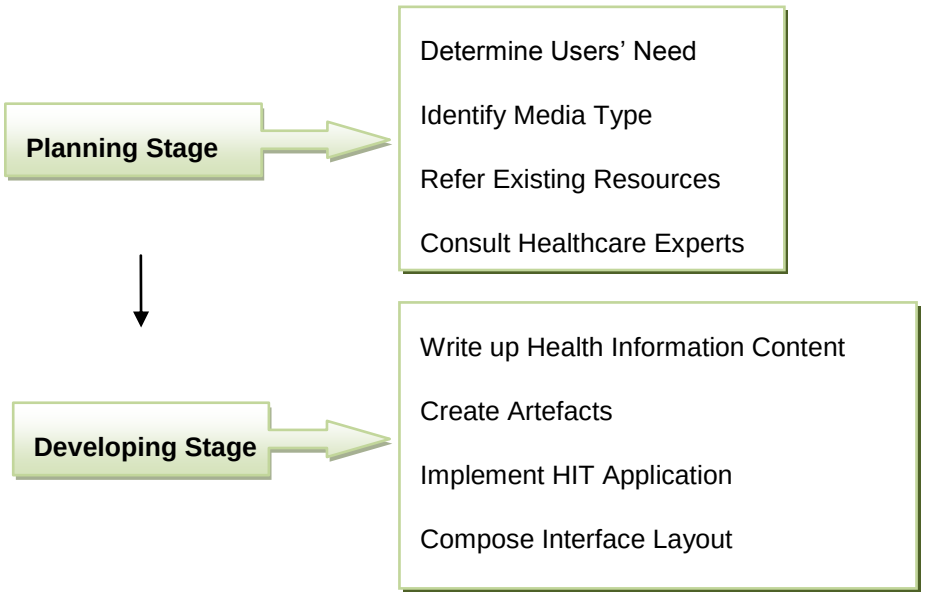
10.2.2 The Design Strategies and Guidelines of Healthcare Media for Low-literate Users

Design Strategies

When a designer develops healthcare media, they focus on certain concerns; for example, who is the target audience? What is the material designed to achieve? Where will you get the information you need? What is the budget to produce the material? Why it looks appealing to target audience? How will the material be distributed? On the other hand, when audiences evaluate healthcare media, they also have some concerns, such as is the health information credible? Is the interpretation clear and adequate? Is the media application suitable? Is the interface easy for navigation? The ways to help designers to properly code healthcare information are as important as the

ways to help audiences to correctly decode them, and the related design strategies and guideline for low-literate healthcare media are suggested below.

A successful healthcare system needs to undergo a step-by-step approach, as detailed in Fig 10. At the planning stage, the designers need to determine users' needs, identify the type of media, refer to existing resources, and consult healthcare experts to establish an applicable concept. At the developing stage, the designers need to write up the information content, create some artefacts, implement an application of health information technology (HIT), and compose the interface layout to create an appropriate platform. At the evaluating stage, the designers need to conduct a pre-post test, usability evaluation, in-depth interview, error amendment and distribute it to achieve a positive outcome. The above is an organisational framework for the design of effective healthcare media, which proposes the fundamental concerns, and sequential key steps that incorporate the planning, developing and accessing issues that need to be considered when designing healthcare media.



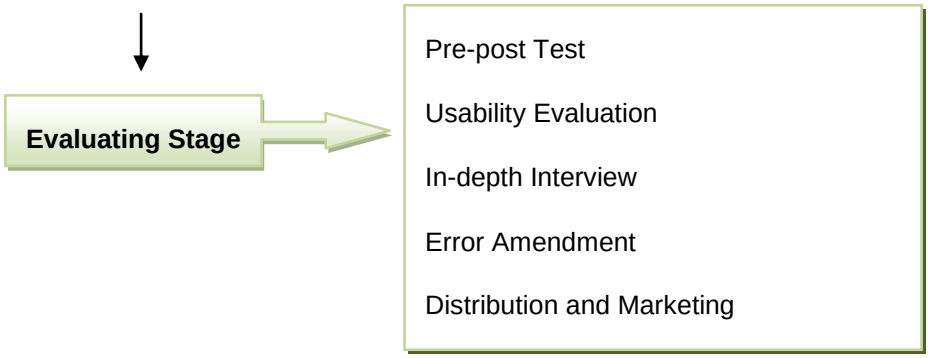


Figure 10 The design strategies of healthcare media

Design Guidelines

The factors of healthcare media that affect low-literate users' satisfaction can be analysed across 4 areas: concept, content, appearance, and process. In terms of concept, schemes based on straightforward, humour, celebrity, culture and ad imitation are recommended, whereas schemes based on intimidation, metaphor and digital effects should be avoided. As for content, readability, recognition and credibility are the issues that low-literate users most concern. With regard to appearance, layout, typeface, colours, illustrations, photography and culture are the visual factors that affect low-literate users' satisfaction. In terms of usability, the features of navigation, interaction and technology should be designed to meet target audiences' needs. Design guidelines, suggested by this study for healthcare media for users with low literacy are listed below. The past and new findings that agree with certain design strategies are presented with bullet points in the table below. The new findings from this study are highlighted with an arrow.

Concept
➢ It is better to use the concept of straightforward to inform low-literate users of the main theme; ➢ It is better to use the concept of humour to make low-literate users sufficiently relaxed to absorb health information; ➢ It is better to use the concept of celebrity to enhance the credibility of healthcare media; ➢ It is better to apply cultural elements to deepen low-literate immigrants' impression of identity; ➢ Since the use of intimidating concepts to force low-literate users to change their behaviour may make them feel uncomfortable, they should be avoided; ➢ Since the use of metaphorical concepts to imply the content may make it difficult to comprehend, they should be avoided; ➢ Since the use of Hi-tech techniques to show the graphical effects may make the materials appear unfriendly, they should be avoided;

Content	
Readability	• It is better to describe a specific objective to meet low-literate users' specific needs; • It is better to adopt a vivid and welcoming tone to make the materials friendlier; • It is better to use short sentences and paragraphs to reduce low-literate users' level of anxiety; • It is better to avoid using medical jargon that may scare low-literate users;

Recognition	• It is better to clarify concepts with examples to aid low-literate users' understanding; • It is better to convey a limited amount of information to reduce the pressure of reading; • It is better to divide information into several unique classifications to help low-literate users to learn more effectively; • It is better to use headings and sub-headings to help to reinforce the flow and content;
Credibility	• It is better to record the authoritative attribution clearly to enhance the credibility of the material; ➢ It is better to provide the latest information to attract low-literate users' attention; ➢ It is better to clearly distinguish advertising from content to gain low-literate users' trust;

Appearance	
Layout	• It is better to use a scheme of segmentation to help low-literate users to learn more effectively; • It is better to adopt plenty of white space in the layout design to reduce low-literate users' memory load; ➢ It is better to design a layout with a symmetrical arrangement to make low-literate users feel balanced; ➢ It is better to design the colour and background consistently to help low-literate users to recognise the chapter they are reading; ➢ It is better to use numbering rather than bullet points to show the sequential order; ➢ It is better to use the scheme of one topic per page to maintain low-literate users' attention; ➢ Since the use of a rhythmic and unbalanced composition may seem chaotic to low-literate users, it should be avoided; ➢ Since displaying tiny subjects on a wide white layout may prevent low-literate users from identifying themes, it should be avoided;

Typeface	• It is better to use a suitable font size for reading to increase legibility; • It is better to use a variety of styles of typeface to stimulate low-literate users to pay attention to important information; ➢ It is better to use graphical headings and corresponding monochrome text to make the content easier to read; ➢ Since the use of monochrome text for a whole section may make the text look dull, it should be avoided; ➢ Since the use of the same style for the title and content may prevent low-literate users from identifying the key point, it should be avoided; ➢ Since the use of graphical devices to highlight key messages may make articles difficult to read, it should be avoided;
Colours	• It is better to use bright colours to generate an active feeling; • It is better to adopt a high degree of contrast between the print and the paper to help low-literate users to distinguish the subject from the background; ➢ It is better to use well-known advertising colours in the long term to evoke low-literate users' memory; • Since the use of a scheme of black and white may give low-literate users the feeling of sloppiness, it should be avoided; • Since the use of a scheme of similar colours for the subjects and background may decrease the readability, it should be avoided; ➢ Since the use of ethnic colours to highlight low-literate immigrants' identity may make them confused, it should be avoided;

Illustration	• It is better to place pictures near the relevant text to amplify it; ➢ It is better to apply painting so that low-literate users feel that the material has been carefully designed; ➢ It is better to apply cartoons to attract low-literate users' attention; ➢ It is better to use realistic sketches rather than simplified line drawings to promote realism; ➢ It is better to use pictures showing three generations rather than a single individual to imply optimism and happiness; • Since the use of abstract forms may cause low-literate users to misunderstand, it should be avoided; • Since the application of negative vision may split low-literate users' attention, it should be avoided;
Photographs	➢ It is better to use photographs of daily life to reduce anxiety caused by unfamiliarity; ➢ It is better to use a photograph of a doctor to represent professional care; ➢ It is better to use photographs of symptoms to help low-literate users to recognise the disease; ➢ It's better to use one photograph per question to help comprehension; ➢ Since the use of intimidating photographs to show the desire for a behavioural change may make low-literate users uncomfortable, it should be avoided; ➢ Since the use of photographs of medical specialisation may make low-literate users feel that the content of the article is difficult to read, it should be avoided; ➢ Since the use of irrelevant photographs with no connection to the theme make low-literate users feel that they have been deceived, it should be avoided;

Culture	➢ It is better to adopt a picture of their hometown landscape to remind low-literate immigrants of their origin; ➢ It is better to adopt a picture of hometown festivals to give low-literate immigrants the impression of a family reunion; ➢ It is better to adopt the familiar living habits of their hometown to make low-literate immigrants feel that they are respected; ➢ Since the use of religious images may make low-literate immigrants feel threatened, it should be avoided; ➢ Since the adoption of an unfamiliar living style may make low-literate immigrants difficult to recognise it, it should be avoided; ➢ Since the adoption of a factor that portrays a lower standard of living may make low-literate immigrants feel that they are victims of discrimination, it should be avoided;

Usability	
Navigation	• It is better to make navigation easy to retain low-literate users' attention; • It is better to design a user-friendly interface to retain low-literate users' interest for longer periods; ➢ It is better to provide language options to meet the specific needs of people of different nationalities; ➢ It is better to provide video narration to reduce the pressure of reading;
Interaction	• It is better to ensure interaction is invited via questions and answers to enhance low-literate users' interest; ➢ It is better to illustrate others' experience to reduce low-literate users' level of anxiety; ➢ It is better to supply an online consultancy service to provide low-literate users with the right knowledge at the right time;
Technology	• It is better to adopt simple digital technology to help low-literate users to easily access healthcare media ;

Table 17 The design guidelines of healthcare media for users with low literacy

10.3 Limitations of the Study and Future Directions for Research

10.3.1 Limitations of the Study

The Use of Probability Sampling

Using a randomised multicentre trial design with a larger patient sample became the most important issue in determining the educational effects of healthcare media. However, it was very difficult to recruit low-literate participants because some of them were reluctant to disclose their personal details on the consent form; moreover, it was hard for those who agreed to participate to maintain their concentration for the whole two hours of the experiment. Therefore, they may have responded in haste or failed to fully complete the questionnaire. However, I was fortunate to have gained the trust of the immigrant community as a result of my support for their activities in recent years. For example, I volunteered to design some official websites and promotional flyers for several immigrant organisations, as well as participating in many important immigrant festivals over the past four years. This connection enabled me to enrol 70 immigrant mothers for the experiment with the strong support of some qualified Vietnamese interpreters.

Language Barrier

The researcher's lack of proficiency in the languages involved in the research could be classed as a limitation. It would have been helpful to talk to the

participants in their own ethnic language to obtain more insight into the problem of doctor-patient communication and acquire some additional strategies of healthcare media design. The language barrier posed a problem for the face-to-face interviews, as well as the questionnaire survey. The extra time it took to find a qualified interpreter, have the documents translated and check the quality of the transcript, prolonged the entire process and made the research costly. Fortunately, the project was strongly supported by some qualified Vietnamese interpreters who volunteered to help to translate the documentation and interpret the interviews because they believed that their contribution would help to enhance the quality of children's healthcare among the immigrant population.

The Reliability of the Questionnaire Survey

Initially, one of the aims of the study was to determine if a good interactive design enhanced users' interest in searching for health information. Unfortunately, not all the technical terms for interactive design were recognised by the immigrant mothers, and embedding hyperlinks, pop-up screen, fast feedback, and recovering errors were discarded according to specialists' suggestions in the Reliability and Validity Test. Moreover, some of the feedback from the questionnaire may have been incomplete because of embarrassing and disconcerting issues. For example, some of the participants may have been too shy to raise their hands to ask a question during the pre-post knowledge tests with the result that some important variable data may have been missed. There may also have been some cases where the participants answered the questions in the way they thought they should

answer them, rather than giving their honest opinion. Therefore, 10 additional participants were recruited for the pre-post knowledge tests to compensate for any discarded samples and a qualified interpreter was enlisted to reduce the stress of the low-literate participants during the semi-structured interviews. As a result, some rich generic data that provided a useful picture of low-literate healthcare education was collected from 80 immigrant mothers.

10.3.2 Future Directions for Research

Comparative Analysis of the Influence of Health Intervention between Low-literate Users and High-Literate Users

Comparing the impact of various forms of media on users with different levels of health literacy may be the solution to increase the success rate of health intervention. Health literacy has been described as being a critical point to create successful health intervention. The reading strategies, information-seeking behaviour, and follow-up healthcare of higher and lower literate users are significantly different. Future studies are needed to determine if there is a correlation between the level of literacy and socio-economic and cultural factors. Identifying these factors and incorporating solutions into a health intervention may effectively optimise information systems.

Comparative Analysis of the Impact of Oriental and Occidental Cultural Factors on Healthcare Delivery

Cultural differences are evident in the delivery of services between East and West because of the differences between the values and beliefs of people

from various racial/ethnic groups within diverse countries. The majority of past research related to healthcare focused on investigating the influence of cultural differences on decision-making and action in the physician-patient relationship, healthcare management, and patients' adherence to treatment. There are comparatively rare studies on the way to improve cross-cultural decision-making through visual design, information technology and digital media. Rapidly shifting immigration trends pose a real challenge for healthcare in the global world. The use of culturally-informed patient-centred information technologies can reduce the healthcare disparities among minority ethnic populations. Therefore, future studies should devote more effort to understanding the preferred means of health communication and the different oriental and occidental culturally-sensitive factors when sharing information.

Exploring Applicable Usability Testing Methods for New Healthcare Media

Exploring available and applicable usability testing methods to assess the effectiveness of healthcare media may be the solution to increase the impact of healthcare media. Recent advances in computer technology have continually increased the impact of technology on the provision of health information. For example, rapid advances in mobile and wireless technologies in recent years have provided new opportunities for innovative means of healthcare delivery. With the rise in the volume of newly-emerging media, the way to compare their impact on health intervention becomes more complex. Additional studies are needed to develop more appropriate and suitable usability testing methods to assess their efficiency over time.

List of References

Abramowitz J. & Birnbaumer L.(2007). Know Thy Neighbor: A Survey of Diseases and Complex Syndromes that Map to Chromosomal Regions Encoding TRP Channels. *Transient Receptor Potential (TRP) Channels, Handbook of Experimental Pharmacology*, 179, 379-408.

Adams RJ, Stocks, NP, Wilson DH, Hill CL, Gravier S, Kickbusch I & Beilby JJ.(2009). Health literacy: A new concept for general practice? *Aust Fam Physician*, 38(3):144–147.

Ahern D, Kreslake J & Phalen J. (2010). What is eHealth: Perspectives on the Evolution of eHealth Reserch. In Krep, Gary L. (Eds.) *Health Communication. v 4. Health Communication and new information technologies (eHealth),* 267-287. London: SAGE Publications Ltd.

Alsos O A, Das A & Svans D.(2012). Mobile health IT: The effect of user interface and form factor on doctor-patient communication, *International Journal of Medical Informatics*, 81(1):12-28.

Altstiel T & Grow J. (2010). *Advertising creative: strategy, copy + design*, 2nd Ed. London : SAGE

Ambrose G & Harris P.(2009). *The Fundamentals of Graphic Design*. Lausanne : AVA Academia.

American Medical Association Foundation (2008) Health literacy [Internet].Boston, MA: The Foundation; 2008 Available: <http://www.ama-assn.org/ ama/pub/ca tegory /8115.html >Accessed:150811.

Arntson AE. (2003). *Graphic design basics*, 4th Ed. Belmont, Calif., London: Wadsworth.

Andersen P, Andersen S, Youngblood E & Colmenares E.(2008).Health education kiosk for low-literacy patients served by community-based clinics, *Proceedings of the 2008 IEEE International Symposium on Technology and Society*, 1-9.

Atkinson NL, Saperstein SL & Pleis J.(2009). Using the internet for health-related activities: findings from a national probability sample. *Journal of Medical Internet Research*, 11 (1):e4.

Balasubramanian, P. (2011).Cross-cultural decision making and action – impact of values and reliefs on decision choices. In Proctor et al. (Eds) *Cultural Factors in Systems Design-Decision Making and Action*. 65-86. CRC Press.

Banda DR, Libin A V, Wang H & Swainb SM. (2012). A pilot study of a culturally targeted video intervention to increase participation of African American patients in cancer clinical trials, *Oncologist*, 17(5): 708–714.

Bang M & Timpka T. (2003). Cognitive Tools in Medication Teamwork: The Spatial Arrangement of Patient Records. *Methods of Information in Medicine*. 42 (4): 331-336.

Bankson HL. (2009). Health Literacy: an exploratory bibliometric analysis, 1997-2007. *Journal of the Medical Library Association,* 97(2):148-150.

Bardram JE& Bossen C. (2005). A web of coordinative artifacts: collaborative work at a hospital ward, *Proceedings of the International ACM SIGGROUP Conference on Supporting Group Work*, 168-176.

Bernal G, Bonilla J & Bellido C.(1995). Ecological validity and cultural sensitivity for outcome research: Issues for the cultural adaptation and development of psychosocial treatments with Hispanics, *Journal of Abnormal Child Psychology*, 23 (1): 67-82.

Bhowmick A, Khasawneh MT, Bowling SR, Gramopadhye AK& Melloy BJ. (2007) Evaluation of alternate multimedia for web-based asynchronous learning, *International Journal of Industrial Ergonomics*, 37(7): 615-629.

Bierman AS, Magari ES, Jette AM, Splaine M & Wasson JH (1998). Assessing access as a first step toward improving the quality of care for very old adults, *Journal of Ambulatory Care Management,* 21(3):17–26.

Bisantz A M, Karsh BT, Wears R L, Lewis VR, Ancker J & Fairbanks RJ.(2011). Health information technology: Can there be meaningful use without meaningful design? *Proceedings of the Human Factors and Ergonomics Society 55th Annual Meeting, pp 724-728.*

Brotherstone H, Miles A, Robb K A, Atkin W & Wardle J. (2006).The impact of illustrations on public understanding of the aim of cancer screening, *Patient Education and Counselling*, 63 (3): 328-335.

Burnham E. (2008). Libraries as Partners in Health Literacy. *Journal of Consumer Health on the Internet*. Available at: <http:// tandfprod.Literatumonline.com/Loi/wchi20

Campbell N.C, Murray E, Darbyshire J, Emery J, Farmer A, Griffiths F, Guthrie B, Lester H, Wilson P & Kinmonth AL.(2011). Designing and evaluating complex interventions to improve health care, *BMJ*, 334 (7591): 455-59.

Campos C. (2006). Narrowing the cultural divide in diabetes mellitus care: A focus on improving cultural competency to better serve hispanic/latino populations, *Insulin*, 1(2): 70-76.

Cassell M, Jackson C & Cheuvront B. (2010). Health Communication on the Internet: An Effective Channel for Health Behaviour Change? In Krep, Gary L.(Eds.) *Health Communication. Vol.4. Health Communication and new information* technologies (eHealth), 17- 42, London: SAGE Publications Ltd.

Chalmers I & Glasziou P.(2009). Avoidable waste in the production and reporting of research evidence. *Lancet* , 374(9683):86-9.

Chen HH, Yeh ML & Yang HJ. (2005). Testing the impact of a multimedia video CD of patient-controlled analgesia on pain knowledge and pain relief in patients receiving surgery, *International Journal of Medical Informatics*, 74 (6), 437-45, July 2005.

Chen MR, Tang ZX, Zheng HM & QIU WX. (2007). The Sources of Health Care Information for the Foreign Spouses in Taipei City, *Health Promotion & Health Education Journal*, 27:115-137.

Chen WT, Lin YR & Xiao WB. (2009). *An investigation of the foreign spouse medical service and the social demand - explore the medical services and social supporting network for foreign spouses in Taizhong and Yunlin County*, A research paper of the Ministry of Interior foreign spouses counselling fund.

Chin MH, Walters AE, Scott, CC & Elbert SH. (2007). Interventions to Reduce Racial and Ethnic Disparities in Health Care, Med Care Res Rev. 2007 October; 64(5 Suppl): 7S–28S.

Choi J & Bakken S. (2010).Web-based education for low-literate parents in Neonatal Intensive Care Unit: Development of a website and heuristic evaluation and usability testing, *International Journal of Medical Informatics*, 79 (8): 565-575.

Clark NM, Brown R, Joseph C, Anderson E, Liu M, Valerio M & Gong M.(2002). Issues in identifying asthma and estimating prevalence in an urban school population, *Journal of Clinical Epidemiology*, 55 (9): 870-881.

Coffman MJ. (2010).Demands of Immigration, Health Literacy, and Depression in Recent Latino Immigrants, *Home Health Care Management Practice*, 22 (2): 116-122.

Cooper L, Hill M & Powe N. (2002). Designing and evaluating interventions to eliminate racial and ethnic disparities in health care, *Journal of General Internet Medicine*, 17 (6): 477-486.

Dabner D, Calvert S & Casey A. (2010). *Graphic design school: the principles and practices of graphic design*, 4th Ed. Hoboken, N.J.: John Wiley & Sons.

Dahl Y & Svanas D.(2008). A comparison of location and token-based interaction techniques for point-of-care access to medical information, *Personal and Ubiquitous Computing*, 12 (6): 459–478.

Dansky H & Thompson D & Sanner T. (2006). A framework for evaluating eHealth research. Evaluation and Program Planning, Volume 29, Issue 4, Pages 397-404.Davies, A. & Newman, S. (2011). *Evaluating telecare and telehealth interventions*. WSD Action Network briefing paper, The Kings fund.

Dawes J. (2008). Do data characteristics change according to the number of scale points used? An experiment using 5-point, 7-point and 10-point scales. *IJMR*, Vol. 50 No. 1, 61–104.

DeWalt DA, Berkman ND, Sheridan S, Lohr KN. & Pignone MP.(2004). Literacy and health outcomes: a systematic review of the literature. *Journal of General Internal Medicine*. 19 (12):1228-39.

DeWalt, DA, Dilling, M H, Rosenthal M S & Pignone M P. (2007). Low Parental Literacy Is Associated With Worse Asthma Care Measures in Children. *Ambulatory Pediatrics*, 7 (1): 25-31.

DeWalt DA & Hink A. (2009). Health literacy and child health outcomes: a systematic review of the literature, *Pediatrics,* 124 (3): 265-74.

Doak C, Doak L, Miller K & Wilder L. (1994). *Suitability Assessment of Materials (SAM)*. American Public Health Association Annual Meeting, Washington, DC.

Doak C, Doak L& Root J. (1996). *Teaching Patients with Low Literacy Skills*. 2nd Ed. Philadelphia: Lippincott.

Doak CC, Doak LG, Friedell GH & Meade CD.(1998). Improving comprehension for cancer patients with low literacy skills: strategies for clinicians, *CA—a cancer Journal for Clinicians*, 48 (3):151-162.

Drever E. (2003). *Using semi-structured interviews in small-scale research: a teacher's guide,* Rev. ed., Glasgow : Scottish Council for Research in Education

Dworkin SL. (2012). Sample Size Policy for Qualitative Studies Using In-Depth Interviews, *Archives of Sexual Behavior*, 41 (6): 1319-1320.

Elliott JO, Charyton C & Long L.(2007). A health literacy assessment of the National Epilepsy Foundation Web site, *Epilepsy & Behavior*, 11 (4):525-532.

Eysenbach G. (2001).What is e-health? *J Med Internet Res,* 2001; 3(2):e20 Available at: http://www.jmir.org/2001/2/e20/ *doi:10*.2196/jmir.3.2.e20

Fill C, Hughes G & De Francesco S. (2013). *Advertising: strategy, creativity and media,* Pearson.

Fotheringham M J, Owies D, Leslie E & Owen N. (2000). Interactive health communication in preventive medicine: internet-based strategies in teaching and research. *American Journal of preventive Medicine*, 19 (2), 113-120.

Fox S & Jones S. (2009).The Social Life of Health Information, *Pew Internet Project*: June 11, 2009). Available at: http://www.pewinternet.org/2009/06/11/the-social-life-of-health-information/

Fox S & Rainie L. (2001). Vital Decisions: how internet users decide what information to trust when they or their loved ones are sick. *Pew Internet & American Life Project*, Available at: www.pewinternet.org.

Frascara J. (2004). *Communication design: principles, methods, and practice*, New York: Allworth Press.

Frazer J & Smith F.(1997). Pretesting health promotion leaflets--A case study. *International Journal of Health Education*, 35(3): 97-101.

Frederikson LG & Bull PE. (1995).Evaluation of a patient education leaflet designed to improve communication in medical consultations, *Patient Education and Counseling*, 25 (1): 51–57.

Gentles SJ, Lokker C & Mckibbon KA. (2010). Health information technology to facilitate communication involving health care providers, caregivers, and paediatric patients: a scoping review, *Journal of Medical Internet Research*, 12 (2): 22-33.

Gill PS, Gill TS, Kamath A & Whisnant B. (2012). Readability assessment of concussion and traumatic brain injury publications by Centers for Disease Control and Prevention, *International Journal of General Medicine*, 5: 923-33.

Glasziou P, Chalmers A, Altman DG, Bastian H, Boutron I, Brice A, Jamtvedt G, Farmer A, Ghersi D, Groves T, Heneghan C, Hill S, Lewin S, Michie S, Perera R, Pomeroy V, Tilson J, Shepperd S & Williams JW. (2010). Taking healthcare interventions from trial to practice, BMJ 2010; 341:c3852.

Glasziou P, Meats E, Heneghan C & Shepperd S. (2008). What is missing from descriptions of treatment in trials and reviews? *BMJ* 2008, 336: 1472-1474.

Global Data (2013). Country focus: healthcare, regulatory and reimbursement landscape - republic of China (Taiwan). Available at:

http://www.reportsnreports.com/reports/287321-countryfocus-healthcare-regulatory-and-reimbursement-landscape-republic-of-china-taiwan-.html .

Gould JD, Boies SJ & Ukelson J. (1997). How to design usable systems in Helander, Landauer & Prabhu (Eds.). Handbook of Human-computer interaction, Elsevier Science B.V.

Green J & Thorogood N. (2004). *Qualitative methods for health research.* London: Sage Publications.

Green J & Tones K.(2010). *Health Promotion: planning and strategie*s. Sage Publication Ltd.

Guest G, Brunce A & Johnson L.(2006). How Many Interviews Are Enough? *Field Methods*, 18 (1): 59-82.

Harvey HD, Fleming F, Cregan K. & Latimer E.(2000). The health promotion implications of knowledge and attitude of employees in relation to health and safety leaflets, *International Journal of Environmental Health Research*, 10(4): 315-329.

Health. gov (2013). U.S *Department of Health & Human Services*. Available at: http://www.health.gov/

Health on the Net Foundation (HON) (2011). Available at: http:// www.hon.ch/

Heller S & Chwast S.(2011). *Graphic style: from Victorian to new century*, 3rd Ed. New York; London: Abrams

Hinchliffe A. & Mummery WK. (2008). Applying usability testing techniques to improve a health promotion website. *Health Promotion Journal,* 19 (1) 29-35.

Hong HJ, Jeong HY, Arriaga RI & Abowd GD. (2010).Trigger Hunter: Designing an educational game for families with asthmatic children, *Proceedings of the Conference on Human Factors in Computing Systems,* 3577-3582.

Houston TK, Robinson K, Berner E, Panjamapirom A, Fouad M & Partridge E. (2006). Bridging the digital divide: Feasibility of training community health advisors to use the Internet for health outreach, *Proceedings of the 39th Annual Hawaii International Conference on System Sciences*, 5, 88c, 2006.

Houts P, Doak C, Doak L& Loscalzo M.(2006). The role of pictures in improving health communication: A review of research on attention, comprehension, recall, and adherence. *Patient Education and Counseling*, 61(2): 173-190.

Huang ZJ, Yu SM & Ledsky R.(2006). Health status and health service access and use among children in U.S. Immigrant Families American, *Journal of Public Health*, 96 (4). 634- 640.

Hubley J & Copeman J. (2008). *Practical health promotion*. Polity Press.

Hung YY. (2005).Children's health and its related factors among women with interracial marriage in Taiwan. Master Thesis, Depart of Health Care Administration. Taipei Medical University.

Hung YL & Stones C.(2011). A Comparative Study of Children's eHealth Design between East and West: A Case Study of a Children's Health Website in China, Taiwan, the UK, and the US. *Proceedings of the International Conference, EHAWC 2011*, Held as Part of HCI International 2011, 129-138.

Hung YL & Li S. (2012). A Comparative Study of the Effectiveness of Leaflets and Videos to educate Low-literacy Mothers to Take Care of Their New Born Babies. In Duffy, V.G. (Ed). *Advances in Human Aspects of Healthcare*, 461-470. CRC Press.

Hsu CJ & Chang PC. (2007). Applying the graphical relational representation technique to represent healthcare web information: taking the query and representation of SARS web information as an example. The Journal of Taiwan Association for Medical Informatics,16 (3):21-34.

Institute of Medicine (2002) Unequal treatment: confronting racial and ethnic disparities in health care, National Academy of Sciences Press, Washington, DC.

Institute of Medicine (2004). *Institute of Medicine: Health literacy: a prescription to end confusion.* Washington DC: The National Academies.

Ishibashi Y & Nakajima I. (2004).The database which creates multilingual web information on preventing infectious diseases, Proceedings of the 6th International Workshop on Enterprise Networking and Computing in Healthcare Industry - Healthcom 2004, pp.129-132.

ISO 13407 (1999). *Human-centred design processes for interactive system*. International Organization for Standardization, Geneve.

Jan RL, Wang JY, Huang MC, Tseng SM, Su HJ & Liu LF. (2007). An Internet-based interactive telemonitoring system for improving childhood asthma outcomes in Taiwan, *Telemedicine Journal and e-Health*, 13(3): 257-268, June 2007.

Jhuang JW.(2008). *The study of unintentional injury of foreign spouses' children.* Master Thesis, Department of Public Health, Tzu-chu University.

Johnson R L, Saha S, Arbelaez JJ, Beach MC & Cooper LA. (2004). Racial and ethnic differences in patient perceptions of bias and cultural competence in health Care. *Journal of General Internal Medicine*, 19:101–110.

Jones-Caballero M, Chren M, Soler B & Pedrosa E.(2007). Quality of life in mild to moderate acne: relationship to clinical severity and factors influencing change with treatment, *Journal of the European Academy of Dermatology and Venereology*, 21(2): 219-226.

Katz M, Kripalani S & Weiss B. (2006).Use of pictorial aids in medication instructions: A review of the literature, *American Journal of Health-System Pharmacy*, 63 (23): 2391-2397.

Kendall JM. (2003). Designing a research project: Randomised Controlled trials and their principles, *Emerg Med J*. 2003, March; 20(2)164-168.

Kerr C, Murray E, Burns J, Turner I, Westwood MA, MacAdam C, Nazareth I & Patterson D. (2008). Applying user-generated quality criteria to develop an Internet intervention for patients with heart disease, *Journal of Telemedicine and Telecare*, 14 (3): 124-127.

Kerr C, Murray E, Noble L, Morris R, Bottomley C, Stevenson F, Patterson D, Peacock R, Turner I, Jackson K & Nazareth I.(2010). The Potential of Web-based Interventions for Heart Disease Self-Management: A Mixed Methods Investigation, *Journal of Medical Internet Research*, 12 (4): 56-67.

Knapp C, Madden V, Wang H, Sloyer P & Shenkman E.(2011).Internet use and eHealth literacy of low-income parents whose children have special health care needs, *J Med Internet Res*, 13(3):e75.

Kodagoda N & Wong W.(2008). Effects of Low & High Literacy on User Performance in Information Search and Retrieval, *Proceedings of the 22nd annual conference of Interaction a specialist group of the BCS*, 1:173-181.

Kodagoda N, Wong W & Kahan N.(2009). Identifying information seeking behaviours of low and high literacy users: combined cognitive task analysis. Published by the British Computer Society, *Proceedings of the 9th International Conference on Naturalistic Decision Making,* pp.347-352.

Kodagoda N, Wong BLW & Khan N. (2010). Information seeking behaviour model as a theoretical lens: high and low literate users behaviour process analysed. ECCE, ACM Press (2010), 117-124.

Kodagoda N, Wong BL, Roone C & Khan N.(2012). Interactive visualization for low literacy users: from lessons learnt to design, *Proceedings of the CHI 2012,* 1159-1168.

Kreps GL & Sparks L. (2008) Meeting the health literacy needs of immigrant populations, *Patient Education and Counselling*, 71 (3): 328-332.

Kreuter M, Strecher V & Glassman B.(2010). One Size Does Not Fit All: The Case for Tailoring Print Materials. In Krep, Gary L. (Eds.) *Health Communication. Vol. 2. Health Communication and health promotion,* 151-168 . London: SAGE Publications Ltd.

Kripalani S, Robertson R, Love-Ghaffari, MH, Henderson LE, Praska J, Strawder A, Katz MG & Jacobson TA. (2007). Development of an illustrated medication schedule as a low-literacy patient education tool, *Patient Education and Counselling*, 66 (3): 368-377.

Krueger RA & Casey MA.(2000). Focus groups: a practical guide for applied research. 3rd Ed. London: Sage Publications.

Kumar D, Sanders L, Perrin EM, Lokker N, Patterson B, Gunn V, Finkle J, Franco V, Choi L & Rothman RL. (2009). Parental Understanding of Infant Health Information: Health Literacy, Numeracy and the Parental Health Literacy Activities Test, *Acad Pediatr.* 2010 Sep–Oct; 10(5): 309–316. Published online 2010 August 2. doi: 10.1016/j.acap.2010.06.007

Kutner JM, Greenberg E, J Y & Paulsen C. (2006). *The health Literacy of America's Adults: Results from the 2003 National Assessment of Adult Literacy* (NCES 2006-483).U.S. Department of Education, National Center for education, Washington, DC, 2006.

Kyng M. (1995). Making Representations Work. *Comm. of the ACM*, Vol. 38, No. 9, 46-55.

Leiner M, Handal G & Williams D. (2004). Patient communication: a multidisciplinary approach using animated cartoons. *Health Education Research*, 19:591–5.

Leung FH & Savithiri R. (2009). Spotlight on focus groups, Canadian Family Physician, Vol. 55, 218-219.

Lewis JR. (2002). Psychometric evaluation of the PSSUQ using data from five years of usability studies. *International Journal of Human-Computer Interaction,* 14 (3&4): 463-488.

Lin SL & Xiao YL. (2007).Social Segregation and the Health Care of Female Immigrants in Taiwan, *The Journal of Nursing*, 54 (4): 67-72.

Lin T. (2013). Medical device regulation of Taiwan and recent updates. UL LLC. Available at: http://www.frostftp.com/dev/2014/FA/Medical%20Device%20Regulations%20of%20Taiwan%20Article.pdf

Liquori E.r (2011). *Construct a Framework for a Cross-Cultural Design, Web Design,* 13th Oct, Available at *http:// www.instantshift.com/2011/10/13/construct-a-framework-for-a-cross-cultural-design*

Liu SH, Liao HL & Pratt JA. (2009). Impact of media richness and flow on e-learning technology acceptance, *Computers & Education*, 52 (3): 599-607.

Lustria MLA. (2007). Can interactivity make a difference? Effects of interactivity on the comprehension of and attitudes toward online health content, *Journal of the American Society for Information Science and Technology*, 58 (6):766-776.

Mackert M, Kahlor L, TylerD & GustafsonJ.(2009). Designing e-health interventions for low-health-literate culturally diverse parents: addressing the obesity epidemic, *Telemedicine journal and e-health*,15(7):672-7.

Macy ML, Davis MM, Clark SJ & Stanley RM.(2011). Parental health literacy and asthma education delivery during a visit to a community-based pediatric emergency department: a pilot study, *Pediatric emergency care*, 27(6): 469-74.

Maibach, E.W., Parrott, R. L. & Maibach, E.(1995). *Designing health messages : approaches from communication theory and public health practice* / Thousand Oaks, Calif. ; London : Sage Publications, c1995.

Maine Health (2010). *Maine Health Website*, Available at http:// www.mainehealth.org/healthliteracy.

Martinez M, Maislos S & Rayford W. (2008). How to engage the Latino or African American v patient with benign prostatic hyperplasia: crossing socioeconomic and cultural barriers, *Am J Med.,*121 (8 Suppl 2):S11-7. doi: 10.1016/j.amjmed.2008.05.022.

Mason M. (2010). Sample size and saturation in PhD studies using qualitative interviews. *Forum: Qualitative Social Research*, 11(3), Article 8.

Maxwell AE, Wang JH, Young L, Crespi CM, Mistry R, Sudan M & Bastani R. (2010). Pilot test of a peer-led small-group video intervention to promote mammography screening among Chinese American immigrants, Health Promot Pract, 12 (6):887-899.

Meade CD, McKinney WP & Bamas GP. (1994).Educating patients with limited literacy Skills: the effectiveness of printed and videotaped materials about colon cancer, *American Journal of Public Health*, 82 (1): 119-121.

Medhi I, Patnaik S, Brunskill E, Gautama S, Nagasena N, Thies W & Toyama K. (2011).Designing mobile interfaces for novice and low-literacy users, *ACM Transactions on Computer-Human Interaction*, 18 (1).

Meyanathan S, Antje BB & Sanei L. (2012). C-Bulletins: Developing and Adapting Materials for Audiences with Lower Literacy Skills. Washington, DC: FHI 360/C-Change.

Miles M & Huberman A. (1994) Qualitative Data Analysis; an Expanded Source Book. Sage Publications, Thousand Oaks, CA.

Miller MJ. (2005). Usability in e-learning. Learning circuits. Available at :< http:// www.astd.org/ LC/2005/0105_miller.html.

Moriarty S, Mitchell N & Wells W. (2012). *Advertising & IMC: principles & practice*. Global ed., 9th ed. Boston [Mass]; London: Pearson.

Morrison L,Yardley L, Powell J & Michie S. (2012).What design features are used in effective e-Health interventions? A review using techniques from critical interpretive synthesis, *Telemedicine and e-Health*, 18 (2): 137-144.

Morse JM. (2000). Determining sample size. Qualitative Health Research, 10 (1): 3-5.

Nair EL & Cienkowski KM. (2010). The impact of health literacy on patient understanding of counseling and education materials, *International Journal of Audiology*, 49 (2):71-5.

National Health Insurance Administration (2014). *Ministry of Health and Welfare Department of National Health Insurance Annual budget*. Available at: http://www.nhi.gov.tw/webdata/webdata.aspx?menu=17&menu_id=1024&WD_ID=1024&webdata_id=2177

National Institute of Health (2002). *Researcher Strengthens Health, Literacy Link: why Johnny is Sick*, National Institute on Deafness and Other Communication Disorders.

Ndwe TJ, Dlodlo M & Nichols J. (2010). Comparison of touch and speech-enabled IVR systems in low literacy users, *Proceedings of the 2010 International Conference on User Science and Engineering*, 244-249.

Negarandeh R, Mahmoodi H, Noktehdan H, Heshmat R & Shakibazadeh E. (2013).Teach back and pictorial image educational strategies on knowledge about diabetes and medication/dietary adherence among low health literate patients with type 2 diabetes. *Primary Care Diabetes*, 7(2):111-8.

Neuhauser L & Kreps GL. (2008) Online cancer communication: Meeting the literacy, cultural and linguistic needs of diverse audiences. *Patient Education and Counseling*, 71(3): 365-377.

Neuhauser L & Kreps GL (2010). Rethinking Communication in the E-Health Era. In Krep, Gary L. (Eds.) *Health Communication. V. 4. Health Communication and new information technologies (eHealth),* 109-131*.* London: SAGE Publications Ltd.

Newell AF. (2011). *Design and the digital divide: insights from 40 years in computer support for older and disabled people.* San Rafael, Calif: Morgan & Claypool, c2011.

Ni T, Karlson AK & Wigdor D. (2011). AnatOnMe: Facilitating doctor-patient communication using a projection-based handheld device, *Proceeding of the 29th Annual CHI Conference on Human Factors in Computing Systems*, 3333-3342.

Nielsen J. (1993). *Usability Professional*, Cambridge, MA., USA. Engineering, AP.

Olives T, Patel R, Patel S, Hottinger, J & Miner JR.(2010). Health literacy of adults presenting to an urban ED. *American Journal of Emergency Medicine*, 29 (8):875-82.

Paul CK & Redman S.(1997). A review of the effectiveness of print material in changing health-related knowledge, attitudes and behaviour. *Health Promotion Journal of Australia*, 7(2): 91-99.

Paul CL, Redman S & Sanson-Fisher RW.(2003). Print material content and design: is it relevant to effectiveness, *Health Education Research*, 18 (2): 181-190.

Plimpton S & Root J. (1994). Materials and strategies that work in low literacy health communication, *Public Health Report*, 109 (1): 86-92.

Proctor RW, Nof SY & Yih Y. (2011). *Cultural Factors in Systems Design-Decision Making and Action.* CRC Press .

Rajwan YG & Kim GR.(2010).Medical information visualization conceptual model for patient-physician health communication, IHI'10 - *Proceedings of the 1st ACM International Health Informatics Symposium*, 512-516.

Rice RE. (2006). Influences, usage, and outcomes of Internet health information searching: multivariate results from the Pew surveys. International Journal of Medical Informatics, 75 (1): 8-28.

Richards B, Colman AW & Hollingsworth RA. (1998).The current and future role of the Internet in patient education, *International Journal of Medical Informatics*, 50 (1-3): 279-285.

Rippen HE, Pan EC, Russell C, Byrne CM & Swift EK. (2012). Organizational framework for health information technology, *International Journal of Medical Informatics*, 82 (4):e1-e13.

Robinson C & Graham J.(2010). Perceived Internet health literacy of HIV-positive people through the provision of a computer and Internet health education intervention, *Health Information and Libraries Journal*, 27 (4): 295-303.

Ross L, Ashford AD, Bleechington SJ, Dark T & Erwin DO (2010). Applicability of a video intervention to increase informed decision making for prostate-specific antigen testing, *Journal of the National Medical Association*, 102 (3): 228-236.

Rowlands GP, Mehay A, Hampshire S, Phillips R, Williams P, Mann A, Steptoe A, Walters P& Tylee AT. (2013). Characteristics of people with low health literacy on coronary heart

disease GP registers in South London: a cross-sectional study, *BMJ Open*,3 (1). doi: pii: e001503. 10.1136/bmjopen-2012-001503. Print 2013.

Rychetnik L, Frommer M, Hawe P & Shiell A. (2002). Criteria for evaluating evidence on public health interventions, *Journal of Epidemiology and Community Health*, 56: 119-127.

Sabo RM & Lorenzen, JM.(2008). Consumer health web sites for parents of children with autism, *Journal of consumer health on the internet*. 12 (1): 37-49.

Schapira M & Nattinger A.(2006). The influence of graphic format on breast cancer risk communication. *Journal of Health communication*, 11, 569-582.

Schär SG & Kaiser J. (2006). Revising (multi-) media learning principles by applying a differentiated knowledge concept, *International Journal of Human-Computer Studies*, 64 (10): 1061-1070.

Schillinger Dean. (2001).Improving the quality of chronic disease management for populations with low functional health literacy: a call to action, *Disease Managemen*t, 4 (3): 103-109.

Sentell T & Braun KL. (2012).Low health literacy, limited English proficiency, and health status in Asians, Latinos, and other racial/ethnic groups in California, *Journal of Health Communication*, 17(3): 82-99.

Shaw A, Ibrahim S, Reid F, Ussher M & Rowlands G. (2009). Patients' perspectives of the doctor–patient relationship and information giving across a range of literacy levels, *Patient Education and Counselling*, 75 (1): 114-120.

Shaw SJ, Armin J, Torres CH, Orzech KM & Vivian J.(2012). Chronic disease self-management and health literacy in four ethnic groups, *Journal of Health Communication,* 17 (3):67-81.

Sheridan SL, Halpern, DJ & Viera AJ. (2011). Interventions for individuals with low health literacy: A systematic review. *Journal of Health Communication: International Perspectives*.16:30–54.Available at http://www.tandfonline.com/doi/pdf/10.1080/10810730.2011.604391

Sherin, A. (2012). *Design elements, color fundamentals: a graphic style manual for understanding how color impacts design*, Beverly, Mass.: Rockport Publishers.

Shone L P, Conn KM, Sanders L & Halterman JS (2009). The role of parent health literacy among urban children with persistent asthma. *Patient Education and Counseling*, 75 (3): 368-375.

Skinner CS & Kreuter MW (1997). Using theories in planning interactive computer programs, In Street, Richard L., Jr.; Gold, William R.; Manning, Timothy R. (Ed). *Health promotion and interactive technology: theoretical applications and future directions*. 39-65. London: Lawrence Erlbaum Associates.

Smaje C. (1995). *Health, 'race' and ethnicity: making sense of the evidence*. London: Kings Fund Institute.

Sperber NR, Bosworth HB, Coffman CJ, Lindquist JH, Oddone EZ, Weinberger M& Allen KD. (2013). Differences in osteoarthritis self-management support intervention outcomes according to race and health literacy, *Health Education Research*, 28(3): 502-511.

Steele M, Dow L & Baxter G.(2011). Promoting public awareness of the links between lifestyle and cancer: A controlled study of the usability of health information leaflets, *International Journal of Medical Informatics*, 80 (12): e214-e229.

Stewart DW, Shamdasani P& Rook DW (2007). Focus groups: theory and practice, research Methods Series, 2nd Ed. Thousand Oaks: SAGE Publications, c2007.

Sudore RL, Landefeld CS, Pe´ rez-Stable EJ, Bibbins-Domingo K; Williams BA & Schillinger D. (2009).Unravelling the relationship between literacy, language proficiency, and patient–physician communication, *Patient Education and Counselling*, 75 : 398–402.

Summers K & Summers M. (2003). Making the web friendlier for lower-literacy users. *Intercom*, 51 (6):19.

Summers K & Summers M. (2005), Reading and navigational strategies of Web users with lower literacy skills. *Proceedings of the American Society for Information Science and Technology*. 42 (1):1-17.

Summers K, Langford J, Wu J, Abela C & Souza R. (2006). Designing Web-based Forms for Users with Lower Literacy Skills, *Proceedings of the American Society for Information Science and Technology*, 43 (1), 1-12.

Taggart J, Williams A & Dennis S. (2012). A systematic review of interventions in primary care to improve health literacy for chronic disease behavioral risk factors. *BMC Family Practice*. 13 (1): 49. Available at: http://www.biomedcentral.com/content/pdf/1471-2296-13-49.pdf

Temkin, J. (2013). How focus groups work? Available at: http://money.howstuffworks.com/business-communications/how-focus-groups-work1.htm

The Ministry of Health of New Zealand (2002). National guideline for health education resource development in New Zealand, Available at: Ministry of Health's website: http://www.moh.govt.nz

The Western Cheshire Primary Care Trust in the UK (2007). A guide to designing and producing patient information leaflets including care treatments and procedures, Version 1, 13.

Thompson TL. (2003).Introducation. In T.L. Thompson, A. M. Dorsey, K.I. Miller, & R. Parrot (eds), *Handbook of Health communication*. Mahwah, NJ: Lawereance Erlbaum Associates, 1-8.

Tomida S, Hanai, T, Koma N, Suzuki Y, Kobayashi T & Honda H. (2002). Artificial neural network predictive model for allergic disease using single nucleotide polymorphisms data, *Journal of Bioscience and Bioengineering,* 93(5): 470-478.

Von Mutiuse E. (2000). The environmental predictors of allergic diseases, The Journal of Allergy and Clinical Immunology, 105:9-19.

van Weert JC, Jansen J, Spreeuwenberg PM, van Dulmen S & Bensing JM.(2011).Effects of communication skills training and a Question Prompt Sheet to improve communication with older cancer patients: a randomized controlled trial, *Crit Rev Oncol Hematol*, 80 (1):145-59.

Wengraf T. (2001). *Qualitative research interviewing: biographic narrative methods and semi-structured methods*, London: SAGE

Wright P. (2009). User-centred Healthcare Design (UCHD). Available at: http://www.ncl.ac.uk/computing/research/project/4167

Wu CC. (2005). *Health and Health Care of Low Birth Weight Newborns by Foreign-born Mothers ：with special emphasis on policies for transcultural marriages and global health*. Master Thesis, Institute of Public Health & Department of Public Health. University of Yang-Ming.

Wu F, Biksey T & Karol MH. (2007).Can mold contamination of homes be regulated? Lessons learned from radon and lead policies, Environmental Science and Technology, 41(14), 4861- 4867.

Wurzbach ME. (2004).*Community health education and promotion: a guide to program design and evaluation* (2nd ed.).Sudbury, Mass: Jones and Bartlett.

Xia XJ. (2003).The Localization of Praxis-Oriented Research: The Case of "Foreign Brides Literacy Programs", *Taiwan : A Radical Quarterly in Social Studies,* 49:1-47.

Yardley L, Morrison LG, Andreou P, Joseph J & Little P. (2010). Understanding reactions to an internet-delivered health-care intervention: accommodating user preferences for information provision, *BMC Medical Informatics and Decision Making*, 10: 52-62.

Yee SR. (2008). A cross-media typographic framework: teaching typographic skills in a convergent media, *Hypen Journal*, 7 (13): 17-36.

Yin HS, Mendelsohn AL, Nagin P, van Schaick L, Cerra ME & Dreyer BP. (2013). Use of active ingredient information for low socioeconomic status parents' decision-making regarding cough and cold medications: role of health literacy, *Acad Pediatr*. 13 (3):229-35.

Yost, K.J., Webster, K., Baker, D.W., Choi, S.W., Bode, R.K.& Hahn, E.A. (2009). Bilingual health literacy assessment using the Talking Touchscreen/la Pantalla Parlanchina: development and pilot testing. *Patient Education and Counseling,* 75 (3): 295–301.

Yusof MM, Kuljis J, Papazafeiropoulou A & Stergioulas LK. (2008). An evaluation framework for health information systems: human, organization and technology-fit factors (HOT-fit), *International Journal of Medical Informatics*, 77(6): 386-98.

Zhou ZC & Wu YC. (2012). *Ahchoo! Ahchoo! The Allergy Village.* Publishers: Yuan Shui Culture.

Appendices

Appendix A: Questionnaire Design

Questionnaire Survey

Please check the box ahead of the option based on your personal information. Single-choice Questions.

1.Your nationality is : □Vietnam □Mainland China
2. Your age is: □20 – 30 □30– 40 □ 40 or above
3. Your education level is: □Primary (grade 1-6) □Middle School (grade 7-9) □High School (grade 10-12) □ Undergraduate or above
4. Your work condition is: □Full-time □Part-time □Housekeeping
5. Your monthly family income is: □ Less than £400 □; £400 –£600 □£600–£800 □ More than £800
6. How many children do you have? □1 □2 □3 or above
7. Does your child have any allergic disease? □Yes □No □No idea
8. The frequency of using a computer is: □Once a day □Once a week □Once a month □Do not know how

Please check the box ahead of the options according to your opinions. Multiple-choice Questions.

What kinds of problems do you usually encounter when seeing a doctor?	□ 1.I don't understand what the medical staffs are talking about. □ 2.The medical staffs don't understand what I am talking about. □ 3.I can't understand the prescription. □ 4.I am too shy to ask the medical staffs any question in person □ 5.I don't know which doctor to see. Other_____

How do you usually acquire your knowledge of health care?	□ 1.I will consult the doctor. □ 2. I will consult the nurse. □ 3. I will consult my family members. □ 4. I will consult my friends. □ 5. I will learn through mass media (brochures, television, and the internet) Other _____
What kind of information of children's health care do you want to know when your child gets sick?	□ 1.What are the factors that trigger this disease? □ 2.What are the common symptoms of this disease? □ 3.How to take care of the children with such disease? □ 4.Will there be any side effect when taking the medicine over a long period? □ 5.When should I take my child to see a doctor? Other _____
What types of mass media do you usually use to get information of children's health care?	□ 1.Promotion brochures □ 2. Video Films □ 3. Internet information □ 4. TV programs □ 5. Books on health issues Other _____

Pre-and-Post Knowledge Test

Please carefully read the following descriptions about children allergies. Make your selection by marking "o" for yes or "×" for no.

About bronchial asthma
( ) 1.If a child has bronchial asthma; his siblings will definitely have the same disease.
( ) 2.If stridor always occurs with a flu, or severe coughs appear after doing exercises, we should consider these symptoms belonging to bronchial asthma.
( ) 3.Although bronchial asthma cannot be completely cured of; the patient can use drugs to control the disease and take daily care of the windpipe to reduce possible outbreaks of bronchial asthma.
( ) 4. Children with bronchial asthma should be sent to the hospital as soon as possible when their breath condition didn't get any improvements after taking medicines.
( ) 5.You should avoid keeping pets, using carpets and curtains at home so as to reduce allergens that may cause bronchial asthma.

( ) 6. Children with bronchial asthma cannot stay in a room with an air conditioner in order to avoid the aggravation of bronchial asthma.
( ) 7.Children with bronchial asthma cannot do violent sports, especially swimming.

About atopic dermatitis
( ) 1. Patients with atopic dermatitis usually have red rashes on the joints of the neck, the wrists, and the knees.
( ) 2. There is no need to see a doctor even when eating allergic food seriously aggravated the red rashes on children's skin. You can simply apply some medication to them.
( ) 3. Atopic dermatitis in children cannot be completely cured, so most of the children with this disease cannot fully recover from it.
( ) 4. Preventing children from being in contact with allergens can help reduce the outbreak of atopic dermatitis.
( ) 5. Children with atopic dermatitis need to use herbal soaps or bactericide when taking a bath.
( ) 6. Lanolin cream is the best moisturizer, so it can be applied to children with atopic dermatitis.
( ) 7. Children with atopic dermatitis should always avoid eating seafood.

About allergic rhinitis
( ) 1.If children whose parents have allergic rhinitis often sneeze and scrub their eyes, they might suffer from allergic rhinitis as well.
( ) 2. Allergic rhinitis has a common complication of allergic conjunctivitis, atopic dermatitis, and bronchial asthma.
( ) 3.As long as a patient can comply with the doctor's prescription and medication instructions; it will help significantly improve most of the symptoms of allergic rhinitis.
( ) 4. When children continually use the new generation medication for allergic rhinitis over a long period, they will suffer from the side effect of sleepiness.
( ) 5. When children have severe nasal congestion, the parents should force them to wash the nasal cavity with normal saline.
( ) 6. If children with allergic rhinitis suffer from severe symptoms which influence their normal sleeps, they should see a doctor.
( ) 7. Children with allergic rhinitis can use air conditioners and fans as long as they stay away from the wind gap.

Usability Evaluation

What are the criteria you use to evaluate the media for health promotions?

Please check the box ahead of the option according to the level of importance to you

Single-choice Questions.

Leaflet Group	
Criteria / Content	**Evaluation**
1. Whether it conveys clear themes.	□Very important □Important □Neutral □Unimportant □Very unimportant
2. Whether it used plain language.	□Very important □Important □Neutral □Unimportant □Very unimportant
3. Whether it used short sentences.	□Very important □Important □Neutral □Unimportant □Very unimportant
4. Whether it is written in a friendly Tone.	□Very important □Important □Neutral □Unimportant □Very unimportant
5. Whether it showed limited information.	□Very important □Important □Neutral □Unimportant □Very unimportant
6. Whether information is divided into several classifications.	□Very important □Important □Neutral □Unimportant □Very unimportant
7. Whether the information of hospital or doctor is contained.	□Very important □Important □Neutral □Unimportant □Very unimportant
8. Whether the advertisement and content are obviously compartmentalised.	□Very important □Important □Neutral □Unimportant □Very unimportant
9. Whether it presents the latest information.	□Very important □Important □Neutral □Unimportant □Very unimportant
Criteria / Appearance	**Evaluation**
10. Whether it has an attractive coverage.	□Very important □Important □Neutral □Unimportant □Very unimportant
11. Whether the colour and background are designed consistently.	□Very important □Important □Neutral □Unimportant □Very unimportant
12. Whether it adopted plenty of white spaces.	□Very important □Important □Neutral □Unimportant □Very unimportant
13. Whether the font size is suitable for reading.	□Very important □Important □Neutral □Unimportant □Very unimportant
14. Whether it has organized layout	□Very important □Important □Neutral □Unimportant □Very unimportant

15. Whether it has cartoons.	□Very important □Important □Neutral □Unimportant □Very unimportant
16. Whether related pictures are placed right next to the descriptions.	□Very important □Important □Neutral □Unimportant □Very unimportant
17. Whether it uses highly contrasting colours.	□Very important □Important □Neutral □Unimportant □Very unimportant
Criteria / Process	**Evaluation**
18. Whether it provides the option for users to select a specific language	□Very important □Important □Neutral □Unimportant □Very unimportant
19. Whether a user-friendly interface is designed.	□Very important □Important □Neutral □Unimportant □Very unimportant
20. Whether it represents information in a way of dialogues.	□Very important □Important □Neutral □Unimportant □Very unimportant
21. Whether it provides others' experience.	□Very important □Important □Neutral □Unimportant □Very unimportant
22. Whether the content is easy for navigation.	□Very important □Important □Neutral □Unimportant □Very unimportant
Website Only	
23. Whether it adopts simple digital technology.	□Very important □Important □Neutral □Unimportant □Very unimportant
24 Whether it offers video narration.	□Very important □Important □Neutral □Unimportant □Very unimportant
25 Whether it offers online consultancy.	□Very important □Important □Neutral □Unimportant □Very unimportant

Appendix B: The Content of Testing Media

Bronchial Asthma
Q1. Why does my child have bronchial asthma?

- Inherited constitution

  If both parents have allergic constitution, there is a high likelihood that their children will have bronchial asthma. However, even with allergic constitution, it doesn't mean the child will fall ill; that is to say, not every child in the same family will suffer from bronchial asthma. On the other hand, if a child does have bronchial asthma, he or she may probably develop eye allergy, nasal allergy, and skin allergy.

- Allergens

  Allergens which float in the air, such as dust mites, mould, animal fur and pollen, will get into our body through the mouth, nose or eyes. Another case will be food allergens, such as mangoes, strawberries, milk, eggs, almonds, drupes, shelled seafood (shrimps, crabs), food additives, etc.

- Environmental factors

  Such as climate changes, respiratory infection, icy foods, air pollution, paints, oil and decorations, and psychological pressure, etc.

Q2. What kinds of situations should be considered symptoms of bronchial asthma?

- A family history of allergic constitution and atopic dermatitis.
- Repetitive stridor and continuous coughs.
- Severe coughs after sports or eating icy foods.
- Coughs and chest tightness because of contact with allergens in the air.

Q3. Can my child be cured of bronchial asthma completely?

Now that bronchial asthma has much to do with personal constitution, basically it cannot be completely cured of. However, as long as a patient can comply with the doctor's prescription and medication instructions, it will help significantly reduce inflammation or seizure frequency. On normal occasions, the patient can use drugs to control and protect the windpipe. When suffering from acute symptoms, the patient can use drugs to relieve or see a doctor. As long as children with bronchial asthma can prevent themselves from a high seizure frequency and aggravation of bronchial asthma before puberty period, most of them can have great improvements after the age of puberty.

Q4. Will there be any sequel when taking medicine for bronchial asthma over a long period of time?

Medicine with steroids is essential and effective for controlling bronchial asthma, and does no harm to the liver or the kidneys. The medicine, originally designed as a kind of long-term medication, is used to relieve allergic reactions and will not induce addiction or sleepiness because of very low dose. Therefore, it will neither cause osteoporosis nor have influence on height even after continuous use for 1 to 2 years

Q5. When should I take my child to see a doctor?

- When having been sick for a long time and not able to stay in bed.
- When having chaotic consciousness and not able to make meaningful sentences.
- When the rib cage in the chest area appearing to have a hollow, and when the lips turning black.
- When the breath condition cannot be improved even after using a spacer.

Q6. How to keep away from allergens which may induce bronchial asthma?

- Avoid using carpets or stuff toys.
- Do not keep pets such as dogs, cats and birds indoors.
- Use vacuum cleaners and wipers instead of brooms while cleaning.
- Use dehumidifiers and air cleaners to assist reducing allergens.
- Prevent children from taking in food that may likely to induce allergic reactions.
- Expose unwashable quilts and pillows to the sun, which helps kill dust mites.

Q7. Should children with bronchial asthma avoid staying in a room with an air conditioner or a heater?

Using an air conditioner or a heater will not induce the outbreak of bronchial asthma. On the contrary, both an air conditioner and a heater will help dehumidify the air and reduce dust mites and mould. However, it is important to note that there shouldn't be distinct temperature differences between the inside and the outside. Also, the wind should not blow straight to the child's head. Frequently clean filters of an air conditioner and a heater to reduce the compilation of allergens that may cause respiratory allergy and to help children with bronchial asthma live in the most comfortable temperature.

Q8. Can children with bronchial asthma do exercises?

40% of allergic children may likely have coughs and even stridor when doing exercises. However, these uncomfortable cases can be prevented, so there is no need to stop them from doing proper exercises. Be very careful when selecting sport types. For example, swimming is a good one while marathon is not. Remember to warm up or appropriately use a spacer before doing exercise, which can significantly reduce or relieve the outbreak of bronchial asthma.

Atopic dermatitis

Q1. What are the common symptoms of atopic dermatitis?

- Red rashes shown in the joints of the neck, wrists and knees.
- Very dry skin, and arrogation of rashes because of inappropriate scratches.
- Dark circles and wrinkles shown below the eyes, and repetitive outbreaks of conjunctivitis.

Q2. What are common prescription drugs and treatments for atopic dermatitis in children?

The doctor will mainly prescribe oral antihistamines for children without symptoms or with slight itchiness. However, if symptoms of red rashes and itchiness do occur, there is a need to use steroids or immunosuppression ointment in partial areas other in addition to oral antihistamines. Moreover, if children have skin inflammation, such as yellow excretions, they are likely to suffer from skin infection. If it is the case, the doctor can use antibiotics, antifungal or antivirus medicine when necessary.

Q3. When should I see a dermatologist?

- When the skin turning itchier, drier, or the red rashes being worse.
- When eating certain types of foods or contact with certain types of allergens, which results in the aggravation of rashes.
- When taking drugs for atopic dermatitis too often, thus worrying about the side effects of steroids.
- When your family doctor recommends you to a specialty doctor.

Q4. Can my child be cured of atopic dermatitis completely?

Although atopic dermatitis has annoying symptoms, 50% of patients can be cured or obviously get improved before school age with positive and proper care. 85% to 90% of children can be cured before puberty period. 15% of uncured children have chronic planus-like lesions only found in the joints. Therefore, as long as we patiently help our children to go through those disturbances of atopic dermatitis, the symptoms can be alleviated as they grow up.

Q5. How to prevent my child from the outbreak of atopic dermatitis?

- Avoid rapid changes and differences of daily temperature.
- Avoid contact with allergens in the environment.
- Try to choose clothes made of 100% cotton.
- Avoid taking in food that may easily trigger allergy.
- Abide by the doctor's instructions to take medicine appropriately so as to control symptoms.

Q6. How do children with atopic dermatitis bathe themselves?

Children with atopic dermatitis should avoid dry and heat environments, so keeping moisture skin is the best treatment for children with atopic dermatitis in different periods. Bathe them in the water twice a day for 15-20 minutes. It is suggested to use light and fragrance-free bath lotion, and avoid herbal soap, salt water and bactericide. Tenderly remove extra water on the body after the bath, and do not dry the body up completely. Then, immediately put on the prescribed ointment or lotion by the doctor to keep the moisture of the skin.

Q7. How to choose proper lotion for children with atopic dermatitis?

- Vaseline, a traditional but useful moisturizer, can be applicable to drier parts of the body.
- Avoid using baby lotions with fragrance and lanolin oil that may easily trigger allergy.
- When using a new moisturizer, daub a thin layer of it on certain parts of the body to observe the effect, and then decide if the new product is applicable.

Q8. What kind of dieting problems should I pay attention to when my child has atopic dermatitis?

- It is recommended to use extensively hydrolyzed formulas if the child is obviously allergic to milk.
- Children aged 2-3 can have a blood test, which helps find out possible food allergens.
- Prevent children from taking in foods that may easily trigger allergy such as eggs and shelled seafood (eg. shrimps, clams, crabs) until they grow older.

Allergic rhinitis

Q1. Does my child have allergic rhinitis?

The diagnosis of allergic rhinitis is made mainly on typical clinical symptoms, such as long-term sneezes, a runny nose, nasal congestion, or even post-nasal drip, scrubbing eyes, and dark circles. These symptoms worsen when there are rapid climate changes, seasonal changes and in contact with allergens. The diagnosis is also based on the family medical history of the child because allergic rhinitis has much to do with an inherited allergic constitution. If the abovementioned symptoms do occur, please go to the hospital for further tests of allergens to identify the real disease.

Q2. What kind of common symptoms can be seen as a complication of allergic rhinitis?

- Allergic conjunctivitis, usually with symptoms of itchy eyes, tears or conjunctival hyperemia.
- Atopic dermatitis, usually with symptoms of itchiness, eczema, or hives.
- Asthma, usually with symptoms of coughs at night or stridor caused by a cold.
- Repetitive nasosinusitis, tympanitis, and even reflex movements in Tourette's Syndrome.

Q3. Can my child be cured of allergic rhinitis completely?

Disease severity of allergic rhinitis varies from person to person. However, as long as a patient can comply with the doctor's prescription and medication instructions, it will help significantly improve the symptoms of allergic rhinitis. Compared with other allergic diseases, allergic rhinitis usually lasts longer, however, as long as the patient can acquire proper care, it can help reduce a complication of nasosinusitis, tympanitis and avoid negative influence on hearing ability and possibility of an operation for nasosinusitis.

Q4. What kind of medication is employed on allergic rhinitis?

- Use antihistamine to improve symptoms like itchy nose, sneezing and a runny nose.
- Use inhalers with topical steroids to treat chronic inflammation.
- Use nasal decongestants to improve nasal congestion. Children are not allowed to use.

- **Q5. Will there be any side effects if a child continually uses medicine for allergic rhinitis over a long period of time?**

The first-generation antihistamine only has short-term effect, and causes sleepiness, which may influence the patient's daily routines. Now with the second- and third-generation antihistamine with long-term effect, the patient only takes medicine 1-2 times a day. This drug won't cause sleepiness, and will not affect the daytime job. However, the new nasal decongestants for mucous membrane which claims to have an instant effect can neither be applied continually nor applied to children because nasal congestion will worsen once stop using.

Q6. Can I use normal saline to ease the symptoms?

Normal saline can be used to wash the nasal cavity or to comfort the nasal cavity as well as to resolute thick nasal mucus of caused by post nasal dripping and nasosinusitis with vapors produced by a nebulizer. It is suggested that when older children with allergic rhinitis have the aforementioned symptoms, their parents can help them with instant treatments at home. However, if they do not have severe symptoms, there is no need to force them to overly aspire nasal mucus.

Q7. When should I take my child to see a doctor?

- If severe symptoms do occur and influence the child's learning activities and normal sleeps.
- If no improvements show up after taking antihistamine or topical steroids.
- If the child shrugs the shoulder reflex or makes abnormal noises which sound like the symptoms of Tourette's Syndrom.

Q8. What should children with allergic rhinitis take notice of in their daily life?

- Avoid contact with allergen, such as dust mites, pollen, cats and dogs.
- Avoid dry and cold wind blowing straight to children with allergic rhinitis, and avoid the wind gap of the air conditioner and the fan.
- Must abide by the doctor's instructions to take medicine appropriately to prevent a complication of chronic tympanitis and nasosinusitis.

Mom Experience
My baby was diagnosed with atopic dermatitis, should I continue breastfeeding?
Q. My baby is now 3 months old, and has red rashes which look like eczema on the face and the scalp. The doctor diagnosed my baby with atopic dermatitis, and suggested me stopping breastfeeding for the time being, and switching to extensively hydrolyzed formulas. However, considering that my baby is only 3 months old, I'm wondering if I suddenly replace breastfeeding with infant formula, will there be any influence on my baby's immunity system and brain development in the future? **A.** Although breast milk is the best food for babies, there are certain breastfeeding babies with serious symptoms of atopic dermatitis. Firstly, you can adjust your constitution, avoid taking in food that may cause allergic reactions, and observe if your baby's skin condition gets better. However, if there isn't any improvement coming up after a period of time, you still need to feed your baby extensively hydrolyzed formulas (eHF).
What to eat and what not to eat when my child has bronchial asthma?
Q. I've heard many people say that children with bronchial asthma cannot eat ice cream. In addition to cold drinks, what kind of food should be avoided? What kind of food can be helpful for treating bronchial asthma? **A.** Certain types of foods that may easily induce bronchial asthma, such as icy foods, drupes, fried foods, chocolate, shelled seafood should be avoided. Moreover, common food artifacts, including preserved fruits and canned food with certain chemical substances such as food coloring, nitrate salt, preservative, and sulfide will also induce bronchial asthma. It is also worth paying attention to some researches saying that children who prefer fast food instead of fish and food with Vitamin C will more likely suffer from bronchial asthma
My child has bronchial asthma. Can she learn to play a wind instrument?

Q. My child is 10 years old now. She suffered from bronchial asthma from time to time in her childhood, but as she grew up and with the help of eliminating allergen at home, her condition gradually got improved. Because there are still opening positions in the school wind band, the teacher ask Me-Me, who once learned the piano, to give it a try. Can she learn to play the flute? Will there be any influence on the health condition of her windpipe?

A. In principle, we are not opposed to learning wind music because playing a wind instrument can help strengthen lung capacity and improve the symptoms. The question is, however, in the process of learning to play a wind instrument, there should be excellent asthma control. Because bronchial asthma will cause windpipe contraction, most patients who cannot acquire great asthma control will have insufficient lung capacity, which influences their experiences of learning an instrument. If she encounters similar problems in her learning process, we suggest her using a spacer before the course begins to improve the windpipe condition. Then she can start playing!

Did my child catch a cold or have bronchial asthma?

Q. My child was diagnosed with bronchial asthma at 2. Now he is 5 years old, and hasn't had bronchial asthma for quite a while. However, the flu just arrived in my son's kindergarten, and he had symptoms such as a runny nose, sneezes and coughs. The doctor said it was upper respiratory tract infection. However, my son has shortness of breath and breath noise in his sleep. How can I distinguish a cold from bronchial asthma?

A. In fact, bronchial asthma is often induced by flu. Respiratory tract infection usually leads to a sore throat and a high fever. However, if there are severe coughs occurring at night and at dawn, and constant chest tightness for more than 2 weeks, the case might be bronchial asthma. We suggest that a child should have a primary doctor who can continuously make diagnoses, understand changes of the child's health condition, and operate appropriate treatments.

My son has allergic reactions. Which doctor should I choose?

Q. My son is 2 years old now, and continually has allergic reactions such as an itchy nose, a black eye, and dry skin. I've heard that an allergic child should be continually taken care of by a specialty doctor, but the question is: should I take him to see a pediatrician, a dermatologist, an ENT(ear-nose-throat) doctor, or an immunology doctor?

A. An allergic child may likely have a complication. For example, if a child with allergic rhinitis continually has symptoms like itchy skin or hyperemia of conjunctiva, you have to consider it a complication of allergic conjunctivitis and atopic dermatitis. If it is the case, you are recommended to see an allergy/immunology doctor for a thorough diagnosis and treatment.

Appendix C: Testing Pictures for Semi-Structure Interviews

Concept Design

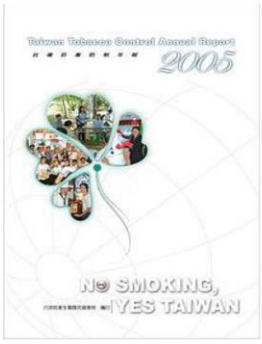
Straightfoward Concept

Shocked Concept

Humored Concept

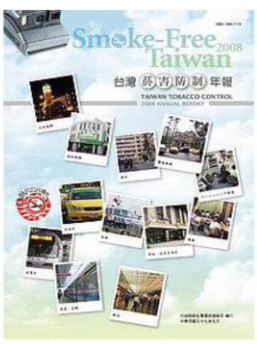
Celebrity-based Concept

Design Layout of Cover



Plenty of White Space

Contrasting Scheme

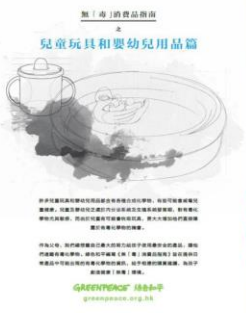


Rhythmic Composition

Symmetrical Arrangement

Design Layout of Content

Segmentation



One topic per page

Bullet Points

One picture per question

Typeface Design

Variety of styles

Suitable font size

List , charts and graphs

Graphic Devices

Colour Scheme

Bright Colour & Ad Colour

Monochrome scheme

Gender Scheme

Ethnic Scheme

Pictorial Illustrations

Line Drawing

Digital Cartoon

Painting

Abstract Forms

Realistic Photographs

Daily Life

Medical Specialisation

Symptoms of Disease

General Medical Equipment

Cultural Factors

Religious References

Living Habits

Hometown Festivals

Hometown Landscape