THE EFFECTS OF AN AUDIO CLIP INTERVENTION ON PUBLIC KNOWLEDGE, ATTITUDES AND PERCEPTIONS OF FOLIC ACID INTAKE IN PREVENTING BIRTH DEFECTS IN KOTA BHARU

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by

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*I can no other **ANSWER** make but thanks, and thanks, and ever thanks …*

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LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS

CDC	-	Centers For Disease Control
CNS	-	Central Nervous System
DNA	-	Deoxyribonucleic Acid
FA	-	Folic Acid
FAKAPQ	-	Folic Acid Knowledge, Attitudes, and Perceptions Questionnaire
FDA	-	Food And Drug Administration
FHLCS	-	Fetal Health Locus Of Control Scale
GT	-	Grounded Theory
HBM	-	Health Belief Model
HREC	-	Human Research Ethics Committee
IDD	-	Intellectual And Development Disability
ITS	-	Interrupted Time Series
JISC	-	Joint Information Systems Committee
KAP	-	Knowledge, Attitude, and Perception
MDG_S	-	Millennium Development Goals
MNNR	-	Malaysian National Neonatal Registry
MOH	-	Ministry Of Health
NTD	-	Neural Tube Defects
RTC	-	Rural Transformation Centre
SDGs	-	Sustainable Development Goals
SMS	-	Short Message Service
SPSS	-	Statistical Package For Social Sciences Software
USPSTF	-	United State Preventive Services Task Force
USM	-	Universiti Sains Malaysia
WHO	-	World Health Organization

KESAN INTERVENSI KLIP-AUDIO KEATAS PENGETAHUAN, SIKAP DAN PERSEPSI ORANG AWAM TERHADAP PENGAMBILAN ASID FOLIK SEBELUM KEHAMILAN DALAM MENCEGAH KECACATAN JANIN DI KOTA BHARU

ABSTRAK

Di Malaysia, brosur dan pamflet telah digunakan secara intensif kepada semua peringkat promosi kesihatan awam sebagai alat media dalam memperbaiki pengambilan asid folik prakehamilan dalam kalangan wanita yang mampu mengandung bagi mengelakkan kecacatan janin. Namun begitu, kadar kecacatan janin masih menjadi cabaran yang berterusan. Objektif kajian ini adalah untuk (1) menilai kesan intervensi klip-audio ke atas pengetahuan, sikap dan persepsi terhadap pengambilan asid folik prakehamilan dalam mencegah kecacatan kehamilan dan (2) meneroka penerangan orang awam berkenaan pengetahuan, sikap dan persepsi serta intervensi pendidikan di Kota Bharu. Penyelidikan kaedah campuran tiga fasa ini melibatkan kajian siri gangguan masa (ITS) dan pra/pos temubual telah dijalankan bermula dari Oktober 2015 sehingga Jun 2016. Fasa 1 terdiri daripada pra temubual (garis dasar), fasa 2 intervensi dan fasa 3 pos intervensi temubual. Soalan berstruktur berkaitan Pengetahuan, Sikap dan Persepsi Berkaitan Asid Folik (FAKAPQ) digunakan untuk menilai dan membandingkan pengetahuan, sikap dan persepsi sepanjang garis dasar dan fasa pos intervensi dengan pengumpulan 6 titik masa. Peserta awam direkrut dalam dua kumpulan dengan menggunakan persampelan bertujuan untuk kumpulan intervensi (n=708 daripada 2 pasar komuniti di Kota Bharu) dan kumpulan kawalan (tiada intervensi, n=708 daripada 1 pasar komuniti di negeri jiran, Terengganu). Kumpulan intervensi didedahkan kepada klip-audio tentang peranan pengambilan asid folik prakehamilan untuk mencegah kecacatan janin yang

dimainkan setiap jam diantara jam 8 pagi dan 2 petang (5 kali sehari) dengan menggunakan sistem pengumuman awam. Pra dan pos intervensi temubual dilaksanakan kepada kumpulan intervensi yang sama iaitu 22 peserta (10 lelaki, 12 perempuan). Analisis regresi bersegmen digunakan untuk menilai kesan intervensi. Analisis tematik (perbandingan tetap) data kualitatif daripada temubual mendalam ditambah dalam penemuan kajian. Analisis deskriptif selepas pasca/pos intervensi menunjukan terdapat peningkatan skor pengetahuan dan sikap tetapi tidak pada skor pesepsi. Akan tetapi analisa ITS menunjukan perubahan tidak signifikan terhadap skor pengetahuan, sikap dan pesepsi. Data kualitatif pra intervensi mengenalpasti tiga tema utama iaitu ‘maklumat separa’, ‘kekurangan komunikasi’ dan ‘penerimaan’. Manakala, data pos intervensi mengenalpasti tema ‘penambahan pengetahuan’, ‘peningkatan sikap dan persepsi’ dan ‘peningkatan persembahan’. Kajian menyimpulkan bahawa intervensi klip-audio berkesan dalam menghasilkan kesan positif terhadap pengetahuan dan sikap orang awam untuk penambahbaikan amalan pengambilan asid folik bagi mencegah kecacatan janin.

THE EFFECTS OF AN AUDIO CLIP INTERVENTION ON PUBLIC KNOWLEDGE, ATTITUDES AND PERCEPTIONS OF FOLIC ACID INTAKE IN PREVENTING BIRTH DEFECTS IN KOTA BHARU

ABSTRACT

In Malaysia, brochures and pamphlets have been employed intensively at all levels of public health promotion as media tools to improve childbearing women's preconception folic acid uptake, and to prevent birth defects. Nonetheless, the incidence of birth defects remains an ongoing challenge. This study's objectives were to (1) evaluate the effects of an audio clip intervention on public knowledge and attitudes to, and perceptions of, preconception folic acid intake in preventing birth defects; and (2) explore the public's narratives about their knowledge, attitudes, and perceptions, and the intervention in Kota Bharu, Malaysia. This three-phase mixed methods research, involving an interrupted time series (ITS) study and pre/post-in-depth interviews, was undertaken between October 2015 and June 2016. Phase 1 consisted of pre-intervention interviews (baseline), phase 2 the intervention, and phase 3 post-intervention interviews. A structured Folic Acid Knowledge, Attitudes, and Perceptions Questionnaire (FAKAPQ) was used to assess and compare knowledge, attitudes, and perceptions during the baseline and post-intervention phases, with data collected at six time points. Public participants were recruited for two groups using purposive sampling; an intervention group (n=708 from 2 community markets in Kota Bharu) and a control group (no intervention, n=708 from 1 community market in neighbouring Terengganu). The intervention group was subjected to an audio clip on the role of preconception folic acid intake in preventing birth defects, which was played hourly between 8 am and 2 pm (5 times per day) using the public announcement

(PA) system. Pre- and post-intervention interviews were conducted with the same 22 (10 male, 12 female) intervention group participants. Segmented regression analysis was used to assess the intervention's impact. Thematic analysis (constant comparative) of qualitative data from the in-depth interviews added to the study findings. Post-intervention descriptive analysis revealed an improvement in the knowledge and attitude scores but not in the perceptions score. The ITS analysis, however, showed no significant differences in knowledge, attitude, and perceptions scores. Pre-intervention qualitative data revealed three major themes: "partial information"; "lack of communication"; and "acceptance". The post-intervention data revealed three themes: "increased knowledge"; "improved attitudes and perceptions"; and "improved presentation". The findings indicate that the use of audio clips for health education is effective in producing a positive effect on the public's knowledge of, and attitudes to, preconception folic acid intake in preventing birth defects. However, the lack of any significant difference in knowledge, attitudes, and perceptions in the ITS analysis indicates that it may be necessary to implement more repetitive, longer audio clip broadcasts in public health promotion campaigns.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The ongoing, unacceptably high incidence of birth defects and infant mortality in Malaysia poses a challenge to researchers to understand contributing factors and seek evidence-based solutions. This thesis describes and explains the effects of an audio clip intervention on public knowledge, attitudes to, and perceptions of, preconception folic acid (FA) intake in preventing birth defects. It reports the public's narratives about their knowledge, attitudes, and perceptions, and the effects of the audio clip intervention in the local context of Kota Bharu, Malaysia. The researcher could find no substantive evidence that previous research had used an audio clip intervention to generate behavioural change in relation to public knowledge, attitudes to, and perceptions of, preconception FA intake in preventing birth defects, or had used the same Interrupted Time Series (ITS), robust quasi-experimental design employed in this study; a design with the ability to infer an intervention's effectiveness and account for data dependency (Cruz, Bender, & Ombao, 2017). Thus, this study intended to fill a gap in the research about this important topic. The theories and knowledge developed from it will provide a valid foundation for future research into public knowledge and attitudes to, and perceptions of, preconception FA intake in preventing birth defects, not only in Malaysia but internationally.

1.2 Background of the Study

Birth defects or congenital anomalies are a serious worldwide public health concern, yet to a certain extent they are a preventable cause of mortality, morbidity

and disability in both developed and developing countries (Thong, Ho & Noor Khatijah, 2005; National Center for Health Statistics, 2010; Christianson, Howson & Modell, 2013; Thong, 2014; WHO, 2018). In 2016, the World Health Organization (WHO) estimated an annual global birth defect rate of 3.2 million, with an expected newborn death rate of 303,000, and the Centers for Disease Control and Prevention (CDC, 2018) recently estimated a serious birth defect rate of 3–6% worldwide.

1.2.1 The Malaysian Situation

The South East Asian region's burden of birth defects is among the highest in the world (Flores *et al*., 2014), which is a public concern. The lack of information about this issue has received considerable critical attention (WHO, 2013), but despite Sustainable Development Goals (SDGs) that aimed to reduce the prevalence of birth defects, this public health problem has remained a challenge that still prevails in Malaysia (WHO, 2017). The Ministry of Health (MOH) Malaysia has identified birth defects as the country's number one cause of death among children under five years old (Wong & Hussain, 2008). Historically, the Malaysian National Neonatal Registry (MNNR) has reported that between 2010 and 2012, 4,830 babies in 38 Malaysian hospitals were born with birth defects, while data from Malaysia's Department of Patient Information, University of Malaya Medical Center showed that between 2003 and 2016, the prevalence of spina bifida was 0.5–10 per 1,000 live births (Adibah *et al*., 2017).

1.2.2 Neural Tube Defects

Looking specifically at neural tube defects (NTDs), in 2010 the worldwide NTD incidence was between 1.0 and 10.0 per 1,000 births, with almost equal

frequencies of anencephaly and spina bifida (Au, Allison & Hope, 2010), while a year earlier, the prevalence rate of spina bifida in Malaysia was 0.42 per 1,000 live births (Boo, Cheah & Thong, 2013). The highest rates (1.09 per 1,000 live births) were recorded among the indigenous people of Sarawak and the lowest rates among Malaysians of Chinese descent (0.09 per 1,000 live births). Anencephaly was the most common NTD, followed by spina bifida and encephalocele.

1.2.3 Folic Acid and Birth Defects Prevention

Birth defects have diverse aetiologies, several of which can be prevented at a primary level from early preconception to post-conception. Nevertheless, the causes of birth defects are unknown in almost 50% of cases (Salotti *et al*., 2015). What is known is the well-documented link between preconceptional FA intake and a reduced risk of birth defects (Tinker *et al*., 2010 ; Boo *et al*., 2013; Hisam, Rahman & Mashhadi, 2014; Keshavarzi *et al*., 2016; Nivedita & Fatima, 2016; Abdulmalek, 2017). There is also evidence to support preconception FA intake as an effective strategy for reducing birth defects (Fekete *et al*., 2012; Schmidt *et al*., 2012). Researchers have highlighted that FA is essential for various bodily functions, particularly in aiding rapid cell division and growth in pregnancy, thus reducing the risk of birth defects (Molloy *et al.,* 2008). Safi, Joyeux and Chalouhi (2012) have shown that folate deficiency has a teratogenic effect, leading to an increased risk of NTDs, while FA supplementation in women of childbearing age has a significant protective effect against birth defects. Adequate consumption of folates in childbearing women's diets during preconception and early pregnancy has been shown to positively impact preventable aetiological and epigenetic factors, and reduce the risk of birth defects, in comparison to the outcomes for folate-deficient childbearing women

(Molloy *et al*., 2008). The risk is significantly reduced when supplemental FA is taken before conception and during the first month after conception (Black, Cousens, & Johnson, 2010), and supplementation in the form of FA fortification of food before and during early pregnancy has been shown to reduce the prevalence of birth defects by 50–70% (Molloy *et al*., 2008). Therefore, efforts to mitigate the hidden problem of preconception FA deficiency in populations worldwide are crucial to the achievement of the Millennium Development Goals (MDGs) (Muthayya *et al*., 2013).

1.2.4 Public Knowledge of the Importance of Folic Acid

Some studies have revealed that health-related knowledge does not translate to increased use of FA among childbearing women. The Ministry of Health (MOH) Malaysia, through education programs and fortification measures, has recommended the use of FA and encouraged childbearing women to take a daily FA preconception supplement to prevent birth defects. However, preconception FA deficiency remains an issue due to childbearing women's low uptake of preconception FA supplementation (Nor Amelia *et al*., 2009). More recently, it was suggested that continuing high rates of birth defects may be due to a lack of knowledge or false perceptions among preconceptual women about FA's role in birth defects prevention, or an attitude problem leading to these women's unwillingness to change their behaviour and take a daily supplement (Mitchell, 2017). The ongoing FA deficiency problem and high rates of preventable birth defects raise questions about the effectiveness of current health promotion strategies to educate the public on this serious public health issue, and to ensure childbearing women take FA supplements both preconception and during pregnancy.

Sustainable public awareness of the benefits of preconception FA intake is essential to empower childbearing-age women to act to prevent birth defects. This is an issue of concern not only among childbearing-age women but also among other members of the public, who need awareness so they can advise women of the benefits of preconception FA supplementation and encourage them to change their behaviour. To date, published research studies have focused only on women, not the public in general. Thus, an appropriate method of health education delivery in the local context is essential to increase public knowledge, and change attitudes to, and perceptions of, preconception FA intake in preventing birth defects.

1.3 Rationale for the Study

Despite the recommendation of a daily intake of FA preconception for preventing birth defects, the prevalence of birth defects remains high in Malaysia. It has been observed that Malaysian childbearing women's knowledge (Keshavarzi *et al*., 2016) and awareness (Nor Amelia *et al*., 2009) of FA is low. It is this lack of awareness of the importance and benefits of preconception FA intake that puts these women at higher risk of having a baby born with birth defects. Also, little is known about the general public's knowledge and perceptions of, and attitudes to, preconception FA in birth defects prevention. Therefore, there is a need for more effective public education programs to increase not only women's, but all members of the public's knowledge about FA and its role in preventing birth defects, and to attempt to change their perceptions of, and attitudes to FA supplementation preconception and during pregnancy.

Knowledge of potential causes of birth defects, and their impact and burden on affected children and families is thus an important part of health education and promotion. Malaysian health communication campaigns over the past two decades have used brochures/pamphlets to deliver health messages targeting population-level health outcomes and promoting behaviour change. However, this approach does not seem to reach its intended objectives in relation to preconception FA supplementation. Reported observations indicate that women only began taking FA supplements after visiting clinics for first-trimester pregnancy check-ups (Mitchell & Verbiest, 2013). Therefore, a different method of delivering the message is needed that will reach all members of the public, not just childbearing women, and achieve better outcomes in relation to birth defects prevention.

Mass media campaigns have long been a tool for promoting public health, being widely used to expose high proportions of large populations to messages through television, radio, and newspapers (Wakefield, Loken, & Hornik, 2010). Mass media campaigns aim to promote knowledge, awareness, and better attitudes, with the end goal of changing behaviour. Expectations of public behaviour change are not high for such campaigns on their own, but the campaigns may help reinforce other efforts such as grassroots activities; in this case, FA supplementation education at antenatal clinics and other forms of health education messages (Wakefield, Loken, & Hornik, 2010).

The researcher's years of experience as a health professional impressed on her the importance of changing the general public's knowledge and perceptions of, and attitudes to, preconception FA intake as a means of changing childbearing women's related behaviour. Family members, friends, work colleagues, and other members of

the public who understand the benefits of FA supplementation due to health promotion campaigns may influence childbearing women's behaviour. As stated by Mockford *et al.*, (2012), capturing public views on public health issues is important to ensure that services meet the public's requirements. Evaluating public opinion, it is possible to determine broader community issues that might not have been identified by researchers or policy makers who are only involved in priority setting, intervention design, and delivery (Barber et al., 2012). In addition, Grandy (2003) showed that public opinion surveys play an important role in framing debate among policymakers. Therefore, the findings from this study could facilitate new public health strategies in encouraging preconception FA intake among childbearing-age women in Malaysia. Such strategies would have two interrelated components; improving awareness and knowledge concerning the benefits of FA and increasing the proportion of childbearing-age women who take supplements before conception (Nelson, Leon, & Evans, 2014).

While Malaysia is progressing towards the SDGs, additional efforts are necessary to address disparities in the preconception use of FA supplements. Therefore, understanding the public's knowledge, awareness, and perceptions of FA is important to determine why some childbearing women choose to take FA and others do not, and how their knowledge and attitudes shape their perceptions and health behaviours. Exploring the public's knowledge, awareness, and perceptions of FA requires more research into the effectiveness of different public health promotion strategies. Bal-Gezegina (2014) showed that the use of audio clips was significant in enhancing learning and conveying messages, while, most relevant to this thesis

research, Faidzan's (2013) study on an audio clip on FA and the prevention of birth defects showed that the clip was well received among patients waiting in a clinic.

Further studies are necessary to illuminate the effects of audio clips on knowledge and attitude transfer to determine whether they can enhance and promote important public health messages and influence behaviour modification. Therefore, this study sought to investigate the effect of mainstream public broadcasting of an audio clip about preconception FA supplementation, hypothesising that audio clip broadcast is effective for increasing the level of knowledge, attitudes, and perceptions of preconception use of FA and birth defects prevention among the public in Kota Bharu.

1.4 Problem Statement

A report from the Malaysian National Neonatal Registry (MNNR, 2012 & MNNR, 2013) indicated that 10% (1227/12263) of babies in the total cohort in 2012 had major congenital anomalies and 10.2% (1323/12880) of babies in the total cohort in 2013 had major congenital anomalies. The mortality rate for baby ≥ 35 weeks with major congenital anomalies was 44.7%. A considerable amount of literature indicates that adequate preconceptional FA can prevent birth defects (Marchetta et al., 2015). Furthermore, despite national health initiatives aimed at increasing the uptake of FA supplements and a diet rich in folates among women of childbearing age (Ministry of Health Malaysia, 2017), a low rate of awareness and knowledge of the importance of FA, including its low uptake, and a continued high rate of birth defects remains in the state of Kelantan, Malaysia (Nor Amelia et al., 2009). This situation is reflected in the 2015 data from the Medical Record Office, Hospital USM, Kota Bahru, Kelantan

(Figure 1.1), which show a significantly high rate of birth defects despite a decrease since 2014.

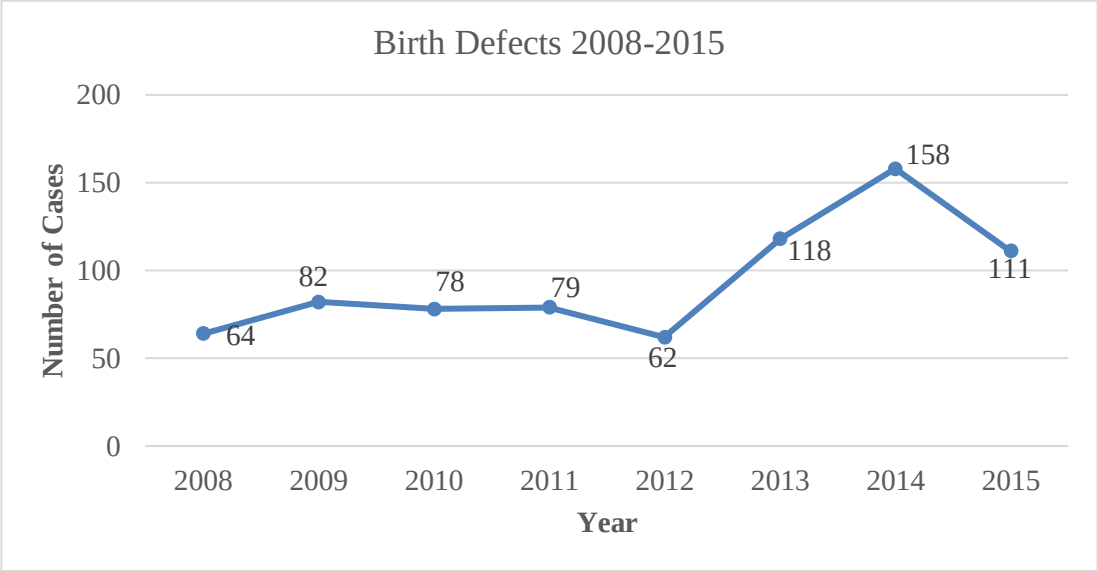

Figure 1.1 Statistic of congenital birth defects in Kelantan, 2008-2015

(Source: Data from the Medical Record Office, Hospital USM, Kelantan)

Most studies worldwide over the past two decades have focused solely on childbearing women's knowledge and awareness of the importance of FA rather than public awareness and involvement in behaviour change (for example, see Zeng *et al.*, 2011; Maher & Keriakos, 2014; Keshavarzi *et al.*, 2016; Stevens *et al.*, 2018). Such studies have stressed the need for greater media communication and information because educational materials such as brochures/pamphlets and photos used across Malaysia to promote FA have failed to produce positive change in health-related behaviour in Kelantan (Nor Amelia *et al.*, 2009). Thus, the local context requires a new approach to primary health promotion regarding preconception FA use to reduce the prevalence of birth defects in this state and across Malaysia. Also, such national Malaysian campaigns have been directed at women only when they attend clinics for

first-trimester pregnancy check-ups; a stage when it is too late to gain maximum benefit from FA supplementation. Hence, poor knowledge and awareness of the importance of preconception FA may be the reason why the message about FA does not seem to translate into women taking FA preconception, and therefore into a reduced rate of birth defects in Kota Bharu, Kelantan, Malaysia. Furthermore, the WHO (2015) strategic framework recommends that "a well-designed communication strategy is an important element for the prevention and control of birth defects". The ongoing problem of birth defects in Malaysia and this WHO recommendation underlay the researcher's aims, objectives, and study design.

1.5 Research Questions

The researcher designed the following quantitative and qualitative research questions to achieve the study's aims and objectives. The qualitative questions were predominantly exploratory.

1.5.1 Quantitative Research Questions

a) What are the levels of knowledge, attitude, and perception scores among the Kota Bharu public towards the preconception use of FA for birth defects prevention?

b) Are there associations between knowledge, attitudes, and perceptions of the preconception use of FA and socio-demographic characteristics of the Kota Bharu public?

c) Is the public broadcast of an audio clip effective in increasing public knowledge and changing attitudes and perceptions towards preconception intake of FA in birth defects prevention?

1.5.2 Qualitative Research Questions

a) What are the public's knowledge, attitudes, and perceptions about the preconception use of FA and its role in birth defects prevention?

b) What are the public's knowledge, attitudes, and perceptions about the effect of audio clip education broadcasts (as a health education campaign in Kota Bharu) on the preconception use of FA in birth defects prevention?

1.6 Research Hypotheses

The research hypotheses (alternative hypotheses H_A) tested were as follows:

Hypothesis 1: There is a significant association between selected socio-demographic characteristics (age, ethnicity, gender, education level, current working place, socio-economic status, marital status, and history of birth defects), and knowledge, attitudes, and perceptions scores of the Kota Bharu public in relation to preconception intake of FA in birth defects prevention.

Hypothesis 2: Audio clip broadcast is effective for increasing the level of knowledge, attitudes, and perceptions of preconception use of FA and birth defects prevention among the public in Kota Bharu.

1.7 Study Aims and Objectives

This study aimed to evaluate the effects of an audio clip educational intervention on the general public's knowledge and perceptions of, and attitudes to, FA (sources, benefits, use of FA supplements, and FA intake requirements preconception and during pregnancy), and the importance of FA in the preconception

and antenatal stages to prevent birth defects in Kota Bharu, Kelantan, Malaysia. As part of the overall aims and objectives, it aimed to explore the public's narratives about FA. The study's specific quantitative and qualitative objectives were as follows.

1.7.1 Quantitative Objectives

a) To determine the knowledge, attitude, and perception level scores of the Kota Bharu public in relation to the preconception intake of FA in birth defects prevention at baseline.

b) To determine the association between selected socio-demographic characteristics (age, ethnicity, gender, education level, current working place, socio-economic status, marital status, and history of birth defects) and knowledge, attitude, and perception scores of the Kota Bharu public in relation to preconception intake of FA in birth defects prevention.

c) To compare the change of knowledge, attitude, and perception scores between intervention (Kota Bharu) and control (Terengganu) groups before and after the intervention (audio clip educational broadcast about preconception FA intake in birth defects prevention).

1.7.2 Qualitative Objectives

a) To explore the knowledge, attitudes, and perceptions of the Kota Bharu public towards the preconception intake of FA in birth defects prevention in Kota Bharu.

b) To explore the Kota Bharu public's perceptions regarding the effectiveness of the audio clip educational broadcast as a health campaign for birth defects prevention.

1.8 Conceptual Framework

A conceptual framework acts as a building block for a research study (Glanz, Rimer, & Lewis, 2002). The researcher chose the Health Belief Model (HBM), one of the first theories of health behaviour, as the conceptual framework to guide this study because it emphasises how and why people adopt or reject health-related behaviours (LaBrosse, 2011). It is also a commonly used theory in health education and health promotion (Glanz, Rimer, & Lewis, 2002). The HBM was first developed in the 1950s by social psychologists Hochbaum, Rosenstock, and Kegels in the United State of Public Health Services as a psychological model that attempts to explain and predict health behaviours (Glanz *et al*., 2002).

As described by Polit and Beck (2012), the framework's focus is to make scientific findings meaningful and generalised and provide direction for relevant questions to practical problems. According to Sogaeezadeh (2002), among the several behaviour-directed models, HBM can specify a person's perception about the intensity of complications of unhealthy behaviours (perceived severity), and the capacity to catch a disease and its complications (perceived severity). It can also influence a person's perceptions about determining the benefits of healthy behaviour (perceived benefit) and barriers (perceived barriers) to healthy behaviour. Determining these issues can help health researchers to assess a person's future behaviour (Sogaeezadeh, 2002).

The HBM focuses on preventing the occurrence of disease and is one of the most precise instruments for showing the relationship between health-related beliefs

and behaviour (Miri *et al*., 2003). It can provide guidelines for program development, thus allowing planners to understand and address reasons for non-compliance and can help the researcher develop a successful health education intervention or program (Carpenter, 2010). The HBM is based on value-expectancy, meaning that behaviours can predict a person's expected outcomes of a particular behaviour and how much value they place on that outcome. There are six constructs to the HBM: 1) Perceived susceptibility; 2) Perceived severity; 3) Perceived benefits; 4) Perceived barriers; 5) Self-efficacy; and 6) Cues to action. This model is useful because it elucidates reasons for a person engaging in a certain health-related behaviour. It is also particularly well-suited to explaining that the likelihood of taking recommended preventive health action depends on many factors (Figure 1.2).

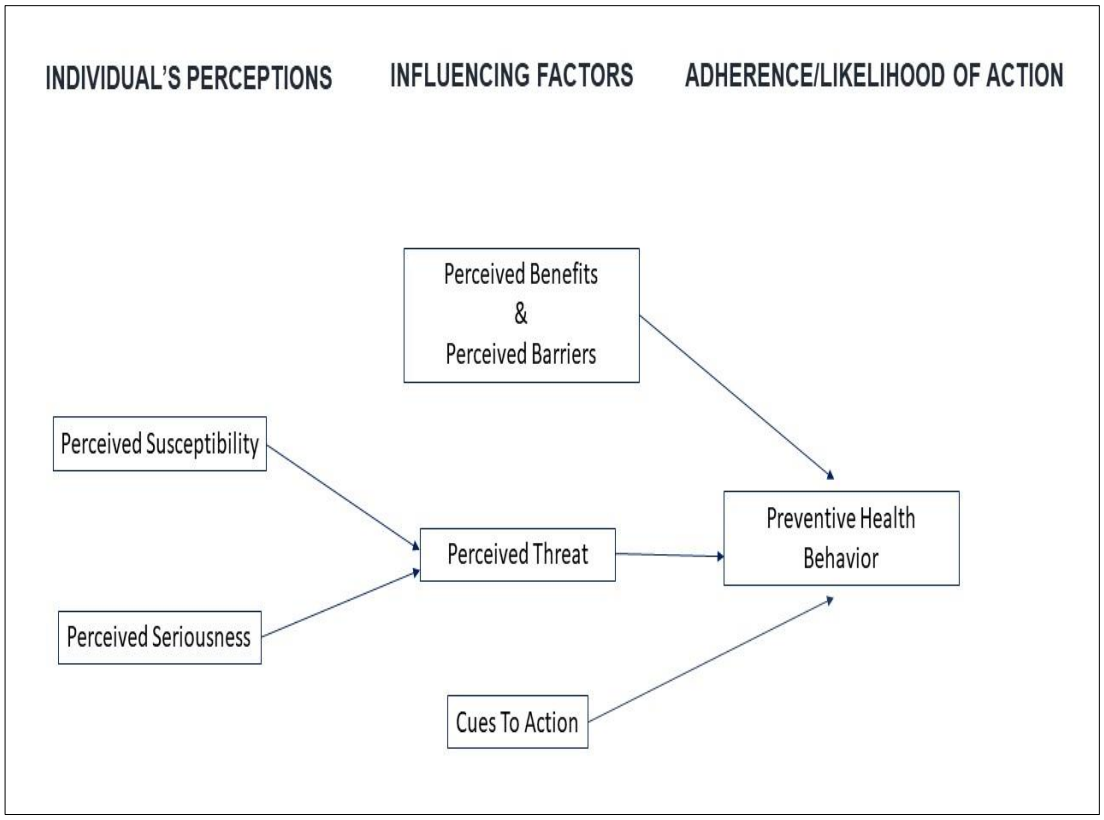

Figure 1.2 The Health Belief Model

(Source: Glanz *et al*., 2002, p. 52)

For the purpose of this study, the HBM was used as the conceptual framework for investigating the general public's health behaviours, particularly in regard to the public knowledge and attitudes to, and perceptions of, the uptake of preconception FA in preventing birth defects, as well as to explore the public narratives about their knowledge, attitudes, and perceptions, and the effects of the audio clip intervention in Kota Bharu. The HBM suggests that people's beliefs about the seriousness of a health problem and how susceptible they are to that condition, as well as cues to action (such as media campaigns and advice from health care professionals), determine the overall perceived threat of a condition (Rosenstock, Strecher, & Becker, 1988). Figure 1.3 illustrates the conceptual framework used in this study, which suggests that the likelihood of taking recommended preventive health action depends on many factors. As noted by Leventhal, Zimmermann and Gutmann (1984) in their critical review, "the HBM is the cognitive model most frequently used in studies of health behaviour and compliance" (p. 384).

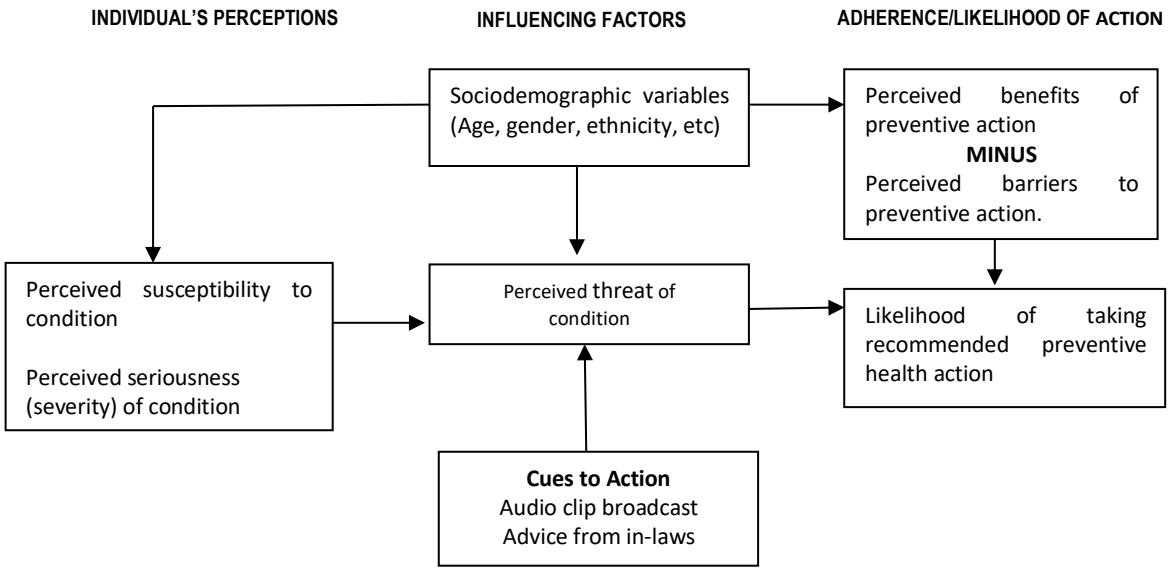

Figure 1.3 The Health Belief Model as the conceptual framework

Few studies have been conducted on the applicability of the HBM for use specifically in an intervention to increase FA intake. A study by Araban *et al.,* (2017) indicated that educational intervention strategies based on HBM could improve dietary iron and FA intake in pregnant women in the primary health care setting. An earlier US study by Kloeblen and Batish (1999) used the HBM to confirm its applicability in determining low-income pregnant women's intention to take folate. They found that perceived benefits were the most predictive factor influencing women's intention to take folate. Self-efficacy, perceived susceptibility, severity, and benefits also had positive correlations with intention to take FA. Contrary to Kloeblen and Batish's findings, Quillin *et al.,* (2000), using the HBM and Fetal Health Locus of Control Scale (FHLCS) to assess the beliefs about FA in college women before and after an educational intervention, found that beliefs were not associated with awareness or use of FA.

Regardless of the outcomes of different studies, the HBM is helpful in explaining why an individual engages in certain health-related behaviour. For example, in relation to this thesis research, the HBM underpins a prediction that a childbearing woman who thinks she has low susceptibility to birth defects, that birth defects are not severe, or that there is no real benefit in taking FA will be much less likely to take a supplement. On the other hand, if she thinks she has a high susceptibility to birth defects, that birth defects are very severe, or that there is a real benefit in taking FA, she will be more likely to take a FA supplement. In the case of members of the general public, if they think there is a risk for very severe birth defects or there is a benefit in taking FA preconception, they may be more likely to advise or try to influence a childbearing woman to take FA, thus positively influencing the

knowledge, perceptions, and attitudes of childbearing-age women towards preconception FA intake.

Using the HBM as a conceptual framework gave the researcher confidence that using an audio clip intervention with members of the general public in a localised context could bring about changes in the public's knowledge and perceptions of, and attitudes to, preconception FA intake, and increase preconception FA intake among childbearing-age women to prevent birth defects. The researcher placed a special focus on the HBM "Cue to Action" construct when designing the audio clip intervention, with hourly public broadcasts (5 times between 8am and 2pm) in the study setting (two marketplaces in Kota Bharu), and broadcast 5 times per day randomly on a local Kota Bharu radio station to communicate this construct. Thus, the HBM as a conceptual framework guided the data collection process.

1.9 Methodology

The nature and context of this study demanded a different approach than a randomised controlled trial or a cluster randomised trial, which would be impractical and prone to significant contamination bias. Thus, it was deemed best to use ITS, a research design that has become increasingly popular in assessing the impact of evidence-based interventions (Spoelman *et al*., 2016; Bernal, Cummins, & Gasparrini, 2017). In this study, ITS was used to collect data across multiple time points before and after the audio clip intervention to assess the intervention's effect. A combination of quantitative and qualitative information was gathered in this mixed methods study.

Applying a mixed methods approach enabled greater use of evidence-based practice in delivering messages and in investigating the hypothesis that the public could play a major role in influencing childbearing women's preconception FA intake. Also, although ITS is the strongest quasi-experimental design, no single study exists that explores the effects of a public broadcast audio clip on public knowledge, and perceptions of, and attitudes to, preconception FA intake in birth defects prevention in Malaysia.

1.10 Significance of the Study

There is a dearth of studies exploring public knowledge and perceptions of the preconception use of FA in preventing birth defects in Malaysia. Most intervention studies in developed and developing countries focus only on women's perceptions and use a quasi-experimental research design. This study is unique because it focuses on the general population (including all genders) and uses an ITS research design. The ITS design is considered the strongest quasi-experimental design available (Cruz *et al*., 2017). Hence, the value of an ITS design in quality improvement and health promotion campaigns cannot be understated.

Furthermore, to the researcher's knowledge, the evaluation of an intervention and the health impacts of unplanned events (Dennis *et al*., 2013; Hawton *et al*., 2013; Derde *et al.,* 2014; Lau *et al.,* 2015) has not been undertaken for public health interventions in Malaysia. Finally, little research has been published about how the public perceives the effects of publicly broadcast audio clip education on increasing public knowledge and awareness about early treatment-seeking behaviour. Hence, this mixed methods research breaks new ground and expands current knowledge in both

the topic under investigation and the methods used. No previous study has investigated the effect of an audio clip intervention on the public's knowledge of, and attitudes to, preconception FA intake in preventing birth defects, nor on their perceptions of an audio clip used in this way. Research to date into FA and birth defects, both nationally in Malaysia and globally, has tended to use cross-sectional studies and focus only on childbearing women. The only previous study undertaken in Kota Bharu, Malaysia, focused solely on women (Keshavarzi *et al*., 2016). The researcher found no research evaluating the impact of an audio clip as a public health promotion and education tool related to knowledge and perceptions of, and attitudes to, preconception FA intake that employed a mixed methods design and an audio clip education intervention. Nor has there been any qualitative analysis of the public's knowledge and perceptions of, and attitudes to, FA intake in the prevention of birth defects in the local context (Kota Bharu). Such analysis is vital to addressing the ongoing issue of birth defects prevention because it currently appears challenging to incorporate the determinants of FA intake into Malaysia's national programs for childbearing women.

This study may benefit health care policymakers and planners in Malaysia. Its findings relating to the public's knowledge and perceptions of, and attitudes towards preconception FA intake in birth defects prevention will expand the view from the current women-only perspective and may provide baseline data for future evaluation or reconstruction plans for current health promotion campaigns. The study is also aligned with the WHO's (2017) call for member countries to initiate educational interventions for the general population and is the first of its kind in Malaysia using ITS. Improving the public's knowledge and changing their attitudes and perceptions towards preconception FA intake is a crucial strategy for preventing birth defects.

Additionally, the results study will help improve the implementation of audio clip interventions by highlighting both the positive and negative aspects of this method. The findings may help provide policy makers and planners with workable suggestions and mechanisms to initiate audio clip interventions in the national health education delivery system.

1.11 Definition of Key Terms

Key terms used in this thesis are:

Audio clip - The audio clip refers to a short segment of media to promote an issue/message to the public (Duncan & Ben, 2009). In this study, it refers to using an audio clip play for 1 minute to broadcast information content regarding daily preconception FA consumption to prevent birth defects risks in newborns.

Attitude - An attitude is "a relatively enduring organisation of beliefs, feelings, and behavioural tendencies towards socially significant objects, groups, events or symbols" (McLeod, 2009). It refers to a public tendency, mental view, and disposition towards FA preconception intake by women of childbearing age.

Birth defects - Birth defects are also known as congenital anomalies, congenital disorders, or congenital malformations. They can be defined as structural or functional anomalies, including metabolic disorders that are present at the time of birth (WHO, 2012). In this study, the term "birth defects" refers to both structural or functional anomalies, for example, neural tube defects, cardiac anomalies, or cleft lips and palates.

Childbearing age - Childbearing age of a woman is between 15 and 49 years (World Health Organization, 2004). In this study, it refers to the ability of those of reproductive age (15-49 years) to become or remain pregnant within five years of exposure to pregnancy.

Knowledge - Facts, information, and skills acquired through experience and education ("Collins English Dictionary," 2015). The knowledge about FA was defined as knowing its preconception beneficial effect on preventing birth defects. In this study, knowledge refers to public knowledge about information on FA and its role in birth defects prevention. The information includes: what is the preconception-use of FA for childbearing women; what are the benefits of FA relating to birth defects prevention; and when should childbearing women consume FA?

Perception - Perception is defined as an awareness of something through the senses. It is also the way in which something is regarded, understood, or interpreted. In this study, it refers to public perceptions; the way they think about or understand the preconception use of FA and its benefit in birth defects prevention, including the usefulness of audio clip broadcast as an approach to increase knowledge and behaviour change.

Public - Ordinary people in general; the community (Cambridge Dictionary, 2016). In this study, “the public” refers to the general public who attend the community markets in Kota Bharu.

1.12 Thesis Structure

This thesis consists of seven chapters. Chapter One has provided an introduction to the whole research project: the study background, rationale, problem statement, aims and objectives, research questions, research hypotheses, conceptual framework, methodology, significance of the research topic, and definition of key terms.

Chapter Two provides an overview of the literature that explores the prevalence of birth defects globally and in Malaysia, the role of FA in preventing birth defects, and the effectiveness of public health campaign interventions.

Chapter Three describes the methodology and methods, and explains the philosophical issues underpinning each phase of the study. It emphasises the role of the mixed methods research approach and explains the rationale for using ITS design, also known as quasi-experimental time series analysis and Grounded Theory (GT).

Chapters Four and Five respectively describe the results from phase 1 and phase 3 (quantitative and qualitative) of the study.

Chapter Six summarises all the key information drawn from the study and discusses the research questions and findings.

Chapter Seven, the conclusion, reviews the study's aims, objectives, and research questions; evaluates the success of the research in meeting its objectives; discusses the strengths and limitations of the research approach; and draws conclusions from the findings. It explains the study's implications regarding the effects of an audio clip intervention on public knowledge and perceptions of, and attitudes to, preconception FA intake in preventing birth defects. This chapter also describes the public narratives about their knowledge, attitudes, and perceptions, and the effects of the audio clip intervention in Kota Bharu. It describes the findings' implications for practice and education, and makes recommendations for future research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The researcher reviewed the literature to search for knowledge gaps in relation to her area of interest; public knowledge, attitudes to, and perceptions of preconception folic acid (FA) intake in local contexts, in particular in her local context of Kota Bharu, Malaysia, and the use of an audio clip intervention to influence these important factors in an attempt to increase preconception FA intake among local, childbearing-age women. The review confirmed a lack of research and knowledge in this area, thus reinforcing the researcher's belief that this research would fill a gap in both research and public knowledge.

The researcher organised the review into five sections related to the study topic. These are birth defects; FA; intervention studies for improving knowledge, attitudes, and perceptions; role of mass media campaigns in changing knowledge, attitudes, and perceptions; and audio and radio broadcasting as an educational medium. The review provides a summary of published quantitative and qualitative studies to inform, enhance, extend, and supplement this study.

2.2 Birth Defects

Birth defects are structural or functional abnormalities present at birth that can cause physical disability, intellectual and developmental disability (IDD), and other health problems. Some may be fatal, especially if not detected and treated early. Birth defects are the leading cause of death in children less than one year of age (DeSilva,