FACTORS INFLUENCING THE PUBLIC'S DECISION-MAKING TO UNDERGO HEALTH CHECKS FOR PREVENTION OF CARDIOVASCULAR DISEASE

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FACULTY OF MEDICINE
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ABSTRACT

Cardiovascular disease (CVD) is the leading cause of mortality globally and in Malaysia. The prevalence of cardiovascular risk factors is high in this country, and more than half of those with risk factors remain ignorant of their cardiovascular risk status. Thus, there is a need to improve the public's participation in health checks for early identification of individuals at high risk for CVD prevention. Early identification will enable measures to be taken to prevent CVD morbidity and mortality. The purpose of this study was to explore the determinants and process of decision-making by the public with regard to health check participation for CVD prevention, and then identify possible factors to target the development of effective strategies to improve CVD health check participation. This study was conducted in three phases. In phase I, a systematic review was conducted to determine the effectiveness of existing intervention strategies to increase the uptake of cardiovascular risk factor screening. This was followed by a sequential exploratory mixed-method in phase II and phase III. In phase II, a qualitative study was carried out using a grounded theory approach to develop an explanatory framework for an individual's decision-making process for participation in CVD health checks. This framework was then used in the conceptualization and development of an instrument in phase III, in which a cross-sectional survey was carried out to identify the significant determinants associated with the public's intention to undergo CVD health checks. A systematic review of the literature showed that effective intervention in promoting uptake of cardiovascular risk factor screening included physician reminders, using dedicated personnel and providing financial incentives to individuals. Nevertheless, there was high heterogeneity for the meta-analysis performed. At the individual level, the decision to undergo CVD health checks was multi-factorial. The main factor was an individual's intention to undergo health checks, which was a result of two key internal

factors: the perception of relevance and the state of readiness to act on or cope with the findings of the health checks. The intention of the health checks is subsequently modified by external factors such as influences from significant others, as well as time, cost, accessibility and health care facilities. At the population level, four significant determinants were found to be associated with the intention to undergo CVD health checks: the perception of benefits and drawbacks of CVD health checks, the perception of external barriers and the readiness to handle outcomes following CVD health checks. Overall, although interventions studied in the systematic review targeted mainly external factors, results from phase II and III noted internal factors appeared to be more important than external factors. This research highlights the need for interventions to improve health check participation to focus on internal factors and not simply target external factors. In conclusion, the study has provided an understanding of the factors influencing the public's decision to undergo CVD health checks from both individual and general public perspectives. These factors can thus be incorporated in developing interventions using effective evidence-based strategies for cardiovascular risk factor screening.

ABSTRAK

Penyakit kardiovaskular (CVD) adalah punca utama kematian di dunia dan Malaysia. Prevalens faktor-faktor risiko kardiovaskular adalah tinggi di negara ini dan lebih separuh daripada populasi yang mempunyai risiko- risiko tersebut tidak mengetahui status risiko kardiovaskular mereka. Oleh yang demikian, terdapat keperluan untuk mempertingkatkan penyertaan orang ramai terhadap pemeriksaan kesihatan bagi pengesanan awal individu yang berisiko tinggi untuk penyakit CVD. Pengesanan awal ini akan membolehkan langkah-langkah diambil untuk mengelakkan morbiditi dan kematian disebabkan oleh CVD. Tujuan kajian ini adalah untuk meneroka proses semasa orang ramai membuat keputusan untuk menyertai pemeriksaan kesihatan bagi pencegahan CVD dan faktor-faktor yang mempengaruhi proses tersebut dan kemudian mengenalpasti faktor-faktor yang dapat disasar untuk membentuk strategi yang berkesan bagi meningkatkan penyertaan pemeriksaan kesihatan CVD. Kajian ini telah dijalankan dalam tiga fasa. Dalam fasa I, satu "systematic review" telah dijalankan untuk menentukan keberkesanan intervensi yang sedia ada untuk meningkatkan penyertaan orang ramai dalam pengesanan faktor risiko kardiovaskular. Seterusnya, kaedah "sequential exploratory mixed method" telah digunakan dalam fasa II dan fasa III. Dalam fasa II, satu kajian kualitatif telah dijalankan dengan menggunakan cara pendekatan "grounded theory" untuk membangunkan satu rangka kerja bagi menerangkan proses bagaimana seseorang membuat keputusan untuk menyertai pemeriksaan kesihatan CVD. Seterusnya, rangka kerja ini digunakan sebagai rangka konseptualasi dan pembentukan instrumen di fasa III, yang digunakan dalam satu kajian keratan rentas untuk mengenal pasti faktor-faktor yang mempengaruhi hasrat orang ramai untuk menjalani pemeriksaan kesihatan CVD. Keputusan "systematic review" menunjukkan bahawa intervensi berkesan untuk menggalakkan orang ramai menyertai saringan faktor-faktor risiko CVD adalah peringatan doktor, penglibatan kakitangan berdedikasi dan penyediaan insentif

kewangan kepada individu. Walau bagaimanapun, terdapat "heterogeneity" yang tinggi dalam meta-analisis tersebut. Di peringkat individu, keputusan untuk menjalani pemeriksaan kesihatan CVD adalah berdasarkan pelbagai faktor. Faktor utama adalah hasrat individu untuk menjalani pemeriksaan kesihatan. Ini adalah hasil daripada dua faktor dalaman utama: persepsi kepentingan dan tahap kesediaan untuk bertindak atau menghadapi keputusan pemeriksaan kesihatan tersebut. Hasrat untuk menjalani pemeriksaan kesihatan kemudiannya boleh diubahsuai oleh faktor-faktor luaran seperti pengaruh daripada orang sekeliling yang penting, kemudahan masa, kos, akses ke klinik dan kemudahan penjagaan kesihatan. Di peringkat orang ramai, empat faktor yang signifikan didapati berkaitan dengan hasrat untuk menjalani pemeriksaan kesihatan CVD: persepsi manfaat dan kelemahan daripada pemeriksaan kesihatan CVD, persepsi halangan luaran dan kesediaan seseorang mengendalikan hasil keputusan lanjutan daripada pemeriksaan kesihatan CVD. Secara keseluruhannya, walaupun kajian dalam intervensi "systematic review" kebanyakannya mensasarkan faktor-faktor luaran, keputusan daripada fasa II dan III menunjukkan faktor dalaman adalah lebih penting daripada faktor luaran. Kajian ini mengetengahkan pentingnya intervensi untuk meningkatkan penyertaan orang ramai dalam pemeriksaan kesihatan yang mensasarkan faktor faktor dalaman dan bukannya faktor luaran sahaja. Kesimpulannya, kajian ini telah memberi pemahaman tentang faktor-faktor yang mempengaruhi keputusan orang ramai untuk menjalani pemeriksaan kesihatan CVD dari aspek individu dan orang ramai. Faktor-faktor itu boleh digabungkan dalam pembentukan intervensi berdasarkan strategi yang berkesan daripada kajian terbukti untuk saringan faktor-faktor risiko kardiovaskular.

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LIST OF SYMBOLS AND ABBREVIATIONS

95%CI	:	95% confidence interval
β	:	Estimates of regression coefficient
BP	:	Blood pressure
BMI	:	Body mass index
CHD	:	Ischaemic heart disease
CVD	:	Cardiovascular disease
FGDs	:	Focus group discussions
I-CVI	:	Item –level content validity index
IDIs	:	In-depth interviews
KMO	:	Kaiser-Meyer-Olkin
KEMAS	:	Department of Community Development
KOSPEN	:	"Komuniti Sihat, Perkasa Negara" or Strengthening communities, empowering the Nation
MeSH	:	medical subject headings
NHMS	:	National Health Morbidity Survey
NNS	:	Number needed to screen
PRISMA	:	Preferred Reporting Items for Systematic reviews and Meta-Analyses
RCTs	:	Randomised controlled trials
RM	:	Ringgit Malaysia
RR	:	Relative risk
SE	:	Standard error
SOCSO	:	Social Security Organisation
TIDieR	:	Template for Intervention Description and Replication checklist
USD	:	United States Dollar

WC	:	Waist circumference
WHO	:	World Health Organisation

LIST OF APPENDICES

CHAPTER 1: GENERAL INTRODUCTION

1.1 Introduction

This thesis presents a rationale for the improvement of cardiovascular health through prevention, by exploring and determining the factors influencing the public's decision to undergo health checks for prevention of cardiovascular disease (CVD), and thereafter to recommend measures that could be taken to improve the uptake of health checks for prevention of CVD. In this introductory chapter, a definition of cardiovascular disease prevention, the importance of health checks for prevention of CVD, the research questions, the aim, and structure of this thesis are presented.

1.2 Definition of cardiovascular disease prevention

Prevention of CVD in this research refers to the primary prevention of CVD. It is defined as the effort to modify risk factors or prevent their development, with the aim of delaying or preventing the onset of cardiovascular disease, that is before a person has exhibited clinical atherosclerotic disease and has not yet been formally diagnosed with CVD (Grundy et al., 1998; Kones, 2011).

This can be controversial as the division of CVD into primary, secondary and tertiary prevention is arbitrary, given the continuum of the pathological process of atherosclerosis. The definition of primary prevention aforementioned might encompass patients who are in the advanced stages of atherosclerosis but have not yet presented clinically; this could affect the results of research investigating the effectiveness of interventions for reduction of mortality and morbidity in primary prevention, in which it is assumed that there are only early atherosclerosis changes in primary prevention. In this study, those with previous history of CVD were excluded because it is highly likely that they would be receiving treatment and monitoring. However, it is possible that those who were included could have underlying extensive atherosclerotic disease that had yet to be

diagnosed. The aim of this study was to explore and determine factors affecting decision-making for CVD health check participation, targeting primary prevention of CVD, people without CVD or with existing atherosclerotic disease that were undiagnosed. It was therefore necessary to exclude those who were already engaged with follow-up and treatment.

1.3 The importance of health checks for prevention of CVD

Cardiovascular disease is a major cause of death globally, and contributed one-third of all deaths in 2015 (World Health Organisation, 2015). The disease burden is high, and the most affected areas are in low- and middle-income countries (Krishnamurthi et al., 2013; Moran, Tzong, et al., 2014).

The majority of CVD are lifestyle-related, with modifiable risk factors accounting for 90% of the CVD risk (Yusuf et al., 2004). Thus, the onset of CVD could be delayed or prevented and is amenable to early interventions such as lifestyle changes and pharmacological therapy (Ford et al., 2007; Lewington et al., 2002; Taylor et al., 2013; Vartiainen et al., 2010). Therefore, preventive care is important for reducing the occurrence of CVD and its related health burden.

Health checks are part of the preventative strategy used in primary care to help identify patients at high risk of CVD for early intervention (Forster et al., 2016). There has been considerable debate about the usefulness of screening for CVD risk factors (Goodyear-Smith, 2013; Kmietowicz, 2013; Krogsbøll, Jørgensen, & Gøtzsche, 2013; MacAuley, 2012; Wookey et al., 2013). A systematic review by Krogsbøll included 14 studies from Western countries, and found that general health checks did not reduce morbidity or mortality of CVD (Krogsbøll, Jørgensen, Grønhøj Larsen, & Gøtzsche, 2012). Others have argued that the results of this review cannot be generalized because of the inclusion of old studies from an era in which management was not as effective as current treatment

(Prochazka & Caverly, 2013). As the review also focused on general health checks, the findings may differ for health checks conducted for specific conditions such as CVD and cancer (Fenton, Kelly, Newton, Patrick, & Richards, 2013; Gidlow, Kumar, Iqbal, Chambers, & Mawby, 2012; Prochazka & Caverly, 2013). On the other hand, two cohort studies from Korea and Japan reported health screening for CVD was associated with lower rates of CVD, all-cause mortality, CVD events and lower healthcare utilization and costs (Hozawa et al., 2010; Lee et al., 2015).

In countries such as low- and middle-income countries with high prevalence and unawareness of cardiovascular risk factors (Mills et al., 2016), health checks are important and necessary for early detection of these people with high risk for timely intervention.

Malaysia is a middle-income and developing country. CVD has been the major cause of death since the 1970s (Khoo, Tan, & Khoo, 1991; Ministry of Health Malaysia, 2015). The prevalence of cardiovascular risk factors is high and increasing (Institute for Public Health (IPH), 2008, 2011a, 2015a). However, more than half of the population with risk factors remain ignorant of their risk status (Institute for Public Health (IPH), 2015a). Opportunistic health checks by health care providers are, therefore, a potentially useful means of detecting risk factors in early stages. This will allow a prediction of their cardiovascular risk to be made so that timely interventions can be taken. For most people, primary care is the first contact of care. It is the ideal setting to engage the public in health checks for CVD prevention. However, the uptake of health checks remains low in Malaysia, ranging from 20% to 40% (Institute for Public Health (IPH), 2011a; The Star online, 2015).

1.4 Research aim and questions

As CVD is prevalent and carries a heavy healthcare burden, health checks for CVD are thus important to detect people at high risk early. However, many people among the public remain unaware of their CVD risk factors, and the uptake of health checks is low. Therefore, there is a need to understand how the public decide to undergo health checks so that effective interventions can be employed to promote health check participation.

The aim of the study is to explore possible factors to target for development of effective strategies to improve CVD health checks. The research questions for this study are:

1. Which interventions have been shown to increase the uptake of CVD risk factor screening by the public?
2. How does the public decide on health checks for CVD prevention?
3. What are the determinants of decision-making by the public with regard to participating in health checks for CVD prevention?

The research strategies and objectives will be discussed in Chapter 2.

1.5 Structure of the thesis

This thesis is divided into six chapters. This chapter, Chapter 1, is the general introduction.

Chapter 2 provides literature reviews on issues relevant to this research. This includes an introduction to the study setting and its health care system, review of the burden of CVD and cardiovascular risk factors, the significance of controlling CVD risk factors, strategy for CVD prevention, total cardiovascular risk assessment, health checks for prevention of CVD and its benefits and harms, health check programmes and uptake of health checks, factors influencing health checks and summary of the literature and

knowledge gap. This chapter ends by providing the justification of conducting the study, the objectives of the research and strategies for conducting the research in this thesis.

Chapter 3 describes the methods, results, discussion and conclusion of the systematic review (phase I study).

Chapter 4 describes the methods, results, discussion and conclusion of the qualitative study (phase II study). The grounded theory approach is used to develop a conceptual framework for explaining an individual's decision-making process to undergo health checks.

Chapter 5 describes the methods, results, discussion and conclusion of the cross-sectional survey (phase III study). This chapter includes the development of the questionnaire based on the results and conceptual framework from the qualitative study written in Chapter 4. A pilot survey was conducted using this questionnaire among the public attending a hypermarket.

Chapter 6 provides a summary of the principal findings from all three phases of the study, and a discussion of the implications and recommendations for practices based on these findings. The chapter ends with a conclusion of this thesis.

For Chapters 3, 4 and 6, some of the contents are quoted verbatim from the following published papers from this thesis:

1. Cheong AT, Khoo EM, Tong SF, Liew SM. To Check or Not to Check? A Qualitative Study on How the Public Decides on Health Checks for Cardiovascular Disease Prevention. PLoS ONE. 2016;11:e0159438.

2. Cheong AT, Liew SM, Khoo EM, Mohd Zaidi NF, Chinna K. Are interventions to increase the uptake of screening for cardiovascular disease risk factors effective? A systematic review and meta-analysis. BMC Family Practice. 2017; 18(1):4

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents the background and rationale for this thesis with a literature review. It starts with an introduction to Malaysia and its healthcare system to provide a background on the study setting to provide the context of the study. Following that, the burden of CVD and its risk factors are reviewed from the global and local perspective. Subsequently, the significance of controlling CVD risk factors and strategies to prevent CVD are presented. Health checks for CVD prevention, its benefit and harms, the issue of screening uptake rate and factors influencing participation in it are reviewed. At the end of the literature review, the knowledge gap is highlighted. This chapter finishes with presenting the research objectives and strategies of conducting the research.

2.2 The study setting: Malaysia and its health care system

Malaysia is a multi-ethnic country located in South-East Asia. It is categorized as a country within the Western Pacific region by the World Health Organisation. Malaysia is classified as an upper-middle income country, with a gross national income per capita of USD10,570 in 2015 (The World Bank, 2016). The neighbouring countries of Malaysia are Thailand, Singapore, Indonesia and the Sultanate of Brunei.

Malaysia has a population of 31.7 million (Department of Statistic Malaysia, 2016a). The majority of the population is Bumiputera (61.5%), followed by Chinese (21.0%), Indians (6.3%) and others. Bumiputera is the term used for communities established in Malaysia before the arrival of British colonialists and it refers to the Malays, the natives of Sabah and Sarawak and the indigenous peoples. The majority of the Bumiputera are Malays. According to the national census of 2010, 70% of the population reside in urban areas (Department of Statistic Malaysia, 2011).

In 2016, the life expectancy at birth in Malaysia was 74.7 years, the crude birth rate was 16.6 live births per 1,000 population and the crude death rate was 5.0 deaths per 1,000 population (Department of Statistic Malaysia, 2016c).

Generally, the health care system in Malaysia is well developed and the majority of the population has access to health care facilities (Jaafar, Mohd Noh, Abdul Muttalib, Othman, & Healy, 2013). About 90% of the urban and 70% of the rural population live within 3 kilometers of a health facility (Jaafar et al., 2013). The health care system is a two-tier system with health care services provided by both the public (government) and private health sector.

For the public health sector, the Ministry of Health is the major provider (Merican & Yon, 2002; Jaafar et al., 2013). Other providers include the Ministry of Higher Education, Ministry of Defence, local governments and the Department of Aboriginal Affairs. The facilities consist of public health clinics, secondary and tertiary hospitals. The public health clinics provide primary care services such as care for maternal and child health, acute and chronic illness and preventive care.

For patients to seek treatment at public hospitals, they need to be referred by a primary care doctor. The patients can sometimes bypass this system by going to emergency units in the hospitals. The public health facilities are highly subsidized. In public health clinics, the patient only needs to pay RM1 to RM5 (USD 0.30-1.20) for a clinic visit. This charge covers consultation, investigations and medications. The general services in government facilities are free of charge for government servants and pensioners, school children and those aged 60 years and above.

The private health sector provides health services mainly in the urban areas (Jaafar et al., 2013). There are private primary care clinics, hospitals and clinical laboratories

(Jaafar et al., 2013). The private health care provision is on a fee-for-service basis and the cost for the patient is significantly higher compared to public health care. In the 2015 Malaysia National Health Morbidity Survey (NHMS), the cost of treatment in private facilities was estimated to be about 8 to 13 times higher than in public facilities, but the waiting time is much shorter and more satisfying (Institute for Public Health (IPH), 2015b; Jaafar et al., 2013). Patients also have the option to choose a specific doctor and specialist without needing a referral (Institute for Public Health (IPH), 2015b; Jaafar et al., 2013).

The payments for the health care services (either public or private) are contributed by individual out-of-pocket payments, employer/panel clinics, personal purchased health insurance and employer-sponsored insurance (Institute for Public Health (IPH), 2015b). In the 2015 Malaysia NHMS, a majority (85.5%) of respondents reported that they themselves or their family members are the usual payer for health care services (Institute for Public Health (IPH), 2015b).

2.3 The burden of cardiovascular diseases

Cardiovascular disease remains the leading cause of death in the world and it contributes to one-third of total deaths (World Health Organisation, 2008, 2015). The top two causes of death were ischaemic heart disease (CHD) and cerebrovascular disease (stroke), and the number of deaths from these diseases in 2015 was estimated to be 14.3 million which represents a quarter of all deaths (World Health Organisation, 2015). CVD is the main cause of death in middle- and high-income countries (World Health Organisation, 2008, 2015). Furthermore, it is predicted to be the major cause of morbidity and mortality in most developing countries by 2020, due to the increasing prevalence of CVD risk factors and the effects of urbanisation and lifestyle changes in these countries

(Celermajer, Chow, Marijon, Anstey, & Woo, 2012; Critchley, Liu, Zhao, Wei, & Capewell, 2004; Hata & Kiyohara, 2013; Ohira & Iso, 2013).

The review by Ohira et al. showed that most Asian countries, except for Japan, South Korea, Singapore and Thailand, had higher age-adjusted mortality from CVD compared to Western countries (Ohira & Iso, 2013). Most Asian countries had higher age-adjusted mortality from stroke (ranging from 82 to 215 per 100,000) compared to Western countries (ranging from 26 to 46 per 100,000) (Ohira & Iso, 2013). The CHD mortality among Asian countries appears to demonstrate a diverse pattern geographically. East Asian countries such as Japan and Korea tended to have lower age-adjusted mortality than Western countries (Ohira & Iso, 2013). West Asia (e.g. Iran, Kuwait), Central Asia (e.g. Tajikistan, Uzbekistan) and South Asia (e.g. India) reported higher age-adjusted mortality from CHD compared to Western countries (Ohira & Iso, 2013). The other East Asian (e.g. China, Mongolia) and South-East-Asian (e.g. Malaysia, Philippines, Singapore) countries were similar in age-adjusted mortality to that found in Western countries (Ohira & Iso, 2013).

The burden of CVD is reflected by disability-adjusted life years (DALYs). DALYs are defined as the cumulative number of years of life lost to premature deaths and years lived with non-fatal disease disability (Moran, Roth, Narula, & Mensah, 2014). It represents the disease burden by taking into account both morbidity and mortality of a disease into a single metric. A higher level of DALYs indicates a higher level of burden of that disease. From the analysis of the GBD (Global Burden of Diseases, Injuries, and Risk Factors) 2010 study, it was estimated that about two-thirds of ischemic heart disease DALYs affected middle-income countries. The age-standardized DALYs were about 7,400 per 100,000 among low-income countries, about 9,000 per 100,000 among middle-income countries and about 4,300 per 100,000 among high-income countries (Moran, Tzong, et

al., 2014). For stroke, the low- and middle-income countries contributed 86% of haemorrhagic stroke and 64% of ischaemic stroke DALY lost worldwide (Krishnamurthi et al., 2013).

Malaysia is a middle-income country in the Western Pacific Region, according to the WHO region classification (World Health Organisation, 2008, 2015). Cardiovascular disease is the major cause of death in this country. It emerged as the number one killer in the 1970s (Khoo et al., 1991). Local data reported by the Ministry of Health in 2014 showed that CVD contributed to 23.3% and 27.5% of deaths in government hospitals and private hospitals, respectively (Ministry of Health Malaysia, 2015).

In summary, the burden of CVD is high in the world. The most burdened is in the low- and middle-income countries. CVD remains a major cause of death in Malaysia. Thus, it is an important field to address in health care services delivery.

2.4 Cardiovascular risk factors

A risk factor is any factor associated with an increased likelihood that disease will develop at a later time. Risk factors represent associations, which may or may not be causal of the disease (Fuster, Gotto, Libby, Loscalzo, & McGill, 1996).

2.4.1 Cardiovascular risk factors: types and association with CVD

There have been many risk factors studied and reported to be associated with cardiovascular disease (Pasternak, Grundy, Levy, & Thompson, 1996). Among these, the traditional risk factors include smoking, hypercholesteroleamia, hypertension, diabetes, obesity, age, gender and family history of premature cardiac death (Furberg et al., 1996; Greenland et al., 2003). These factors are recognized as major risk factors because of their high prevalence in cardiovascular-prone population and dominance in CVD risk prediction (D'Agostino, Pencina, Massaro, & Coady, 2013; Frohlich & Al-Sarraf, 2013;

Greenland et al., 2003; Pasternak et al., 1996). The relation of these risk factors to the development of CVD was first identified by The Framingham Heart Study, a longitudinal cohort study (D'Agostino et al., 2013). In addition, the Framingham Heart Study was also the first to demonstrate the cumulative effect of these risk factors to CVD, and is a basis for risk score prediction (D'Agostino et al., 2013).

Some of these risk factors are modifiable such as smoking, hypercholesteroleamia, hypertension, diabetes and obesity. The non-modifiable risk factors are age, gender and family history of premature cardiac death. The modifiable risk factors can be targeted for preventive measures and the presence of non-modifiable risk factors warrant greater intensity of risk factor management in clinical settings.

A large, international, standardized case-control study in 52 countries worldwide (INTERHEART study) reported that nine risk factors were significantly associated with myocardial infarction in both sexes and at all ages in all regions (Yusuf et al., 2004). The risk factors identified were smoking, abnormal lipids, diabetes, hypertension, psychosocial factors and abdominal obesity. On the other hand, daily consumption of fruits and vegetables, regular consumption of moderate levels of alcohol, along with regular physical exercise, were found to be protective factors. Collectively, these nine risk factors accounted for 90% of the risk of myocardial infarction in men and 94% in women worldwide. Five modifiable risk factors i.e. smoking, abnormal lipids, hypertension, diabetes and obesity, accounted for about 80% of the population attributed risk. It also showed that there was a cumulative effect of risk factors, with the odds ratio of myocardial infarction being increased with increasing number of risk factors; for example, those with smoking, hypertension and diabetes increased the odds ratio for acute myocardial infarction to 13.01 (99%CI 10.69-15.83) compared to those without these

risks, and addition of abnormal lipids increased this ratio to 42.3 (99%CI 33.2-54.0) (Yusuf et al., 2004).

2.4.2 The significance of controlling cardiovascular risk factors

Studies have shown that treatment and control of cardiovascular risk factors, such as high cholesterol and high blood pressure, resulted in a reduction of CVD morbidity and mortality. A systematic review showed that treating cholesterol with statins in people without CVD reduced all-cause mortality and fatal and non-fatal CVD events (Taylor et al., 2013). Medical literature had also shown that blood pressure lowering is effective in reducing CVD events (Law, Morris, & Wald, 2009; Law, Wald, & Morris, 2003). A meta-analysis of 61 prospective cohort studies showed an estimated age- and sex-specific reduction in cardiovascular mortality of 50% for every reduction of 20mmHg in systolic blood pressure, and 1mmol/L lower total cholesterol was associated with about a half, a third and a sixth lower CHD mortality in both sexes at ages 40-49, 50-69 and 70-89, respectively (Lewington et al., 2002; Prospective Studies Collaboration et al., 2007).

Modeling analyses in Western countries showed that the decline in CHD mortality can be explained by the decline of cardiovascular risk factors and medical treatments (Björck, Rosengren, Bennett, Lappas, & Capewell, 2009; Capewell, Beaglehole, Seddon, & McMurray, 2000; Ford et al., 2007; Unal, Critchley, & Capewell, 2004; Vartiainen et al., 2010). Based on different models from different studies, the impact of risk factors on mortality varied from 44% in the United States to 60% in Finland, and the impact of treatments on mortality varied from 36% in Sweden to 47% in the United States (Björck et al., 2009; Capewell et al., 2000; Ford et al., 2007; Unal et al., 2004; Vartiainen et al., 2010). In Beijing between 1984 and 1999, CHD mortality had increased by 50% in men and 27% in women, which could be due to the increase of total cholesterol, prevalence of diabetes and obesity in the population (Critchley et al., 2004).

In summary, cardiovascular diseases are largely preventable by modifying the modifiable risk factors. The risk factors can be modified through lifestyle changes (e.g. weight management, smoking cessation, reduced salt intake etc.) and pharmacological therapy for those at high risk of cardiovascular diseases such as use of anti-hypertensive or anti-lipid agents. Modification of cardiovascular risk factors and medical therapies has been shown to reduce mortality and morbidity in people with diagnosed (secondary prevention) or undiagnosed cardiovascular disease (primary prevention) (Björck et al., 2009; Capewell et al., 2000; Capewell & O'Flaherty, 2011; Critchley et al., 2004; Di Chiara & Vanuzzo, 2009; Ford et al., 2007; Unal et al., 2004). These modifiable risk factors can thus be targeted for preventive measures.

2.4.3 Prevalence of cardiovascular risk factors

Of concern in controlling CVD is the high prevalence of cardiovascular risk factors such as hypertension, diabetes and obesity worldwide (Kearney et al., 2005; Kelly, Yang, Chen, Reynolds, & He, 2008; Shaw, Sicree, & Zimmet, 2010). The Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group reported that between 1980 and 2008, mean body mass index (BMI) had increased in almost all countries (Finucane et al., 2011). Although systolic blood pressure has decreased in high-income countries, it has increased in many low- and middle-income countries (Danaei et al., 2011). For serum concentrations of total cholesterol, results were highest in wealthy nations, but the trend of total cholesterol was decreasing; in developing countries, particularly in Asia, the trend of total cholesterol was rising (Farzadfar et al., 2011).

Current literature reported that there is a disparity of the prevalence, proportions of awareness, treatment and control of hypertension between high-income and low- and middle-income countries. A systematic analysis from 90 countries reported that in 2010, the prevalence of hypertension was higher in low- and middle-income countries (31.5%)

than high-income countries (28.5%) (Mills et al., 2016). Furthermore, the prevalence in high-income countries had decreased by 2.6% from 2000 to 2010, but in low- and middle-income countries, the prevalence had increased by 7.7% in this 10-year period (Mills et al., 2016). It was also found that in 2010, the proportions of awareness, treatment and control in high-income countries (67.0%, 55.6% and 28%) was higher than the low- and middle-income countries (37.9%, 29.0% and 7.7%) (Mills et al., 2016).

In Malaysia, there is high prevalence of cardiovascular risk factors as reported in the National Health Morbidity Survey (NHMS) among adults aged 18 years and older (Institute for Public Health (IPH), 2011a, 2015a). The prevalence of diabetes has increased from 11.6% in 2006 to 15.2% in 2011 and 17.5% in 2015.(Institute for Public Health (IPH), 2008, 2011a, 2015a) The prevalence of hypercholesteroleamia has increased almost 130% from 20.7% in 2006 to 35.1% in 2011 and to 47.7% in 2015 (Institute for Public Health (IPH), 2008, 2011a, 2015a), whereas the prevalence of hypertension remains high at 30.3% in 2015 (Institute for Public Health (IPH), 2015a). It was found that more than 50% of these patients were undiagnosed.

Table 2.1: Prevalence of hypertension, diabetes, hypercholesteroleamia, obesity and smoking among adults ≥ 18 years old for NHMS 2006, 2011, 2015

	2006	2011	2015
Prevalence of hypertension (%) - known, - undiagnosed	32.2	32.7 12.8 19.9	30.3 13.1 17.2
Prevalence of diabetes (%) - known, - undiagnosed	11.6	15.2 7.2 8.0	17.5 8.3 9.2
Prevalence of hypercholesteroleamia (%) -known -undiagnosed	20.7	35.1 8.4 26.6	47.7 9.1 38.6
Prevalence of obesity (%)	14.0[$]	15.1[$] , 27.2*	17.7[$] , 30.6*
Abdominal obesity[#] (%)	-	43.0	48.6
Prevalence of current smokers (%)	21.5	-	22.8^

waist circumference >90cm for men and >80cm for women
[$]BMI ≥ 30.0kg/$m^2$ based on WHO 1998
*BMI ≥ 27.5kg/m^2 based on Malaysian clinical practice guideline on management of obesity (2004)
^adults aged 15 years and above

There is clustering of cardiovascular risk factors in the local population. Based on the database of NHMS 2006, analysis of 34,505 participants, adult aged 18 years old and above showed that 63% of the participants had at least one cardiovascular risk factor, 33% had two or more risk factors and 14% had three risk factors or more. The clustering was similar in urban and rural populations (Selvarajah, Haniff, Kaur, Hiong, et al., 2013). Other studies in this country have reported that the prevalence of metabolic syndrome ranged from 30% to 40% of the adult population from Peninsular and East Malaysia, based on the different definitions used (Mohamud et al., 2011; Ramli et al., 2013).

In summary, there is a disparity of prevalence and control of cardiovascular risk factors between high-income and low- and middle-income countries, in which the burden of CVD risk factors is increasing in low- and middle-income countries. In Malaysia, the prevalence of cardiovascular risk factors is increasing and there is clustering of risk factors in our population. Half of those with risk factors are unaware of their risk status. There is a need to improve the detection rate of these people as well as to prevent the worsening of this epidemic.

2.5 Strategy for prevention of cardiovascular diseases

A combination of population-wide strategies and strategies targeted at individual-based primary prevention is needed to reduce cardiovascular disease burden (Doyle, Furey, & Flowers, 2006; Manuel et al., 2006; Rose, 2001). The extent to which one strategy should be emphasized over the other depends on cost-effectiveness and availability of resources.

Population strategy aims at reducing CVD incidence through lifestyle and environmental changes. It attempts to shift the whole distribution of exposure in a population, such as mass exposure control for tobacco or reducing salt content of food via policy implementation. This may bring large benefits to the population but offer little to an individual. People with low levels of risk will benefit from population-based public health strategies.

The individual-based prevention strategy is targeted at high risk patients. Individuals are more likely to benefit from this preventive intervention; the impact at the population level is limited. It can involve two approaches (Otgontuya, Oum, Buckley, & Bonita, 2013). The first approach is to manage each single risk factor such as hypercholesterolemia, initiate the treatment according to the defined level for initiation of treatment, irrespective of presence or absence of other risk factors. For the second

approach, the physician decides on the treatment based on the total cardiovascular risk assessment.

It is recognized that cardiovascular risk factors cluster and act synergistically to promote vascular risk (Jackson, Lawes, Bennett, Milne, & Rodgers, 2005), and the risk factors commonly coexist in an individual. Thus, the total risk of developing cardiovascular disease depends on the combined effects of multiple risk factors, and total cardiovascular risk assessment is more accurate than the use of individual risk factors.

One of the five priority interventions for combating non-communicable diseases is cardiovascular risk reduction by treating individuals at high risk (Beaglehole et al., 2011). The literature has shown that pharmaceutical treatment for these high-risk individuals was cost-effective and affordable in most countries, including low- and middle-income countries (Gaziano, Opie, & Weinstein, 2006; Lim et al., 2007). The guidelines for prevention of cardiovascular disease from WHO and various countries consistently recommend the use of total cardiovascular risk assessment for targeting limited healthcare resources. It is most cost-effective to target high-risk groups to prevent cardiovascular disease (National Vascular Disease Prevention Alliance, 2012; Perk et al., 2012; World Health Organisation, 2007). It is proposed that if resources allow, the target population can be expanded to include those with moderate levels of risk; however, lowering the threshold for treatment will increase not only the benefits but also the costs and potential harm (World Health Organisation, 2007).

A local study used Malaysian NHMS 2006 data for the modeling analysis to examine the effectiveness of universal cardiovascular screening at five categories of age group (aged 30 and above, aged 35 and above, aged 40 and above, age 45 and above and those aged 50 and above) (Selvarajah, Haniff, Kaur, Guat Hiong, et al., 2013). The results showed that the number needed to screen (NNS) reduced when the cut-off age for

screening was increased. The NNS was smaller for men compared to women. The cost effectiveness was highest for the older age group and by using the cut-off age at 50, it was predicted to capture 97% of the high-risk people. However, choosing the optimal screening strategy will depend on the amount of financial resources one has.

In summary, population and high-risk preventive strategies should be complementary to achieve the largest preventive effect in cardiovascular disease prevention. The threshold for screening and treatment very much depends on the health resources available, and its implementation needs to tailor to the needs and resources of the individual country.

2.6 Health checks for prevention of CVD

According to the Oxford Dictionary of English, a health check is an examination to determine whether a person is suffering from illness or injury (Oxford University Press, 2015). It carries the concept of health screening, which aims to identify asymptomatic populations or high risk people for a particular disease such as hypertension, diabetes and hypercholesteroleamia as well as assessing health risk behaviours such as smoking and status of physical activity and screening for symptomatic conditions that are under-reported by patients e.g. depression (Consensus working group screening guidelines, 2015; Murtagh, 2011). In practice, it is used for the means of promoting and maintaining health, which apart from screening of health risk and disease, health education and advice are also given to patients for prevention of disease. It is often referred to as a periodic health examination in preventive service delivery in primary care. In Malaysia, a health check is also known as a medical check-up.

Health checks for prevention of CVD are part of the individual-based prevention strategy, which is aimed to identify high-risk patients for further intervention. It is a health assessment including history taking, physical examination and related basic laboratory

tests which involve screening of various risk factors such as smoking, alcohol consumption, physical inactivity, hypertension, diabetes, high cholesterol and obesity as well as performing the global CVD risk scoring for those who are indicated. Current clinical practice emphasizes that health checks should be individualized and carried out periodically, targeting the patient's age, sex and specific risk factors that are supported by evidence (Canadian Task Force on Preventive Health Care, 2016; Consensus working group screening guidelines, 2015; Krogsbøll et al., 2012; Lim, 2013; Prochazka & Caverly, 2013; Royal Australian College of General Practitioners, 2012; Thompson & Tonelli, 2012; U.S.Preventive Services Task Force, 2016).

In view of the high prevalence of cardiovascular risk factors in Malaysia, individual CVD risk factor screening is recommended for adults above 18 years old, which include screening of hypertension, smoking, overweight, obesity, unhealthy diet, physical inactivity and family history of premature CVD. For adults with no known diabetes risk factors, the screening of diabetes is recommended at aged 30 and above, and for adults without prior known cardiovascular risk factors, the screening of dyslipideamia is recommended at aged 40 and above (Consensus working group screening guidelines, 2015). However, early screening for diabetes and dyslidipeamia is indicated for those with known diabetes risk factors and those with prior known cardiovascular risk factors. Also, total CVD risk assessment (global risk scoring) is recommended for individuals aged 40 years and above without any CVD risk factors and for individuals aged 30 years with identified CVD risk factors (Consensus working group screening guidelines, 2015). The management of risk factors would be based on a patient's risk group (National Vascular Disease Prevention Alliance, 2012; World Health Organisation, 2007).

2.7 Benefits and harms of general or CVD health checks

Unlike the proven benefits of treating CVD risk factors discussed in section 2.4.2 (Law et al., 2009; Law et al., 2003; Lewington et al., 2002; Pignone et al., 2001; Prospective Studies Collaboration et al., 2007; Sheridan, Pignone, & Donahue, 2003; Taylor et al., 2013; U.S. Preventive Services Task Force, 2009), the benefits of health checks are less established. A Cochrane review, which involved 14 randomized controlled trials from Western countries, showed that general health checks in the primary care and community setting did not show the benefit of cardiovascular morbidity or mortality reduction, although they increased the number of new diagnoses (Krogsbøll et al., 2012). However, this result was limited by its inclusion of old studies (seven of nine studies included in the meta-analysis were before 1971) for which the management at that time was likely to be of lesser efficacy compared to current treatments. Krogsbøll et al. emphasized that their results were mainly applicable to general health checks aimed at the general population with systematic invitation and mass screening. These results did not imply that physicians should stop clinically motivated testing and preventive activities, as that would be an important reason why an effect of general health checks has not been shown (Krogsbøll et al., 2012). As this review also focused on general health checks, the findings may differ for health checks conducted for specific conditions such as CVD and cancer (Fenton, Kelly, Newton, Patrick, & Richards, 2013; Gidlow, Kumar, Iqbal, Chambers, & Mawby, 2012; Prochazka & Caverly, 2013). In low- and middle-income countries, in which the preventive activities in primary health care are less organized and established than in Western countries, the prevalence of CVD risk factors is increasing, with more than half of those at risk not aware of their CVD risks. Thus, the benefits of CVD health checks are likely to be higher than estimated by the meta-analysis.

Another systematic review and meta-analysis by Si et al. looked at the effectiveness of general practice-based general health checks (Si, Moss, Sullivan, Newton, & Stocks,

2014). This review differed from Krogsbøll's review as Krogsbøll did not differentiate between general health checks conducted in general practice and those undertaken in the community or workplace. This review found that general practice-based health check studies reported slightly better results for surrogate outcomes (mean difference of total cholesterol, systolic, diastolic BP and BMI) than non-practice based studies. No differences were found in total mortality, but the general practice-based studies were not originally designed to assess this outcome. There is a limitation of small sample size and the need of longer follow-ups. The longest study only involves a ten-year follow-up.

In contrast to the above findings, two observational cohort studies showed the benefits of health checks in Asian countries. A nationwide cohort study from Korea reported that CVD health screening was associated with lower rates of CVD, all-cause mortality and CVD events and lower healthcare utilisation and costs (Lee et al., 2015). In addition, another study from Japan showed that mortality rates were lower in participants of general health checks than non-participants (Hozawa et al., 2010). The participants of health checks were reported to have a healthier lifestyle (never smoked, often consumed vegetables, good self-rated health) in their baseline characteristics. However, by using the propensity matched cohort analysis, these baseline differences were adjusted and with identical baseline characteristics, yet participants consistently showed a reduced hazard ratio of all-cause and cause-specific mortality of cardiovascular disease (Hozawa et al., 2010).

The difference of results between cohort studies compared to RCTs could be attributed to the participant's health behavior. In RCTs, participants and clinics which agreed to participate in the studies were likely to be those who were more motivated in taking care of their health, including those in the control group. Thus, the real effect of the benefits of health checks is attenuated. Cohort studies were conducted in natural settings and could

be more reflective of real-life effects.

To achieve the final benefits of CVD health checks i.e. morbidity and mortality reduction, it requires a series of actions from the identification of high-risk patients from health checks to subsequent management and follow-ups. Patients' non-adherence to subsequent management could dilute the benefit effects of health checks.

Regarding the psychological impact of screening, the literature has consistently shown that screening of cardiovascular risk factors was not associated with long-term psychological distress (Christensen, Engberg, & Lauritzen, 2004; Collins, Lopez, & Marteau, 2011; Jørgensen et al., 2009; Meland, Laerum, & Maeland, 1996).

In summary, there are controversial results of the benefits of health checks on CVD mortality and morbidity, with no long-term psychological impacts. The meta-analysis of general health checks from Western countries showed no beneficial effects and the large retrospective cohort from CVD health checks in Asian countries reported positive effects. CVD health checks are potentially beneficial in low- and middle-income countries, due to the high prevalence of CVD risk factors and undiagnosed cases in the population. To have the benefit of health checks, there is a need to have a good support programme to maintain patients' adherence to healthy lifestyles and pharmacological treatments for those who are indicated.

2.8 Health check programme and uptake

There are systematic preventive health check programmes in some countries, such as the NHS Health Check in England (Department of Health, 2009), which targets screening and management of CVD risk, and the 45-year-old general health check in Australia (Amoroso et al., 2009). However, in most countries, the health check is performed opportunistically by the primary health care provider. Primary care doctors are in an

excellent position for early detection of cardiovascular risk factors and health counselling for risk reduction as they see each of their patients, on average, three or four times a year (McWhinney & Freeman, 2009; Stange et al., 1998). The primary care consultation offers an opportunity for conducting preventive health management (Stott & Davis, 1979).

Research has found that the utilisation of health screening for cardiovascular risk factor checks ranged from 7.7% to about 90% (Artac et al., 2013; Chan, Amoroso, & Harris, 2008; Chin & Pengal, 2009; Dalton, Bottle, Okoro, Majeed, & Millett, 2011; Epidemiology & Disease Control Division, 2009; Kim & Beckles, 2004; Pappa et al., 2009; Rosediani, Ranimah, & Harmy, 2012; Van der Meer et al., 2013). The results differed with differences in study design, participants' characteristic and settings involved. Primary care studies targeted at total cardiovascular risk assessment for high-risk patients reported that the uptake rates for invited estimated high-risk patients were about 30% to 40% in developed countries, such as the NHS health checks in England and cardiometabolic risk factor screening in the Netherlands (Artac et al., 2013; Cook et al., 2016; Dalton et al., 2011; Van der Meer et al., 2013).

In Malaysia, the approach towards CVD prevention is mainly opportunistic (Institute for Public Health (IPH), 2011a) or through individual initiation from the public. In 2011, the Malaysian National Health Morbidity Survey reported that 37.8% of adults 18 years and above had a medical check-up that included screening of blood pressure and blood sugar level for the past 12 months (Institute for Public Health (IPH), 2011a).

In October 2013, the Ministry of Health of Malaysia, in collaboration with the Department of Community Development (KEMAS) and the Community Watch (Rukun Tetangga) implemented a community-based intervention, the KOSPEN initiative ("Komuniti Sihat, Perkasa Negara" or Strengthening Communities, Empowering the Nation) (Institute for Public Health (IPH), 2015a). This programme had five main scopes:

healthy eating, active living, weight management, smoke-free (not smoking) and screening of non-communicable disease risk factors (Institute for Public Health (IPH), 2015a) such as BMI, waist circumference, smoking history, BP and sugar level. It involved training of volunteers in selected localities to lead these activities. It targeted participation of 10,000 localities, with 50,000 volunteers trained and 1.5 million adults screened for non-communicable disease risk factors (Community Development Department (KEMAS), 2015).

In terms of the result of the KOSPEN programme, until September 2015, 18,473 volunteers were trained in 3506 localities, and 101,875 people aged 18 years and above (6% of the targeted population) were screened. Of those screened, 12,365 were referred to the nearest clinics for further assessment (Community Development Department (KEMAS), 2015), but there was no data about the attendance of these referrals to the clinics or hospitals.

Besides the KOSPEN initiative, the Social Security Organisation (SOCSO) of Malaysia under the Ministry of Human Resources initiated a health screening programme in 2013 which aimed to screen for non-communicable diseases such as hypertension, diabetes, kidney disease, dyslipidemia and assessing the CVD risk by using Framingham risk scores for male and female workers. For women, additional cervical cancer and breast cancer screening was provided (SOCSO, 2016). The SOCSO Health Screening Programme (HSP) was offered to all active workers aged 40 years and above and who were contributors to SOCSO. The one-off health screening vouchers were allocated for 1.9 million SOCSO contributors from January to December 2013. The programme was extended to the year 2014, 2015 and 2016 to provide an opportunity to those who have not utilized their voucher to go for screening as well as giving out a new voucher to those people attaining the age of 40 at the mentioned year above.

The SOCSO health screening uptake rate was low. It achieved only 14.7% (280,000/1.9 million) in December 2013 (New Straits Times, 2013) and increased to 16.2% (308,309/1.9 million workers) in February 2015 (The Star online, 2015).

In summary, systematic preventive health check programmes are implemented in some developed countries. In Malaysia, the mainstay of preventive measures is through opportunistic health checks by health care providers and individual initiation. There have been strategies that have been implemented to increase participation of health checks such as KOSPEN and SOCSO, but these programmes are not inclusive of all public. SOCSO programme only involved their organisation members while KOSPEN involved public from certain localities.

The uptake of health checks or health screening varies among studies due to differences in study design, participant characteristics and settings involved, ranging from 7.7% to about 90%. In Malaysia, about 40% of adults have reported an experience of general health checks. The uptake rate for CVD risk factor screening is poor for the SOCSO health screening programme and KOSPEN.

2.9 Factors influencing the uptake and participation of CVD health checks

Various factors have been reported to be associated or influenced the uptake of CVD health checks. These include the participants' sociodemographic characteristics, individuals' health beliefs and their attitude as well as the practical issues (cost, time, accessibility), which are further elaborated below.

A narrative scoping review of 39 studies from Western countries reported on the sociodemographic characteristics of those attending and not attending CVD health checks or general health checks (Dryden, Williams, McCowan, & Themessl-Huber, 2012). This review reported that in general, the sociodemographic characteristics associated with non-

attenders were men, people with low socio-economic status, unemployed or less well educated and those who were single. Older white individuals were more likely to participate in health checks (Dryden et al., 2012). Though the majority of the studies in the review reported the above results, this review also included studies which had contradictory findings or found no difference in attendance with those factors. The findings are not consistent across the studies. Thus, generalisation of these results should be undertaken with caution.

A number of qualitative and quantitative studies from Western countries have explored factors influencing public participation in health checks. These studies were mostly targeted at the population which had been invited for the CVD risk factor health checks. Some studies focused on the non-attenders and described their reasons for non-attending (Ellis et al., 2015; Nielsen, Dyhr, Lauritzen, & Malterud, 2004; Pill & Stott, 1988; A. Sinclair & Alexander, 2012; Wall & Teeland, 2004). Others looked at both attenders and non-attenders to explore the barriers and facilitators for health check participation (Burgess et al., 2014; Jenkinson, Asprey, Clark, & Richards, 2015).

Barriers for attending health checks or reasons for the non-attenders not attending the CVD health checks could be attributed to personal health beliefs. Non-attenders often perceived themselves as being in good health, which were expressed as feeling well, healthy, fit or no health worries (Ellis et al., 2015; Jenkinson et al., 2015; Nielsen et al., 2004; Pill & Stott, 1988; Wall & Teeland, 2004). The belief of low risk for CVD was cited as a barrier to health check uptake (Burgess et al., 2014). Besides, non-attenders did not believe in the benefit of health checks. Normal health screening results could not give reassurance of absence of disease (Nielsen et al., 2004). However, another study found that non-attenders did not perceive themselves as having low risk of developing serious

disease. Rather, they feared facing the outcome of screening (Simpson, Johnston, & McEwan, 1997).

The next common reason cited for non-attending was emotional factors, such as fear. This included fear about outcome, results, procedures, consequences of identifying health problems and implication to work and daily activity (Burgess et al., 2014; Ellis et al., 2015; Groenenberg et al., 2015; Jenkinson et al., 2015; Norman & Fitter, 1991; Pill & Stott, 1988; Simpson et al., 1997; A. Sinclair & Alexander, 2012). Another emotional factor described was not wanting their feeling of good health to be disturbed (Nielsen et al., 2004).

Next, the practical barriers such as lack of time, inconvenience of appointment, accessibility were also often reported as reasons for non-attendance (Ellis et al., 2015; Harkins et al., 2010; Nielsen et al., 2004; Pill & Stott, 1988; A. Sinclair & Alexander, 2012; Wall & Teeland, 2004). Some studies reported failure to receive an invitation letter (Ellis et al., 2015; Harkins et al., 2010; A. Sinclair & Alexander, 2012), and already being in contact with health services (Ellis et al., 2015; Pill & Stott, 1988; Wall & Teeland, 2004), as reasons for non-attending.

Though not attending the health checks, the non-attenders showed a positive attitude towards health checks in some studies, in which some agreed that health checks would be worthwhile (Ellis et al., 2015; Pill & Stott, 1988). On the other hand, some studies have shown otherwise. In one study, non-attenders emphasized the individual's responsibility for maintaining good health such as having a positive mind and avoiding stress instead of health checks. The non-attenders also stressed the importance of individuals' autonomy to determine their own health and disliked being advised by health care providers about their lifestyle (Jenkinson et al., 2015; Nielsen et al., 2004; Simpson et al., 1997). Thus,

non-attenders may not be unaware of the importance of health, but have different views of how it could be achieved.

Motivators and facilitators described in the literature, which contributed to uptake of CVD health checks included beliefs about susceptibility to CVD such as having a family history of CVD or not feeling well (Burgess et al., 2014; Jenkinson et al., 2015), having a positive attitude towards health checks and perceiving health checks as an opportunity to know their health status and for early detection and prevention of disease (Burgess et al., 2014; Jenkinson et al., 2015). Besides, awareness of the health check programme, easily accessible health check facilities in terms of distance and availability of appointment at a convenient time were also cited as facilitators for the participation in CVD health checks (Burgess et al., 2014).

Some quantitative studies have determined the overall significance of predictors of attenders and the intention to participate in health checks (Armitage, Norman, & Conner, 2002; Hsu & Gallinagh, 2001; Norman, 1993, 1995; Norman & Fitter, 1991; Norman & Conner, 1996; Petter, Reitsma-van Rooijen, Korevaar, & Nielen, 2015; Shiloh, Vinter, & Barak, 1997; Wilson, Sisk, & Baldwin, 1997). Some of these studies have adopted the health belief model (Norman, 1993, 1995; Norman & Fitter, 1991; Wilson et al., 1997) or theory of planned behaviour (Armitage et al., 2002; Norman & Conner, 1996) to investigate the association of its domains with the intention and uptake of health checks. For studies using the health belief model, among the significant predictors reported were perceived efficacy and benefit of health checks, perceived barriers such as time barriers, motivational barriers, potential worries about health checks, for example, fear about results or screening procedure (Norman, 1993, 1995; Norman & Fitter, 1991; Shiloh et al., 1997; Wilson et al., 1997). In contrast to qualitative studies, perceived susceptibility to disease was not found to be a significant predictor in the above-mentioned quantitative

studies. For studies examining the association between domains of theory of planned behavior and the intention of participation in CVD health checks, it was found that attitudes toward health checks, subjective norms and perceived behavioural control were the significant predictors for intention of CVD health checks (Armitage et al., 2002; Norman & Conner, 1996). The results found were not consistent across the studies, the significant predictors varied among the studies. This might be due to the different populations and also as the questionnaire used and items reflecting the domains differed from one to another study.

There was a study examining the predictors of intention of health check participation without referring to any health behaviour theory. A questionnaire survey of 1,500 Dutch adults reported that the desire to know the individual's risk for CVD, the desire to be aware of healthy lifestyles and perceived higher chance of healthy ageing due to health checks were associated with willingness to participate in health checks. Whereas, lack of time, feeling of unnecessarily worry due to health checks and not expecting any diseases were associated with a decreased willingness to participate in health checks (Petter et al., 2015).

In Malaysia, there have been very few studies regarding health checks for CVD prevention. There was a cross-sectional study conducted in the state of Kelantan looking at the knowledge, attitude and practice on CVD among women aged 25 to 65 years in a public health clinic with a family medicine specialist (Rosediani et al., 2012). This study reported that the proportion of participants who had measured their blood pressure, cholesterol, blood sugar and body weight were 83.1%, 58.5%, 74.1% and 90.0%, respectively. However, only about half of the participants had good knowledge, attitude and practice scores (Rosediani et al., 2012). These results need to be interpreted with caution in view of the study's limitations, such as the study population only targeting

women in public clinics with a family medicine specialist, and that 98.4% of the studied population were Malays, which does not represent the population ethnic distribution in this country.

In summary, various factors related to sociodemography, personal health beliefs, attitude, fear and worries towards health, and practical issues could influence participation in CVD health checks. CVD health check participation and non-participation might not necessary reflect opposing beliefs, barriers or facilitators, for example, it was not always the case for those perceived to be at higher risk of participating in health checks and those with low risk to not participate in health checks. Besides, the results varied for different studies as health behaviour is very much different given the diversity of the population and cultural background of one society to the other. Thus, one needs to be cautious in generalising the findings; its applicability would very much depend on the context and characteristics of the studied population.

2.10 Summary of the literature and knowledge gap

Cardiovascular disease (CVD) remains the leading cause of death globally. Its burden is high and affects most low- and middle-income countries. The majority of CVD can be prevented. Modelling analyses have shown that the decline in coronary heart disease mortality in developed countries was largely due to improvement of cardiovascular risk factor management and availability of CHD treatments. However, this decline is not seen in the developing world where the prevalence of CVD risk factors, such as hypertension, diabetes and obesity, is increasing at an alarming rate and satisfactory control of these risk factors is lacking. In Malaysia, there is a persistently high prevalence of hypertension, hypercholesterolaemia and diabetes. Yet, half of those with existing risk factors were unaware of their increased risk for CVD.

Health checks are useful for early identification of individuals at high risk of CVD. Though the evidence of health checks in reducing CVD mortality and morbidity is controversial, the treatment and control of cardiovascular risk factors is proven to be beneficial. This has prompted countries to implement national screening programmes, such as the NHS Health Check in England and the 45-year-old health check in Australia. However, the success of a prevention programme depends on the participation of targeted groups. The uptake rate of the health checks for invited estimated high-risk patients were 30% to 40% in developed countries. In Malaysia, the uptake of health checks remains low. The Malaysian National Health Morbidity Survey 2011 reported that only 37.8% of those aged 18 years and more had undergone health checks in the past year and the uptake rate for health screening programmes organized by the Social Security Organisation (SOCSO) for all members aged 40 years and more in 2013 was dismal at only 16.2% (308,309/1.9 million workers).

The literature describes various factors influencing the uptake of CVD prevention health checks. These include sociodemographic characteristics, personal attitude and health beliefs, emotional factors and practical issues. As noted in the earlier section of this chapter, facilitators of health checks uptake include the beliefs about susceptibility to CVD, having positive attitudes towards health checks, easy access to health checks facilities and convenience of obtaining appointments. The barriers of health checks uptake include the perceptions of self being in good health, beliefs of self being at low risk for CVD, disbeliefs of the benefits of health checks, fear of facing outcomes of screening and practical barriers such as time constriants, inconvenience of appointments and difficulty in accessibility. However, the literature does not provide a framework of how these factors interact. There is lack of clear explanation about how people decide on health checks for CVD prevention. The listings of barriers and facilitators might oversimplify the complexity of one's decision-making process for health check

participation. It is recommended that an intervention should be designed based on a theoretical framework to increase its likelihood of success for its desired effect (Craig et al., 2008). Thus, understanding public decision-making processes is crucial in order to plan a successful intervention to promote the uptake of health checks for CVD prevention. In Malaysia, the study on health checks for CVD prevention is scarce. A study specifically regarding how the public decides on participation in health checks has not been undertaken. In addition, factors found in other populations might not apply to our society, in view of the diversity of the population, cultural background and health system. Thus, a study of public decision-making processes with respect to health checks for CVD prevention is required.

2.11 Aims and justification of this study

The overarching aim of this thesis is to improve the participation of the CVD health checks among the public. This necessitates finding effective strategies to encourage them to undergo health checks for prevention of CVD. The strategies are likely to be most effective if we have a better understanding of the underlying factors which affect the decision-making of the public for participation in health checks for CVD prevention. Therefore, it is of interest to know about the effective interventions available and how the public decides on health checks for CVD prevention; an understanding of the decision-making process in the local context could provide insight about what and which factors an intervention should be targeted at, and whether existing interventions in the literature could be applied to local settings or there is a need to develop other strategies tailoring to local contexts. Thus, as stated in the general introduction, section 1.3, the research questions asked in this study are as follows:

1. Which interventions have been shown to increase the uptake of CVD risk factor screening by the public?

2. How does the public decide on undergoing health checks for cardiovascular disease prevention?
3. What are the determinants of decision-making by the public with regard to participating in health checks for CVD prevention?

2.12 Research objectives

With the need to know the effective interventions, understanding the decision-making process of people's participation in health checks and addressing the research questions, the following objectives were set.

2.12.1 General objective

To explore the determinants and process of decision-making by the public in the participation of health checks for CVD prevention.

2.12.2 Specific objectives

1. To examine the literature to determine the effectiveness of intervention to increase the uptake of cardiovascular risk factor screening for the adult population from primary care practices and community.
2. To explore the views and experiences of the public in making decisions to participate in health checks for CVD prevention and to develop an explanatory framework for the decision-making process to participate in health checks.
3. To develop a survey questionnaire and conduct a pilot survey to determine the significant determinants associated with the publics' intentions to participate in health checks for CVD prevention.

2.13 Research strategies

A systematic review was employed to address the first research question and specific objective. In phase I, a systematic review of the literature and meta-analyses of the

intervention studies were carried out. It was useful to identify effective interventions which had been used to increase the uptake of CVD risk factor screening. The applicability of these interventions in the local setting would be examined based on the understanding of the public's decision-making process in phase II and phase III study.

A mixed-method approach was used to address the second and third research questions and their specific objectives in phase II and phase III. This approach takes pragmatism as the philosophical approach, which focuses on "what works" for the research questions and research problems (Creswell, 2009; Teddlie & Tashakkori, 2009). Therefore, it advocates the use of whatever methodological tools are appropriate to answer the research questions, and acknowledges that the researchers play a large role in the interpretation of results (Teddlie & Tashakkori, 2009). The mixed-methods sequential exploratory design was adopted in this study, which implied collecting and analyzing qualitative data first, followed by the quantitative data in two consecutive phases (Phase II and phase III).

Locally, there is little known about the public's decision-making process on health checks for CVD prevention. Therefore, it is appropriate that this research is explorative in nature. The qualitative approach was carried out first to provide an in-depth understanding of how the public decides to participate in health checks. The use of the grounded theory approach (Charmaz, 2014) in this inquiry allowed the developing of an explanatory framework to explain this phenomenon grounded in the views of participants. This result provides a comprehensive understanding of the decision-making process in an individual at a local context. This qualitative study was carried out in phase II to address the second research question.

Next, to address the third research question, a quantitative survey with regression analysis was conducted. The mixing of the qualitative and quantitative research in this study was from the use of the explanatory framework, and results from the phase II study

for the conceptual framework and the items developed for the questionnaire employed in the cross-sectional survey in phase III. This quantitative survey was normative, and its findings would show an average pattern of which determinants affect health check participation in the study population. Thus, the mixed-method approach provides stronger inferences, in which qualitative results provide an understanding of decision-making processes at the individual level, and the quantitative study provides the average pattern and impact of the determinants on the intention of health check participation at the population level (Tong & Low, 2015). Therefore, the combined use of qualitative and quantitative methods in this study complemented each other, which provided an expanded understanding of the public's decision-making at both individual and population perspectives (Creswell, 2009; Tong & Low, 2015).

The methods of each phase will be further elaborated in Chapters 3, 4 and 5.

CHAPTER 3: PHASE I: SYSTEMATIC REVIEW

3.1 Introduction

In this phase I study, the aim was to examine the literature to determine the effectiveness of interventions to increase uptake of cardiovascular risk factor screening for adult populations from primary care practices and the community. This would provide an insight as to which intervention would be effective for cardiovascular risk factor screening. A brief literature review on the rationale to conduct this systematic review was presented in section 3.2, followed by details of the materials and methods used in section 3.3, results in section 3.4, and discussions and conclusion in sections 3.5 and 3.6, respectively.

3.2 Brief Literature Review

Various strategies and interventions have been used to increase individuals' participation in CVD risk factor screening. Their effectiveness varied from study to study, ranging from no benefit to an 80% increase in the participation rate from baseline (Grunfeld et al., 2013; Hutchison et al., 1998; Marteau et al., 2010; Van der Meer et al., 2013). Jepson et al. conducted a comprehensive systematic review to examine factors associated with the uptake of screening programmes and to assess the effectiveness of methods used to increase uptake (Jepson et al., 2000). However, the majority of the studies included in that review were related to cancer screening, with limited studies on CVD risk factor screening. Other systematic reviews related to CVD risk factor screening have focused on assessing the effectiveness of using community pharmacies as the site for CVD risk factor screening (Willis, Rivers, Gray, Davies, & Khunti, 2014), the evaluation of behavioural components used in the intervention of screening programmes (Holland, Cooper, Shaw, Pattison, & Cooke, 2013), and reviewing types of screening approaches in primary care (Engelsen, Koekkoek, Godefrooij, Spigt, & Rutten, 2014).

To the best of my knowledge, there has been no previous systematic review analyzing the effectiveness of interventions used to increase uptake rate of CVD risk factor screening amongst the general population from primary care practices and the community. Thus, a systematic review is appropriate to examine the literature, in order to determine the effectiveness of interventions used to increase uptake of CVD risk factor screening in adult populations from primary care practices and the community. It is hoped that this review will provide some insight on the types of effective interventions that might be useful to increase the uptake of cardiovascular risk factor screening.

3.3 Materials and Methods

3.3.1 Study design

A systematic review and meta-analysis was performed in this phase I study. This is an important approach to summarize evidence relating to efficacy or effectiveness and safety of health care interventions accurately and reliably (Liberati et al., 2009).

A systematic review attempts to collate all empirical evidence that fits the inclusion criteria of the review to answer a research question (Green et al., 2011; Liberati et al., 2009). The methods used in reviews are systematic and explicit to minimize bias and to provide reliable findings and conclusions (Green et al., 2011; Liberati et al., 2009). The steps involved in systematic reviews include identifying all relevant records, selecting eligible studies, assessing quality of the studies, extracting data, performing qualitative synthesis of the included studies and the meta-analyses if applicable (Liberati et al., 2009).

Meta-analysis uses statistical methods to combine quantitatively the results of two or more independent studies (Deeks, Higgins, & Altman, 2011; Liberati et al., 2009). It has the potential benefits of increasing the power and improving the precision of the result, and is able to answer questions not posed by individual studies, as well as providing the

opportunity to settle controversies arising from conflicting claims of different studies (Deeks et al., 2011). Nevertheless, it also has the potential to mislead if reporting biases are not carefully considered (Deeks et al., 2011). Thus, clarity and transparency of reporting the systematic reviews and meta-analyses are important to provide useful and reliable results for use by related parties such as clinicians, policy makers and grant funders.

In order to ensure good quality of reporting in this systematic review, the checklist of the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) was adhered to as much as possible (Appendix A) (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009). This 27-item checklist was developed by a group of 29 review authors, methodologists, clinicians, medical editors and consumers (Moher et al., 2009). The first and second items - the title and structured abstract of the systematic review - were not included in this thesis, as that would only be appropriate in independent systematic report writing or in an article.

3.3.2 Research question

The research question followed "PICO" to provide a clear picture of the scope of the review, where "P" refers to the populations or the disease being addressed, "I" refers to the interventions or exposure of interest, "C" refers to the comparators and "O" refers to the main outcome of interest.

The research question and "PICO" addressed in this systematic review is as follows:

Which interventions have been shown to increase the uptake of CVD risk factor screening by individuals?

P: adult age 18 years and above

I: all types of interventions targeted on the uptake of CVD risk factor screening at the individual, health care professional level or the provision of service in primary care practices or in the community

C: comparator groups with usual care

O: uptake rate of CVD risk factor screening (participation rate by public or patients/screening rate which represents the tests performed by physicians)

3.3.3 Protocol registration

The protocol of this systematic review was registered with the Australian New Zealand Clinical Trials Registries (Trial ID: ACTRN12615001306505).

3.3.4 Criteria for study selection

The selection of studies for the review was based on the types of studies and risk factors assessed, characteristics of the study population, types of interventions and outcome measures. These criteria are further described as follows:

3.3.4.1 Types of studies

Studies on interventions that aimed to increase participation of individuals to screen for CVD risk factors were included. Study designs included randomized controlled trials (RCTs), quasi-RCTs, non-randomized trials with controlled group and studies which used baseline data as the control group (pre- and post-studies). Studies comparing different interventions were excluded if there was no control or baseline group.

This review has included both randomized and non-randomized controlled trials as well as pre- and post-study interventions. Pre-post studies were included because some of the studies used complex interventions and multifaceted approached to

increase the uptake of CVD risk factors screening, which would be difficult to be carried out in randomized controlled trials.

3.3.4.2 CVD risk factors assessed

The CVD risk factors screened that were included for assessment in the review were measurements of blood pressure (BP), weight, body mass index (BMI), waist circumference (WC), glucose, lipids, total cardiovascular risk score and history taking on smoking, physical activity, or nutritional intake. These are important risk factors recommended for screening in various guidelines (Canadian Task Force on Preventive Health Care, 2016; Consensus working group screening guidelines, 2015; U.S.Preventive Services Task Force, 2016; World Health Organisation, 2007). In addition, these factors are amenable to change for CVD prevention.

These screenings of CVD risk factors could have been carried out in a program specifically targeting CVD risk factor screening, or as part of a program with other preventive services such as cancer screening and vaccination.

3.3.4.3 Study population

Studies that involved individuals aged 18 years and above recruited from attendees of primary care practices or the communities were included. We included studies of mixed populations with or without known CVD and studies limited to populations without known CVD.

Studies which targeted specific populations or conditions such as safety screening for sports or exercise participation, gestational diabetes or post partum screening, familial hypercholesterolaemia and participants with a defined condition such as mental disabilities or rheumatoid arthritis were excluded. The CVD risk and management of these groups of patients were different from the general population, and thus the

intervention approach in these patients would be difficult to generalize to the general population.

3.3.4.4 Types of interventions

All types of interventions or strategies to increase participation of CVD risk factor screening were included, regardless of whether they were targeted at the individual, community, health-care provider or health-care system level.

3.3.4.5 Outcome measures

The CVD risk factor screening uptake was measured by 1) participants' attendance rate for screening, or 2) screening rate by health-care providers. We excluded studies that only reported on the intention to participate or physicians' compliance with the prescription. In cases where the studies had included screening for health conditions other than CVD risk factors, only outcomes related to CVD risk factors were included into this study.

3.3.5 Search methods

A systematic search was conducted using four electronic databases: PubMed (12 June 2014), CINAHL (3 July 2014), EMBASE (10 July 2014), and the Cochrane Central Register of Controlled Trials (3 July 2014). Updates of this search strategy were obtained from PubMed weekly until August 2015, and no new study was identified that fitted the inclusion criteria.

A mixture of medical subject headings (MeSH terms) and free text was used for the concept of "cardiovascular", "uptake" and "screening". The MeSH terms have a tree structure that covers a broad set of synonyms and captures an entire subtree of MeSH terms under a single word. The free text can help to capture incompletely coded articles. Thus, a combination of MeSH terms and free text could widen the coverage of the articles

(National Health and Medical Research Council, 2000)**.** The search strategy was reviewed by the research team members and pilot tested before it was finalized for use. The search strategy for PubMed is shown in Table 3.1.

Table 3.1: Search strategy in PubMed

Concepts	Search	Keywords/textwords
Cardiovascular	#1	((((((((("Hyperlipidemias"[Mesh]) OR "Cardiovascular Diseases"[Mesh]) OR "Hypertension"[Mesh]) OR "Diabetes Mellitus"[Mesh])) OR ((((((((((cardiovascular[Text Word]) OR coronary[Text Word]) OR stroke[Text Word]) OR heart[Text Word]) OR family history[Text Word]) OR early cardiovascular death[Text Word]) OR hyperlipidemias[Text Word]) OR diabetes mellitus) OR hypertension)))
Screening	#2	((((((((general practice[Text Word]) OR preventive health service[Text Word]) OR health check*[Text Word]) OR mass screening[Text Word]) OR opportunistic screening[Text Word])) OR (((((health check*) OR "General Practice"[Mesh]) OR "Preventive Health Services"[Mesh]) OR "Mass Screening"[Mesh]))))) OR screening[Text Word]
Uptake	#3	(((((((("Patient Acceptance of Health Care"[Mesh]) OR "Patient Participation"[Mesh]) OR "Consumer Participation"[Mesh]) OR "Refusal to Participate"[Mesh]) OR uptak*))) OR (((((patient participation[Text Word]) OR consumer participation[Text Word]) OR uptak*[Text Word]) OR patient acceptance of health care[Text Word]) OR refusal to participate[Text Word]))) OR participat*
Combine all three concepts	#4	#1AND #2 AND #3

These search terms and limits were modified accordingly for different databases to meet its specification. Limits applied were English language and adult population. There was no limit applied to the year of publication.

Additional articles were located through cross-checking of reference lists and bibliography citations of the included studies. The backward citation tracking was performed by checking through the reference list of each included paper. When the title of the reference was found to have related to this review, the abstract and full papers were retrieved. For forwarded citation tracking, the cited papers for each included paper were detected by going through PubMed. In cases where the included papers were not found in PubMed, the forwarded citation tracking was done through Google scholar. The reference list and bibliography citations included review papers. For these review papers, we checked through their reference lists to retrieve relevant studies.

3.3.6 Data collection and analysis

3.3.6.1 Study selection and data extraction

The objectivity of the process of study selection and data extraction is important for reliable results. At least two reviewers were involved in these processes to avoid mistakes and minimize biases (Liberati et al., 2009).

References identified from databases were first imported to EndNote, a reference management software package which helps organize and track the number of included records in each step of the process. EndNote was used to identify the duplicated articles and these duplicates were screened and removed accordingly. Two reviewers (myself, ATC and another member of the research team, NFMZ) then screened the titles and abstracts of the articles and conference proceedings. ATC and NFMZ had been trained in a systematic review workshop before conducting the review. In addition, personal training was obtained from SML (my supervisor), who is also a systematic review trainer

for both Cochrane and non-Cochrane reviews and evidence-based practice. Full papers were retrieved for potentially eligible articles and reviewed for relevance by these two reviewers independently. An article was included when there was agreement between the two reviewers on the fulfillment of the inclusion criteria. In circumstances where there was a discrepancy, discussions with another two team members (my supervisors, SML and EMK) were held to reach a consensus. SML and EMK are both experienced researchers in systematic reviews and intervention studies.

When further details of any paper were required, the corresponding authors would be contacted via email. Six authors of six studies were contacted for full details of the numerator and denominator of the screening rate (Grunfeld et al., 2013; Kenealy, Arroll, & Petrie, 2005; Lemelin, Hogg, & Baskerville, 2001; McMenamin, Nicholson, & Leech, 2011; Melnikow, Kohatsu, & Chan, 2000; Putnam, Mann, Lindsay, & Davis, 1998). One author was contacted to clarify about the same data being presented in three publications that described a single study, to avoid problems of double counting of subjects in the meta-analysis (Wee et al., 2013; Wee, Koh, & Toh, 2010; Wee & Koh, 2011). Nine authors of nine studies were contacted to determine the types of population, i.e. whether it was from a population without known CVD or a mixed population (Apkon et al., 2005; Bailie, Togni, Si, Robinson, & d'Abbs, 2003; Butala, Chang, Horwitz, Bartlett, & Ellis, 2013; Christensen, 1995; Frank, Litt, & Beilby, 2004; Franks & Engerman, 1991; McDowell, Newell, & Rosser, 1989; Ornstein, Garr, Jenkins, Rust, & Arnon, 1991; Robson et al., 1989)

Data collection forms were developed using a Microsoft Excel spreadsheet and pilot-tested on 5 included studies for data extraction. Data were then extracted independently by the two reviewers from the included studies. Relevant information extracted included author(s), year, country of study, title, setting, screening assessment, study design, study

population characteristics, type of intervention and the proportion of participation in the intervention and the controlled arm, which represented the CVD risk factor screening uptake rate. Information on study design, study population characteristics (those without known CVD or mixed population), and types of intervention were extracted to allow for meta-regression.

3.3.6.2 Assessment of quality

The individual quality feature and the validity of the included studies contributed to the likelihood that the intervention effect reported in a particular systematic review was valid (Higgins, Altman, & Sternne, 2011; Liberati et al., 2009). Thus, it is important to assess the risk of bias of each included study.

Quality of methodology of the included studies was appraised using The Cochrane Collaboration's "Risk of bias" tool (Higgins et al., 2011). Each study was assessed on features of selection bias, performance bias, detection bias, attrition bias, reporting bias and other potential sources of bias for quality of methodology (Higgins et al., 2011). The types and sources of bias are summarized in Table 3.2.

Table 3.2: Types of bias and sources of bias (Centre for Research in Evidence-Based Practice, 2014; Higgins et al., 2011)

Types of bias	Description of bias	Sources of bias
Selection bias	Systematic differences between baseline characteristics of the groups that are compared.	- random sequence generation -allocation concealment
Performance bias	Systematic differences between groups in the care that is provided, or in exposure to factors other than the interventions of interest.	-blinding of participants and personnel.
Detection bias	Systematic differences between groups in how outcomes are determined.	-blinding of outcome assessment.
Attrition bias	Systematic differences between groups in withdrawals from a study.	-incomplete outcome data.
Reporting bias	Systematic differences between reported and unreported findings.	-selective outcome reporting.
Other bias	Bias due to problems not covered elsewhere.	-anything else

The risk of bias for each domain was classified as low, high or unclear risk of bias based on the information provided in the studies (Higgins et al., 2011). For selection bias, judgement made was based on the appropriateness of generation of a random allocation sequence to produce comparable groups and sufficient concealment for the allocation sequence. For performance bias, judgement made was based on the effective measures used to blind participants and health care providers from knowing about the intervention the participants received. For detection bias, judgement made was based on the effective measures used to blind the outcome assessors from knowing which intervention the participants received. For attrition bias, judgement made was based on the completeness of the outcome data such as the proportion of patients lost to follow-up and whether the principle of intention to treat was used in the analyis. For reporting bias, judgement made

was based on whether only a selected outcome was reported. For other biases, judgement made was based on the presence of any other important concerns which were not covered by other domains in the tool which could contribute to the bias of the study; for example, the sponsorship of the study by a pharmaceutical company whose drugs were used as an intervention in that study.

Two reviewers were involved in the assessment of risk of bias. Each reviewer first performed the assessment independantly after which the results were compared. If there was discrepancy in the results, the papers were revisited and consensus was made. In circumstances where a consensus could not be accomplished, discussions were held with another two research members (SML and EMK) to reach a consensus.

3.3.6.3 Assessment of the quality of the descriptions of interventions

In addition to the assessment of risk of bias for each paper, the quality of the descriptions of interventions in the papers was assessed using the Template for Intervention Description and Replication (TIDieR) checklist and guide (Hoffmann et al., 2014). Completeness of description of interventions in published studies was important to allow other researchers, health care providers or patients to reliably replicate the intervention shown (Hoffmann et al., 2014).

The TIDier checklist has 12 items to assess the reproducibility of the intervention based on the description, which included items such as brief name, why, what (materials), what (procedure), who provided, how, where, when and how much, tailoring, modifications, how well (planned), how well (actual) (Hoffmann et al., 2014). The TiDieR checklist is shown in Appendix B.

3.3.7 Data synthesis and analysis

In this review, two analyses were conducted. First, an analysis was carried out on the overall effectiveness of screening uptake of the interventions compared with its control. Second, a subgroup analysis was done to measure the effectiveness of screening uptake by study design and types of intervention. The relative risk (RR) with 95% confidence interval (95% CI) was performed for all sets of comparisons.

Data from relevant studies were pooled using a random-effects model with OpenMetaAnalyst software ("OpenMeta[Analyst]," 2015; Wallace, Schmid, Lau, & Trikalinos, 2009). The random-effects model was used because the included studies could differ in terms of population and implementation of interventions, and the random-effects model allows the true effect sizes to differ from study to study (Borenstein, Hedges, Higgins, & Rothstein, 2010; Hunter & Schmidt, 2000).

Heterogeneity is used to assess consistency of effects of the studies for generalisability of the results of the meta-analyis (Higgins, Thompson, Deeks, & Altman, 2003). Cochran's Q statistic, a test of heterogeneity, was performed with a p-value reported and the degree of inconsistency across studies was quantified using I^2(Higgins et al., 2003), the percentage of total variation across studies. It ranges between 0% to 100%, with larger values denoting higher heterogeneity, and 25%, 50% and 75% being tentatively classified as low, moderate and high heterogeneity (Higgins et al., 2003).

Meta-regression is a method used to explore heterogeneity seen in meta-analysis by examining differences between studies by effect modifiers (Glasziou & Sanders, 2002). In this study, meta-regression was performed to explore whether differences in study design (RCT, Controlled trial, pre- and post-studies), types of population (no known CVD, mixed population of known and unknown CVD) and types of intervention (physician reminder, patient invitation, using financial incentives, using dedicated

personnel and multifaceted approach) could explain the heterogeneity shown. Random-effects meta-regression was performed using OpenMetaAnalyst software ("OpenMeta[Analyst]," 2015).

In this review, four included studies compared more than one type of intervention with usual care (Grunfeld et al., 2013; McDowell et al., 1989; Ornstein et al., 1991; van Wyk et al., 2008). For example, in the study by Ornstein et al., there were three intervention groups: physician reminder, patient reminder, physician and patient reminder and usual care as the controlled group. Each of these intervention groups was analyzed independently and compared with the group with usual care.

There were ten studies in this review reporting separate screening uptake rates for the different risk factors measured, and the outcome could be represented by any one of these rates (Apkon et al., 2005; Bailie et al., 2003; Butala et al., 2013; Frank et al., 2004; Fullard, Fowler, & Gray, 1987; Grunfeld et al., 2013; Harari et al., 2008; Robson et al., 1989; Toth-Pal, Nilsson, & Furhoff, 2004; Wee et al., 2013). For example, the study by Harari et al. reported the uptake rate for BP, cholesterol and blood glucose separately (Harari et al., 2008). The effectiveness of the intervention would be affected with the different uptake rate used in the analysis. Thus, it is more appropriate to show a range of effectiveness of such interventions by analyzing each uptake rate.

In order to provide a range of the effectiveness of such interventions, two meta-analyses were performed; one pooling the highest effect sizes of the uptake rate (hereon referred to as optimistic) and the other pooling the lowest effect sizes of the uptake rate (hereon referred to as pessimistic). In studies that reported results of screening uptakes at different time periods, we used the rates with the longest duration of timeline for analysis (Bailie et al., 2003; Ornstein et al., 1991).

3.4 Results

3.4.1 Literature retrieval process

The search strategy found 23,922 citations from four databases (PubMed, CINAHL, Embase, Cochrane Central Register of Controlled Trials). After removing the duplicates, 21,307 citations were identified. After screening the titles and abstracts, 167 full papers were retrieved for assessment for eligibility. Of these, 158 papers were excluded as they did not fulfill the inclusion criteria. The reasons for exclusion included the age of the population not fulfilling criteria, the absence of a comparator group (no control or baseline group), or that the outcomes were not related to screening uptake. One study published three papers from the overlapping data obtained at different periods (Wee et al., 2013, 2010; Wee & Koh, 2011). After clarification with the corresponding author (Wee et al., 2013), the most recent paper was included as this paper had the most updated data. A total of 9 studies that fulfilled the inclusion criteria were included (Christensen, 1995; Frank et al., 2004; Grunfeld et al., 2013; McDowell et al., 1989; McMenamin et al., 2011; Putnam et al., 1998; Stocks, Allan, Frank, Williams, & Ryan, 2012; Toth-Pal et al., 2004; Wee et al., 2013).

Subsequently, forward and backward searches of the reference lists and bibliography citations of the 9 studies yielded an additional 16 studies (Apkon et al., 2005; Bailie et al., 2003; Butala et al., 2013; Franks & Engerman, 1991; Fullard et al., 1987; Harari et al., 2008; Holt et al., 2010; Kenealy et al., 2005; Lemelin et al., 2001; Marshall et al., 2008; Melnikow et al., 2000; Ornstein et al., 1991; Robson et al., 1989; Sinclair & Kerr, 2006; van Wyk et al., 2008; Vincent, Hardin, Norman, Lester, & Stinton, 1995), resulting in a total of 25 studies for qualitative synthesis.

The proportion of attendance, in which the numerator was the number of people screened and the denominator was the number of target population for screening, was

required for meta-analysis. Six studies did not have full details of the numerators and denominators of the screening uptake rates required for meta-analysis, and authors were therefore contacted. Two authors provided the requested information (Grunfeld et al., 2013; Kenealy et al., 2005), but authors of the other four studies were either not contactable or stated they no longer had access to the data. These four studies (Lemelin et al., 2001; McMenamin et al., 2011; Melnikow et al., 2000; Putnam et al., 1998) were excluded, and the final number of studies included in the meta-analysis was 21. Figure 3.1 illustrates the process of search and selection.

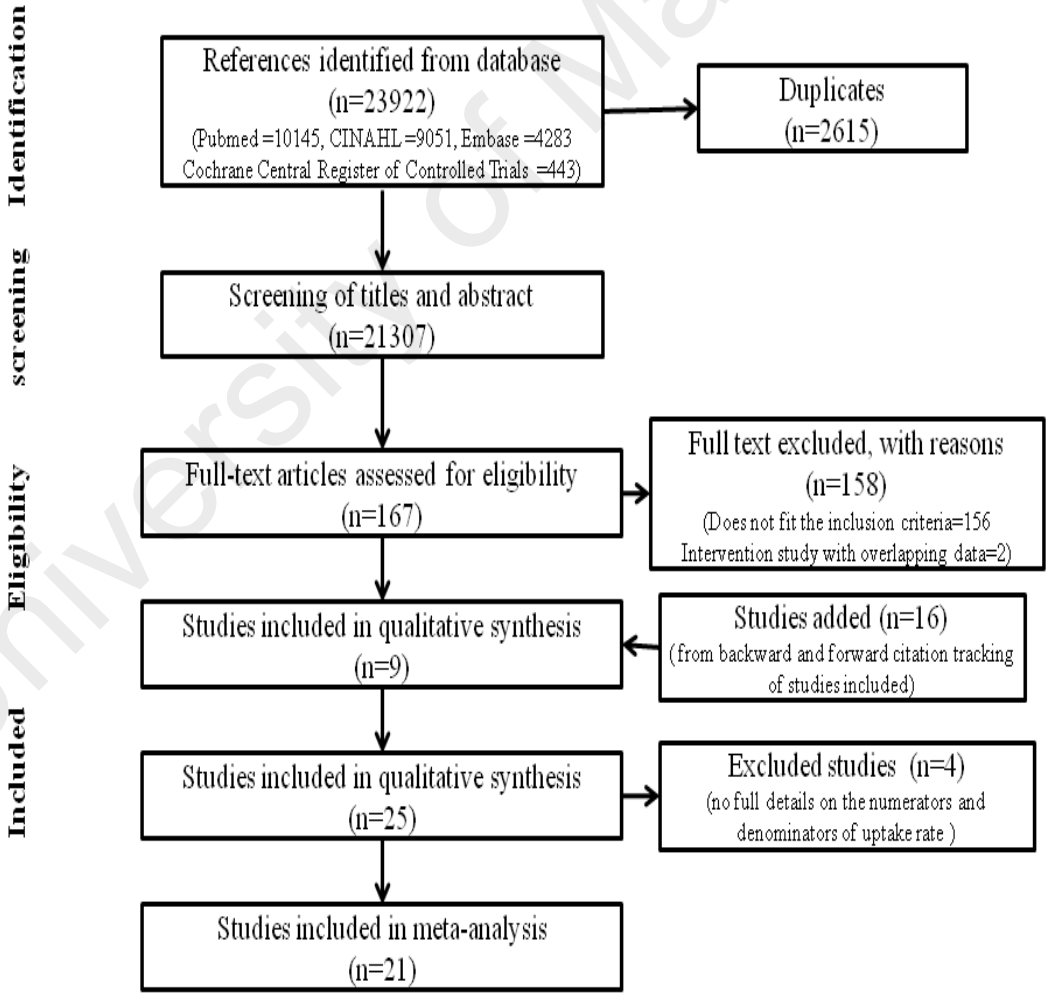


Figure 3.1: Flow chart of search and selection

3.4.2 Study characteristics of included studies

Among the 21 studies, ten were randomized or cluster-randomized controlled trials (Apkon et al., 2005; Grunfeld et al., 2013; Harari et al., 2008; Holt et al., 2010; Kenealy et al., 2005; McDowell et al., 1989; Ornstein et al., 1991; Robson et al., 1989; Stocks et al., 2012; van Wyk et al., 2008), six were non-randomized trials with a controlled group (Christensen, 1995; Frank et al., 2004; Franks & Engerman, 1991; Fullard et al., 1987; Marshall et al., 2008; Toth-Pal et al., 2004) and five were pre- and post-studies (Bailie et al., 2003; Butala et al., 2013; Sinclair & Kerr, 2006; Vincent et al., 1995; Wee et al., 2013).

Eleven studies focused on CVD risk factor screening (Christensen, 1995; Franks & Engerman, 1991; Fullard et al., 1987; Holt et al., 2010; Kenealy et al., 2005; Marshall et al., 2008; McDowell et al., 1989; Sinclair & Kerr, 2006; Stocks et al., 2012; van Wyk et al., 2008; Wee et al., 2013) and 10 studies focused on multiple preventive services, including screening for CVD risk factors, cancer, vitamin B_{12}, depression, hearing, vision, urine, dental, HIV, allergies, thyroid dysfunction and promotion of vaccination (Apkon et al., 2005; Bailie et al., 2003; Butala et al., 2013; Frank et al., 2004; Grunfeld et al., 2013; Harari et al., 2008; Ornstein et al., 1991; Robson et al., 1989; Toth-Pal et al., 2004; Vincent et al., 1995). The follow-up period of these studies ranged from 2 months to 3 years.

Out of the 21 studies, eight were conducted in Europe (five in the United Kingdom) (Fullard et al., 1987; Harari et al., 2008; Holt et al., 2010; Marshall et al., 2008; Robson et al., 1989), one each in the Netherlands (van Wyk et al., 2008), Denmark (B. Christensen, 1995) and Sweden (Toth-Pal et al., 2004), seven in North America (five in the United States of America (Apkon et al., 2005; Butala et al., 2013; Franks & Engerman, 1991; Ornstein et al., 1991; Vincent et al., 1995), two in Canada (Grunfeld et al., 2013;

McDowell et al., 1989)), three in Australia (Bailie et al., 2003; Frank et al., 2004; Stocks et al., 2012), two in New Zealand (Kenealy et al., 2005; Sinclair & Kerr, 2006) and one in Singapore (Wee et al., 2013). Tables 3.3, 3.4 and 3.5 provide overviews of the studies.

Table 3.3: Overview of studies included in systematic review: Randomized/cluster-randomized controlled trials

Study (author, year, country)	Population	Type of screening	Setting	Intervention	CVD risk factors reported for uptake rate
McDowell, 1989 Canada	Adults aged ≥ 18 years*	CVD risk factors	Primary care practice	3 intervention groups: 1. Physician reminder (computer-based reminder) 2. Patient reminder (telephone) 3. Patient reminder (letter) Control: Usual care	BP
Robson, 1989 UK	Adults aged 30-64 years*	Multiple screening	Primary care practice	Dedicated personnel: health promotion nurse Control: Usual care	BP, smoking history, cholesterol, family history of heart attack
Ornstein, 1991 USA	Adults aged ⩾ 18 years*	Multiple screening	Primary care practice	3 intervention groups: 1. Physician reminder (paper-based) 2. Patient reminder (letter) 3. Multifaceted approach (both 1 & 2)) Control: Usual care	Cholesterol
Apkon, 2005 USA	Adults aged ⩾ 18 years*	Multiple screening	Primary care practice	Physician reminders (computer based) Control: usual care	Lipid, smoking
Kenealy 2005 New Zealand	Adults aged 50 years or older*	CVD risk factors	Primary care practice	3 intervention arms: 1. Physician reminder (flash alert on computer screen) 2. Physician reminder (patient handing over the completed diabetes risk self-assessment form to the doctor) 3. Multifaceted approach (both 1 & 2) Control: Usual care	Glucose#
Harari, 2008 UK	Adults aged ⩾ 65 years*	Multiple screening	Primary care practice	Mmultifaceted approach (Health Risk Appraisal via mailed questionnaire and feedback to participants and general practitioners) Control: Usual care	BP, cholesterol, blood glucose

*mixed population those with known and unknown CVD #results provided by corresponding author BP: Blood pressure Overall CVRS: Uptake for cardiovascular risk factors as a whole

Table 3.3, continued.

Study (author, year, country)	Population	Type of screening	Setting	Intervention	CVD risk factors reported for uptake rate
van Wyk, 2008 Netherlands	Men aged 18 to 70 years and women aged 18 to 75 years*	CVD risk factors	Primary care practice	2 interventions for physician reminder (computer-based) are: 1. Auto-alert 2. On-demand alert Control: Usual care	Cholesterol
Holt, 2010 UK	Adults aged 50 -74 years identified as probable high risk	CVD risk factors	Primary care practice	Physicians reminder (computer-based screen alert) Control: Usual care	Overall CVRs
Stocks, 2012 Australia	Adults aged 40-74 years	CVD risk factors	Primary care practice	Financial incentives ($25 shopping voucher) Control: Usual care (free test)	Overall CVRs
Grunfeld, 2013 Canada	Adults aged 40-65 years	Multiple screening	Primary care practice	3 intervention arms: 1. Dedicated personnel (practice facilitator at practice level) 2. Dedicated personnel (prevention practitioner at patient level) 3. Multifaceted approach (both 1 &2) Control: Usual care	FBS, BP, Framingham risk calculated, BMI, waist circumference, smoking, physical activity, nutrition#

*mixed population those with known and unknown CVD #results provided by corresponding author BP: Blood pressure Overall CVRS: Uptake for cardiovascular risk factors as a whole

Table 3.4: Overview of studies included in systematic review: Non-randomized trials with controlled group

Study (author, year, country)	Population	Type of screening	Setting	Intervention	CVD risk factors reported for uptake rate
Fullard, 1987 UK	Adults aged 35-64 years*	CVD risk factors	Primary care practice	Multifaceted approach (practice facilitator with a practice nurse for prevention services) Control: Usual care	Weight, BP, and smoking history
Franks, 1991 USA	Adults aged ⩾ 18 years*	CVD risk factors	Primary care practice	Financial incentives: Free Control: Usual care (paid)	Cholesterol
Christensen, 1995 Denmark	Men aged 40-49	CVD risk factors	Primary care practice	Financial incentives: Free Control: Usual care (paid)	Overall CVRS
Toth-Pal, 2004 Sweden	Adults aged ≥ 70 years	Multiple screening	Primary care practice	Physician reminder (computer-based) Control: Usual care	BP, diabetes
Frank, 2004 Australia	Eligible adults who fulfilled criteria*	Multiple screening	Primary care practice	Physician reminder (computer-based) Control: Usual care	Weight, smoking status, BP, diabetes, lipid
Marshall, 2008 UK	Adults aged 35-74 years identified as probable high risk	CVD risk factors	Primary care practice	Dedicated personnel (project nurse) Control: Usual care	Overall CVRs

*mixed population those with known and unknown CVD BP: Blood pressure Overall CVRS:Uuptake for cardiovascular risk factors as a whole

Table 3.5: Overview of studies included in systematic review: Pre- and post-studies

Study (author, year, country)	Population	Type of screening	Setting	Intervention	Related CVR outcome measures for uptake rate
Vincent, 1995 USA	Adults*	Multiple screening	Primary care practice	Multifaceted approach: computer-generated worksheet with reminder on health maintenance procedure, periodic physician performance report, patient reminders (letter invitation)	Cholesterol
Bailie, 2003 Australia	Adults ≥ 50 years (majority indigenous)	Multiple screening	Primary care practice	Multifaceted approach: clinical guidelines, computerized reminder systems, audit and feedback	Weight, BP, waist circumference, BMI, glucose
Sinclair, 2006 New Zealand	Adults eligible for cardiovascular risk screening*	CVD risk factors	Primary care practice	Multifaceted approach: 1) practice management software enhancement (alert to identify eligible patients for screening, electronic cardiovascular risk assessment tool) 2) CME for the clinical champion who oversees the project 3) Provision of relevant reporting and feedback 4) Eligible patients: letter invitation	Completed cardiovascular risk screen (5-year absolute cardiovascular risk)
Wee, 2013 Singapore	Adults aged ≥ 40 years	CVD risk factors	Community	Multifaceted approach: free screening and convenient screening at housing estate	BP, fasting blood glucose and lipid
Butala, 2013 USA	Adults*	Multiple screening	Primary care practice	Physician reminders (paper-based notes for recommended preventive services)	Lipid and glucose

*mixed population those with known and unknown CVD BP: blood pressure Overall CVRS: Uptake for cardiovascular risk factors as a whole CME: Education session

The interventions for CVD risk factor screening were classified into five types based on their characteristics, using the classification by Jepson et al. (Jepson et al., 2000) as close as possible. These were: (1) physician reminder (paper-based and computer-based reminders), (2) patient invitation (letter and telephone invitations), (3) financial incentives, (4) using dedicated personnel such as project nurse and practice facilitator to help organize and/or carry out screening, and (5) using a multifaceted approach targeting both physicians and patients for screening, or using more than one measure to target a population for screening.

Physician reminders, patient invitations and financial incentives for screening were interventions that could influence either provider or patient behaviour directly or indirectly, while using dedicated personnel was targeted at the provider and organizational levels. Multifaceted approaches were targeted at either behavioural or organizational levels, or both. Tables 3.3, 3.4 and 3.5 represent an overview of the interventions of the included studies. Details of the interventions, screening uptake rates (for different risk factors and periods) and the types of assessment are provided in Appendix C.

3.4.3 Quality assessment of the studies included

Two quality assessments were performed; one for quality of methodology using risk of bias assessment, and another for quality of description and replication using the TIDieR checklist.

3.4.3.1 Quality of methodology

The risk of bias for randomization was unclear and low in 9 out of 10 of the randomized-controlled trials, except for one which was allocated high risk as the randomization used odd or even numbers of the last digit of the registration number – a process that was not true randomization (Holt et al., 2010). The risk of bias for

randomization was high for all non-randomized trials. A description of allocation concealment was presented in five (24%) studies (Christensen, 1995; Harari et al., 2008; Holt et al., 2010; Kenealy et al., 2005; van Wyk et al., 2008).

Blinding of participants and personnel was lacking in all studies due to the nature of the interventions, which involved the participants or health-care professionals directly. The risk of bias for blinding of outcome assessment was low in 13 (62%) studies, as the outcome measured in most studies was generated from electronic record systems.

One study was found to have a high risk of bias for risk of incomplete outcome data: data from two practices could not be extracted and analyzed (van Wyk et al., 2008). For reporting bias, low risk of bias was found in all studies except the study by Frank et al., where it was unclear (Frank et al., 2004). For other biases, the validity of one of the studies needed to be interpreted with caution as one of the authors was related to the company that programmed the trial software (Holt et al., 2010). The proportion of studies with low, unclear and high risk of bias is presented in Figure 3.2. A summary of the judgements of the risk of bias and its supports are provided in Appendix D. A summary of risk of bias for individual studies is also provided in Appendix D.

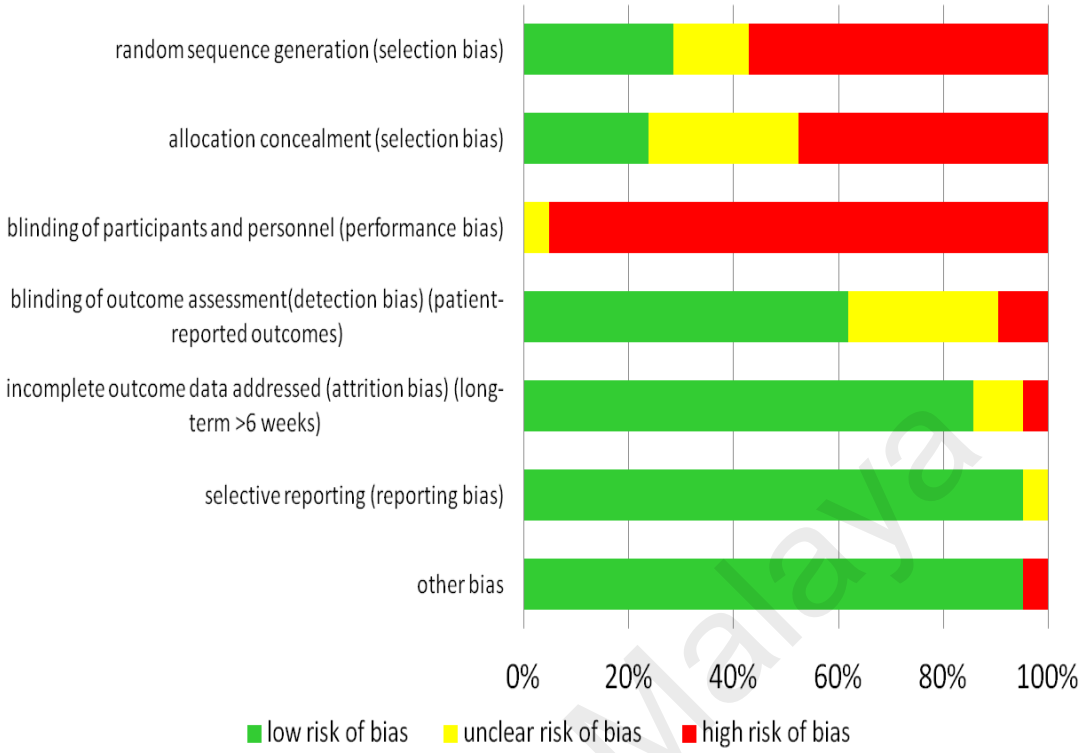


Figure 3.2: Proportion of studies with low, unclear and high risk of bias

3.4.3.2 Quality of descriptions of interventions

All the studies had described the rationale of the elements essential to the intervention, but none of the interventions were guided by theory. Most studies were clear in the descriptions of the interventions. Two studies lacked descriptions of the education and training materials (Fullard et al., 1987; Wee et al., 2013). Another two studies were unclear on description of whether interventions on training and feedback were provided individually or in a group (Bailie et al., 2003; Grunfeld et al., 2013). Details of the descriptions of the interventions are provided in Appendix E.

3.4.4 Overall effect of the interventions compared with controls

Based on the pooled estimate of the effects of interventions, in both optimistic and pessimistic analyses, the CVD risk factor screening uptake rate was higher in the intervention groups compared with the controls. The RR was 1.443 (95% CI 1.264 to 1.648) using the pessimistic estimate and 1.680 (95% CI 1.420 to 1.988) using the optimistic estimate (refer to Figure 3.3 & 3.4).

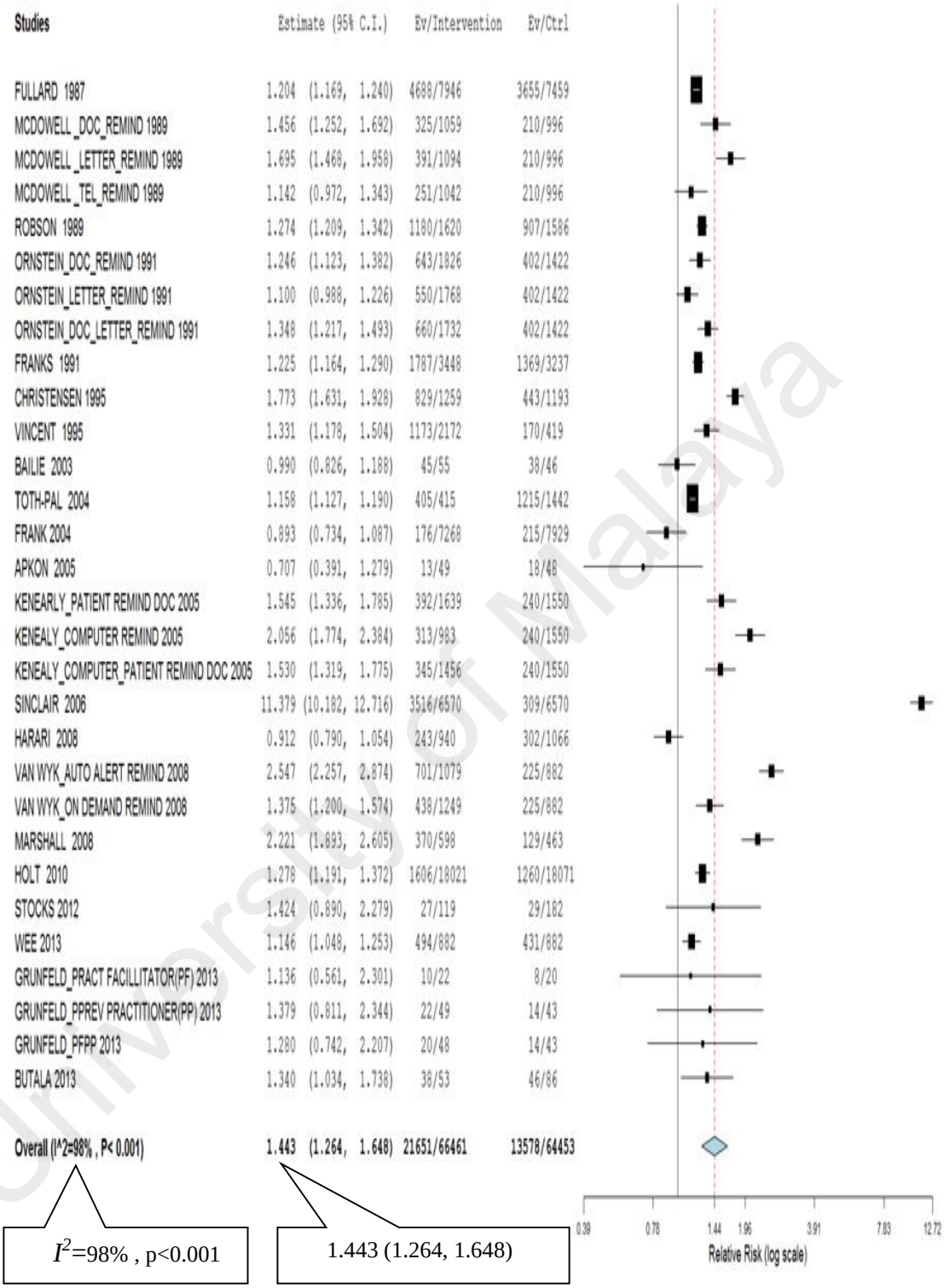


Figure 3.3: Effect of interventions vs. controls (using lowest effect size as outcome measure)

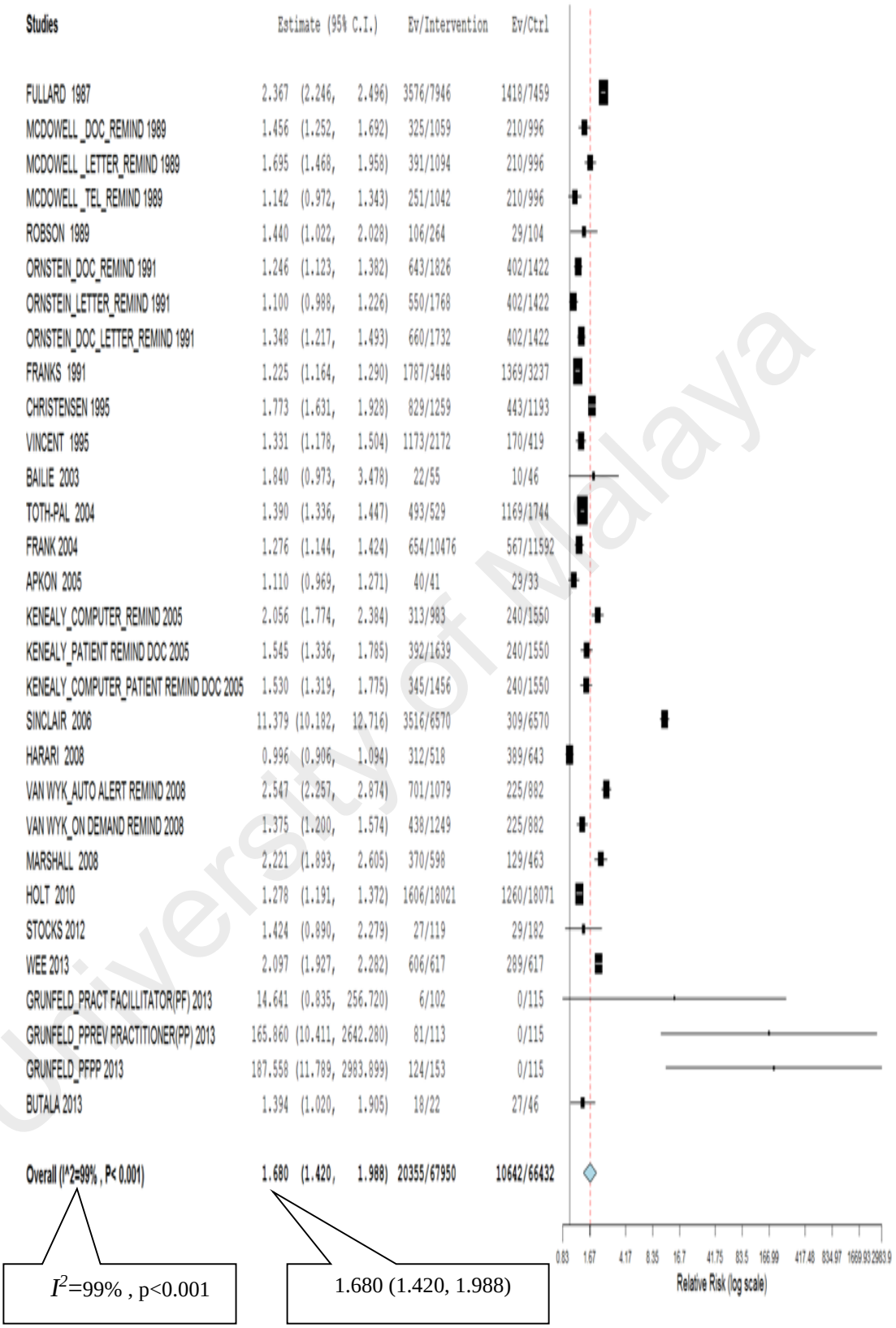


Figure 3.4: Effect of interventions vs. controls (using highest effect size as outcome measure)

3.4.5 Subgroup analyses

Subgroup analyses were performed for the effects of study designs and the effects of types of intervention, and the results are illustrated in the following sections.

3.4.5.1 Effects of study designs

The quality of studies differed with different study design. Therefore, data were pooled according to study design i.e. RCT (Subgroup 1), non-randomized with controlled group (Subgroup 2) and pre- and post-studies (Subgroup 3) (refer to Figures 3.5 & 3.6).

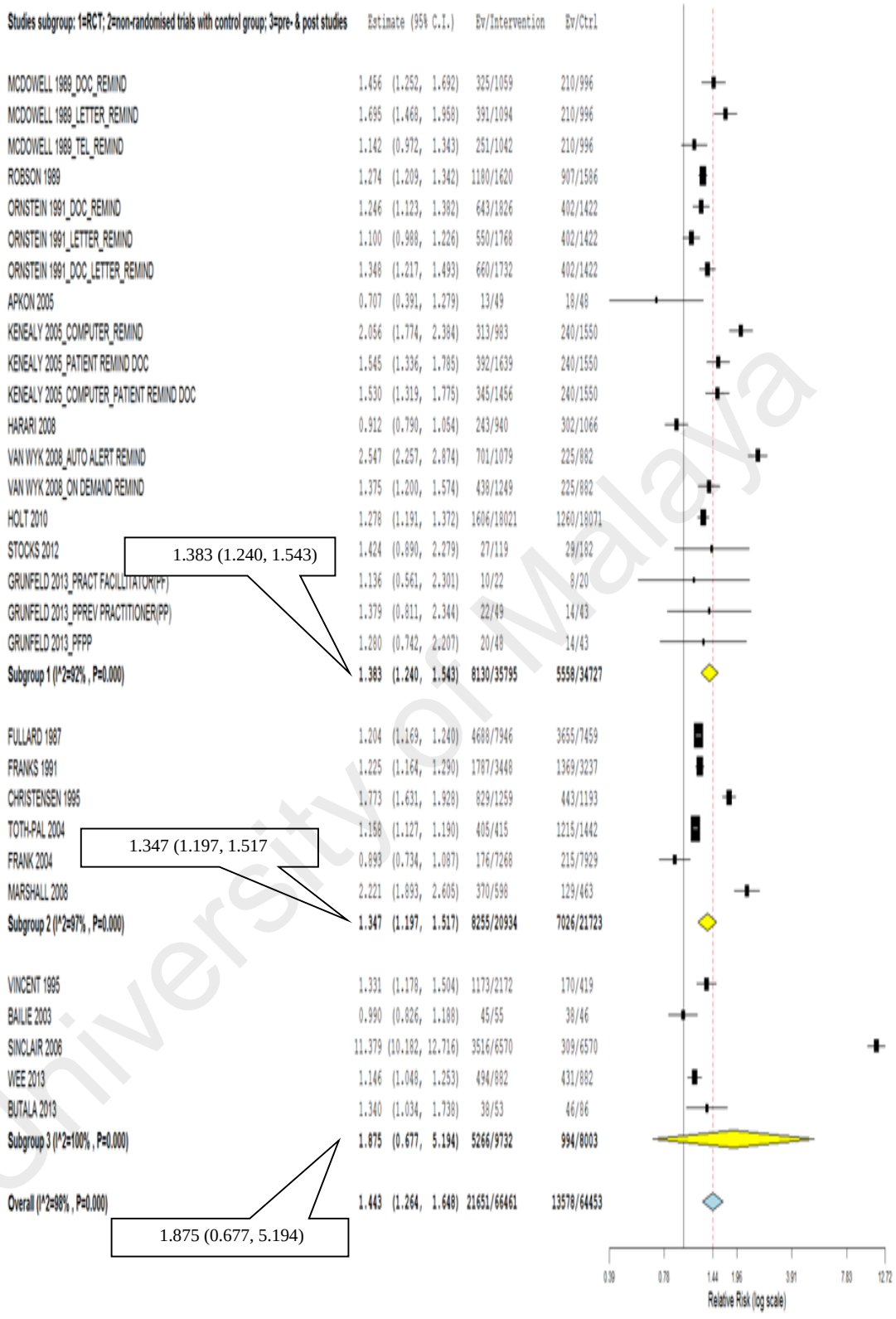


Figure 3.5: Effect of interventions vs. controls according to study design (using lowest effect size as outcome measure)

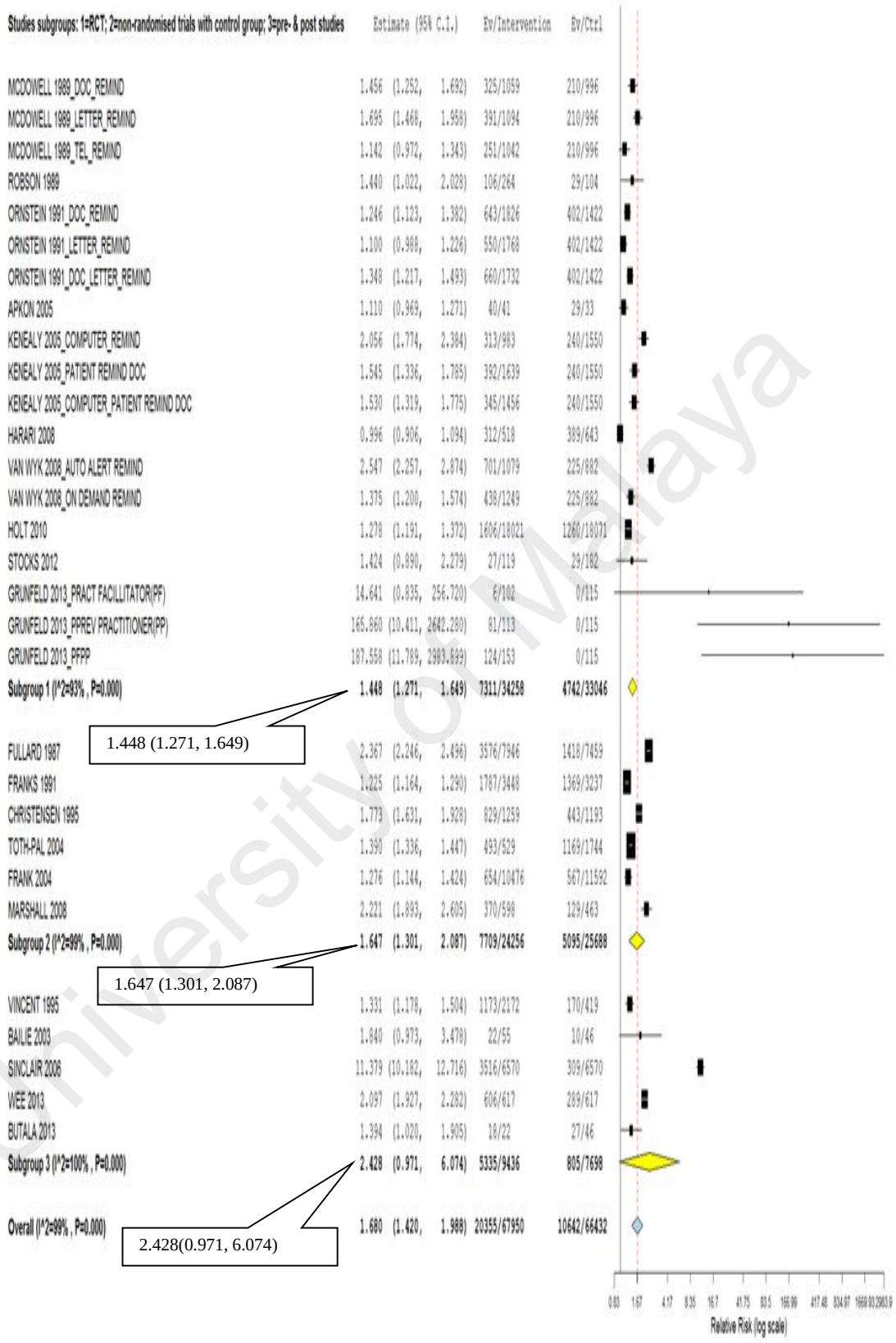


Figure 3.6: Effect of interventions vs. controls according to study design (using highest effect size as outcome measure)

Of the ten studies in the randomized/cluster-randomized controlled trials (Subgroup 1), four studies had three arms of interventions (Grunfeld et al., 2013; Kenealy et al., 2005; McDowell et al., 1989; Ornstein et al., 1991), one study had two arms of interventions (van Wyk et al., 2008) and the others had one arm of intervention. The majority of the studies showed positive effects from the interventions. Two studies, Grunfeld et al. and Apkon et al., reported more than one effect size, and the effects varied from negative to positive effect when pessimistic and optimistic analyses were performed, respectively (Apkon et al., 2005; Grunfeld et al., 2013). However, the overall pooled estimate using both pessimistic and optimistic analyses were positive with a RR of 1.383 (95% CI 1.240 to 1.543) and 1.448 (95% 1.271 to 1.649), respectively (refer to Figures 3.5 & 3.6. subgroup 1).

All of the non-randomized trials with controlled groups in Subgroup 2 and the pre- and post-studies in Subgroup 3 showed significant effects in favour of intervention, except for one study each from both subgroups when pessimistic analysis was performed (Bailie et al., 2003; Frank et al., 2004). Bailie and colleagues' pre- and post-study remained ineffective even when an optimistic analysis was performed (Bailie et al., 2003). The pooled estimate of the effect for non-randomized trials with controlled groups in Subgroup 2 for both pessimistic (RR 1.347; 95% CI 1.197 to 1.517) and optimistic analyses (RR 1.647; 95% CI 1.301 to 2.087) were significantly in favour of interventions. For the pre- and post-studies in Subgroup 3, the pooled estimate of the effect was not significant in both pessimistic (RR 1.875; 95% CI 0.677 to 5.194) and optimistic analyses (RR 2.428; 95% CI 0.971 to 6.074) (refer to Figures 3.5 & 3.6, Subgroups 2 and 3).

There was significant heterogeneity between the studies in all three groups of study design. The I^2 was more than 90% for all these groups.

3.4.5.2 Effects of types of interventions

There were five subgroups in the analyses of the effects of types of intervention as follows:

- Subgroup 1: physician reminder
- Subgroup 2: patient invitation
- Subgroup 3: financial incentive
- Subgroup 4: dedicated personnel
- Subgroup 5: multifaceted approach

Pessimistic and optimistic analyses were performed for Subgroups 1, 4 and 5. There was only one effect size analyzed for Subgroups 2 and 3, as there was only one uptake rate reported for each study in these subgroups.

Three types of interventions showed significant increase in the uptake of CVD risk factor screening, compared with the controlled groups: using physician reminders (RR 1.392; 95% CI 1.192 to 1.625 in pessimistic analysis and RR 1.471; 95% CI 1.304, 1.660 in optimistic analysis), providing financial incentives (RR 1.462; 95% CI 1.068 to 2.000) and using dedicated personnel (RR 1.510; 95% CI 1.014 to 2.247 in pessimistic analysis and 2.536; 95% CI 1.297 to 4.960 in optimistic analysis). Interventions that used multifaceted approaches were effective when optimistic analysis was performed (RR 2.268; 95% CI 1.401, 3.672) but not when pessimistic analysis was performed (RR 1.549; 95% CI 0.978, 2.453). Patient invitations were not effective in increasing the uptake of CVD risk factor screening (RR1.285; 95% CI 0.980, 1.686) (refer to Figures 3.7 & 3.8).

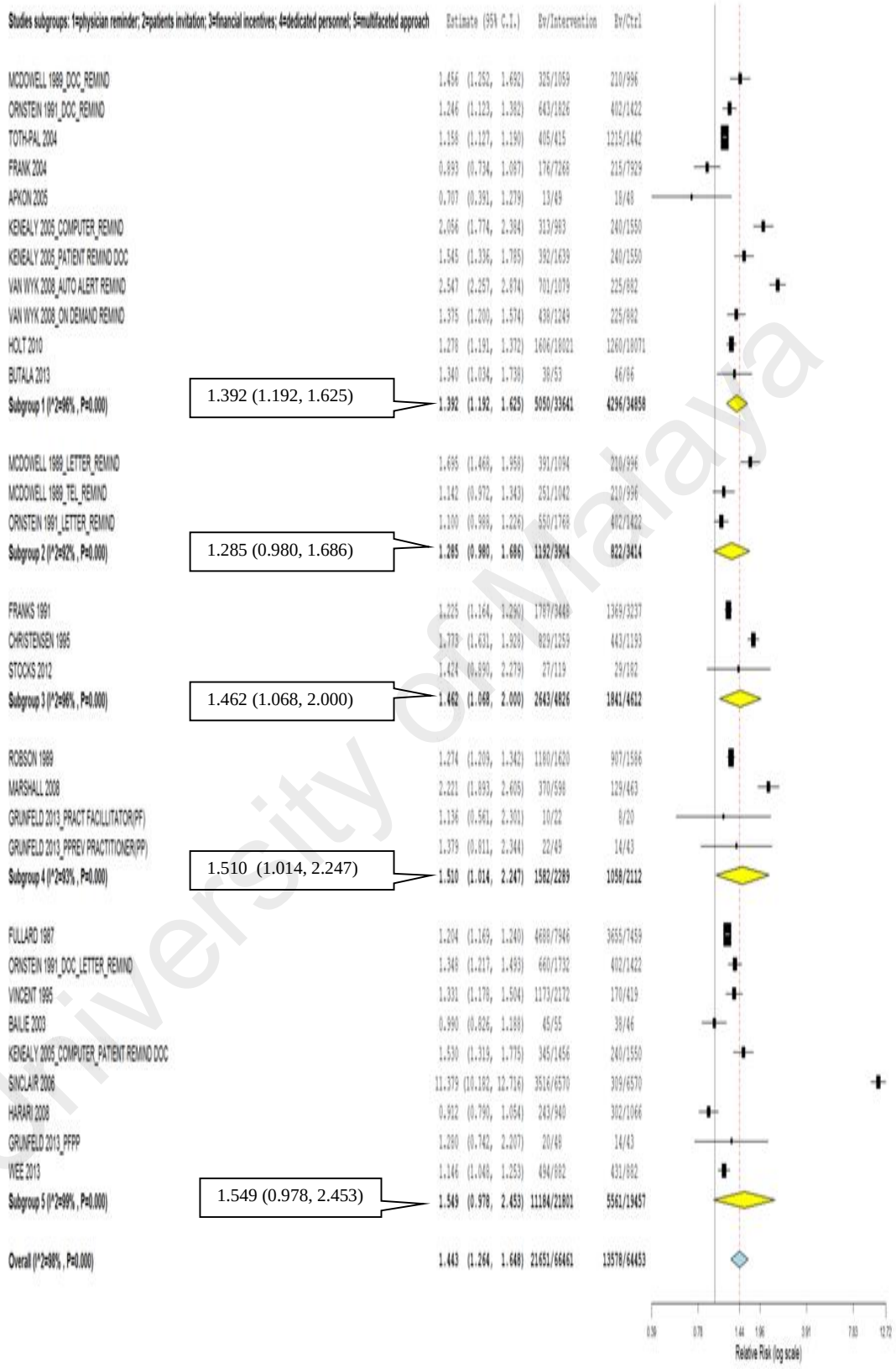


Figure 3.7: Effect of types of interventions vs. controls (using lowest effect size as outcome measure)

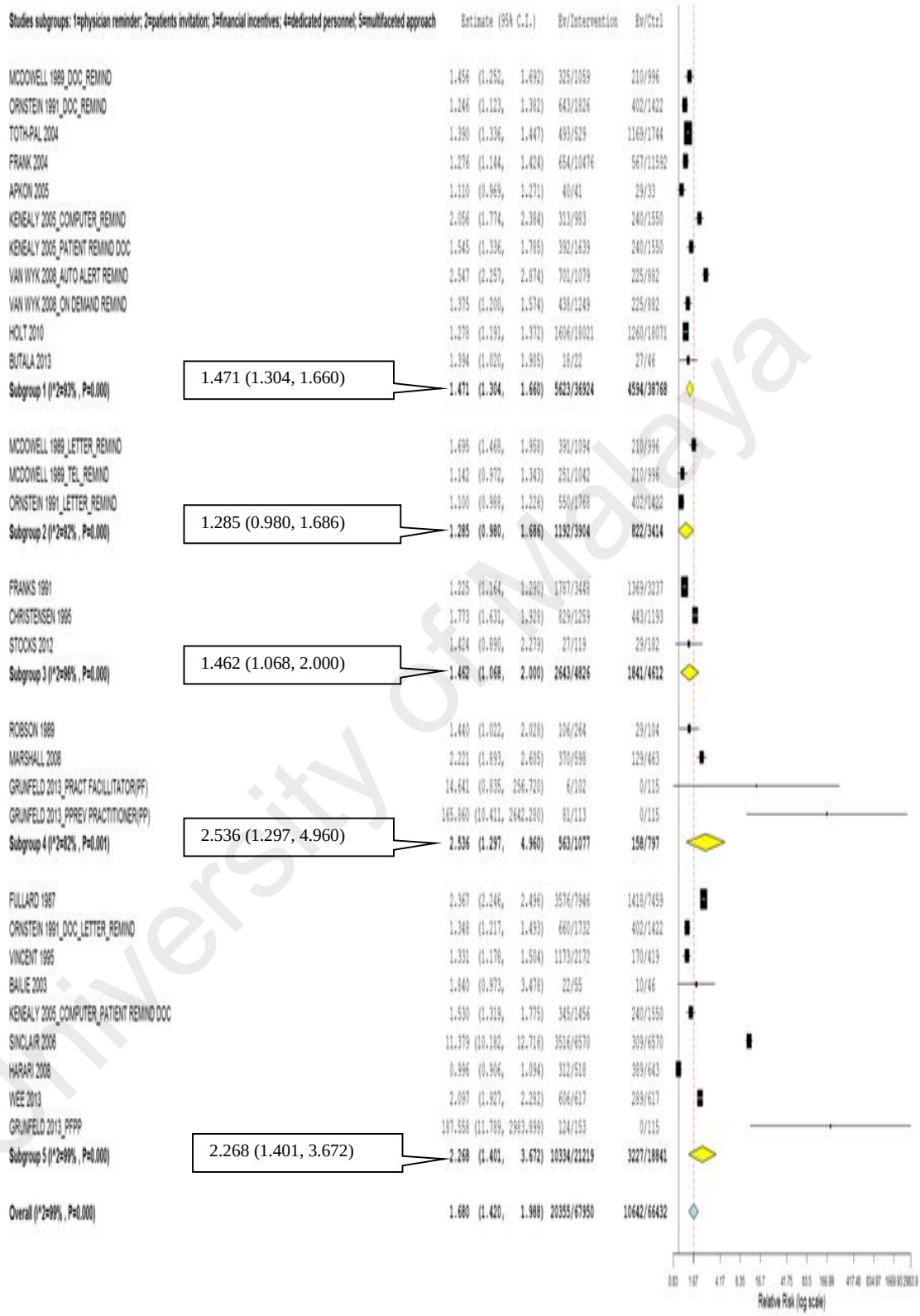


Figure 3.8: Effect of types of interventions vs. controls (using highest effect size as outcome measure)

For interventions using physician reminders, six studies used computer-based screen alert system reminders (Apkon et al., 2005; Frank et al., 2004; Holt et al., 2010; McDowell et al., 1989; Toth-Pal et al., 2004; van Wyk et al., 2008), and two studies used paper-based reminders (Butala et al., 2013; Ornstein et al., 1991). One study used two approaches, one arm used computer-based screen alert system reminders, while the other used patients' completed diabetes risk self-assessment forms handed over to physicians as reminders (Kenealy et al., 2005). All studies were significantly in favour of interventions (Butala et al., 2013; Holt et al., 2010; Kenealy et al., 2005; McDowell et al., 1989; Ornstein et al., 1991; Toth-Pal et al., 2004; van Wyk et al., 2008) except for two (Apkon et al., 2005; Frank et al., 2004). Study by Frank et al. showed a significant positive effect in the optimistic analysis but not in the pessimistic analysis (Frank et al., 2004). Apkon and colleagues' study did not show significant effects in both optimistic and pessimistic analyses (Apkon et al., 2005) (refer to Figures 3.7 & 3.8, Subgroup 1).

There were only two studies that used patient invitations to increase uptake of CVD risk factor screening. The effect was not significant (RR 1.285; 95% CI 0.980 to 1.686) but there was a trend towards positive effects observed. One study used letters to invite patients for cholesterol checks, and the results showed insignificant effects (Ornstein et al., 1991). The other study used two approaches to invite patients for BP checks (McDowell et al., 1989). In the first approach, a letter was sent to invite patients for the check, and to those not responding within 21 days a reminder letter was sent. This approach showed a significant positive effect. In the second approach, a nurse contacted patients via telephone and encouraged them to come for checks. This intervention was not significant (refer to Figures 3.7 & 3.8, Subgroup 2).

For interventions using financial incentives for screening, all studies (Christensen, 1995; Franks & Engerman, 1991) were significantly in favour of intervention except for

the study by Stocks et al. (Stocks et al., 2012). Stocks et al. used shopping vouchers as rewards for screening, while the other two studies offered free or subsidized screening as the intervention (refer to Figures 3.7 & 3.8, Subgroup 3).

For interventions using dedicated personnel to increase screening uptake for CVD risk factors, all three studies were conducted at clinics (Grunfeld et al., 2013; Marshall et al., 2008; Robson et al., 1989). Two studies used project nurses and health promotion nurses to deliver the screening (Marshall et al., 2008; Robson et al., 1989). Their tasks were to invite, follow-up and deliver the preventive care service. One study used two different approaches: a dedicated personnel to deliver the screening, or a practice facilitator to help the organization improve the system and implement changes for better care (Grunfeld et al., 2013). The first two studies that used dedicated personnel to deliver screening showed significant positive effects in both optimistic and pessimistic analyses (Marshall et al., 2008; Robson et al., 1989). The third study that used dedicated personnel to deliver screening was effective in the optimistic analysis; but using dedicated personnel targeted at the organizational level was not (Grunfeld et al., 2013) (refer to Figures 3.7 & 3.8, Subgroup 4).

For interventions using a multifaceted approach to increase screening uptake for CVD risk factors, a significant positive effect was shown in the optimistic analysis (RR 2.268; 95% CI 1.401 to 3.672) but not in the pessimistic analysis (RR 1.549; 95% CI 0.978 to 2.453). There were nine studies in this subgroup. Six studies showed significant positive effects in both optimistic and pessimistic analyses (Fullard et al., 1987; Kenealy et al., 2005; Ornstein et al., 1991; Sinclair & Kerr, 2006; Vincent et al., 1995; Wee et al., 2013). One study that used dedicated personnel to deliver screening and also targeted at organizational level was found to be effective in optimistic analysis but not in pessimistic analysis (Grunfeld et al., 2013). Another two studies, one targeting both patients and

physicians to act on health risk appraisal information feedback to them (both patients and physicians), and another study incorporating the use of clinical guidelines, computerized reminder systems, audits and feedback did not show any significant positive effect in both pessimistic and optimistic analyses (Bailie et al., 2003; Harari et al., 2008) (refer to Figures 3.7 & 3.8, Subgroup 5).

3.4.5.3 Study settings

All 21 studies were conducted in primary care settings except for one study from Singapore (Wee et al., 2013) that was conducted in a housing estate. We have included this community study in the analysis as the objective of this review was to determine the effectiveness of intervention strategies carried out in primary care settings or the community. Removal of this study from the analysis did not alter the statistical significance of the effect size, although there were magnitude changes in the estimates and 95% CI. Table 3.6 shows the comparison of the effect size by including and excluding this study in the analysis.

Table 3.6: Comparison of the effect size by including or excluding the community study (by Wee et al., 2013)

Analyses	Outcome using lowest effect size (pessimistic analysis)		Outcome using highest effect size (optimistic analysis)	
	Effect size for all studies (n=21)	Effect size excluding study by Wee et al. (n=20)	Effect size for all studies (n=21)	Effect size excluding study by Wee et al. (n=20)
	Relative risk (95% CI)	Relative risk (95% CI)	Relative risk (95% CI)	Relative risk (95% CI)
Effect of interventions vs. control group	1.443 (1.264, 1.648)	1.455 (1.269, 1.669)	1.680 (1.420, 1.988)	1.667 (1.401, 1.984)
Effect of interventions vs. control group by study design (Subgroup 3 Pre & post study)	1.875 (0.677, 5.194)	2.121 (0.568, 7.920)	2.428 (0.971, 6.074)	2.510 (0.623, 10.122)
Effect of types of interventions vs. control group (Subgroup 5 multifaceted approach)	1.549 (0.970, 2.453)	1.608 (0.928, 2.789)	2.268 (1.401, 3.672)	2.350 (1.318, 4.190)

3.4.6 Meta-regression

The meta-regression was performed to explore whether the differences in study design, type of population and type of intervention could explain the heterogeneity seen in the meta-analysis. Meta-regression analysis showed that the effect size of CVD risk factor screening uptake was not associated with the study design, type of population and type of intervention in both optimistic and pessimistic analyses (Tables 3.7 and 3.8).

Table 3.7: Meta-regression using optimistic analysis

Covariate	Study group	Study no	Coefficients	Lower bound	Upper bound	Standard error	p-Value
Intercept			0.577	0.058	1.096	0.265	0.029
Type of population	Mixed population	20					
	Unknown CVD	10	0.100	-0.322	0.521	0.215	0.643
Study design	NRTC	6					
	RCTs	19	-0.010	-0.464	0.443	0.231	0.965
	Pre- & post-studies	5	0.347	-0.257	0.951	0.308	0.260
Type of intervention	Multifaceted approach	9					
	Physician reminder	11	-0.230	-0.664	0.205	0.222	0.300
	Patient invitation	3	-0.315	-0.934	0.304	0.316	0.318
	Financial incentive	3	-0.260	-0.942	0.422	0.348	0.455
	Dedicated personnel	4	0.229	-0.494	0.952	0.369	0.534

Metric: Relative Risk NRTC: non-randomized trials with controlled group RCT: randomized-controlled trials

Table 3.8: Meta-regression using pessimistic analysis

Covariate	Study group	Study no	Coefficients	Lower bound	Upper bound	Standard error	p-Value
Intercept			0.301	-0.226	0.828	0.269	0.263
Type of population	Mixed population	20					
	Unknown CVD	10	-0.205	-0.601	0.192	0.202	0.312
Study design	NRTC	6					
	RCTs	19	0.031	-0.423	0.484	0.231	0.894
	Pre- & post-studies	5	0.419	-0.192	1.029	0.311	0.179
Type of intervention	Multifaceted approach	9					
	Physician reminder	11	-0.008	-0.442	0.426	0.221	0.971
	Patient invitation	3	-0.080	-0.712	0.552	0.322	0.805
	Financial incentive	3	0.199	-0.487	0.885	0.350	0.569
	Dedicated personnel	4	0.223	-0.403	0.849	0.319	0.486

Metric: Relative Risk NRTC: non-randomized trials with controlled group RCT: randomized-controlled trials

3.5 Discussion

3.5.1 Summary of principal findings

The objective of this systematic review was to determine the effectiveness of interventions that aimed to increase uptake of CVD risk factor screening. We included 21 studies in the meta-analysis. The risk of bias for randomization was low to medium in the randomized-controlled trials, except for one, and high in the non-randomized trials. Two

analyses were performed using lowest and highest effect sizes of the studies; optimistic (using the highest effect sizes) and pessimistic (using the lowest effect sizes). Overall, interventions were shown to increase the uptake of screening for CVD risk factors (RR 1.443; 95% CI 1.264 to 1.648 for pessimistic analysis and RR 1.680; 95% CI 1.420 to 1.988 for optimistic analysis). Effective interventions that increased screening participation included: use of physician reminders (RR ranged between 1.392; 95% CI 1.192 to 1.625, and 1.471; 95% CI 1.304 to 1.660), use of dedicated personnel (RR ranged between 1.510; 95% CI 1.014 to 2.247, and 2.536; 95% CI 1.297 to 4.960) and provision of financial incentives for screening (RR 1.462; 95% CI 1.068 to 2.000). Multifaceted approaches were effective when optimistic analysis was performed (RR 2.268; 95% CI 1.401 to 3.672).

3.5.2 Interpretation of the findings and comparison with previous findings

In this review, 21 articles were obtained for analysis, of which 9 were the result of an initial search and 16 from forward and backward bibliography and citation checks of the search. The cross checking of bibliographies and citations led to increased yield. This was especially true when an article was cited in a review paper; by going through the studies included in the review paper, we found more papers relevant to our study. Thus, the back and forth citation search could be a better way of tracking relevant articles.

Our results showed that studies with lower quality (pre- and post-studies) had larger effect size (RR ranged from 1.875 to 2.428) but lower precision compared with studies with higher quality such as the non-randomized trials with controlled groups (RR ranged from 1.347 to 1.647) and randomized controlled trials (RR ranged from 1.383 to 1.448). This is expected as studies with better methodology had lower effect size but higher precision, which was consistent with the literature and suggested quality assessment of papers was useful (Dickersin & Berlin, 1992).

The heterogeneity observed was significant and high for all the meta-analyses performed. This was expected given the diverse population, settings, study designs, interventions and risk factors measured (Dickersin & Berlin, 1992; Lau, Ioannidis, & Schmid, 1997). Despite this, the results for study effects were robust in one direction (refer to Figures 3.3 to 3.8). This implied that the results could possibly be generalized to various populations (Dickersin & Berlin, 1992).

The meta-regression was performed to explore whether the differences in study design, type of population and type of intervention could explain the heterogeneity seen in the meta-analysis. Meta-regression is used to explore associations between study-level features and the outcome. For example, the quality of study design can result in artefactual variation. There may also be true differences in effects arising from associations with differences in study population (for instance variation in disease severity) or intervention. Such effect modification may help identify participants for whom the intervention is likely to produce benefit (Glasziou & Sanders, 2002). In this meta-regression analysis, it was found that study design, type of population and type of intervention did not influence the effect size.

The risk factors targeted for screening were heterogenous and ranged from single to multiple CVD risk factors. There were also interventions that involved other preventive services such as vaccination. By performing two sets of meta-analysis on the highest and lowest uptake rate for each intervention, a range of effect size was provided to clearly demonstrate the effectiveness of interventions across various risk factors.

This review found using physician reminders, dedicated personnel or financial incentives for screenings were effective interventions. This study extends the evidence from a previous systematic review by Jepson et al., where the types of interventions previously found to be effective in cancer screening seem to have similar effects in CVD

risk factor screening (Jepson et al., 2000). This suggests that people's health behaviour towards interventions to improve screening was similar, regardless of the conditions they had.

Although using physician reminders can increase CVD risk factor screening uptake rates, its effect is limited to patients attending clinics for other reasons. For interventions using financial incentives to improve screening uptake rates, our result was consistent with the results in Jepson's review (Jepson et al., 2000). Both reviews showed that interventions using reduced cost or free screening increased screening uptake, but not those providing incentives such as shopping vouchers, gifts or transportation incentives. The effect of free or subsidized screening is likely to be different depending on the way in which health services are funded. When free screening is provided by existing health-care systems, added rewards do not provide a further effect on the uptake of screening (Stocks et al., 2012).

Dedicated personnel can be used to deliver screening or to facilitate screening uptake at the organizational level. This review found that using dedicated personnel to deliver the screening was effective in increasing CVD risk factor screening uptake; the effect was uncertain for using dedicated personnel targeted at the organizational level as there was only one study researching into this intervention. The use of dedicated personnel (non-physician providers) to increase preventive activities has been shown to be effective in previous literature for adult immunization and cancer screening (Stone et al., 2002; Winston, Mims, & Leatherwood, 2007). This intervention requires system resources and support such as organisational change in staffing and clinical procedures. Although using dedicated personnel at the organizational level, such as a practice facilitator, has been shown to be effective in improving the use of evidence-based guidelines in primary care and preventive care performance (Baskerville, Liddy, & Hogg, 2012; Hogg, Lemelin,

Moroz, Soto, & Russell, 2008), the intervention did not consistently show positive results in other studies (Grunfeld et al., 2013; Liddy et al., 2015). This highlights the challenge in the implementation of this intervention which may vary from practice to practice.

For interventions using a multifaceted approach, this review showed inconsistent results in the effectiveness of this intervention. The intervention was effective in optimistic analysis but not when a pessimistic model was used. A systematic review by Jepson et al. reported some evidence in the effectiveness of multiple interventions aimed at individuals or physicians and interventions aimed at both physicians and individuals in increasing screening uptake (Jepson et al., 2000). Further studies are needed to confirm the effectiveness of multifaceted approaches in increasing the uptake of CVD risk factor screening.

In contrast with other reviews for breast, cervical and colorectal cancer screening (Bonfill, Marzo, Pladevall, Martí, & Emparanza, 2001; Everett et al., 2011; Ferroni et al., 2012), an invitation to patients either by telephone or letter did not show a significant effect in increasing CVD risk factor screening uptake, although a positive trend was observed. Due to the small samples (two studies and three comparisons), it is difficult to conclude the effectiveness of this intervention for CVD risk factor screening. With the global use of information technology with mobile phones, telephone invitations could be used as a mode for such invitations. There was an increased use of mobile text messages that have been shown to be effective in delivering reminders for adherence to treatment and appointments in health-care services (Kannisto, Koivunen, & Välimäki, 2014). Thus, mobile text messages might be useful as a mode of invitation for screening. However, we did not find any study using this mode as an intervention for CVD risk factor screening.

3.5.3 Implications for policy and practice

The results of this review show that active recruitment targeted at any level, either individual, health-care professional, or health-care system were effective in increasing CVD risk factor screening uptake. However, the intervention one chooses would depend on the practice resources and support and the target of coverage within a set time frame. For example, physician reminders would not be applicable to individuals who did not attend the clinic, and they could potentially be the most at risk group. Provision of free screening can be effective in health-care systems where participants have to pay for screening. Using dedicated personnel to deliver screening was effective, but the cost and human resources demand would be high.

3.5.4 Strengths and weaknesses of this review

Our review has included both randomized and non-randomized controlled trials as well as pre-and post-study interventions to provide more comprehensive views of various interventions aimed to increase the uptake of CVD risk factor screening. We believe that each of these studies can contribute useful information to the review. Although the non-randomized and non-controlled trials could inflate the effect size of the interventions, the meta-regression we performed did not show any significant association between study design and the effect size of the CVD risk factor screening uptake.

There are several limitations in this review. At study level, there was a high risk of bias for blinding of participants and personnel in all the studies. However, this was unavoidable due to the nature of the interventions. At review level, we have employed an extensive search strategy. However, we limited it to publications in the English language, due to limited resources. Hence, the analysis should be treated with caution. In addition, we did not identify any unpublished trials; thus publication bias could not be examined. There is a possibility some papers from regional journals that are not indexed were

missed. Some cultural and local issues on uptake of health checks could have been missed. However, it is unlikely to change the magnitude and direction of effect size as any influencial papers would have been published or cited in indexed journals. Other interventions such as providing incentives to health practices might be useful, but we could not find any of such studies.

We did not include cost-effectiveness of interventions in this review which is an important area to look into when choosing an intervention. This will be a useful area to explore in future reviews.

3.5.5 Linking of phase I results to phase II and III studies

The results of this systematic review have provided insight of effective interventions to increase the uptake of the CVD risk factor screening. However, the applicability of this intervention to local settings needs further evaluation in view of the following reasons:

1) All studies except one were conducted in Western countries, in which the health systems and population characteristics were different from local settings. In addition, all studies were conducted in developed countries where health resources and support would probably be better than in Malaysia, a developing country. The replicability of the interventions would depend on local resources and their needs.
2) The high heterogeneity of the meta-analysis means that generalization of the results would need to be interpreted with caution. Although meta-regression has shown that the effect size of CVD risk factor screening uptake was not associated with the study design, type of population and type of intervention, other study characteristic such as ethnicity, gender, underlying health structure had not been examined.
3) There was a lack of theory to guide the development of these interventions in the included studies in this review. It is recommended that an intervention should be

designed based on a theoretical framework to increase its likelihood of success for its desired effect (Craig et al., 2008).

In view of the aforementioned reasons, the understanding of public's decision-making processes is crucial to identify factors which need to be targeted in the development of an intervention. Thus, this study sought to develop a conceptual framework for explaining the public's decision-making processes in phase II of the study and to determine significant factors in phase III of the study to guide the strategy of interventions. Based on the results of phases II and III, the results of this systematic review would best be visited for its applicability to development of an intervention for increased uptake of CVD risk factor screening in local settings, and this will be further discussed in Chapter 6.

3.6 Conclusion

Physician reminders and providing financial incentives were effective in influencing the provider's and patient's behaviour to increase CVD risk factor screening uptake. At the organizational level, using dedicated personnel to deliver the screening was found to be effective.

CHAPTER 4: PHASE II: QUALITATIVE STUDY

4.1 Introduction

In this phase II study, the aim was to explore how individuals decide to participate in health checks for CVD prevention, and to develop an explanatory framework for the cognitive process in decision-making for health checks. This chapter provides a brief literature review on the rationale for conducting this qualitative study and theories related to medical decision-making in section 4.2, followed by details of the materials and methods used in section 4.3, and the results of the background of the participants and factors influencing the public's decision-making to undergo health checks in section 4.4. The discussions and conclusion are presented in the last two sections 4.5 and 4.6.

Sections 4.3.1 and 4.3.2 are written in first person to elaborate on my position and reflexivity in this project. The other sections are presented in third person: the researcher (ATC).

4.2 Brief Literature Review

4.2.1 Rationale for conducting this qualitative study

Health checks have been shown to be useful for early identification of individuals at high risk of CVD (Members of the Expert Panel, 2011; National Vascular Disease Prevention Alliance, 2012; Perk et al., 2012; World Health Organisation, 2007). The success of a prevention programme depends on the participation of targeted groups.

In Malaysia, the uptake of health checks remains low. The Malaysian National Health Morbidity Survey 2011 reported that only 37.8% of those aged 18 years and more had undergone health checks in the past year (Institute for Public Health (IPH), 2011a). In addition, the Social Security Organisation (SOCSO) under the Ministry of Human Resources in Malaysia provided a free one-time voucher for CVD risk assessment to all their members, aged 40 years and above in 2013. Despite the incentives, the uptake of

this programme was only 16.2% (308,309/1.9 million workers) (The Star online, 2015). It is, therefore, important to understand the public's decision-making process to engage in health checks for CVD prevention.

A number of studies conducted in Western countries have analyzed the factors influencing the uptake of CVD health checks. These include personal health beliefs and attitudes towards illness and health prevention such as beliefs about susceptibility, positive or negative health check concept, fear of outcome and system-related factors such as appointment convenience, time, cost and location (Burgess et al., 2014; Dryden et al., 2012; Ellis et al., 2015; Harkins et al., 2010; Jenkinson et al., 2015; Nielsen et al., 2004; Sinclair & Alexander, 2012; Wall & Teeland, 2004). Other factors reported include recommendation of health care workers and experiences of health checks by self or others and influences by family and friends (Jenkinson et al., 2015; Sinclair & Alexander, 2012). The results varied for different studies, as health behaviour is very much different in view of the diversity of population and cultural background of one society to the other. There is no study found locally regarding factors influencing the public's decision-making in terms of CVD health check participation. Thus, there is a need to explore how one decides to participate in health checks for CVD prevention. The result of this study is hoped to facilitate the understanding of the factors influencing individuals' decision-making on the participation of CVD health checks, which health care providers can tap into while counselling patients for CVD health checks.

4.2.2 Theories related to medical decision-making

There are extant theories that can help to hypothesize factors influencing the decision-making and the health behaviour. Four extant theories related to medical decision-making and health are the health belief model (Janz & Becker, 1984), the integrative model of behavioural prediction (Fishbein, 2008), the transtheoretical model

of health behaviour change (Prochaska, 2008; Prochaska & Velicer, 1997) and the fuzzy trace theory (Reyna, 2008). The health belief model and theory of planned behaviour (in which the integrative model of behavioural prediction was an extension of it) were reviewed at the initial stage of study proposal before deciding on using grounded theory approach as the research methodology in this study. The appropriate timing of the initial literature review in the grounded theory approach was further discussed in section 4.3.1. The other theories were reviewed after developing the conceptual framework in this study.

4.2.2.1 Health belief model

The health belief model suggests that the interaction between four different types of belief influence a person's decision to take action for a given health problem. Individuals will be more likely to take action to protect their health if they:

- perceive themselves to be susceptible to the problem (perceived susceptibility)
- believe that the given problem has potentially serious consequences
- believe that taking action will reduce their susceptibility or minimize the consequences
- believe that the benefits will outweigh the costs of barriers

4.2.2.2 Integrative model for behavioural prediction

The integrative model is an extension of the theory of planned behavior and reasoned action (Ajzen, 1991; Fishbein, 2008). A central factor in this model is the individual's intention to perform a given behaviour. The stronger the intention of a person to engage in a given behaviour, the more likely this will be performed. The intention of behaviour is influenced by three conceptually independent determinants as follows:

- Attitude towards the behaviour

This refers to the degree to which a person has a favorable or unfavorable evaluation of the given behaviour and the attitudes of an individual are affected by one's belief of an outcome, which occurs following the execution of that behaviour by evaluating the outcomes of whether it is going to be beneficial or not.

- Perceived social norms

Subjective norms explain how social pressure can influence behaviour. This relates to an individual's beliefs about what other people think they should do (normative beliefs) and the motivation to comply with the standard set by the norm. The social pressure could be from a person who is perceived to be important to an individual such as one's spouse, parents or peers.

- Self-efficacy (perceived behaviour control)

This refers to people's perception of how well one can execute the given behaviour, for example, the ability to get transport to undergo health checks.

In addition to these three factors, the integrative models also recognize the environmental factors and acquired skills and abilities to carry out the action or behaviour, can moderate the intention-behaviour relationship. For example, one's behaviour in using a condom for contraception would depend on one's skill and ability to use condoms and also whether condoms were easily available.

4.2.2.3 The transtheoretical model of health behaviour change

The transtheoretical model states that health behaviour changes involve various stages of change, including precontemplation, contemplation, preparation, action, maintenance and termination (Prochaska, 2008). People in the different stages make decisions

differently with different perception of the pro and cons of the change. For example, in the precontemplation stage, the cons of change clearly outweigh the pros; in the contemplation stage, the pro and cons are equal, and when it progress to later stages, the pros of change outweigh the cons (Prochaska, 2008).

4.2.2.4 Fuzzy trace theory

Fuzzy trace theory explains that one's judgement and decision-making is based on the gist of information. The gist is a vague, imprecise representation which captures the bottom-line meaning of information, incorporating an individual's emotion, education, culture, experience and worldview (Reyna, 2008). Thus, the fuzzy trace theory proposes that the precise information might not be effective in supporting medical decision-making.

These theories have the strength to be generalized to a bigger population and thus comparing the conceptual framework of this study to the extant theories will further illuminate the understanding of the decision-making process of health checks for prevention of CVD. In addition, this could help to identify and fill the knowledge gaps and contribute to the existing body of knowledge. These theories are discussed in alignment with the conceptual framework of this study in section 4.5.2.

4.3 Materials and Methods

4.3.1 Study design

A qualitative approach was used in this phase II study, as there is little known about the public's decision-making with regard to health checks for CVD prevention locally. Therefore, it is appropriate that this research is explorative in nature.

The grounded theory approach was used as the research methodology in this study. This method provides a systematic yet flexible guideline for data collection and analysis to develop a substantive theory to explain the phenomenon of interest (Charmaz, 2014).

The phenomenon of interest in this study was the public's decision to undergo health checks for CVD prevention. It is known that the decision is made through a cognitive process with consideration of a few factors. These factors could be interrelated and could possibly be portrayed with an explanatory model or conceptual framework, which is the expected outcome of grounded theory methodology.

The theoretical perspective and assumption of grounded theory lies in symbolic interactionism (Charmaz, 2014; McCann & Clark, 2003), which assumes that humans act on things in response to the meaning those things have for them (Benzies & Allen, 2001; Charmaz, 2014). In line with this theoretical perspective, the public's decision to or not to undergo health checks for CVD prevention would be dependent on what health checks meant for them. This could further mean how they perceived health checks and factors they would take into account when deciding for health check participation. Hence, this phase aimed to explore the public's decision-making processes for CVD health checks.

Grounded theory methodology was developed by Barney Glaser and Anselm Strauss in the 1960s, following the result of studying death and dying in hospitals (Charmaz, 2014; McCann & Clark, 2003). The first book on the grounded theory method was *The Discovery of Grounded Theory* published in 1967 by Glaser and Strauss. Following that, other versions of the grounded theory method have been published over the years; these include *Basic of Qualitative Research: Grounded theory and procedures and techniques* by Strauss and Corbin in 1990, and *Constructing Grounded Theory* by Charmaz in 2006 (Charmaz, 2014). Its perspective has moved from the objectivist paradigm (by Glaser) to a constructivist paradigm (by Charmaz). The objectivist approach believes that there is an objective external reality and the researcher is believed to be independent from the researched (Creswell, 2009). In contrast, the constructivist approach believes that the social reality is multiple and it is constructed from an individual's experiences as well as

the researcher's interpretation of the data. This approach acknowledges the subjectivity the researcher brings to the research, thus there is a need to take into account the researcher's position, perspective, privileges and interaction as an inherent part of the research reality (Charmaz, 2014). Though the assumption of the objectivist and constructivist are diverse in nature, the basic grounded theory strategies such as coding, memo-writing, theory development with constant comparative methods are applicable in both paradigms (Charmaz, 2014).

This study has adopted the constructivist grounded theory approach by Charmaz. In this approach, the researcher serves as a research tool and is directly involved in the interviews, and the data analyses do contribute to data interpretation and research results. Thus, the results are constructed through interactions between the researcher and the participants.

There is a considerable discussion on the appropriate timing of the initial literature review in the grounded theory approach (Giles, King, & de Lacey, 2013; Hallberg, 2010; McCallin, 2003; McGhee, Marland, & Atkinson, 2007). Glaser advised not to review literature prior to the study, and to delay this until the grounded theory was nearly completed. This is to avoid importing preconceived ideas and imposing them onto the research study, in which these preconceived ideas might constrain or inhibit the researcher's analysis of the theoretical codes emerging from the data (Giles et al., 2013; Glaser, 1998). In contrast with this, other grounded theory researchers, including Strauss, Corbin and Charmaz acknowledged the value of a preliminary review of the literature in identifying the gaps of knowledge, providing the rationale for the study, satisfying the ethical committees and enhancing the theoretical sensitivity, credibility and rigor of the study (Charmaz, 2014; Giles et al., 2013; Hallberg, 2010; McCallin, 2003). To overcome the problem of forcing the data to preconceived ideas, the emphasis is on the need to stay

open-minded when dealing with data (Charmaz, 2014; Giles et al., 2013; McGhee et al., 2007). The process of reflexivity and use of constant comparative methods are important steps to ensure the focus and results are from the emerging data rather than from the literature (Charmaz, 2014; Hallberg, 2010; McCallin, 2003; McGhee et al., 2007).

In keeping with the pragmatism and constructivist approach, a preliminary literature review has been conducted to identify knowledge gaps and focus of this study. In addition, a literature review was required for justification of this study for ethics review and grant application. It enhanced the theoretical sensitivity and sharpened my thoughts during data collection and analysis. However, I am cautious with the possibility of being influenced by preconceived ideas and keep reminding myself to stay open-minded throughout the research process.

4.3.2 Reflexivity

Reflexivity is the researcher's scrutiny of his or her research experience in examining how his or her research interest, positions and assumptions influenced the research process (Charmaz, 2014). In a qualitative study, the researcher is the research tool who is directly involved in data collection and analysis. Thus, self-reflection is an important process to make the researcher aware that any of his or her past experiences and preconceived ideas could influence the quality of data collection and analysis, so that steps could be taken to enhance the quality of these processes. In line with the constructivist grounded theory approach, I believe the data and analysis are derived from the shared experiences and relationships between the researcher and participants. Thus, the results need to take into account the researcher's reflexivity on his or her research process.

As a family physician, I believe that prevention is better than cure. In primary care, we are in the best position to provide prevention care. Cardiovascular disease is largely

preventable and the procedures for screening of the risk factors are simple and can be easily done in primary care clinics. However, results from the National Health Morbidity Survey over the years have consistently shown high prevalence of undiagnosed diabetes, hypertension and hypercholesteroleamia in this country. From my clinical experiences in inviting patients for CVD health checks in public health clinic, though I did not encounter direct refusal during these invitations, not many patients would turn up for checks subsequently. I thought this could be attributed to the long waiting times and overcrowded clinic that put patients off. However, in private clinics where the waiting time is not an issue, a personal experience of inviting a patient who had a SOCSO voucher for free health checks was also not successful, when financial burden, waiting time and accessibility were not issues. This raised my interest in the inquiry of this research question. I believe the patient plays a central role in the decision to participate in health checks and thus understanding their decision-making process would prepare me to be more empathetic and able to address the concerns they might have when promoting or engaging an individual for CVD health checks.

I have conducted all the in-depth-interviews and moderated all the focus group discussions. During the interviews, I introduced myself as a family physician and a PhD student. I was aware that by knowing the interviewer's profession background as a doctor, the participants might try to response positively to the aspect of health check participation. For this, I attempted to ensure that participants understood that I was there to learn from their views and experiences by emphasizing that there was no right or wrong answer to the issue discussed. With the communication skills acquired from the training of a family physician (being non-judgmental and patient-centred), I managed to establish a good rapport with the participants and make them feel comfortable to voice their views. From the interviews, I had heard participants commenting negatively about doctors and the health care system, for example a participant commented on the doctors' poor

communication skills, the government clinics' system which was not friendly; with this information, I knew that I had probably gained trust from the participants and had encouraged them to disclose their views and experiences.

I was aware that as a family physician, I have a preconceived idea that health checks are useful and essential for middle-aged individuals. I had to constantly remind myself to stand neutral in the interview and not to influence the participants to respond towards my interest. To do this, I used a semi-structured interview guide that phrased questions in an objective manner.

I set off with the intention to learn from the participants about their perception of health checks and practice with respect to these checks. I sought an understanding of the significant factors contributing to their decisions in health check participation. As a result, I would note not only the participants' knowledge about the CVD risk factors, the disease and health checks from a health-care professional perspective, but to accept the participants' stories as what is significant to them as well.

With the theoretical perspective of symbolic interactionism, I actively analyzed conversations by making comparison of what they say and do during the interviews. For example, there was a participant who said that the health checks were good but he did not go for health checks. Being aware of this incongruence between words and action, I probed further for clarification.

I understand that by reviewing the literature and reading up on various theories (the health belief model and theory of planned behaviour) before data analysis might contribute to me having preconceived ideas on factors influencing the public's decision-making for health check participation when analyzing the data. The semi-structured interview guide had also incorporated some elements of these theories and literature

review. Having prior knowledge of these theories has contributed to the theoretical sensitivity of the data. However, these earlier theoretical concepts only provided a starting point when looking at data. I understand that these should not be used as existing codes when analyzing data. My approach to managing these preconceptions was to memo-write and use constant comparative methods to continually compare the appropriateness of the coding, categories and the emerging data. I found constant comparison of the code, categories and data an effective way to avoid forcing the data to preconceived ideas. I constantly reminded myself to keep an open mind to allow new insights to be gained from emerging data. In addition, in order to minimize my personal influence on the analysis, I had coded three transcripts with a second coder (SFT, an experienced qualitative researcher) and had shown the coding and transcripts to a third party (my supervisor, EMK). The purpose was to counter check my coding was relevant and appropriate with the emerging data.

In summary, I appreciate the trust of the participant-researcher relationship, which prepared the participants to be open and honestly share their thinking and experiences. The reflexivity of the research process brought me to see clearer about my stance in the research and make me aware of the problems faced in the research. Therefore, this allowed me to adopt some strategies to overcome the challenges to enhance the quality of this research as well as be aware of the limitations of the study.

4.3.3 Sampling of participants

Two sampling methods were used to recruit the participants into the study: purposive and theoretical sampling. The reasons two sampling approaches were used was because in purposive sampling, the individuals are selected because they are "information rich" and can inform an understanding of the phenomenon of interest in the study (Creswell, 2007; Patton, 2002). In theoretical sampling, the researcher decides who or what to

sample next, based on the initial findings from the data in order to develop the properties of the developing categories or theory (Charmaz, 2014; Glaser, 1978; Hesse-Biber & Leavy, 2011).

The inclusion criteria for recruitment of this study was adults aged 30 years and above who lived in the Klang district, and did not have a history of CVD or other serious illnesses such as cancer or psychosis. Klang is one of the nine districts in the state of Selangor, Malaysia. It takes about 40 minutes' drive from Kuala Lumpur, the capital of Malaysia. Public and private health check facilities are widely available in this district. The above age group was recruited as this is the recommended age group for CVD risk screening in current practice, though it is suggested to screen earlier in view of high prevalence of hypercholesterolemia, hypertension and diabetes in the younger age group (Institute for Public Health (IPH), 2011a, 2015a). The participants were recruited from the community as the focus of this research was on the public.

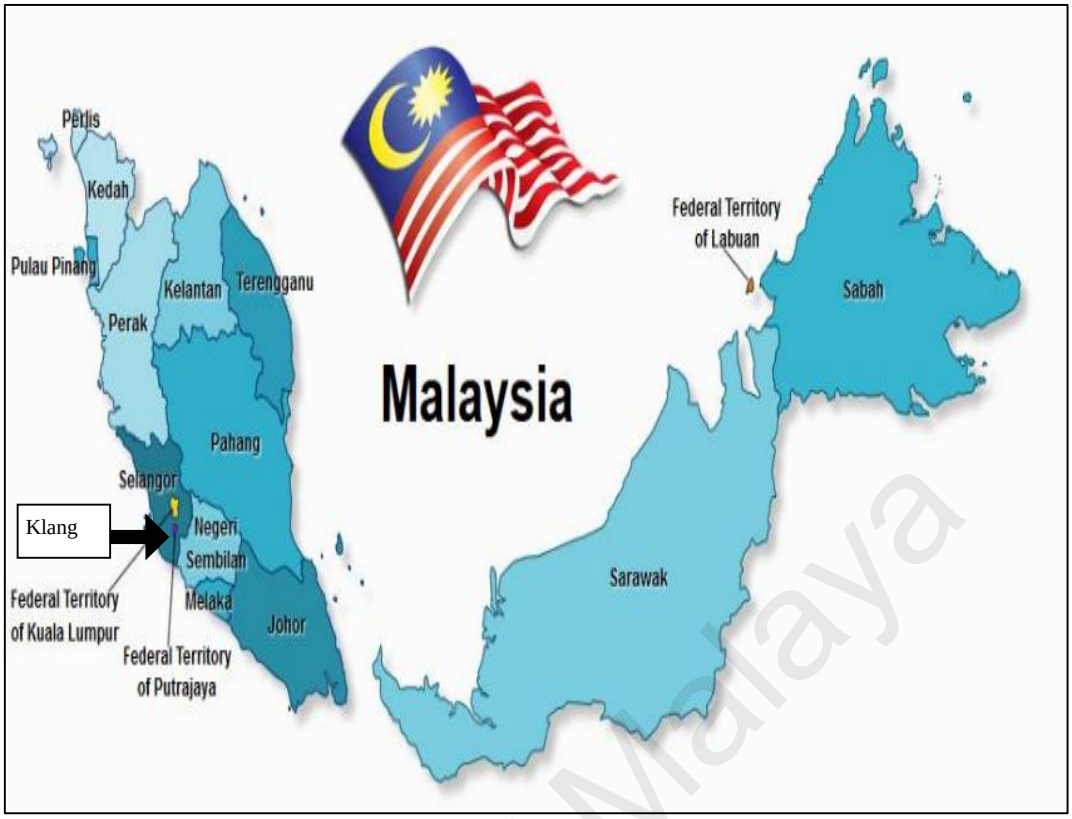


Figure 4.1: Map of Malaysia and study areas

(Source: https://www.statistics.gov.my/index.php?r=column/cone&menu_id=ZmVrN2FoYnBvZE05T1AzK0RLcEtiZz09, retrieved 12 December 2016)

The first three in-depth interviews (IDIs) and the first focus group were conducted with participants recruited through purposive sampling to include the three main ethnic groups in the country: Malay, Chinese and Indian (Refer Figure 4.2). Recruitment was done through social network contacts. The invitation to participate was spread by word of mouth through colleagues and friends from the three ethnic groups. In focus group, participants were grouped based on their sociodemographic characteristic, the language used by the participants and their convenience for interview. The inclusion criteria were explained and a patient information sheet was provided to these contacts for them to advertise to potential participants. Potential participants were then contacted and invited to participate in the study.

Next, theoretical sampling was carried out based on the preliminary analysis and findings of the initial four transcripts. Participants from these initial four sessions (three interviews and one focus group) were those who had undergone health checks. During the preliminary analysis, it was found that socio-demographic background had a great impact on health check decision-making. Hence, members of the public from different socio-economic backgrounds and those who had not undergone health checks were subsequently recruited. Participants with different characteristics were deliberately selected to challenge, refine, elaborate and exhaust the conceptual categories constructed from the initial analysis. Participants were identified through the social networking and also snow balling from those participants who had undergone the interview.

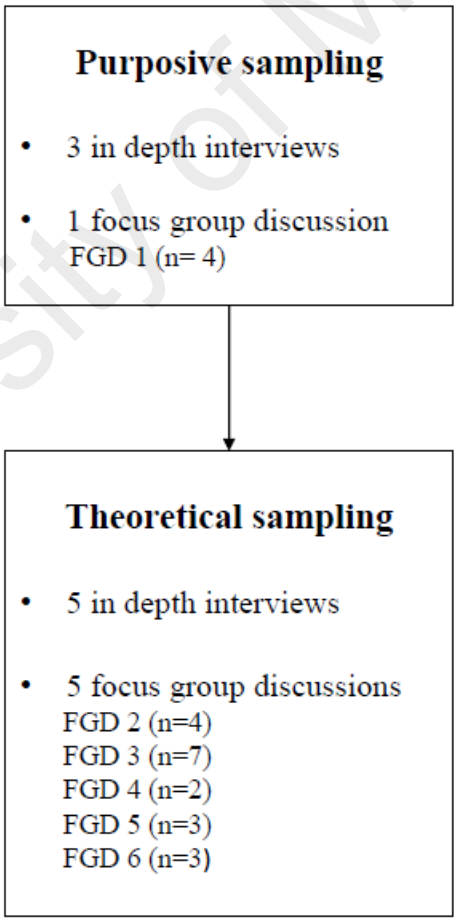


Figure 4.2: The flow of sampling and data collection method

4.3.4 Data collection

Data were collected through focus group discussions (FGDs) and in-depth interviews (IDIs). A focus group provides an opportunity for participants to interact and exchange ideas to further stimulate thoughts from the interactions (Patton, 2002). An IDI allows participants to express their experiences in detail and voice views that they may otherwise not reveal in the presence of others (Hesse-Biber & Leavy, 2011).

Appointments were set with the participants prior to the interviews. The estimated time taken for the interviews was one hour for IDIs and one to two hours for FGDs. This information was informed to the participants when setting the appointment. The time and venue for IDIs and FGDs were arranged to suit participants' preferences and convenience. All IDIs and FGDs were conducted and facilitated by ATC, who is fluent in the three languages commonly used in the community (English, Malay and Mandarin). Each interview or focus group was conducted in one of these languages as preferred by the participants.

4.3.4.1 Conducting focus group discussions

There were six FGDs carried out in this study. Each focus group had two to seven participants who shared similar socio-demographic backgrounds and languages. There were three FGDs with less than 4 participants; this was conducted for the convenience of the participants. Although this might have limited the interaction of the discussions, there were another three FGDs conducted with more participants. ATC had moderated FGDs with the help of a note taker, who took notes for verification during subsequent transcribing.

During each session, the note-taker and ATC arrived half an hour earlier than the formal session to set-up the place, register the participants and gather their basic information (Appendix F). Informal chatting with the participants was carried out before

the formal sessions to help build up rapport which could facilitate the interviews. Each participant was given a name tag to facilitate identification for note taking.

The formal sessions started by an introduction of one another. ATC introduced herself as a family physician and a PhD student. The real name was used during the conversation and this was transcribed verbatim later. If the name appeared in the quotes, this was made anonymous for the write-up and publications.

The participants were briefed on the objective of the study and times were provided for them to go through the patient information sheet (Appendix G) and to raise any questions before completing the consent form (Appendix H). It was emphasized to them that there were no right or wrong answer and the discussion was not meant for any assessment. The researcher's position as a PhD student (ATC) was to learn from their views and experiences. Participants were assured about confidentiality and permission was sought for audio-recording.

The interviews were conducted using a semi-structured interview guide with open-ended questions (Appendix I). This interview guide was constructed based on the literature review, incorporating the elements of the health belief model and the theory of planned behaviour model (Ajzen, 1991; Janz & Becker, 1984). The questions included some of the concepts of these models such as attitude and perception of susceptibility towards CVD. These questions could help to trigger discussions. The guide was also used to assist and facilitate discussions on understanding of CVD and its risk factors, participants' experiences and decision on health checks, and barriers and motivators for their participation in health checks. Nevertheless, participants' opinions and experiences on cardiovascular health checks were explored without restriction from the guide. Constant reflections were carried out to ensure openness to participants' voices.

The sequence of the questionnaire was not adhered to completely nor the phrasing of the questions; it was used flexibly to smoothen the discussion process. For example, after a few interviews, it was realised that some participants were getting tired and had less concentration with the progression of time during the discussion. Thus, subsequent interviews discussed health checks first and how they decided to go for health checks, rather than following the sequence of the initial topic guide, which discussed CVD first. This was to gather more about their experiences and decision-making on health checks, as the aim of the research was to explore how the public decides on CVD health check participation. Also, most of the participants did not understand the term health checks for CVD prevention, and mistook it as health checks to diagnose CVD. The question was rephrased to "health checks that check for example hypertension, high cholesterol or diabetes".

While the data collection and analysis were in progress, the questions in the guide were modified and new questions were generated based on findings from analysis of earlier interviews taking into account the local and cultural context. This allowed ATC to examine and explore the relevance of ideas and concepts and the relationships between the concepts in subsequent interviews. For example, a participant had expressed that the disease was the fate and life was predestined. Following that, a question was added *"Do you think heart attack and stroke are preventable?"* to help examine the relationship of this concept with the decision of health check participation.

The average time taken for an FGD was 74 minutes (range 60–115 minutes). All participants were reimbursed RM50 (USD 12) to partially compensate for the time lost for attending the session.

4.3.4.2 Conducting in-depth interviews

There were eight IDI sessions conducted. Participants were recruited for IDIs if they preferred to be interviewed alone or they had difficulty to arrange the time and to travel to be interviewed in a group. The IDIs were conducted in a similar manner to FGDs without the note taker. The average time taken for an IDI was 66 minutes (range 20–81 minutes).

Data collection continued until subsequent information did not contribute substantially to the understanding of the decision-making process, when theoretical saturation was reached. Theoretical saturation refers to the point at which gathering more data does not yield any further theoretical insights about the emerging grounded theory (Charmaz, 2014).

4.3.5 Data analysis

Data preparation is needed for analysis. All recorded data were transcribed verbatim in the original languages used in the interviews to preserve the semantics as much as possible. Four transcribers were involved in the transcribing (including ATC). After transcribing, each transcript was reviewed and checked by ATC, by listening to the audio-recording and referring to the field notes taken. Amendment was made for errors detected such as missing words or misspelled words. Non-verbal cues observed during the interviews and field notes were added in the transcripts.

Data were organized using the qualitative data management software QSR NVivo 10 to facilitate analysis. The analysis process involved various stages of coding (open coding, focus coding), categorisation, constant comparison, memoing and diagramming to facilitate generation of frameworks. The analysis procedures involved were as follows:

4.3.5.1 Open coding

Open coding is the process of breaking down the data into discrete parts and assigning a label (code) to the fragments of data (Charmaz, 2014; Glaser, 1978; McCann & Clark, 2003). The fragments of data can be the words, lines or segments of data. The coding process was an interpretative one, where the labelling (code) represents the researcher's view on what fits with the actions and events in the study (Charmaz, 2014). The initial line-by-line coding was done in a way so that it keeps closely to the data, in order to avoid applying pre-existing categories to the data (Charmaz, 2014).

In keeping with symbolic interactionism as the theoretical perspective of grounded theory approach, gerunds were used as much as possible in the initial coding. Gerunds were action codes with verbs that end with "_ing". According to Glaser, coding with gerunds helps the researcher to detect processes and keep to the data (Glaser, 1978), and Charmaz viewed this step as useful to encourage the researcher to begin to analyse from the participant's perspective, and also avoids the tendency to force the data to extant theories (Charmaz, 2014). An example of open coding is as follows:

So my husband said, wow we better do it. If the young people nowadays ah we cannot say. They might look healthy but they are not right? So he said wah better do. (IDI6)

This was coded as "getting encouragement from husband for health check".

4.3.5.2 Focused coding

Focused coding allows the researcher to sift through the large amount of data. Focused coding can be conducted when the analytic direction is established (Charmaz, 2014; Glaser, 1978). In this study, focused coding was carried out when there were no new concepts emerging from the data. This process could help to examine the adequacy of the tentative framework and whether it was fit, relevant and worked for subsequent transcripts. An example of focus coding is as follows:

Table 4.1: An example of focus coding

Interview statement	Focused coding
But I think, my rationale for blood test, I feel, I think I go for blood test because, if the disease happens to me, actually I can't do anything, because it is in the body, how would I know about this? So, it is better to know early than later, If I know early I can decide what to do , what else can I do, isn't it? If know it later, then I just have to rely on fate.	Reasoning to undergo health checks Perceived benefit of health checks Perceived possibility to change the course of disease if known early

4.3.5.3 Constant comparison

Constant comparison is the method of analysis used to generate more abstract concepts and theories (Charmaz, 2014). In this study, it was used in each level of analytic work to generate and refine codes, categories and theoretical framework. During the initial analysis, the codes were compared with the data to ensure the labelling was appropriate. Then, the initial codes were compared for similarities and differences and grouped into categories. The categories were again compared to generate the higher level of concepts which these categories could be subsumed under. For example, the category of "perception of CVD risk" emerged from the following codes and subcategories (refer to Table 4.2):

Table 4.2: Emerging category and subcategories from codes through constant comparative method

Codes	Subcategories	Category
• Believe herself being at risk of CVD in view of high blood pressure • Believe herself being at risk of CVD in view of having obesity • Believe herself being at risk of CVD in view of having diabetes	Perceived to be at risk of CVD as having disease	Perception of CVD risk
• Perceiving her age at 50 has the risk of getting any health problems • Perceiving herself at risk of CVD as getting older • Going to health checks yearly in view of increasing age	Perceived increasing age as being at risk of CVD	

4.3.5.4 Memo-writing (Memoing)

Memo-writing is the process of writing informal analytic notes to facilitate the process of data analysis (Charmaz, 2014). It helped the researcher to catch her thoughts and analyse her ideas during the research process. Immediately after each interview session, the general impressions obtained from the sessions were written down and these notes provided an overview of what the participants' opinions were. During subsequent analysis, memo-writing served as a tool to capture the comparison and connection made between the codes, categories and the concepts. This process helped the researcher to understand the relationship between one category and another when developing the framework. In addition, any questions raised from the analysis result were jotted down to act as a reminder for further clarification in the next interview. Memo-writing also served as a tool for reflexivity. It enabled the researcher to examine her pre-conceived ideas and assumptions by checking carefully on the ideas written in the memos during analysis.

4.3.5.5 Modelling process and generation of framework

Theoretical coding is the process that aims to determine how the conceptual codes relate to each other as hypotheses and to be integrated in the theoretical framework (Charmaz, 2014; Glaser, 1978). During the process of analysis, theoretical coding of causal effect was applied to look at the relationships between the conceptual categories and its explanation for health check participation. This process was facilitated by clustering. Clustering is a technique used to help to organize and map up the linkages between categories and sub-categories through diagramming (Charmaz, 2014). This was done by sketching a tentative conceptual map (Appendix J). The visual image of the diagram was useful to sort the linkages and examine the relationships between the categories and subcategories and their relationships with the participants' decision to undergo health checks for CVD prevention. This conceptual map formed the initial framework. The initial framework outlined was continually modified and reconstructed following analysis of subsequent transcripts through the constant comparative method and memo-writing.

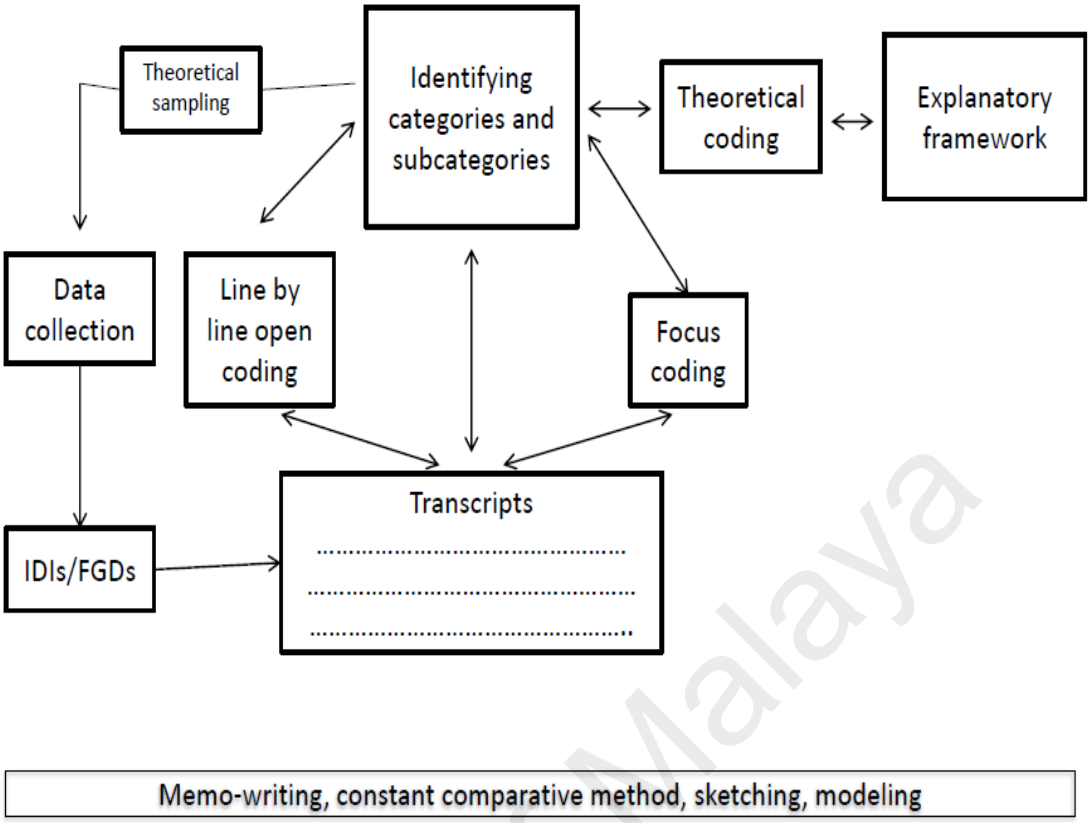


Figure 4.3: The iterative process of data analysis

The data analysis was an iterative process (Figure 4.3). The sequence of analysis did not take on the linear order as listed above. The process of analysis commenced as soon as data collection started. Memo-writing was done after each IDI and FGD to capture the overall impressions of the participants' opinions and ideas of tentative themes arising from the interviews. The first three transcripts were coded with a second coder (SFT) who is experienced in qualitative research and grounded theory approach. As a novice in qualitative analysis, this step was helpful for ATC to gain skills and confidence to carry out the analysis procedures. First, SFT and ATC read through the transcripts several times to familiarize themselves with the data and gain an overall view of the interview. Next, data were analyzed independently using line-by-line open coding. The initial codes were provisional as the researchers remained open to other analytic possibilities and the codes might be reworded to improve their fit to the data. After completing the line-by-line

coding, the findings were discussed between the two coders and differences were debated. In the event of unresolved differences, the original transcript was revisited, discussed and new codes were reassigned. Codes from the three transcripts were then merged. The first three transcripts generated 733 codes. These codes were then consolidated into categories and sub-categories through clustering and memo-writing. The transcripts and summary of the concepts were then read by a third person (my supervisor, EMK) who is an experienced qualitative researcher, to examine fitness of the concepts generated. Again, where the fitness of concepts was lacking, discussion ensued and amendments were made. ATC, SFT and EMK are all trilingual (English, Malay and Mandarin). The transcripts were transcribed in the languages used while coding and analysis were done in English. Following the first three transcripts, all 11 transcripts were coded by ATC and the results were discussed as aforementioned. Theoretical sampling was carried out based on the preliminary results, which provided a direction on the data to be collected for the next interview to have better understanding of the study phenomenon.

The relationships of the categories and sub-categories and modelling process were carried out by clustering, constant comparative method and memo-writing as described above. The explanatory framework was further refined following subsequent data collection, in which the analysis went back and forth by constantly comparing the earlier results with the results of subsequent analyses. Frequent discussions were carried out among the researchers during data analysis. Memos were used as reflexive notes for researchers to reflect on and minimize the effect of preconceived ideas during analysis. Theoretical saturation was reached after analyzing the ninth transcript, where no new properties of the core category were noted from subsequent five transcripts.

4.3.6 Rigour and trustworthiness of the analysis

The quality of the analysis was assured in several ways. First, the grounded theory method was adhered to as closely as possible during the research process. The adherence of the use of techniques and methods proposed by the grounded theory method during the data collection and analysis enhanced the quality of analysis (Elliott & Lazenbatt, 2005). The use of theoretical sampling resulted in appropriate data collection. Constant comparison and memo-writing provided an avenue for constant checking of the coding and data at all levels of analysis, thus ensuring the coding was appropriate at all levels (from initial codes to conceptual and theoretical codes). This in turn enabled the generation of an emergent theory which can represent accurately the respondents' experiences.

Second, the line-by-line coding, grouping of categories and subcategories for the first three transcripts were done independently with a second coder (SFT), and then these were further checked by a third person (EMK), who both SFT and EMK are experienced qualitative researchers. These steps further increased the trustworthiness of the analysis. Subsequent coding was done by ATC alone, but frequent discussions were carried out with SFT and EMK for the analysis of the conceptual categories and development of the explanatory framework.

Third, feedback sessions for member checking were conducted. All the participants were invited for feedback sessions where the concepts regarding the factors influencing the decision-making process were presented. An information sheet of the results was provided to the participants and researcher further explained to participants how these factors influenced one's decision to undergo health checks. Then, the participants were asked if the results correctly depicted their decision-making process. Eighteen participants provided feedback; 15 participants attended six group sessions, two attended

individual sessions and one provided feedback via e-mail. All participants agreed with the results presented and that their opinions had been included in the results.

"Agree [with the results presented], when she [the researcher] presented the results, I thought, I belonged to this category." 48-year-old Chinese, teacher, FGD

"Oh, it's very complete [the results]." 46-year-old Chinese, teacher, FGD

"These [results] reflect what we are." 56-year-old Chinese, teacher, FGD

Fourth, the preliminary findings were presented at several meetings and conferences. The participants included academics from various expertise areas including family physicians, psychologists, nurses, pharmacists, dentists and research students. This served as a peer review process and the feedback was valuable for refining the framework.

4.3.7 Ethical issues

This study had obtained ethical approval from the Medical Ethics Committee of the University of Malaya Medical Centre (20145-274) (Appendix K).

The participation of the participants was voluntary. Written consent (Appendix H) was taken after the participants had read through the participant's information sheet (Appendix G). Participants were encouraged to raise any questions concerned pertaining to the study before signing the consent form. Permission for audio-taping was sought before starting the interview session. Participants were allowed not to answer any questions if they did not wish to during the interview sessions. Debriefing was done at the end of the interview sessions for any concerns raised by the participants during the interviews. All names and places were removed in the quotes when used for results and publications.

4.4 Results

Eight IDIs and six FGDs were conducted in this study with 31 participants involved. Due to the exploratory nature of a qualitative study, the data was rich and many meaningful categories emerged from the analysis. However, in order to answer the research question and stay focused on developing an explanatory framework on how the public decides to undergo health checks, only categories related to the decision-making process are presented in this thesis. To provide the background and put the explanatory framework in context, sections 4.4.1 and 4.4.2 present the demographic characteristics of participants and what the participants understood about CVD and its risk factors. Subsequent sections present an overview of the framework and concepts contributed to this framework. In the Results section, the quotes are translated into English if the language used in the transcripts was different. The translated quotes are marked with * in the result section (refer to Appendix L for the original and translated quotes presented in the Results section). The accuracy of the translated quotes was counter-checked by EMK.

4.4.1 Demographic characteristics of participants

The participants consisted of three major ethnic groups, the Malays, Chinese and Indians from various backgrounds. Details of the demographic characteristics of the participants are shown in Table 4.3. There were more women than men in the study. The interviews with the last two men recruited to the study did not add to further understanding of the decision-making process. Thus, the framework was adequate to explain the decision-making process for both men and women in the study.

Table 4.3: Demographic characteristics of the participants

Characteristics	Total no. of participants (n = 31)	IDI (n=8)	FGD (n=23)
Age range (years)	31-60	33-54	31-60
Age group (years)			
30–39	3	1	2
40–49	12	4	8
50–60	16	3	13
Gender			
Male	7	3	4
Female	24	5	19
Ethnicity			
Malay	8	4	4
Chinese	13	4	9
Indian	10	0	10
Education level			
Primary	7	1	6
Secondary	13	3	10
Tertiary	11	4	7
Employment status			
Private	11	5	6
Government	9	1	8
Self-employed	2	1	1
Pensioner	1	0	1
Housewife	8	1	7
Co-morbidities#			
Yes	17	5	12
No	14	3	11
Experiences in health check participation*	17	3	14
Frequent health check attender	9	3	6
Infrequent health check attender	5	2	3
Never attended health check			

#One or more of these conditions was present: hypertension, hypercholesterolaemia, diabetes, obesity, thyroid disorders, bronchial asthma.
*Frequent health check attender: People who underwent health checks almost annually or more often than annually.
Infrequent health check attender: People who underwent infrequent health checks previously and had no plans to go for a further health check.
IDI: in depth interview
FGD: focus group discussion

4.4.2 Public's understanding of CVD and its risk factors

All participants were aware of heart attack or stroke and its risk factors. They had heard about the disease and risk factors through media, friends, relatives or healthcare providers. Some participants had encountered friends or family members with heart attack or stroke.

4.4.2.1 Public's perception about CVD

CVD was perceived to have great impact on self and family members. These perceived impacts included physical disability, mental stress, loss of family income and death. Some participants perceived stroke to be more burdensome than heart attack as it tended to have long-term implications compared with heart attack which usually ended up with sudden death.

> " ... stroke will lead to long term problem, it will cause burden to others ... heart disease will die early, and it attack occurs, that will be it, it will not bring to others too much troubles.. ...."* 48-year-old Chinese woman, teacher, infrequent health check attender, FGD

Other participants viewed people as not being as concerned about CVD compared to cancer, as it was viewed to be less serious and was treatable and controllable.

> "I believe everyone is more worried about cancer. So I feel what you said about stroke, those heart diseases, these they are probably not so bothered about, because stroke can be mild or serious, and he can still be alive, so they may not be too concerned about it,…….otherwise if they occasionally have chest pain, they may feel that there are medication that can be used to treat, to control. But for cancer, till now, there is still no real treatment found, to cure

…”* 45-year-old Chinese women, account executive, frequent health check attender, IDI

CVD is also viewed as burdensome and treatment cost is expensive.

“Stroke also send you helpless and then wonder the heart attack can be sudden, can be you know. Anyhow all those, in term of the medications is going to be very expensive, the treatment are all expensive.” 50-year-old Malay woman, senior hospitality manager, frequent health check attender, IDI

4.4.2.2 Public’s perception about the risk factors and causes of CVD

The public perceived increasing age, having co-morbidities such as hypertension, obesity, hypercholesteroleamia, diabetes, presence of family history of CVD, unhealthy lifestyle (smoking, unhealthy diet, lack of exercise) and stress as risk factors of CVD. However, some participants were unsure about the risk factors but get ideas from others.

“I don’t know, some says your family got heart disease, your risk is higher.” 60-year-old Indian man, laboratory assistant, frequent health check attender, FGD

Though the aforementioned factors were thought to contribute to CVD, some participants were perplexed about why CVD occurred to someone without risk factors.

“I have an example xxx, her health is okay, then she suddenly had a stroke, and she is just approaching 50 years old, [she is] thin, every time people talk about obesity and whatever, in fact, ... I find many diseases happened to younger people now. .. One cannot say about a marker as before, one cannot say if one has this [risk factors] you will get this [disease]. It seems that now you cannot say who [is the one], the age group, the body shape …”* 47-year-old Chinese woman, teacher, frequent health check attender, FGD

4.4.2.3 Perception of absolute global risk score

Participants were not aware of the absolute global cardiovascular risk scores. They received advice on their CVD risk from health care providers based on individual risk factors.

> "So far, but they have said, you are at high risk. That's they told me because you are having both diabetes and blood pressure…." 52-year-old Indian woman, library assistant, frequent health check attender, FGD

> "Oh, it will not mention about percentage, [it] would only tell you, you will have the condition [heart disease]. He [doctor] did not talk about percentage. He only said this [high cholesterol] would affect, would bring about what kind of disease. He did mention, reminded me about it."* 45-year-old Chinese woman, account executive, frequent health check attender, IDI

There was a wide range of percentages the participants perceived for various risk levels. For example high risk was quoted to be from any risk to 70%. Some participants found it difficult to appreciate the concept of ten-year global cardiovascular risk as the figure or percentage was too abstract to grasp and it was difficult to relate future incidences to current context.

> " … I don't think of all this [10-year risk] in future, ten years whether I get a heart attack…" 60-year-old Indian man, laboratory assistant, frequent health check attender, FGD

> "In fact, just now we discussed, if it is over 50% [10-year cardiovascular risk] I feel it is a risk. Because it is already over half. But we may not be sensitive to the figures, because it is very abstract."* 45-year-old Chinese woman, account executive, frequent health check attender, IDI

Some participants perceived the presence of risk factors informed them about their risks, thus it did not matter about the percentage. Some participants did not want to have any risks at all, viewing any percentage as risks.

> "…Whatever it is, once you have the risk, then you're already going towards [CVD] ahh…So you think you already have the trigger. So no matter what they tell your… or what type of percentage it doesn't matter." 50-year-old Malay woman, senior hospitality manager, frequent health check attender, IDI

> "If possible [I] do not want. Whatever percent, be it one percent, two percent, if possible [I] don't want… If it can, be zero percent. If possible, and there is no risk at all, if possible."* 52-year-old Malay man, administrative assistance, infrequent health check attender, IDI

Knowing about the risk score and risk level could have an impact on individuals. The acceptance and perception of percentage and risk level vary among individuals; some perceived positively to the information, which could alert them for early prevention.

> "I think I want to know [the 10-year risk level], because I feel that the benefit of knowing is that whether it is good or bad , you can prepare for it, and you can do more for yourselves."* 47-year-old Chinese woman, teacher, frequent health check attender, FGD

Some had a negative perception on the information as they felt psychologically burdened with the results.

"If that one [10-year risk] they tell you, you will sick more often. Tomorrow you will sick already." 50-year-old Indian woman, clerk, frequent health check attender, FGD

Though knowing the risk could have some impact on positive behaviour for prevention, sustainability of this behaviour is a challenge.

"Yes [feel want to do something], improve ourselves further *lah* for our health. So we need to take care of diet, we need to take care of health. We will follow *lah* initially, but later we will become lazy again. *Ha, ha, ha*."* 52-year-old Malay man, administrative assistant, infrequent health check attender, IDI

Participants viewed doctors as needing to assess the readiness of an individual for accepting the results of the 10-year CVD risk before disclosure.

"Actually I feel the doctor may ask the patient whether he wants to hear the truth. That is, will he want to accept it? Because if he is not prepared to accept it and you tell him, it will only make his condition worse, because his pressure is already great. If he can accept it, then maybe he needs to be tested first before telling him the actual percentage, it would be better this way."* 48-year-old Chinese woman, teacher, infrequent health check attender, FGD

The public was aware of CVD and it appeared to be a concern to many people, though the extent of concern varied among individuals. Though the public had some ideas about CVD risk factors, there was confusion regarding its causation. The occurrence of CVD was often perceived to be sudden and unpredictable. The participants had fair knowledge about the risk factors. However, an individual only perceived themselves at risk if they perceive those factors are significant and applied to their condition. The results of participant's perception of CVD risk are further illustrated in section 4.4.4.1. The 10-year

cardiovascular risk was a new concept to the participants. The public varied widely in their perception of percentages for different risk levels of the 10-year CVD risk. It would be challenging when using this in risk communication.

4.4.3 Overview of the explanatory framework

Based on the results of this qualitative study, a conceptual framework was constructed as shown in Figure 4.4, which illustrates the public's decision-making process to undergo health checks for CVD prevention.

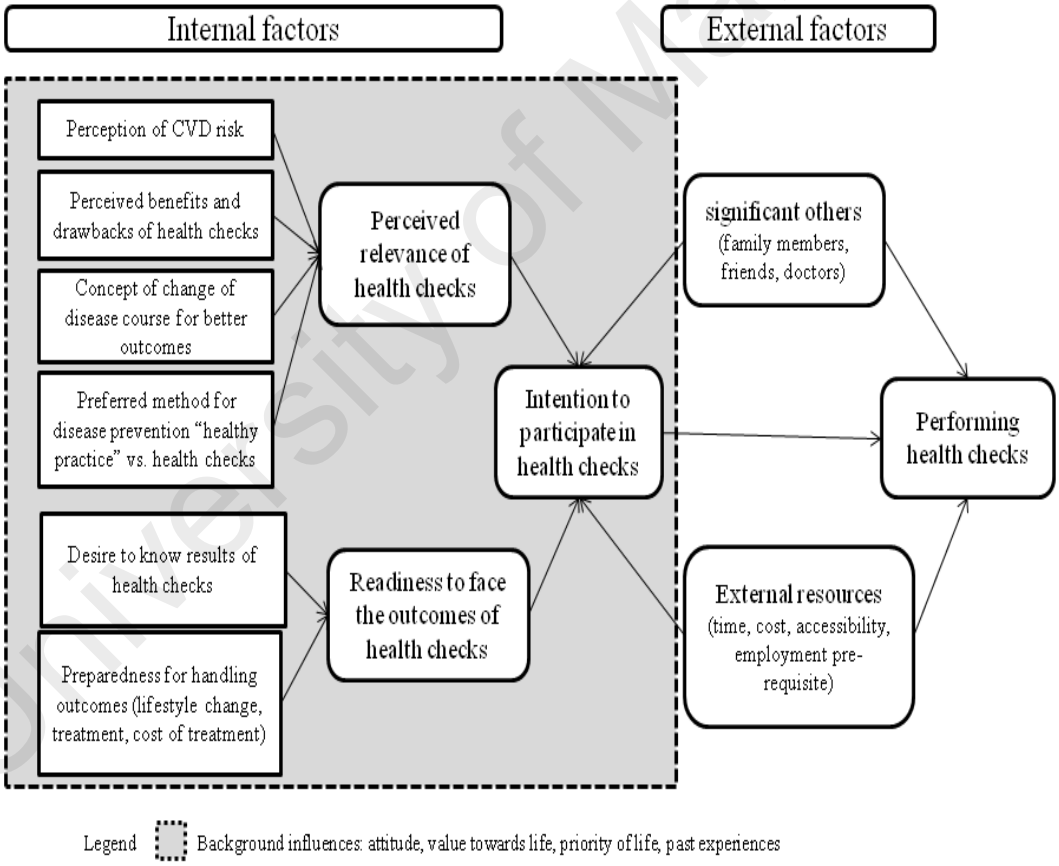


Figure 4.4: Public's decision-making process to undergo health checks for CVD prevention

There are internal and external factors that influence an individual's decision-making for health checks. An individual would consider these factors before deciding to undergo health checks for CVD prevention. Weighing of these factors during the decision-making process is a cognitive process. The main factor in people deciding to undergo CVD prevention health checks was the degree of intention to participate.

The intention to participate in health checks was influenced by internal factors: the interplay between perceived relevance and the individual's readiness to face the outcome of health checks. The level of relevance an individual perceived health checks was based on their perception of CVD risk, perception of benefits and drawbacks of health checks, concept about whether the disease course can be changed for better outcomes and their preferred method for disease prevention. The readiness to face the outcome of the health checks was determined by an individual's desire to know the result of the health checks and preparedness for handling outcomes arising from health checks. In addition, an individual's attitude, personal value towards health, life goal and life experiences could influence these factors aforementioned and thus have indirect roles in influencing one's intention to undergo health checks.

External factors, such as the influence of significant others, and resources, such as accessibility to health care facilities, time, venue of the health checks, as well as cost of screening tests could modify the intention and realization to perform health checks.

This model explains the decision-making process for an individual at each episode of decision-making. Each decision to undergo health checks depends on the weightage one places on the various components of the framework at a given time. It is a dynamic process, for example, previous health check experiences influence the weightage placed on subsequent decisions to undergo health checks.

4.4.4 Perceived relevance of health checks

Perceived relevance of health checks was one of the two key internal factors that influenced the process of decision-making. The public's perception of the relevance of health checks was a net gain in health benefits from undergoing health checks. For health checks to be seen as relevant, individuals would have to perceive themselves to be at risk of CVD and have the intention of improving their chances for a better outcome. Health checks are perceived as a preferred strategy in disease prevention in addition to lifestyle modification or/and use of complementary medicine.

4.4.4.1 Perception of CVD risk

The perception of being vulnerable to CVD depended on an individual's stance on CVD risk factors, such as increasing age, presence of family history, unhealthy lifestyle and presence of co-morbidities such as hypertension and hypercholesterolaemia. The use of 'I' in conversations denoted internalisation of the risks.

The perceived risks of CVD differed between age groups. Older people viewed age as a CVD risk factor, but younger people viewed a stressful lifestyle as a risk.

> "I personally think there is a need for it [health checks], especially my age is older, 50-odd years old, so I felt I should have, earlier check…"* 56-year-old Chinese woman, teacher, frequent health check attender, FGD

> "If for me *lah*, it [the risk] is more on stress. When stress, you can easily get hypertension. If you have hypertension, of course it is easy for you to have heart problem…"* 33-year-old Malay woman, receptionist, infrequent health check attender, IDI

On the other hand, aging may not be viewed as a CVD risk but rather as a natural process of life.

> "No, I think this [father's history of heart attack] is nothing to do with me, because they are old, they would have it [heart attack]. Like my mum, she has… high blood pressure, diabetes, she has everything, everything."* 54-year-old Chinese man, contractor, never attended health checks, IDI

People also felt a health check is only necessary when one is symptomatic. Otherwise, they did not feel the necessity for health checks.

> "Why don't I want to go [health checks] *ah*? I have nothing wrong [no symptoms], why do I need to go? I think I have nothing wrong, why bother going?"* 49-year-old Chinese woman, school bus driver, infrequent health check attender, FGD

> "That is, that is because of my neck swelling [thyroid]... at that time I went to see the doctor, since then I began to go for checks every year… So, it's because of my neck swelling, it's like this, I will continue like this to go for body check."* 42-year-old Chinese man, supervisor, frequent health check attender, IDI

The relationship between perceived health check relevance and perceived risk of CVD was not straightforward. The relevance of health checks depended on the perceived risk for CVD and the weight assigned to the risks. For example, in one focus group, a participant felt that she was at risk of CVD due to her lifestyle, but did not feel the urge to undergo health checks as she did not experience any discomfort. Thus, having symptoms was perceived as more relevant for health checks than having a CVD-risky lifestyle.

"I think yes [have the risk of getting CVD], because our eating habits, our environment is not so healthy, so I think there is [risk]… The main problem is, the main problem is [to go for health checks], I should say, it's because there is no serious problem encountered yet."* 48-year-old Chinese woman, teacher, infrequent health check attender, FGD

The degree of relevance changed with circumstances. The perception of risk could be enhanced by the occurrence of a significant event, such as death among friends, which served as a trigger for the relevance of health checks and participation therein.

"We both talk about it and… most of our friends are like 40, 42, and 45. Sometimes they passed away you know. Sometimes we are so shock, heart attack, so *ah* we must, *errr*, better do. So my husband said, wow we better do it [health check]." 47-year-old Malay woman, housewife, never attended health checks but plans to attend, IDI

4.4.4.2 Perceived benefits and drawbacks of health checks and possibility of a change in the course of CVD outcome

The perceived relevance of health checks depended on how individuals weighed its benefits and drawbacks. The benefits considered included personal awareness of health status, sense of security in terms of health, early detection of risk factors and diseases and the opportunity for disease prevention and treatment. These benefits are linked closely with one's perception about the possibility to change the course of CVD outcome if the risk factors are managed early.

"...my rationale for blood test, I think… if the disease has happened to me, actually I can't do anything… So, it is better to know earlier than later. If I know early I can decide what to do, I can still do something about it, isn't it? If know it later,

then it'll all be left to fate..."* 47-year-old Chinese woman, teacher, frequent health check attender, FGD

On the contrary, if an individual believed that life was predestined and there would be no possibility of changing the course of CVD outcome, they would not undergo health checks.

"…you go to see specialist *lah*. I heard from my friend, nearly a hundred plus ringgits *lah*, medical check-up *lah*, everything *lah*, give you to know, answer everything (you) got, but what for, if you know, how? …Don't waste your time, you can eat how much, drink how much, it's given by God. It's true. I don't feel shameful to say this. Seriously I tell you, it's better not to think too far ahead *lah*. Let's live day by day. If you can't live beyond the day, that's decided by the god, not you …He [the god] wants you to die; you can't avoid death, isn't it?"* 54-year-old Chinese, contractor, never attended health checks, IDI

In addition, an individual's perceived drawbacks of health checks were barriers for one to undergoing health checks. The drawbacks of health checks include perceived limitation of health checks, where a normal blood test does not ensure the absence of disease, and burden of health check procedures such as having to fast overnight for performing the blood test.

"Well, for the price, six hundred plus is affordable. However, I feel that if paying such a sum of money and it seems not to offer protection towards pain relief or reduction of the disease, no ..."* 46-year-old Chinese woman, teacher, infrequent health check attender, FGD

"He [the doctor] only wants to check the next day, have to fast [overnight], then only can go [for blood test]."* 31-year-old Chinese man, labourer, never attended health checks, FGD

4.4.4.3 Preferred method for disease prevention: 'healthy practice' vs. health checks

Some participants preferred to adopt healthy lifestyle practices such as sleeping hygiene, exercising, following a healthy diet, reducing stress, or using alternative medicine such as qi gong and tai chi over health checks for disease prevention.

"For me, I am very reluctant to do health checks. Because I know this, our body has the ability to heal on its own, and this is my preferred way. Not going for health checks… we have learned what he said about "longevity practice". We believed this will slow down the degenerative process, then it made the body function rejuvenates… this is what I liked the most, so I'll learn this."* 48-year-old Chinese woman, teacher, infrequent health check attender, FGD

Others believed that undergoing regular health checks would inform personal health status and prevent disease.

"Annual is just blood pressure, no I mean blood test. Then for me to wait for the next year will be too late. Better, I mean, I have a frequent check. Anything I can prevention earlier." 50-year-old Malay woman, senior hospitality manager, frequent health check attender, IDI

4.4.5 Readiness in facing health check outcomes

Readiness to face the outcomes of health checks is the other key internal factor influencing decision-making processes to undergo health checks. It refers to a person's mental preparedness to deal with health check outcomes such as the results, diagnosis, the need for medication or lifestyle modification and the cost incurred from management

following outcomes of health checks. The stage of readiness to face health check outcomes influenced a person's intention to participate in health checks.

In an IDI, a participant viewed strongly that one should only undergo health checks if one is ready to accept the outcome of the checks.

> "…you put it [abnormal results] under [the] table, it is better not to let me know. If it is a little [abnormal]... ah, that is ok. I think it is better not to let me know, because we will not feel the pressure then, need to take medicine, headache [stressful], we have work to do. *Oh.* Then, we have to do this and that [have to follow the advice in disease management]. Some medicines cause sleepiness, right? That's why, we have to work, we cannot [afford to fall asleep] … let me tell you, you have to standby [be prepared], if the doctor tells you, what your problem is, you must accept, that's all. Go for health checks, you must accept [the outcomes], believe. If you do not believe, don't go."* 54-year-old Chinese man, contractor, never attended health checks, IDI

An infrequent attender of health checks was not ready to accept the diagnosis and hence was non-compliant to treatment.

> "After seeing the doctor, gave me medicine. I follow *lah*. It should be every day. But sometimes I take it today, tomorrow I don't. I am lazy to think about this, I think I don't have disease."* 52-year-old Malay man, administrative assistant, infrequent health check attender, IDI

In contrast, participants who were willing to undergo health checks showed their desire to know their health status and were ready to act on their results for prevention of CVD.

"... Initial trigger [abnormal result from health checks] I will sense already something wrong. Then I quickly do whatever necessary. Control on my food. Cut down on this and that then drink more plain water. And then workout and all that thing. Much more extensive than the normal one." 50 year-old-Malay woman, hospitality manager, frequent health check attender, IDI

4.4.6 Background influences

Attitude, personal values on health, life priority, life goals and life experiences are background influences that influenced the intention to undergo health checks indirectly (Figure 4.4). These factors are dynamic and influence various aspects on perception of relevance of health checks and readiness to face the outcomes of health checks. For example, a middle-aged woman who had a life goal of caring for and raising her young children valued the importance of health for her to carry out this responsibility. This had encouraged her to take care of her own health and thus she felt that health checks are beneficial and was ready to accept subsequent management following health checks to maintain her health.

"...because our children were still young. We thought, *aiyo*, how are we going to look after them, we have to take care of ourselves first, then we can see them growing up. If the two of us are not around [die], like what you said, getting stroke, or getting whatever, who is going to look after them?"* 54-year-old Chinese woman, housewife, frequent health check attender, focus group

4.4.7 External factors

The intention and decision to undergo health checks could be modified by external factors. These were environment circumstances that affected one's decision to undergo health checks. The external factors involved were the views of significant others and

external resources such as accessibility of health checks, convenience of time and venue for health checks, and cost.

4.4.7.1 Significant others

Significant others were people who were perceived as important to an individual. These include one's spouse and other family members, friends, peers or health care providers. The views of significant others could have positive or negative impacts on one's intention to undergo health checks. Significant others have a potential impact on internal factors because perception of health might be exchanged resulting from the information received from significant others.

(a) ***Doctors***

Doctors play a role in influencing people's decision-making to undergo health checks. The trust and relationship with the doctor is one of the factors which determine whether one took up invitations or recommendations by the doctor to undergo a health check.

> "Oh, that's because I have always been seeing this doctor only, because he knows my problems, he will know better. whatever he said is [I am] OK, ... I see him every year, …He told me the best is to go see him every year, because he told me I have obesity and it is best to check annually."* 42- year-old Chinese man, supervisor, frequent health check attender, IDI

People were more likely to go for health checks if doctors invited them. Some participants found that doctors were not proactive in taking the initiative to invite the public for health checks; the doctors were usually focused on acute care only.

> "…if they invite me [for health check] then I think I will do it la. If they invite *lah*. But sometimes doctors, but most of the clinics I went to, they don't invite,

and if you ask, he said ah you better go to the hospital *lah* and do it." 47-year-old Malay woman, housewife, never attended health check (plans to go), IDI

It was important for doctors to explain the reasons for invitations to health check participation to encourage the public to undergo health checks.

"I will ask, I will definitely be asking the doctor, why will you introduce me to this package [health check]? Is it because you have found something wrong with me? If so, I will definitely go [for the health check]."* 48-year-old Chinese woman, teacher, infrequent health check attender, FGD

(b) ***Family members***

Family members such as spouse, siblings and children could influence one's decision to undergo health checks. Family members who had undergone health checks would usually encourage other family members to participate. Some participated in health checks to please their family members.

"... sometimes my brothers will mention about them having some health checks. Then I'll ask my sister to go together … we will remind each other in my family [to undergo health checks]."* 47-year-old Chinese woman, teacher, frequent health check attender, FGD

"For my children's satisfaction, I went for check, that's the reason I went for check."* 51-year-old Indian woman, supervisor, infrequent health check attender, FGD

However, people might not be influenced by their family members if their intention to undergo health checks was low.

"For example, my husband has done it [the health checks], he does it once a year and spend RM600 plus for it. He kept asking me to go together, but I am not bothered, so I did not go."* 46-year-old Chinese woman, teacher, infrequent health check attender, FGD

(c) ***Friends and peers***

Colleagues and friends usually shared their life experiences, including health checks. Participation of a friend in health checks could motivate others to undergo health checks too.

"Because I am over 40 years old already, and I have not done this health checks yet. ... many of my friends had done these blood tests."* 45-year-old Chinese woman, executive officer, infrequent health check attender, IDI

"At the beginning, in fact, when the earliest [health check], was the same as them, I went with friend…"* 47-year-old Chinese woman, teacher, frequent health check attender, FGD

Although many made decisions that were influenced by people around them, others did not. In an IDI, a participant said he was not influenced by others with respect to his decision-making regarding health checks.

"Yes, yes [is my decision]. Nobody influenced me. Only myself. I do not want to blame [others] because I be myself, that's all. So anything happen on me is my fault."* 52-year-old Malay man, administrative assistant, infrequent health check attender, IDI

4.4.7.2 External resources

External resources were aids or supports which could draw from the environment. These included financial support, accessibility and convenient time.

(a) ***Cost***

Cost is a factor one considered when making decisions to undergo health checks. Availability of financial support from the work place or family members can facilitate participation in health checks. Free health checks or discounted health checks might also increase one's intention to undergo such checks.

> "If they asked me to go and check, I'll go. After all is nothing, I pay nothing, just spend some time only. What is wrong? University [employer] is also encouraging to go. University's [employer] arrangement all this." 50-year-old Indian woman, clerk, frequent health check attender, FGD

For people who need to pay out of pocket for health checks, the decision for participation would depend on their affordability and their priority. The spacing of health checks might be changed depending on their ability to pay for these checks.

> "I have to consider my budget next year too... I need to know the budget, you see. Recently, this year for example, going to my panel clinic [husband's panel clinic] also have to pay first. Like me, he said medical check-ups cost more, and you have to pay..."* 43-year-old Indian woman, housewife, infrequent health check attender, FGD

However, some people did not view cost to be an issue, as they could seek health checks from government health clinics where payment was minimal (USD0.30).

(b) ***Time***

The amount of time required for health checks and the convenience of appointment are among the important factors for the consideration to undergo health checks.

> "That is to say the location, the time, should not need to wait for too long. If doing a check has to wait for two or three hours, everybody would not want to have the check."* 45-year-old Chinese woman, executive officer, infrequent health check attender, IDI

> "I have, like GP [general practitioner] you can go on Sunday. I can do at night. So even you say ok, I want your blood pressure next morning, that's why I will just go to clinic in the morning and then go to work. So it is my time. Instead of they fix the time." 50 year-old-Malay woman, hospitality manager, IDI

Private clinics were preferred for some participants, compared to government settings, as the waiting time was short and the clinic opening hours and appointment was convenient. One would weigh the cost and time needed to spend for health checks in choosing the setting to perform the health check.

> "We go to the one that is comfortable. If it is private, it is more comfortable *lah* because it is faster. If it is this government hospital, we sill indeed think ten times first *lah* [to go for the check]."* 52-year-old Malay woman, kindergarten manager, frequent health check attender, IDI

> "You think just now you mentioned about time and money. I think I will be more inclined to consider the time factor. Because it gave me the impression that if you go to the group type [health check], you also have to wait for a long time, there are also a lot more people, so I prefer to walk in, [appointment] it is more flexible

in terms of time."* 47-year-old Chinese woman, teacher, frequent health check attender, FGD

Time constraint at work and at home is a barrier for health checks. These activities took priority over health checks.

"To leave things to go for check. There are things to do, how to go for check?"* 49-year-old Chinese woman, school bus driver, infrequent health check attender, FGD

"Yes, like this work, I only finished work at 4 o'clock. When I go Back home I've many children, six children. That's why. I have to cook. At night I have to teach the children. So, it's like that *lah*, there is so little time."* 43-year-old Malay woman, kindergarten headmistress, never attended health checks, FGD

(c) ***Accessibility***

Accessibility to health checks referred to whether an individual was able to easily reach the health check facilities. The available of nearby private or public clinics and the outreach of the health check team to the work place or housing estate could facilitate participation in a health check. This reduced the transport problem of some participants, who need to rely on others to bring them to the health check.

"... recently, I do it every year, when they [the health check team] come to school, I will do ..."* 46-year-old Chinese, teacher, infrequent health check attender, FGD

4.4.7.3 Relationships between degree of intention and external factors

The influence of the external factors varied with the degree of intention one had to undergo health checks. Some people had the strong intention of undergoing health checks, and they would do so regardless of external factors.

> "No [appointment], about a year I will go for checks. I also keep the report *lah*. But the doctor says do not to waste money. He said you come around one and a half years; I said never mind, never mind, I will go for checks."* 34-year-old Chinese man, labourer, frequent health check attender, FGD

Some participants who had weaker intention to undergo health checks would participate if the health checks were readily available, accessible, convenient, at reduced cost and if they had peer accompaniment.

> "… when he [health checks team] came here, I asked my colleagues whether they want to go together for checks. Because for me, I don't go for yearly check, although I know it is best to do it once a year, but I thought I won't bother to go. Now that he is here, and there are colleagues here, must go together [with colleagues], to take blood, *ha ha*, then I will go just this."* 48-year-old Chinese woman, teacher, infrequent health check attender, FGD

> "If there is a promotion, there is a package [promotion] I will go for checks directly."* 46-year-old Chinese, teacher, infrequent health check attender, FGD

Nevertheless, for some participants, accessible and free health checks would not persuade them to attend the checks. A participant who had been given a free voucher did not utilize this privilege as she believed that her current health was not problematic.

"No [not going for health checks]. I do not feel anything [symptoms], I feel there is no problem. I did not go [for health checks]."* 43-year-old Malay woman, kindergarten headmistress, never attended health checks, FGD

Thus, the lack of relevance of health checks appeared to contribute to a low degree of intention to undergo these checks in this case, and this was not modified by favourable resources.

4.4.8 Intention to participate in health checks

The intention to participate in the health checks refers to the desire or wish of an individual to undergo health checks. The degree of intention is reflected by the strength of the desire of an individual to undergo health checks. It reflects the individual's estimate of the likelihood of performing the health checks. The strength of the desire to act can be expressed as follows:

" If they asked me to go and check, I'll go…" 50-year-old Indian woman, clerk, frequent health check attender, FGD

"For me, I am very reluctant to do health checks…"* 48-year-old Chinese woman, teacher, infrequent health check attender, FGD

As discussed in the above section, the intention of health checks was directly shaped by an individual's perceived relevance of health checks and their readiness to face the outcome of such checks. The level of intention for health checks was contributed by the degree of relevance one perceived and the level of readiness one has for the health checks. It is modifiable by the external factors.

4.4.9 Performing health checks

This refers to the act of undergoing or not undergoing health checks, which is the outcome of the decision-making process. The decision made is the result after weighing and balancing the factors involved in relation to the context each individual faced during the decision-making process.

4.5 Discussion

4.5.1 Summary of findings

From this phase II study findings, a conceptual framework was developed to provide an overview of the decision-making process in the participation of CVD prevention. The decision to undergo CVD health checks was multi-factorial. The main factor was an individual's intention to undergo health checks, which was a result of two key internal factors: the perception of relevance and the state of readiness to act on or cope with the findings of the checks. The intention of health checks is subsequently modified by external factors such as influences from significant others, as well as time, cost, accessibility and health care facilities. The final decision is then made by weighing all these factors depending on the weightage one placed on these components.

4.5.2 Comparison of the conceptual framework developed with existing theories

4.5.2.1 Health belief model

The concepts developed in this framework, which contribute to the perception of the relevance of health checks: the perception of CVD risk, the possibility of a change in CVD outcomes and the perceived benefit of health checks, are analogous to the concepts mentioned in the health belief model. In this study, it was found that individuals who underwent health checks were those who perceived themselves to be at risk of CVD, perceived health checks as beneficial for early detection and treatment and believed in

the possibility of CVD prevention and treatment. However, the health belief model does not cover the other concepts of the conceptual framework in this study.

4.5.2.2 Integrative model for behavioural prediction

Many concepts of the conceptual framework developed in this study are similar to the concepts in the integrative model. The advantage of the conceptual framework is to provide details of the contents of the concepts, which the extant theory (in this case the integrative model) is lacking. For example, the attitude towards the behaviour in the integrative model is reflected by the perceived benefit and drawbacks of the health checks. In an extension to this extant concept, the conceptual model developed from this study emphasizes perception of CVD risk, preferred methods for disease prevention, and perception of possible change in disease course with health checks. Also, the significant others such as doctors, friends, spouse or relatives could influence intention for health check participation and these social influences resemble the perceived social norms in the integrative model, which could motivate or demotivate an individual to undergo health checks. The environmental factors are reflected by external resources, such as financial support from the workplace and the available of nearby facilities or outreach programmes for health checks, whereas self-efficacy is reflected by an individual's ability to find time, money or transport to undergo health checks.

Some part of the conceptual framework from this study could not fit in with the integrative model. The readiness to face outcomes of health checks is not consistent with the cognitive process in the integrative model. This concept is one of the two key internal factors found to shape an individual's intention to undergo health checks for CVD prevention. Issues regarding fear of abnormal results and worrying about change of lifestyle, treatment cost and the side effects of treatments were often raised by those participants who had reservations about undergoing health checks, which suggested the

lack of readiness to face the outcome of health checks. This is an important area, which needs to be addressed, in addition to other aspects described in the integrative model when developing an intervention to improve participation in health checks for CVD prevention.

4.5.2.3 The transtheoretical model of health behaviour change

This model helps to illuminate the concept of readiness to face the outcomes of health checks in the conceptual framework. The precontemplation stage is characterized by those people who were not ready to face health check outcomes, such as fear of knowing the results, and not prepared to accept management following these health checks. They perceived more cons than pros of knowing the outcome of the health checks. As a result, their intention to undergo health checks diminished and they were less likely to undergo such checks. The preparation, action, maintenance and termination stages were reflected by people who were ready to face the outcome of health checks, who wanted to know their health check results and were prepared to act on subsequent management following the health checks. Thus, these people would have a stronger intention and would be more likely to undergo health checks. Nevertheless, this model does not explain other concepts in the framework such as perceived relevance of health checks, significant others and external resources, which can influence one's intention and participation in the health checks.

4.5.2.4 Fuzzy trace theory

In the decision-making process of undergoing a CVD health check, the perception of relevance of the health checks could be represented by the gist of information, which is the result of the subjective interpretation of the information about their perceived CVD risk, the benefits and drawbacks of the health check and the disease concept. If the gist of information was recognized as relevant by an individual, this would probably increase

their intention to undergo a health check. However, the degree of intention would also depend on their readiness for the outcomes of the health check. Thus, the balance of these two factors would determine one's intention to undergo a health check. The fuzzy trace theory illuminates the conceptual framework on how people derived the relevance of health checks. However, this theory is insufficient to explain other concepts in the framework such as readiness to face the outcome of the health check, influence from significant others and external resources. Nevertheless, this theory highlights the need to present the facts in a meaningful way for people to easily extract the gist of that information, and thus facilitate the decision-making process. This idea is very important when framing the health information such as using relative risk or absolute risk in risk communication, in order to convey the gist appropriately to facilitate people in making decisions to undergo health checks for CVD prevention.

In summary, the four extant theories, which are relevant to health behaviour and decision-making, are useful for providing an understanding of the public's decision-making processes to undergo health checks. However, these theories lack substantive contents to apply to local settings. Thus, the conceptual framework developed from the empirical data in this study has the advantage of providing substantive contents in the understanding of the decision-making process which could be targeted in future interventions. This conceptual framework demonstrates the cognitive process of decision-making, which goes well with the integrative model, intertwined with stages of behavioural change that corresponds well with the transtheoretical model.

Each of these four theories could explain some of the concepts of this conceptual framework. The grounded theory approach used in this study allowed the researcher to have a fresh look at the data, and provided the freedom to develop the conceptual

framework which is most applicable to our population, based on the findings which best fit the data.

4.5.3 Comparison with other studies

While other studies have focused on exploring patients' influences, barriers and motivators to participate in health checks (Burgess et al., 2014; Ellis et al., 2015; Harkins et al., 2010; Jenkinson et al., 2015; Nielsen et al., 2004), this study developed a framework to explain how the decision-making process was formed for health checks. The framework illustrates a dynamic process of decision-making for health check participation. It also illustrates the complex interplay within and between each concept. For example, the external factors for decision-making on CVD prevention health checks such as time, cost and accessibility were barriers for health check participation in the literature (Burgess et al., 2014; Ellis et al., 2015; Wall & Teeland, 2004); however, in this study, further exploration of the relationship between these factors has shown that the extent of the barrier is relative to the intention to undergo health checks.

Individuals who perceive health checks as relevant and are ready to handle the outcomes of health checks would have a greater intention to undergo health checks and be less influenced by external factors. On the other hand, individuals with low intention for health checks might not attend despite having favourable resources. This was illustrated by the low uptake rate of the SOCSO health screening programme in Malaysia (16%) (The Star online, 2015), despite members being provided a free voucher and convenient access to health checks at their chosen clinics. Similar results have also been reported elsewhere, where the response rate to free health checks conducted within working hours near the workplace for low-paid government employees in England was only 20% (Abbas et al., 2015). Thus, the intention to undergo health checks is apparently determined prior to being influenced by external factors.

Various factors had been found to be the motivators and facilitators for health check participation in the literature; these include the beliefs about susceptibility to CVD such as having a family history of CVD (Burgess et al., 2014; Jenkinson et al., 2015), having a positive attitude towards health checks and perceived health check benefits such as having an opportunity to know their health status and to identify risk factors early (Burgess et al., 2014; Jenkinson et al., 2015). In this study, these are underlying factors which contribute to an individual's perception of relevance to the health check. In contrast to the literature, which directly relates these factors as motivators, the framework explains that the relevance of health checks for an individual is dependent on the weight one placed on these factors. As the weight perceived for these factors could vary between individuals, the degree of relevance of health checks would vary too between individuals. Expressing this as degree of perception provides an advantage of having a notion of spectrum rather than motivators, which can be misunderstood as discrete factors.

Another reason to undergo health checks found in the literature and this study is when an individual is symptomatic and perceives that he/she is at risk of CVD (Burgess et al., 2014; Ellis et al., 2015; Nielsen et al., 2004). This portrayed a reactive, help-seeking behaviour in seeking health checks. This also suggests a lack of understanding of screening and disease prevention, which is a deterrent in CVD health check participation. Health education through media would be helpful to address this.

This study also found some individuals opted for healthy practices such as getting adequate sleep, exercise, and avoiding stress over health checks for disease prevention and health maintenance; which is consistent with other literature (Nielsen et al., 2004). The autonomy of individuals who opt for healthy practices such as healthy diets and physical activity over health checks for disease prevention and health maintenance should be respected (Nielsen et al., 2004). Health care providers could facilitate informed

decision-making by the public through education and dissemination of evidence and effectiveness of such practices.

The literature reports that people avoided knowing their CVD risk and health check due to fear of identifying health problems and the consequences of health checks (Burgess et al., 2014; Ellis et al., 2015; Groenenberg et al., 2015; Jenkinson et al., 2015; Sinclair & Alexander, 2012). In this study, these fears are indicative of a lack of readiness to face the outcomes of health checks and hence weaken the intention to undergo these checks. The readiness to face the outcomes of CVD health checks is similar to the readiness for change in many health interventions, such as quitting smoking and treating obesity, involving the 5As (ask, assess, advise, agree and assist) approach (The Royal Australian College of General Practitioner, 2015; Vallis, Piccinini-Vallis, Sharma, & Freedhoff, 2013), in which Prochaska's trans-theoretical model (Prochaska, 2008) is applied. A similar model could perhaps be used in the future to assess readiness for health check participation.

4.5.4 Strength and limitations

This study recruited members of the public with a wide spectrum of health check experiences (those who were committed to regular health checks, those who had attempted but did not sustain health check activities and those who had never gone for health checks). The diversity of health check experiences provided a better understanding of the health check process, and helps to develop a more comprehensive framework to explain one's decision-making in health check participation. The framework was grounded in the data and was relevant and fitted the explanations of the participants' decision-making processes. Besides validating barriers and motivators noted in many studies concerning health checks and help-seeking behaviour (Burgess et al., 2014; Ellis et al., 2015; Groenenberg et al., 2015; Jenkinson et al., 2015; Nielsen et al., 2004; Wall

& Teeland, 2004), the framework explained the relationships between the concepts derived from the empirical data on the topic of understanding of CVD and its risks and health check practices on CVD prevention. Its transferability to another setting will require further testing. Our participants consisted of three major ethnic groups and were from a district where health care facilities are widely available. The views from other minority ethnic groups and those from deprived areas, such as the indigenous groups, were not covered. Thus, the framework might not be able to explain the decision-making process of these populations.

4.6 Conclusions

The decision to undergo health checks for CVD prevention depends on an individual's intention to participate in such checks, and this intention is motivated by two internal factors: the perceived relevance of the disease and readiness to face the outcomes of a health check. It can then be modified by the external factors such as the influence from significant others and the availability of resources such as cost, time and accessibility. Interventions to encourage participation in health checks need to address these issues.

CHAPTER 5: PHASE III: CROSS-SECTIONAL SURVEY

5.1 Introduction

The objective of this phase III study is to develop a survey questionnaire to identify significant determinants associated with the public's intention to undergo health checks for CVD prevention, in order to examine the average impact of these factors on the public. A pilot cross-sectional survey was carried out to examine this association. This chapter provides a brief literature review on the rationale to develop a survey questionnaire and to conduct a survey in section 5.2, followed by details of the materials and methods used in section 5.3 and the findings of the internal validity of the developed questionnaire and findings of the cross-sectional survey in section 5.4. The discussion and conclusion are presented in the last 2 sections - 5.5 and 5.6.

5.2 Brief Literature Review

Phase II developed an explanatory model and identified factors which people take into consideration during their decision-making for undergoing health checks. This model is useful in explaining how an individual decides on CVD health checks. However, it does not provide information about the average impact of these factors at the population level (Tong & Low, 2015). A research survey using a questionnaire is useful so that the questionnaire could be tested on a sample population, in order to provide a profile of the determinants among the general public and to determine significant determinants associated with the public's intention to undergo CVD health checks (Creswell, 2009).

To have a proper measurement of the determinants associated with the intention to undergo health checks, items used in the questionnaire need to be able to assess the factors (concepts) intended to be measured (Streiner & Norman, 2008). There were a number of questionnaires used in previous literature for the intention of participating in health checks using a health belief model (Norman, 1993, 1995; Norman & Fitter, 1991; Wilson

et al., 1997) or theory of planned behaviour (Armitage et al., 2002; Norman & Conner, 1996). However the items used were not grounded to our local context and the concepts measured did not cover all the factors found in the phase II study. Thus, it is appropriate to develop a questionnaire based on findings from the phase II study to reflect all factors found that influenced one's decision-making to undergo health checks. It is hoped that this survey could provide insight about the significant determinants associated with the general public's intention to undergo health checks, and this result could help guide the development of strategies targeted at the population level for promoting health checks for CVD prevention.

5.3 Materials and Methods

5.3.1 Conceptual framework

The conceptual framework for phase III was constructed based on the model developed in the phase II study. The factors examined in this cross-sectional survey were as follows:

1. Public's readiness to face outcomes of CVD health checks, which included the following two concepts:
   a) public's readiness to know the results of CVD health checks
   b) public's readiness to handle the outcomes following CVD health checks
2. Public's perception of relevance of health checks for CVD prevention. These included the following five concepts:

a. Believe that the course of CVD can be changed for better outcomes
b. Perceived self at risk of CVD
c. Perceived benefits of CVD health checks
d. Perceived drawbacks of CVD health checks
e. Preferred method for CVD prevention (healthy practice vs. medical measures)

3. External barriers such as accessibility to the CVD health checks, time and cost factors.
4. The influence of significant others such as doctors, family members, friends and employers to undergo CVD health checks.

The dependent variable was the intention to undergo health checks for CVD prevention.

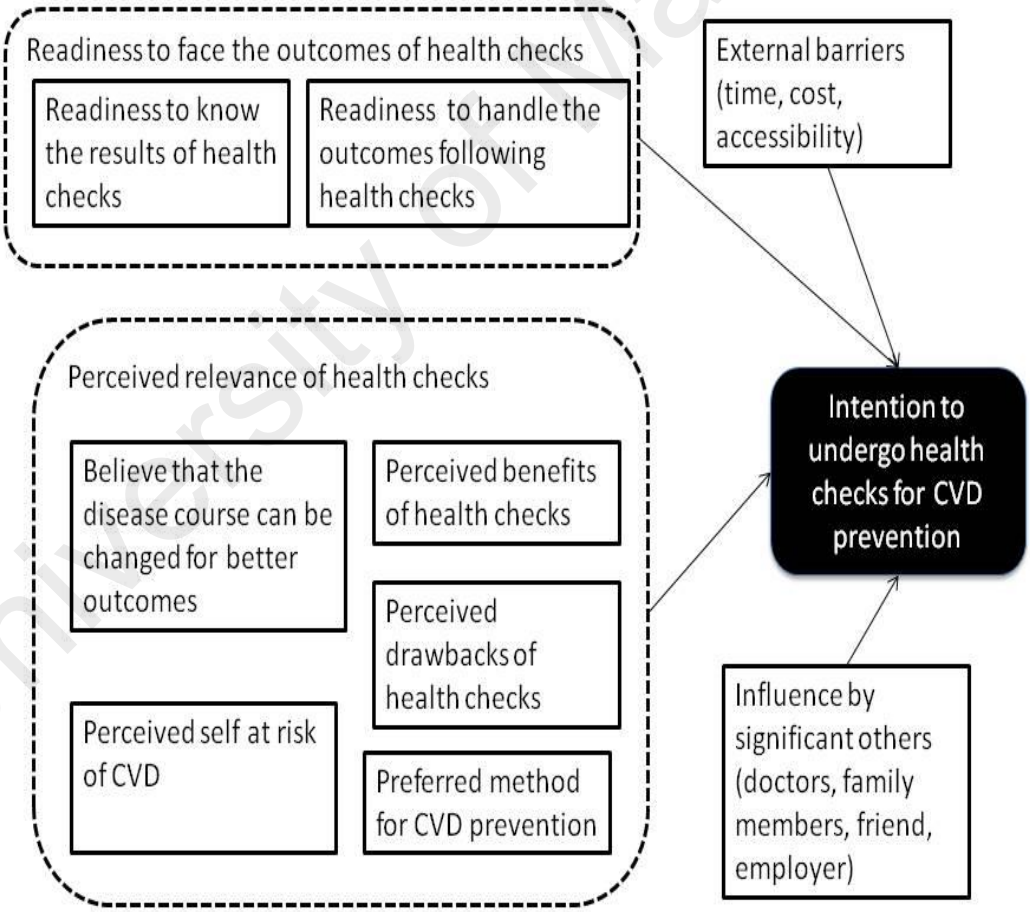


Figure 5.1: Conceptual framework: factors influencing public's intention to undergo health checks for CVD prevention

5.3.2 Study design

Phase III was a cross-sectional questionnaire survey using mall intercept interviews (Zikmund, Babin, Carr, & Griffin, 2010). This method was chosen as it allowed the researcher to recruit the public from various backgrounds, who were the population of interest in this study.

5.3.3 Study population

The participants were the public who fulfilled the following inclusion criteria:

1. Malaysian nationality aged 30 years and older. The age group is consistent with the Ministry of Health recommendation for screening of risk factors of cardiovascular diseases (Institute for Public Health (IPH), 2008).

The exclusion criteria were:

1. Those with known history of stroke or coronary heart disease.
2. Those who could not understand the Malay language (the Malaysia national language).

5.3.4 Sample size

The sample size was calculated by considering the sample required for exploratory factor analysis and regression model. Calculation of sample size was done for each analysis and the one with the bigger sample size of these calculations was taken as the study sample size.

The sample size estimated for the exploratory factor analysis was based on the rule of thumb of five participants for every item (Costello & Osborne, 2005; Floyd & Widaman, 1995). This gave an estimated sample size of 180 participants for the 36 items included in the questionnaire for factor analysis.

The minimal sample size for the logistic regression model based on the work of Peduzzi et al. was calculated using the following formula (Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996):

$$N=10k/P$$

Where k=number of independent variables (9 independent variables were examined in this model as describe in the conceptual framework)

P=smallest of the proportions of negative or positive cases in the population

(There was no local study on the intention to undergo health checks. Thus, P was estimated from the uptake rate of medical check-ups from the Malaysia National Health Morbidity Survey (Institute for Public Health (IPH), 2011b), which potrayed the general population. The uptake rate reported was 37.8% (95%CI 36.7 % to 38.8 %). Thus, P was estimated to be 0.367.

The required minimal sample size for logistic regression was 245. An additional 30% of the calculated sample size was added to account for possible missing data. Thus, the sample size required was 318.

5.3.5 Setting

This cross-sectional pilot survey was carried out in a hypermarket selling grocery and household products to the surrounding communities. It is located at Cheras, Klang Valley, which is an urban area surrounded by housing estates. There are health facilities such as private and public primary care clinics available in the area. The hypermarket was selected purposively in view of the wide variety of population it covers. The housing estates surrounding this hypermarket consisted of a mixed population with ranges of

socioeconomic background and this allowed the researcher to recruit the public from various backgrounds for this study.

5.3.6 Survey instrument

A questionnaire was developed for this phase III study. The language used was Malay (Bahasa Malaysia), as this is the national language and the commonest language used to communicate among various races in the country.

The questionnaire was divided into four sections as follows:

1. Part I was about the participants' socio-demographic information such as age, gender, ethnicity, highest education level, marital and working status. It also included participants' history of CVD risk factors (diabetes, high blood pressure, high cholesterol, overweight or obesity, smoking and family history of heart attack or stroke) and their awareness of stroke and heart attack. The operational definitions of the variables are shown in Table 5.1.

Table 5.1: Operational definition for the socio-demographic variables

Variable	Operational definition
Age	The age at year 2016.
Gender	Male or female as reported by the participants.
Ethnicity	Malay, Chinese, Indian or other ethnicity as reported by the participants.
Highest Level of Education	
Tertiary	Had qualification of diploma, degree or above.
Secondary	Had attended secondary school (Form one to form six or pre-university)
Primary	Had attended primary school (Standard one to standard 6).
No formal education	Had not attended any formal education.

Table 5.1, continued.

Variable	Operational definition
Marital status	
Married	Those who have a spouse.
Divorced /separated	Those who had terminated marriage or split-up with his/her spouse.
Widow/widower	Those whose spouse had passed away.
Never married	Never married before.
Working status	
Yes	Those who have a job.
No	Those who are unemployed, housewife or pensioner.
Occupation	
Professional	Jobs that require special qualifications and education e.g. doctor, engineer, scientist, pharmacist, teacher, manager, social worker, director, etc.
Skilled worker and clerical worker	Jobs that require special skills or training e.g. artist, clerk, mechanic, supervisor, businessman etc.
Semi-skilled workers	Jobs that require some skills and knowledge to carry out the work with the help of a machine or simple tools e.g. farmer, plantation worker, factory worker etc.
Non-skilled worker	Jobs that require no special training e.g. labourer, maid, taxi/bus/lorry driver, casual worker etc.
History of CVD risk factors	Presence or absence of factors associated with an increased likelihood of CVD such as diabetes, high blood pressure, high cholesterol, overweight/obesity.
Family history of CVD	Presence or absence of heart disease or stroke in parents or siblings.
Awareness of heart attack	Whether participants had heard about heart attack.
Awareness of stroke	Whether participants had heard about stroke.

2. Part II was about the participants' experience of health checks. A health check experience is defined as any health check that one had participated in previously.
3. Part III was about the nine factors from results of the phase II conceptual framework that measured the following concepts:

a. Public's readiness to know the results of CVD health checks
b. Public's readiness to handle the outcomes following CVD health checks
c. Public's belief that the course of CVD can be changed for better outcomes
d. Perceptions of self at risk of CVD
e. Perception of benefits of CVD health checks
f. Perception of drawbacks of CVD health checks
g. Preferred method for CVD prevention
h. External barriers
i. Influence by significant others.

These factors were illustrated in the conceptual framework above in section 5.3.1. The development of items for these nine concepts is presented in sections 5.3.6.1 and 5.3.6.2.

Table 5.2: Operational definition for factors influencing intention of undergoing health checks

Factors	Operational definition
Readiness to know the results of CVD health checks	One's preparedness to receive the results of CVD health checks.
Readiness to handle the outcome following CVD health checks	One's preparedness to deal with management arising from results of CVD health checks.
Believe that the course of CVD can be changed for better outcomes	Believe that CVD is preventable and treatable.
Perceptions of self at risk of CVD	Perceive self is vulnerable to CVD.
Perception of benefit of CVD health checks	Perceive there are gains for undergoing health checks.
Perception of drawbacks of CVD health checks	Perceive there are disadvantages for undergoing health checks.
Preferred method for CVD prevention	Prefer using medical measures (health checks and medical treatment) or healthy lifestyle for CVD prevention.
External barriers	Barriers in terms of time, cost and accessibility.
Influence by significant others	Significant others are people who have the influence to encourage or discourage one's intention to undergo health checks.

4. Part IV was about the participant's intention to undergo CVD health checks. This intention is defined as the strength of one's desire to undergo health checks.

The final version of this questionnaire is shown in Appendix M.

5.3.6.1 Development of items in the questionnaire

The nine factors in Part III of the questionnaire were concepts, which are represented by items.

These items were statements derived from common themes and wording expressed by participants in phase II. For example, under the concept of perception of self at risk of CVD, the theme "perceived age as a risk" was rephrased into "My current age puts me at risk of CVD". The number of items for each concept took into consideration the breadth and length of the questionnaire. A Likert scale of scores 1 to 5 was used to indicate participant's level of agreement with each item; in which a score of 1 indicated "strongly disagree" to score 5 "strongly agree".

The items in part IV of the questionnaire were questions asking how likely the participants were to undergo CVD health checks in the given time. Again, a Likert scale was used to denote the intention from scores 1 "very unlikely" to 5 "very likely".

5.3.6.2 Internal validation of the instrument

The aim of the internal validation is to establish an instrument which is valid and reliable to measure what this instrument is supposed to measure (Hair, Black, Babin, & Anderson, 2010; Streiner & Norman, 2008). The process of validation started with content validation by the expert panel, pre-testing survey instrument with the participants, pilot testing of the questionnaire for assessment of correlation between items, followed by structural validation (exploratory factor analysis) and reliability testing (internal consistency and test-retest reliability) (refer to Figure 5.2). This then allows the use of surrogate variables such as a summated scale (mean score) or factor score (e.g. regression score) to represent the underlying concepts (DiStefano, Zhu, & Mindrila, 2009; Hair et al., 2010; Streiner & Norman, 2008) for examining the factors associated with intention for health checks in the cross-sectional survey.

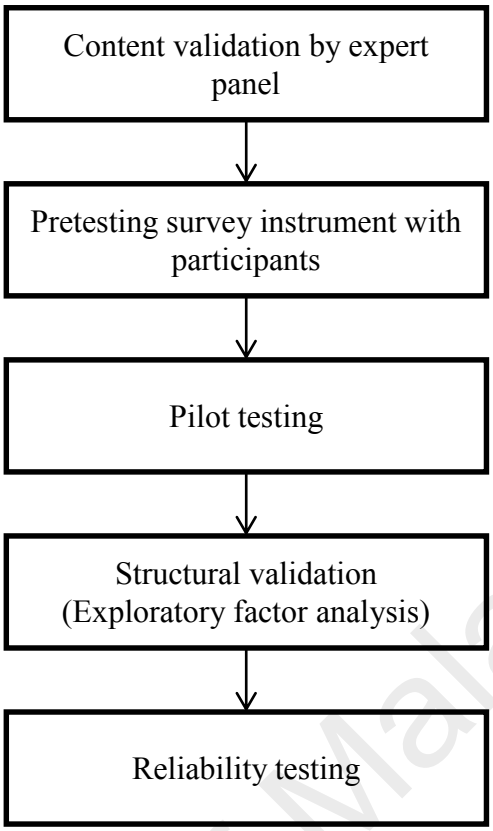


Figure 5.2: Internal validation process for questionnaire development

(a) ***Content validation***

Content validity is a judgement of whether an instrument samples all the relevant or important content and whether it is appropriate for what it intends to measure (Streiner & Norman, 2008). In this study, the aim of the process of content validation was to examine whether the content of the developed instrument was relevant, important and adequate for representing the underlying concept being measured (Hair et al., 2010; Mokkink et al., 2012; Polit & Beck, 2006; Streiner & Norman, 2008). This was done through reviewing the items and concepts by the experts.

The first draft consisted of 41 developed items which addressed the underlying concepts. This questionnaire was reviewed by a panel of six content experts, four family physicians from academia, a family physician from a public primary care clinic and a

psychologist, for content validity. Each item was rated in terms of its relevance to the underlying concept by the expert panel using a 4-point scale ranging from not relevant (score 1) to highly relevant (score 4); a score of 3 or 4 were indicative of relevance (Polit & Beck, 2006). An item–level content validity index (I-CVI) was the proportion of experts in agreement about relevance of the contents. I-CVI was computed as follows:

$$\text{I-CVI} = \frac{\text{Number of experts giving a rating of either 3 or 4}}{\text{Total number of experts}}$$

Items with an I-CVI of 0.78 or higher was considered to have good content validity (Polit & Beck, 2006; Polit, Beck, & Owen, 2007). The items were emailed to members of the panels for rating and comments. Feedback and comments from the expert panels were used to further refine the items for better clarity and to provide representativeness of the concepts. In cases where the items were modified, added or dropped, the rating and review processes were repeated.

(b) ***Pretesting survey instrument***

The pretesting of survey instrument involved the testing of the questionnaire with the participants to make sure that the questionnaire is understood and meets the purpose of what it intends to measure (Collins, 2003). In this study, this process aimed to assess the readability and clarity of the items in terms of consistency and appropriateness of the interpretations from the participants (Collins, 2003).

After the content validation process, a face-to-face interview was carried out with participants for pretesting of the items. A total of six participants, a man and a woman each from the three major ethnic groups i.e. Malays, Chinese and Indians, were recruited from the public setting.

Six interview sessions were carried out. During the interview session, the participants first self-administered the questionnaire. Then, the researcher (ATC) asked the participants to report their thoughts for each item. Clarity of the items and ease of completing the questionnaire was assessed. Feedback from the participants was used to further improve the readability and clarity of the questionnaire.

(c) ***Pilot testing***

Pilot testing is a small-scale trial in the field. In this study, the aim of pilot testing was to assess the feasibility of the study and to assess the preliminary correlation of the items for its underlying concept being measured. A sufficient correlation of the items of the underlying concepts is important for preparing an appropriate data matrix for application of factor analysis in subsequent structural validation (Hair et al., 2010).

In this study, pilot testing of the questionnaire was carried out on 40 participants from a hypermarket. Correlation of the items was analyzed. In cases where the correlations between the items were poor (<0.30), the items were then modified and a second pilot testing was carried out. This pilot testing also helped to identify any logistical problems prior to the cross-sectional survey in the hypermarket.

(d) ***Structural validation (exploratory factor analysis)***

The structural validation was carried out after the pilot testing, using exploratory factor analysis. Factor analysis is a statistical method to check the dimensionality among the items (Hair et al., 2010). To belong to a single dimension (factor), the items must be sufficiently intercorrelated (Hair et al., 2010; Streiner & Norman, 2008). In this study, items for each concept were subjected to factor analysis separately. The items measuring one concept should group into one factor.

This analysis involved 240 participants recruited through convenient sampling in the hypermarket. Principle axis factoring was selected as the factor extraction method. This method was selected to identify underlying factors that reflect what the items share in common (Hair et al., 2010). For the rotation method, an oblique rotation method of promax was used because the factors were likely to be correlated and conceptually linked (Costello & Osborne, 2005; Hair et al., 2010).

For application of factor analysis, the data matrix needs to have sufficient correlation. The correlation among the items in the data matrix was assessed by Bartlett's test of sphericity. A statistically significant Bartlett's test of sphericity ($p < 0.05$) indicates that the correlation matrix had significant correlations among at least some of the items and thus supports the application of factor analysis (Hair et al., 2010). The inter-item correlation for items intended to measure the same factor should range between 0.30 and 0.85. If the highest correlation of each item with at least one other item in the factor is between 0.30 and 0.85, the item was considered to be correlated adequately in the factor. If the highest correlation of an item is less than 0.30, this indicates inadequate correlation and this item should be dropped. The correlation of 0.85 and more indicates multicollinearity and redundancy of items; one of the items needs to be dropped.

The sampling adequacy of the data matrix for factor analysis was assessed using Kaiser-Meyer-Olkin (KMO) measure. A KMO value ≥ 0.6 was considered adequate ($\geq$ 0.7 was good) (Hair et al., 2010). The number of factors extracted is based on the Eigenvalues. An Eigenvalue >1.0 denotes it is significant as a factor to be extracted (Hair et al., 2010). Factor loading indicates whether the item adequately represents the factor tested. It is the correlation of the item with the factor tested. A factor loading of 0.40 was considered to have met the minimal level for an item to be retained in the factor (Hair et al., 2010).

The total variance extracted is the amount of variance in the indicators (items) that is explained by the latent factor (factor tested). Its value of more than 50% is desirable (Hair et al., 2010).

(e) ***Reliability testing***

The reliability of the questionnaire was assessed after the structure of the questionnaire was established. Reliability is an assessment of the degree of consistency between multiple measurements of a variable (Hair et al., 2010). In this study, the reliability was assessed by measuring the internal consistency of the items in the concept and test-retest reliability.

The internal consistency of the items was assessed with Cronbach's alpha, in which the individual items of the questionnaire should be highly intercorrelated and measuring the same concept (Hair et al., 2010). Cronbach's alpha was calculated separately for each concept (Streiner & Norman, 2008). A Cronbach's alpha of ≥0.60 is considered realiable and acceptable for exploratory factor analysis (≥0.70 is good) (Hair et al., 2010; Streiner & Norman, 2008).

The test-retest reliability assesses the stability and reliability of an instrument over time (Hair et al., 2010; Streiner & Norman, 2008). A Kappa coefficient is used to measure the degree of concordance of the results between the test and retest of the participants when the analysis involved categorical data (Landis & Koch, 1977; Streiner & Norman, 2008). There are two types of kappa, a simple unweighted kappa and weighted kappa. A simple unweighted kappa is meaningful when the categorical data are nominal. When the categorical data are in ordinal, it is potentially meaningful to use weighted kappa as the measurement of agreement.

Weighted kappa takes into account both the absolute concordance and also the relative concordance: each category in a row of the matrix is weighted in accordance with how near it is to the category in that row that includes the absolutely concordant items. There are two ways of doing the weighting, linear weights and quadratic weights. Linear weights assumes the difference between each category of the Likert scale is the same. For quadratic weights, it bases the disagreement weights on the square of the amount of discrepancy between the category in the Likert scale (Streiner & Norman, 2008). In this study, the unweighted and weighted kappas (both linear and quadratic weights) were presented to provide the range of possibility of the results. The strength of agreement of the kappa statistic according to the criteria of Landis & Koch is shown in Table 5.3 (Landis & Koch, 1977; Streiner & Norman, 2008). The kappa coefficient of ≥0.60 is desirable (Streiner & Norman, 2008).

Table 5.3: Strength of agreement associated with kappa statistic (Landis & Koch, 1977)

Kappa statistic	Strength of agreement
<0.00	Poor
0.00-0.20	Slight
0.21-0.40	Fair
0.41-0.60	Moderate
0.61-0.80	Substantial
0.81-1.00	Almost perfect

The test-retest analysis involved 88 samples who had administered the questionnaire at two points in time. All participants recruited for the factor analysis were invited to answer the questionnaire a second time two weeks later. The participants who agreed to participate in the retest were given the option to return to the hypermarket for the retest or performing the retest via an online survey. For those who chose to come to the hypermarket, a text message was sent two days before the appointment date to remind the participants to come for the retest in the hypermarket. If the participant did not turn up, a text messages was sent on the same day and another two text messages were sent three days apart. For those who chose to answer the online survey, an email was sent on the appointment date to invite the participant to answer the survey via the link and if the participant did not respond, an email reminder was sent three days later and this reminder was sent up to three times. Each reminder was sent three days apart.

A valid structure and good internal consistency allows the use of surrogate variables such as summated scale (mean score) or factor score (e.g. regression scores in this study) to represent the underlying factor (DiStefano et al., 2009; Hair et al., 2010; Streiner & Norman, 2008). The summated scale is the average of the scores for all items loading in that scale and the weight of each item is assumed to be equal. The calculation of the factor score is based directly on the factor loading, meaning that every item contributes to the factor score based on the size of its loading (Hair et al., 2010). The summated scale has the advantage of being able to be replicated in other studies, and provides easy result interpretation as it is measured in the metric of what is studied. However, the summated scale discounts the weight of items which the regression score performs. The consistency of the summated scale and factor score can be assessed by the correlation between them.

5.3.7 Data collection process

Data collection was carried out in a hypermarket by the author (ATC) solely. A bunting was set up to advertise and attract shoppers. A table and chairs were prepared for the participants to be seated at and answer the questionnaire.

The participants were recruited in a convenient manner as follows:

a) The shoppers were approached and invited by ATC to participate in the survey.
b) The shoppers self-volunteered to take part in the survey.

Pilot testing was used to assess the flow of hypermarket to identify the best time and venue for sampling. The best time for participant recruitment was found to be the weekend. During the weekdays, the time with the biggest yield for recruitment was from 930 am to 6 pm. Therefore, the recruitment was performed every day from 9 am to 6 pm June to August 2016. Initially, shoppers were approached at the entrance of the hypermarket. However, it was found that if shoppers were approached at exit area, it increased the success of recruitment as they were less hurried. Therefore, in the cross sectional study, the exit area of hypermarket was chosen as the place for recruitment.

First, participants were briefed about the objective of the study project and screened for the inclusion criteria. Participants who agreed were given the participants information sheet (Appendix N) and filled out the consent form (Appendix O) before answering the survey. To minimize the social desirability bias, it was emphasized to the participants that there were no right or wrong answers and genuine answers would be most appropriate. The medical history of stroke or heart disease of the participants were self-repoted.

Participants were encouraged to self-administer the questionnaire. In circumstances where the participants had problems reading the questionnaire, for example having eyesight problems because of not bringing their glasses or having literacy issues, the

investigator provided assistance by reading aloud the questionnaire to the participants. The time taken to complete the questionnaire ranged from 10 to 20 minutes. A token of appreciation of about RM5 (USD 1) was given to participants after completing the survey. The token of appreciation given was a food product such as a packet of biscuits or peanuts. The questionnaires were checked for completeness immediately after being returned to minimize missing data.

5.3.8 Data analysis

All statistical procedures were performed using IBM SPSS Statistics software version 22, unless otherwise stated. The weighted kappa was performed by the statistical calculator from the Statistical Computation Web Site (VassarStats, 2016). Data cleaning was performed before the analysis. The reverse scoring was carried out for the items which implied negative direction from the concept they measured, so that the scale was unidirectional and allowed calculating of the meaningful summated scales. For example, reverse scoring was carried out for the item "I don't want to think and know about CVD diseases at all" which had a negative association with its concept "Readiness to know the results of health checks".

5.3.8.1 Variables and type of data

In parts I and II of the questionnaire, the information about socio-demography, awareness of cardiovascular disease and health check experience of the participants were captured. These were categorical data except for the variable age, year of birth and the time of latest health check.

In part III, a Likert scale of score 1 to 5 was used to indicate participant's level of agreement with each item. These were treated as continuous data as mean scores of each concept were computed from its item's score and used for analysis. The nine concepts were the determinant variables (independent variables) which were examined for their

association with the intention to undergo health checks. The mean scores of the determinant variables were classified into 5 categories as follows:

Table 5.4: Classification of mean score distribution for determinant variables

Category	Mean score
Strongly disagree	1.0 - <2.0
Disagree	2.0- <3.0
Not sure	3.0
Agree	>3.0 – 4.0
Strongly agree	>4.0 – 5.0

In part IV, participants were asked about their likeliness to undergo health checks in the specified timeline (within 3 months, 6 months or 1 year). Two outcome variables (dependent variable) were derived from this question: the degree of likeliness of undergoing health checks and the likely timeline to undergo health checks. These outcome data were ordinal data.

The degree of likeliness of undergoing a health check for a participant was indicated by the highest score that individual answered, regardless of timeline. It was ranked from very unlikely (score of 1) to very likely (score of 5) (refer to Table 5.5). Initial scores of 1, 2 or 3 were combined into one category due to the small numbers of these scores for ordinal regression analysis.

Table 5.5: Classification of the degree of likeliness to undergo health check

Category	The highest score regardless of timeline
Very unlikely	1
Unlikely	2
Not sure	3
Likely	4
Very likely	5

The likely timeline to undergo health checks for a participant was indicated by the earliest time which a participant would likely or very likely undergo a health check (score of 4 or 5 for the indicated time period) (refer to Table 5.6). For example, in part IV, if a participant chose a score of 3 within 3 months, a score of 4 within 6 months and a score of 5 within 1 year, the earliest time they would likely undergo a health check was within 6 months. With this, they would be classified into the category of likely to attend within 6 months.

Table 5.6: Classification of likely timeline to undergo health checks

Category	Definition
Not sure or not likely to attend	Score of 1, 2 or 3 for all the time period
Likely to attend within one year	Score of 4 or 5 within 1 year
Likely to attend within 6 months	Score of 4 or 5 within 6 months
Likely to attend within 3 months	Score of 4 or 5 within 3 months

5.3.8.2 Descriptive statistics

The descriptive statistics were used to illustrate characteristics of participants, patterns of distributions of the determinants and outcome variables.

Frequency and percentage were used to present categorical and ordinal data. Mean and standard deviation (SD) were reported for normally distributed data and median and interquartile range (IQR) for non-normally distributed continuous data.

The determinants (independent variables) consisted of nine concepts: five concepts represented the public's perception of relevance of health checks for CVD prevention, two concepts represented the public's readiness to face the outcomes of CVD health checks, a concept of external barriers towards CVD health checks and a concept of influence of significant others. Mean score of the items was used to describe the average level of perception or readiness of participants of these determinants.

The public's perception of relevance of health checks for CVD prevention included five concepts as follows:

a. Believe that the course of CVD can be changed for better outcomes
b. Perceived self at risk of CVD
c. Perceived of benefits of CVD health checks
d. Perceived of drawbacks of CVD health checks
e. Preferred method for CVD prevention (healthy practice vs. medical measures)

For the first three determinants, the higher the mean score of the determinants denoted the more relevance of health checks one perceived. For the last two determinants "perceived drawbacks of CVD health checks" and "preferred method for CVD prevention", the higher score denoted the lesser degree of relevance towards CVD health checks.

The readiness of the participants to face the outcomes of CVD health checks included two determinants: the public's readiness to know the results of CVD health checks and the public's readiness to handle the outcomes following these checks. The higher the mean score of the concepts denoted the higher degree of readiness one had in facing the outcomes of CVD health checks.

The external barriers towards CVD health checks were assessed in terms of time, cost, transportation and distance from the health check facilities. The higher the mean score of this determinant denoted the higher degree of barrier towards CVD health checks.

Influence from significant others included the influence from doctors, family members, friends, employers and surrounding people. The higher the mean score of this determinant denoted the higher degree of influence by others for the participants to undergo CVD health checks.

The intention to undergo health checks for CVD prevention was described by two outcome variables: degree of likeliness to undergo CVD health checks and likely timeline to undergo health checks. The higher intention of CVD health checks was reflected by the higher degree of likeliness to undergo CVD health checks. The higher intention of CVD health checks might also reflect the likely time they would attend the CVD health checks. The earlier the time a participant decided to attend the health checks might indicate higher degree of intention.

5.3.8.3 Regression analysis

The regression analysis was used to determine the relationship between the nine determinants and the two outcome variables (public's degree of likeliness to undergo health check and the likely timeline to undergo health check).

The mean score of the factor was used for each determinant variable as there was high correlation between the mean score (summated scale) and the regression score (factor score) in the analysis. This supports the use of mean scores as valid substitutes for factor scores (refer to result section 5.4.1.3, Table 5.22).

The multicollinearity of the determinant variables was examined before performing regression analysis. This was done by examining the correlation coefficient of the determinant variables. If the correlation coefficient of the determinant variables was >0.85, there was a problem of multicollinearity (Hair et al., 2010).

The outcome variables were measured in an ordinal scale. Thus simultaneous ordinal regression was used in the analysis. Simultaneous regression is useful for determining the relative influence of each determinant on the outcome (Keith, 2006). In ordinal regression model, the relationship between the outcome variables and the model parameters is not linear. Thus, ordinal regression uses a link function to predict the model parameters. There are several link functions (Chan, 2005) and the choice depends on the distribution of outcome variables (Table 5.7). In this study, the complimentary log-log link function was used because the frequencies of the higher outcome categories were more. For the first outcome variable: public's degree of likeliness to undergo CVD health checks, the proportion of three outcome categories (very unlikely/unlikely/not sure, likely and very likely) were 16.2%, 45.0% and 38.7%. For the second outcome variable: likely timeline to undergo health checks, the proportion of four outcome categories (not sure/not likely to attend, likely to attend within 1 year, likely to attend within 6 months, likely to attend within 3 months) were 16.2%, 21.3%, 21.3%, 41.2%.

Table 5.7: Application of link function based on the distribution of outcome variable

Link function	Typical application
Logit	Evenly distributed categories
Complimentary log-log	Higher categories more probable
Negative log-log	Lower categories more probable

Model fit is assessed by using the Pearson and Deviance goodness-of-fit measures. The goodness-of-fit is acceptable when the p-value for the Pearson and Deviance chi-square value is >0.05 (Chan, 2005).

In ordinal regression analysis, the proportional odds assumption needs to be met. The slope coefficients in the model are identical across all the outcome categories and lines of the same slope are parallel (Cohen, Cohen, West, & Aiken, 2003). The test of Parallel lines was used to assess the proportional odds assumption. The assumption is met if the Chi-Square statistic was non-significant (p-value >0.05) (Chan, 2005). In this study, the relative importance of the determinant variables can be examined by comparing the magnitude of the regression coefficients (estimates) of each significant variable.

5.3.9 Ethical issues

Participation in the survey was voluntary. Written consent was obtained from each participant. In cases where the participants refused to disclose their name or/and identity, the provision of their signature was sufficient. The questionnaire did not have any personal identifier. It was indexed with an office code number. All data were handled by the investigator solely. The token of appreciation of a food product was as compensation for their time spent to complete the survey.

This study had obtained ethical approval from the Medical Ethics Committee, University of Malaya Medical Centre (20145-274) (refer to Appendix K).

5.4 Results

The results were presented into two parts. The first part was the findings for the internal validation of the questionnaire and the second part was the findings for the survey. The steps taken in the stages of the study and sample size used in various stages are shown in Figure 5.3.

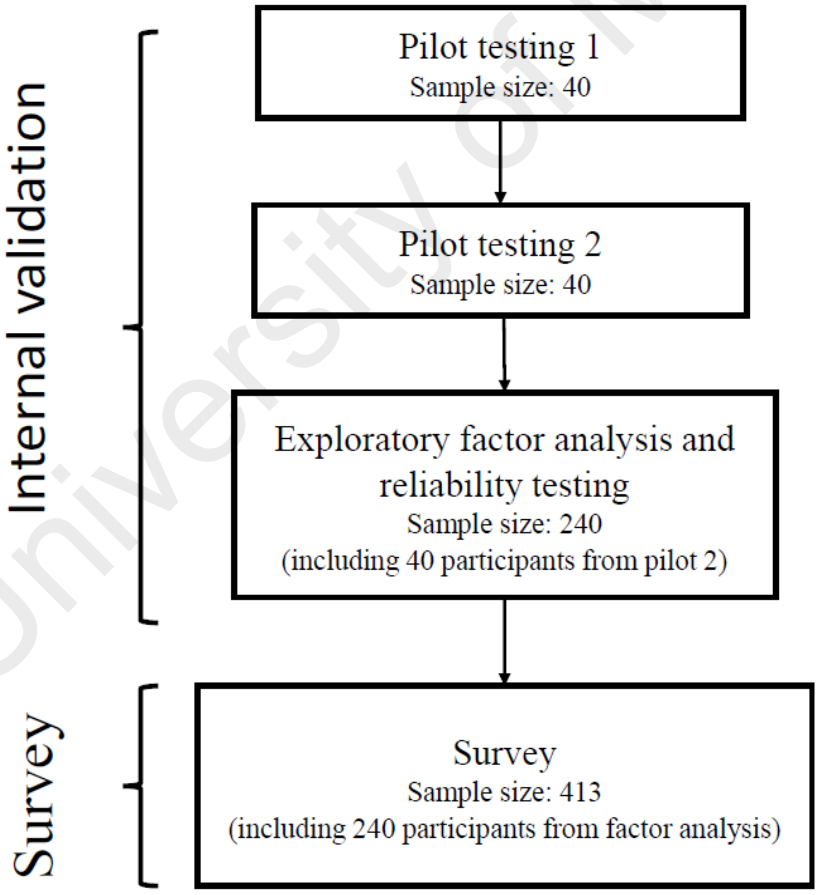


Figure 5.3 Flow chart of steps taken in the stages of the study and sample size used in various stages

5.4.1 Findings of the internal validation

The findings of content validation, participants' profile, factor analysis, the internal consistency and the test-retest reliability were illustrated in this part.

5.4.1.1 Content validation

The first draft had 41 items with seven underlying concepts and a question for the outcome variables. Following the feedback from the expert panels, 6 items were removed and 7 items were added and 16 items were refined and rephrased. The removal of the items was because they were not able to reflect the underlying concept (I-CVI<0.78) or had strong similarities with other items. The new items were added to increase the extent of representativeness of the contents for the measured concepts. The revised version of 42 items was then sent to the same expert panels for reevaluation. The I-CVI for all the items were satisfactory (ranged from 0.83 to 1.00).

After the content validation process, the pre-testing survey instrument of the items was carried out by interviewing six participants; two participants each from the three major ethnic groups i.e. Malays, Chinese and Indians. The result showed that there was no major issue in the readability and understanding of the contents. Small changes were made for substituting more common words for improving clarity of the items.

Forty participants were then recruited for pilot testing of the questionnaire in which the intercorrelation of the items was examined. Based on the correlation results of the pilot test, the initial concept of "perceived benefits of and drawbacks of health check" were reclassified into two concepts i.e. "perceived benefits of health check" and "perceived drawbacks of health check"; the concept of "readiness to face the outcome of health check" was reclassified into two concepts "readiness to know the results of health checks" and "readiness to handle the outcome following health check". The items were further refined and seven items were deleted based on poor correlation (r <0.30) with

other items. Two new items were constructed and this revised version was sent to expert panels for reevaluation. The I-CVI was satisfactory with the index ranging from 0.83 to 1.00. The second pilot version of 37 items was carried out with another 40 participants. One item was deleted due to poor correlation, resulting in 36 items being subjected to factor analysis. Table 5.8 showed the concepts and number of items in the initial version and revised version used for factor analysis.

Table 5.8: Comparison of concepts and number of items in the initial and revised version of the questionnaire used for factor analysis

	Initial version		Revised version for factor analysis	
	Concepts	**no. of items**	**Concepts**	**no. of items**
	Believe that the disease course can be changed for better outcomes	6	Believe that the disease course can be changed for better outcomes	4
	Perceived self at risk of CVD	4	Perceived self at risk of CVD	5
	Preferred method for CVD prevention	5	Preferred method for CVD prevention	3
	Perceive benefit and drawbacks of health checks	8	Perceived benefit of health checks	4
			Perceived drawback of health checks	4
	Readiness to face the outcome of the health checks	6	Readiness to know the result of health checks	3
			Readiness to handle the outcomes following health checks	4
	External barriers	8	External barriers	4
	Influence by significant others	4	Influence by significant others	5
Total concepts/ items	7	41	9	36

5.4.1.2 Participants' profile in the factor analysis and internal consistency

A total of 240 participants were recruited for the analysis. The participants were recruited in a similar manner as in the pilot-testing. This analysis included the 40 participants from the pilot 2 in view of there being no changes in the questionnaire from pilot 2 except deletion of one item which had poorly intercorrelated items. The response rate was 39.7% (240 participants recruited out of a total of 605 shoppers approached).

The median age of the participants was 45 years (IQR 17 years). The majority of the participants were female (60%) and Malays (53.3%). Almost all of the participants were aware of heart attack (97.8%) and stroke (98.7%). Half (55.0%) of the participants had a history of regular health checks at least once in two years. Details of the participants' characteristics are shown in Table 5.9.

Table 5.9: Characteristics of participants in questionnaire validation phase

Characteristics		Frequency	Percentage
Gender, n=240	Male	96	40
	Female	144	60
Age group (years), n=240	30-39	78	32.5
	40-49	72	30.0
	50-59	52	21.7
	≥60	38	15.8
Ethnicity, n=240	Malay	128	53.3
	Chinese	88	36.7
	Indian	15	6.3
	Others*	9	3.8
Education level, n=240	Primary	8	3.3
	Secondary	105	43.8
	Tertiary	127	52.9
Marital status, n=240	Never married	20	8.3
	Widow/widower	6	2.5
	Separated	13	5.4
	Married	201	83.8
Working status, n=239	No	73	30.5
	Yes	166	69.5
History of co-morbidities, n=239	Diabetes	28	11.7
	Hypertension	51	21.3
	Hypercholesteroleamia	43	18.0
	Overweight/obesity	58	24.3
	Smoking	25	10.5
Family history of CVD, n=239	No	136	56.9
	Yes	103	43.1
Awareness of CVD, n=239	Heart attack	234	97.9
	Stroke	236	98.7
Health check experience, n=240	Having any form of health check experience	225	93.8
Regular health check experience, n=238	At least once a year	100	42.0
	Once in two years	31	13.0

*dusun, sikh, iban, kadazan, melanau, bidayuh

5.4.1.3 Factor analysis and internal consistency

Table 5.10 lists the concepts and related items which were subjected to factor analysis. The original questionnaire was in Malay, which was used for the data collection (refer to Appendix M). The translated version was for the purpose of the write-up and to allow for wider dissemination of the results. The item number was used to represent the item for subsequent reporting of the results.

Table 5.10: Concepts and their related items

Concepts	Items
Believe that the disease course can be changed for better outcomes	(A1) I believe CVD (for example heart disease, stroke, etc.) can be prevented
	(A2) I believe early treatment of CVD risk factors (for example high blood pressure, high cholesterol level, diabetes mellitus) can prevent CVD
	(A3) I believe CVD is treatable
	(A4) If CVD can be detected early, the treatment will be easier
Perceived self at risk of CVD	(B1) I am at risk of CVD
	(B2) My current age puts me at risk of CVD
	(B3) My lifestyle puts me at risk of CVD
	(B4) Medical problems in my family members put me at risk of CVD
	(B5) My current health condition puts me at risk of CVD

Table 5.10, continued.

Concepts	Items
Preferred method for CVD prevention	(C1) For CVD prevention, I think practicing a healthy lifestyle is sufficient (for example: healthy diet, exercise, qi gong, etc)
	(C2) For CVD prevention, I prefer to adopt a healthy lifestyle than undergoing CVD health checks
	(C3) For CVD prevention, I am more confident with practising a healthy lifestyle than using medical treatment
Perceived benefit of health checks	(DB1) I feel undergoing a CVD health check will give assurance for my health
	(DB2) We will not know our CVD health status if we do not undergo CVD health checks
	(DB3) CVD health checks can act as an indicator for CVD prevention
	(DB4) CVD health checks enable us to detect risk factors of heart disease/stroke early
Perceived drawbacks of health checks	(DD1) A CVD healthcheck is a waste of time
	(DD2) A CVD health check is a waste of money
	(DD3) A CVD health check involves a troublesome procedure (e.g. the need to fast before blood tests)
	(DD4) A CVD health check which finds abnormal health results will give rise to problems (e.g. affect the chance of purchasing insurance or securing a job).
Readiness to know the result of health checks	(RFR1) I am ready to face the results of the CVD health check
	(RFR2) I want to know my CVD health status
	(RFR3) I don't want to think and know about CVD diseases at all*

*reverse scoring was performed.

Table 5.10, continued.

Concepts	Items
Readiness to handle the outcomes following health checks	(RHO1)If the CVD health check results are abnormal, I am ready to take medication
	(RHO2)If the CVD health check results are abnormal, I am ready to adjust my lifestyle
	(RHO3)If the CVD health check results are abnormal, I am ready to bear the cost of subsequent treatment
	(RHO4)If the CVD health check results are abnormal, I am not ready to do anything*
External barriers	(F1) I will make the effort to allocate time to go for a CVD health check*
	(F2) The cost of doing CVD health checks is a burden for me
	(F3) The place for CVD health checks is far from my house/workplace
	(F4) I have a problem with transportation to go for CVD health checks
Influence by significant others	(G1) I will perform the CVD health check if recommended to do so by doctors
	(G2) I will perform the CVD health check if my family member advises me to do so
	(G3) I will perform the CVD health check if my friend advises me to do so
	(G4) I will perform the CVD health check if my employer requires me to do so
	(G5) I will perform the CVD health check as people around me have already done so.

*reverse scoring was performed.

Each concept was subjected to the factor analysis separately. The sample size for all factor analyses except one, was adequate, which was indicated by a KMO value ≥0.60 (refer to Table 5.11). One factor analysis had a KMO value of 0.579, which was close to

0.60. According to Hair et al (2010), a KMO value of >0.50 is acceptable to proceed with exploratory factor analysis (Hair et al., 2010). The Bartlett test of sphericity was statistically significant for all, indicating that the correlation matrix had significant correlations among at least some of the items, which supported the application of factor analysis.

Table 5.11: Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy value for nine factor analysis procedures

No.	Concepts examined	KMO
1.	Believe that the disease course can be changed for better outcomes	0.785
2.	Perceived self at risk of CVD	0.794
3.	Preferred method for CVD prevention	0.579
4.	Perceived benefits of health checks	0.794
5.	Perceived drawbacks of health checks	0.717
6.	Readiness to know the result of health checks	0.629
7.	Readiness to handle the outcomes following health checks	0.679
8.	External barriers	0.673
9.	Influence by significant others	0.813

For all the nine factor analyses, the highest correlation of each item with at least one other item in the concept was between 0.30 and 0.90, indicating all the items correlate

adequately in the concepts. The mean, standard deviation of items and correlation matrix of each concept are shown in Tables 5.12 to 5.20, respectively.

Table 5.12: Mean, standard deviation of items and correlation matrix for concept of "Believe that the disease course can be changed for better outcomes"

	Mean score	Standard deviation	A1	A2	A3	A4
A1	4.13	0.74	1.000	0.547	0.467	0.412
A2	4.27	0.63		1.000	0.528	0.512
A3	4.04	0.72			1.000	0.520
A4	4.41	0.57				1.000

Table 5.13: Mean, standard deviation of items and correlation matrix for concept of "Perceived self at risk of CVD"

	Mean score	Standard deviation	B1	B2	B3	B4	B5
B1	3.34	0.90	1.000	0.644	0.485	0.456	0.573
B2	3.54	0.88		1.000	0.444	0.383	0.433
B3	3.16	0.96			1.000	0.304	0.541
B4	3.05	1.01				1.000	0.503
B5	2.89	1.00					1.000

Table 5.14: Mean, standard deviation of items and correlation matrix for concept of "Preferred method for CVD prevention"

	Mean score	Standard deviation	C1	C2	C3
C1	4.06	0.87	1.000	0.333	0.242
C2	3.53	1.03		1.000	0.604
C3	3.74	0.98			1.000

Table 5.15: Mean, standard deviation of items and correlation matrix for concept of "Perceived benefits of health checks"

	Mean score	Standard deviation	DB1	DB2	DB3	DB4
DB1	3.94	0.79	1.000	0.484	0.493	0.417
DB2	4.23	0.59		1.000	0.682	0.628
DB3	4.23	0.54			1.000	0.716
DB4	4.37	0.52				1.000

Table 5.16: Mean, standard deviation of items and correlation matrix for concept of "Perceived drawbacks of health checks"

	Mean score	Standard deviation	DD1	DD2	DD3	DD4
DD1	1.78	0.67	1.000	0.838	0.577	0.380
DD2	1.81	0.68		1.000	0.563	0.344
DD3	2.00	0.82			1.000	0.385
DD4	2.71	1.08				1.000

Table 5.17: Mean, standard deviation of items and correlation matrix for concept of "Readiness to know the result of health checks"

	Mean score	Standard deviation	RFR1	RFR2	RFR3*
RFR1	4.07	0.53	1.000	0.676	0.380
RFR2	4.17	0.54		1.000	0.511
RFR3*	4.09	0.76			1.000

*reverse scoring

Table 5.18: Mean, standard deviation of items and correlation matrix for concept of "Readiness to handle the outcomes following health checks"

	Mean score	Standard deviation	RHO1	RHO2	RHO3	RHO4*
RHO1	3.88	0.75	1.000	0.336	0.526	0.298
RHO2	4.19	0.55		1.000	0.342	0.542
RHO3	3.73	0.78			1.000	0.351
RHO4*	4.02	0.74				1.000

*reverse scoring

Table 5.19: Mean, standard deviation of items and correlation matrix for concept of "External barriers"

	Mean score	Standard deviation	F1*	F2	F3	F4
F1*	1.95	0.54	1.000	0.304	0.292	0.263
F2	2.65	0.95		1.000	0.396	0.241
F3	2.45	0.87			1.000	0.496
F4	2.14	0.82				1.000

*reverse scoring

Table 5.20: Mean, standard deviation of items and correlation matrix for concept of "Influence by significant others"

	Mean	Standard deviation	G1	G2	G3	G4	G5
G1	4.18	0.60	1.000	0.622	0.494	0.583	0.361
G2	3.9	0.75		1.000	0.749	0.577	0.498
G3	3.73	0.82			1.000	0.554	0.560
G4	4.06	0.65				1.000	0.411
G5	3.51	0.94					1.000

One factor was extracted for each concept. The minimal factor loading of the item in each concept was >0.40 except for item C1, for which the factor loading was 0.368. Thus, C1 was eliminated and the reanalysis with two items (C2 and C3) showed the correlation coefficient of 0.595 and factor loading of 0.770.

Six out of nine factors had the desirable total variance extracted value of ≥50%. Three factors reported total variance extracted values of slightly less than 50% (48.6%, 40.0%

and 35.1% respectively), though slightly low than the desirable value, these results were considered acceptable for exploratory factor analysis. Cronbach's alpha values for the eight factors were good (≥0.70). One Cronbach's alpha was 0.658, which was acceptable in exploratory factor analysis. Table 5.21 showed the summary of number of factors extracted, minimal factor loading, total variance extracted and Cronbach's alpha value for each concept.

Table 5.21: Number of factors extracted, total items, minimal factor loading, total variance extracted and Cronbach's alpha value for each concept

No.	Concepts examined	Number of factors extracted	Final number of items	Minimal factor loading	Total variance extracted	Cronbach's alpha
1.	Believe that the disease course can be changed for better outcomes	1	4	0.662	50.0%	0.793
2.	Perceived self at risk of CVD	1	5	0.573	48.6%	0.817
3.	Preferred method for CVD prevention	1	2	0.770#	59.4%#	0.745#
4.	Perceived benefits of health checks	1	4	0.565	58.8%	0.819
5.	Perceived drawbacks of health checks	1	4	0.442	56.0%	0.771
6.	Readiness to know the result of health checks	1	3	0.537	56.6%	0.738
7.	Readiness to handle the outcomes following health checks	1	4	0.604	40.0%	0.719
8.	External barriers	1	4	0.444	35.1%	0.658
9.	Influence by significant others	1	5	0.594	55.3%	0.845

#results from factor analysis of C2 and C3 items, after elimination of C1

The mean score (summated scale) for each factor was computed and the regression score (factor score) was saved from the factor analysis. High correlation of the mean score and the regression score supported the use of the mean score for subsequent analysis (refer to Table 5.22).

Table 5.22: Correlation coefficient between the mean score and regression score

No.	Concepts examined	Spearman's rho Correlation coefficient
1.	Believe that the disease course can be changed for better outcomes	0.993
2.	Perceived self at risk of CVD	0.982
3.	Preferred method for CVD prevention	0.996
4.	Perceived benefits of health checks	0.985
5.	Perceived drawbacks of health checks	0.957
6.	Readiness to know the result of health checks	0.976
7.	Readiness to handle the outcomes following health checks	0.990
8.	External barriers	0.971
9.	Influence by significant others	0.973

5.4.1.4 Test-retest reliability

The test-retest reliability of the items for the concepts being measured was not satisfactory. The strength of agreement for the items ranged from slight to moderate

agreement for unweighted kappa, fair to moderate agreement for weighted kappa with linear weighting and fair to substantial agreement for weighted kappa with quadratic weighting (refer to Table 5.23).

Table 5.23: Summary of test-retest reliability for all items in the questionnaire

Item	Unweighted kappa (Strength of agreement)		Weighted kappa with linear weighting (Strength of agreement)		Weighted kappa with quadratic weighting (Strength of agreement)	
A1	0.334	(fair)	0.364	(fair)	0.417	(moderate)
A2	0.433	(moderate)	0.587	(moderate)	0.576	(moderate)
A3	0.353	(fair)	0.423	(moderate)	0.516	(moderate)
A4	0.327	(fair)	0.324	(fair)	0.319	(fair)
B1	0.418	(moderate)	0.491	(moderate)	0.584	(moderate)
B2	0.198	(slight)	0.268	(fair)	0.367	(fair)
B3	0.283	(fair)	0.390	(fair)	0.519	(moderate)
B4	0.369	(fair)	0.474	(moderate)	0.576	(moderate)
B5	0.219	(fair)	0.352	(fair)	0.479	(moderate)
C2	0.329	(fair)	0.382	(fair)	0.404	(moderate)
C3	0.333	(fair)	0.470	(moderate)	0.615	(substantial)
DB1	0.328	(fair)	0.339	(fair)	0.360	(fair)
DB2	0.214	(fair)	0.272	(fair)	0.370	(fair)
DB3	0.277	(fair)	0.307	(fair)	0.361	(fair)
DB4	0.381	(fair)	0.409	(moderate)	0.460	(moderate)
DD1	0.255	(fair)	0.365	(fair)	0.510	(moderate)
DD2	0.179	(slight)	0.331	(fair)	0.518	(moderate)
DD3	0.279	(fair)	0.351	(fair)	0.450	(moderate)
DD4	0.229	(fair)	0.259	(fair)	0.302	(fair)
RFR1	0.320	(fair)	0.357	(fair)	0.418	(moderate)
RFR2	0.361	(fair)	0.393	(fair)	0.448	(moderate)
RFR3	0.284	(fair)	0.336	(fair)	0.397	(fair)
RHO1	0.361	(fair)	0.511	(moderate)	0.688	(substantial)
RHO2	0.409	(moderate)	0.413	(moderate)	0.426	(moderate)
RHO3	0.513	(moderate)	0.533	(moderate)	0.561	(moderate)
RHO4	0.280	(fair)	0.341	(fair)	0.428	(moderate)
F1	0.355	(fair)	0.374	(fair)	0.405	(moderate)
F2	0.319	(fair)	0.372	(fair)	0.414	(moderate)
F3	0.462	(moderate)	0.495	(moderate)	0.496	(moderate)
F4	0.350	(fair)	0.513	(moderate)	0.682	(substantial)
G1	0.346	(fair)	0.322	(fair)	0.281	(fair)
G2	0.340	(fair)	0.440	(moderate)	0.547	(moderate)
G3	0.189	(slight)	0.264	(fair)	0.354	(fair)
G4	0.344	(fair)	0.377	(fair)	0.403	(moderate)
G5	0.218	(fair)	0.354	(fair)	0.493	(moderate)

The test-retest reliability for the intention to undergo health checks, measured by assessment of "likely timeline to undergo health checks" and "degree of likeliness to undergo health checks" was not satisfactory. All unweighted kappa and weighted kappa were <0.60 except one, in which the weighted kappa with quadratic weighting for "likely timeline to undergo health checks" was 0.615 (refer to Table 5.24).

Table 5.24: Summary of test-retest reliability for "likely timeline to undergo health checks" and "degree of likeliness to undergo health checks"

Item	Unweighted kappa (Strength of agreement)		Weighted kappa with linear weighting (Strength of agreement)		Weighted kappa with quadratic weighting (Strength of agreement)	
likely timeline to undergo health checks	0.464	(moderate)	0.550	(moderate)	0.615	(substantial)
Degree of likeliness to undergo health check	0.422	(moderate)	0.486	(moderate)	0.563	(moderate)

In summary, the internal validity of the questionnaire was established. The criteria of content validity, structural validity and the internal consistency were met. The I-CVI for all items was satisfactory, indicating the relevance of the contents. The KMO and Bartlett's test indicated that the data were appropriate for factor analysis. The number of factors extracted was consistent with the theoretical concepts. The factor loadings and correlations between the items were satisfactory, indicating structural validity. All the factors had acceptable Cronbach's alpha values, indicating good internal consistency. High correlation between the mean score and the regression score supported the use of mean scores in subsequent analysis. The items did not show satisfactory test-retest reliability; this indicated that one's perception towards the concepts being measured and

intention to participate in health checks could change from one occasion to the other. This finding was consistent with the qualitative results in phase II, where the decision-making process is dynamic.

5.4.2 Findings for the survey

The analysis of the survey included 413 participants; this included the 240 participants from factor analyses. The recruitment process and the questionnaire used were the same except one item (C1) which had been deleted, as has been explained in section 5.4.1.3. The response rate for this survey was 47.1% (413 shoppers participated out of 877 shoppers approached).

The findings were presented in 3 subsections. The first subsection described the participants' profile in the survey. The second subsection described the pattern of the determinants and outcome variables. The last subsection reported the findings of the ordinal regression analyses in order to ascertain the usefulness of the models, with all the determinants, in explaining the public's intention to undergo CVD health checks. The relative importance of these determinants was examined in the last subsection.

5.4.2.1 Participants' profile in the survey

The median age of the participants was 45 years (IQR 17 years) and the mean age was 50.5 years (SD 4.3 years). More females (60%) than males participated in the survey. The majority of participants consisted of Malays (53.3%) and Chinese (37.3%). The awareness of heart attack and stroke was high; almost all of the participants reported that they were aware of heart attack (98.3%) and stroke (99.0%). Half (53.5%) of the participants had reported history of regular health checks at least once in two years. About 40% of the participants had a family history of CVD. About one fifth of the participants reported the comorbidity of hypertension, hypercholesteroleamia and obesity

or being overweight, respectively. The details of the participants' characteristics are shown in Table 5.25.

Table 5.25: Characteristics of participants in survey

Characteristics		Frequency	Percentage
Gender, n=413	Male	163	39.5
	Female	250	60.5
Age group (years), n=413	30-39	136	32.9
	40-49	132	32.0
	50-59	80	19.4
	≥60	65	15.7
Ethnicity, n=413	Malay	220	53.3
	Chinese	154	37.3
	Indian	24	5.8
	Others*	15	3.6
Education level, n=413	Primary	16	3.9
	Secondary	186	45.0
	Tertiary	211	51.1
Marital status, n=413	Never married	40	9.7
	Widow/widower	11	2.7
	Separated	16	3.9
	Married	346	83.8
Working status, n=411	No	122	29.7
	Yes	289	70.3
History of co-morbidities, n=412	Diabetes	40	9.7
	Hypertension	74	18.0
	Hypercholesteroleamia	71	17.2
	Overweight/obesity	87	21.1
	Smoking	38	9.2
Family history of CVD, n=412	No	237	57.5
	Yes	175	42.5
Awareness of CVD, n=412	Heart attack	405	98.3
	Stroke	408	99.0
Health check experience, n=413	Having any form of health check experience	386	93.5
Regular health check experience, n=411	At least once a year	158	38.4
	Once in two years	62	15.1

*dusun, sikh, iban, kadazan, melanau, bidayuh

5.4.2.2 The descriptive pattern of determinant and outcome variables

As illustrated in the conceptual framework in section 5.3.1, the determinants (independent variables) consisted of nine concepts: five concepts represented the public's perception of relevance of health checks for CVD prevention, two concepts represented the public's readiness to face the outcomes of CVD health checks, a concept of external barriers towards CVD health checks and a concept of influence of significant others.

The intention to undergo health checks for CVD prevention was described by two outcome variables: degree of likeliness to undergo CVD health checks and likely timeline to undergo health checks.

(a) ***Perception of relevance of health checks for CVD prevention***

The public's perception of relevance of health checks for CVD prevention included five concepts as follows:

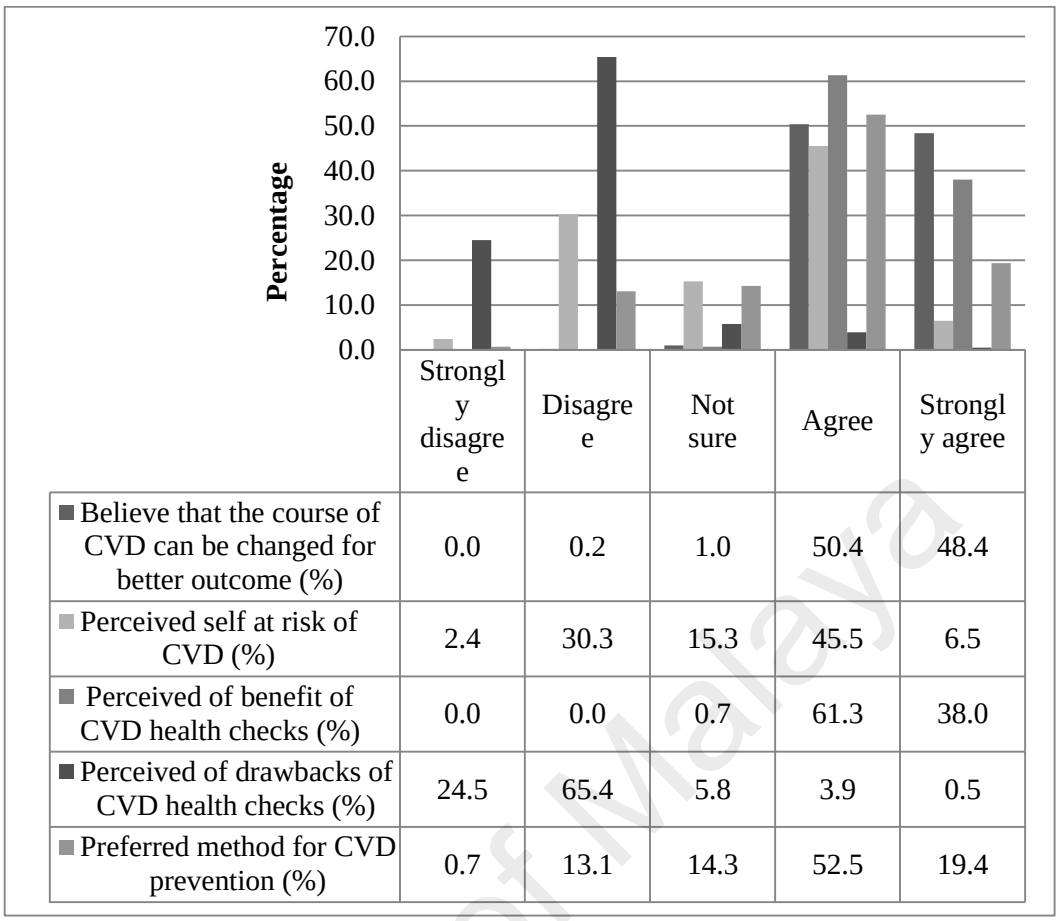
a. Believe that the course of CVD can be changed for better outcomes
b. Perceived self at risk of CVD
c. Perceived of benefits of CVD health checks
d. Perceived of drawbacks of CVD health checks
e. Preferred method for CVD prevention (healthy practice vs. medical measures)

Generally, the public agreed that the disease course can be changed for better outcomes and health checks were beneficial. The mean score of perceived self at risk was just slightly above 3, which implied that on average the perception of CVD risk was not strong. The public preferred using health practice for CVD prevention. The mean scores and 95% confidence intervals (95% CI) for degree of agreement for each determinant are presented in Table 5.26.

Table 5.26: The mean scores and 95% confidence intervals for degree of agreement for determinants included in public's perception of relevance of health checks

Determinants examined	Mean score (95% CI)
Believe that the disease course can be changed for better outcomes	4.22 (4.17, 4.26)
Perceived self at risk of CVD	3.15 (3.08, 3.21)
Perceived benefits of health checks	4.18 (4.13, 4.23)
Perceived drawbacks of health checks	2.11 (2.05, 2.17)
Preferred method for CVD prevention (preferred healthy practice than medical measures)	3.70 (3.61, 3.78)

Half of the participants perceived themselves at risk of CVD (52.0%). Almost all of the participants believed that the course of CVD can be changed for better outcomes (98.8%) and perceived the CVD health checks were beneficial (99.3%). A small proportion of the participants (4.4%) agreed or strongly agreed about the drawbacks of CVD health checks. Nearly three quarters (71.9%) of the participants preferred the use of healthy lifestyle such as healthy diet, exercise, tai chi, etc than health checks and using medical treatment (refer to Figure 5.4).



	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Believe that the course of CVD can be changed for better outcome (%)	0.0	0.2	1.0	50.4	48.4
Perceived self at risk of CVD (%)	2.4	30.3	15.3	45.5	6.5
Perceived of benefit of CVD health checks (%)	0.0	0.0	0.7	61.3	38.0
Perceived of drawbacks of CVD health checks (%)	24.5	65.4	5.8	3.9	0.5
Preferred method for CVD prevention (%)	0.7	13.1	14.3	52.5	19.4

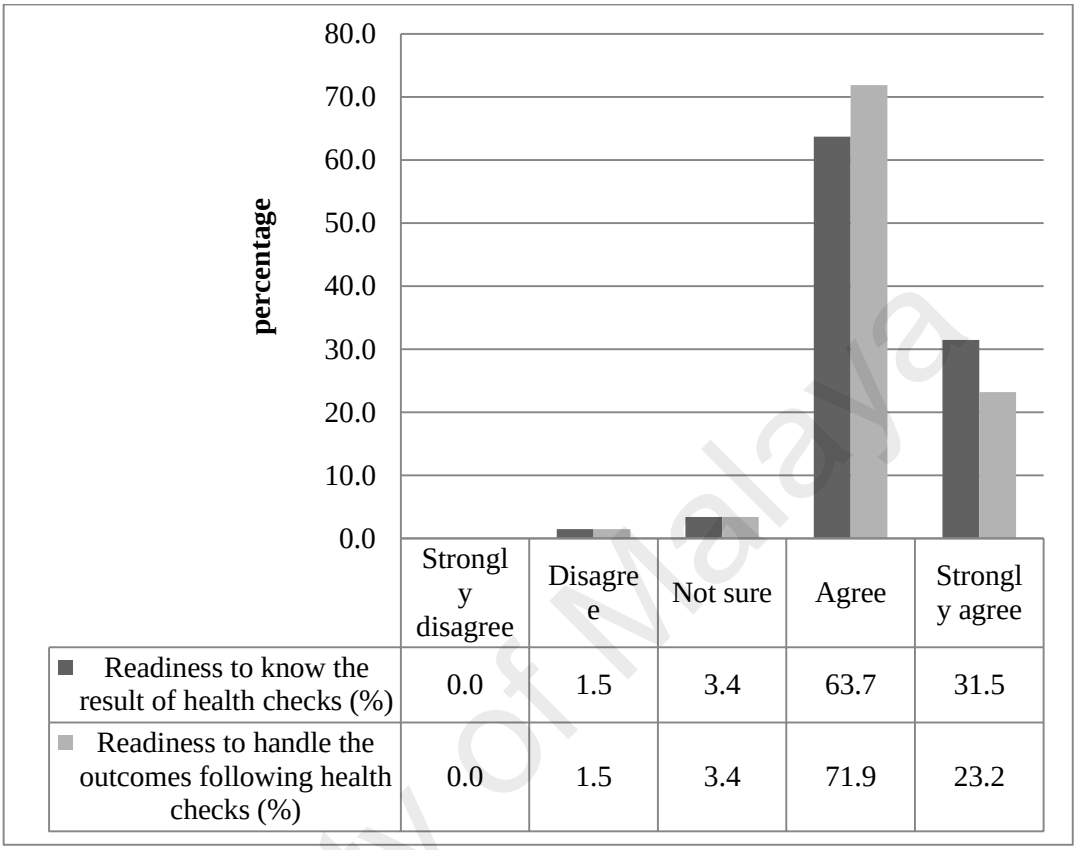
Figure 5.4: Public's degree of agreement for determinants included in public's perception of relevance of health checks

(b) ***Readiness to face the outcomes***

The readiness of the participants to face the outcomes of CVD health checks included two determinants: public's readiness to know the results of CVD health checks and public's readiness to handle the outcomes following CVD health checks.

On average, the participants were ready to know the results of CVD health checks and handle the outcomes following CVD health checks, in which the mean score of these two determinants was 4.10 (95% CI 4.05, 4.14) and 3.94 (95% CI 3.90, 4.00), respectively. Almost all of the participants agreed or strongly agreed that they were ready to know the health check results and to handle the outcomes following health

checks (refer to Figure 5.5). This might be due to the fact that nearly all participants had some form of health check previously.

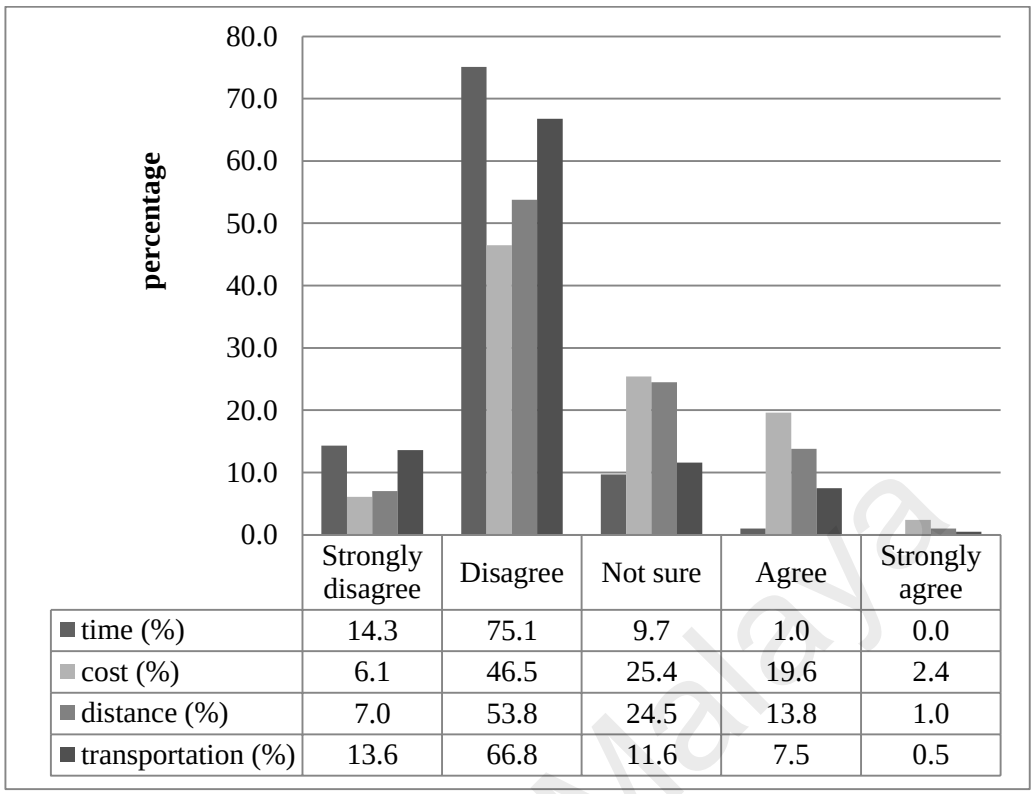


	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Readiness to know the result of health checks (%)	0.0	1.5	3.4	63.7	31.5
Readiness to handle the outcomes following health checks (%)	0.0	1.5	3.4	71.9	23.2

Figure 5.5: Public's degree of agreement for determinants included in public's readiness to face the outcome of CVD health checks

(c) ***External barriers***

Generally, external barriers were not an issue for the participants, with the mean score being 2.31 (95% CI 2.26, 2.37). About one fifth of the participants agreed or strongly agreed that cost was a barrier. About one tenth of the participants reported that the distance of the health check facilities and the transportation were the barriers to undergo health checks. Only one percent of the participants agreed that time was a barrier (refer to Figure 5.6).

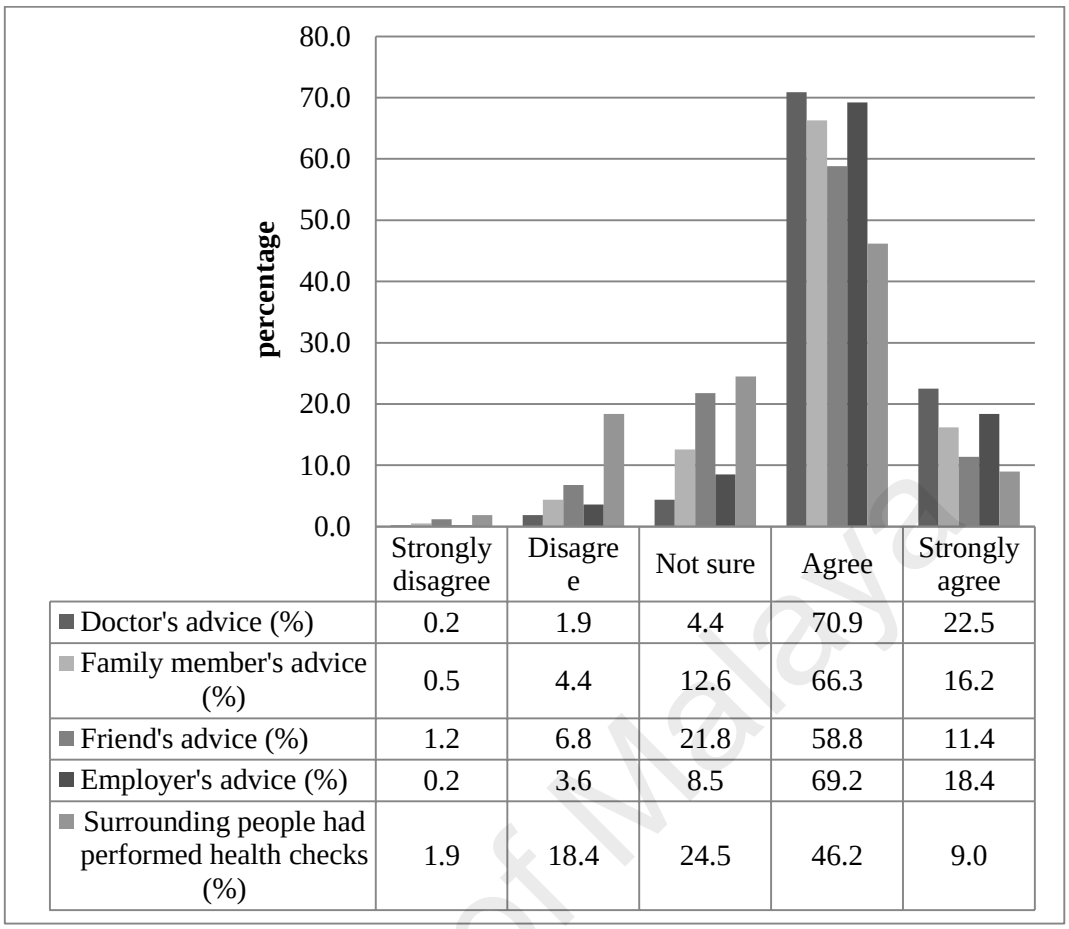


	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
time (%)	14.3	75.1	9.7	1.0	0.0
cost (%)	6.1	46.5	25.4	19.6	2.4
distance (%)	7.0	53.8	24.5	13.8	1.0
transportation (%)	13.6	66.8	11.6	7.5	0.5

Figure 5.6: Public's degree of agreement on the external barriers to undergo CVD health checks

(d) ***Influence from significant others***

The mean score of this concept was 3.85 (95% CI 3.79, 3.90), which indicated that significant others played a role to influence the public to undergo CVD health checks. The majority of the participants reported that they would undergo CVD health checks following advice from doctors, family members, friends or employers. Near half of the participants reported that they would undergo CVD health checks when knowing the surrounding people had performed these health checks (refer to Figure 5.7).



	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Doctor's advice (%)	0.2	1.9	4.4	70.9	22.5
Family member's advice (%)	0.5	4.4	12.6	66.3	16.2
Friend's advice (%)	1.2	6.8	21.8	58.8	11.4
Employer's advice (%)	0.2	3.6	8.5	69.2	18.4
Surrounding people had performed health checks (%)	1.9	18.4	24.5	46.2	9.0

Figure 5.7: Public's degree of agreement on the influences of significant others to undergo CVD health checks

(e) ***Degree of likeliness to undergo CVD health checks***

The higher intention of CVD health checks was reflected by the higher degree of likeliness to undergo such checks. The majority of the participants indicated that they were likely or very likely to undergo CVD health checks. 16.2% of the participants indicated that they were not sure, unlikely or very unlikely to undergo health checks (refer to Figure 5.8).

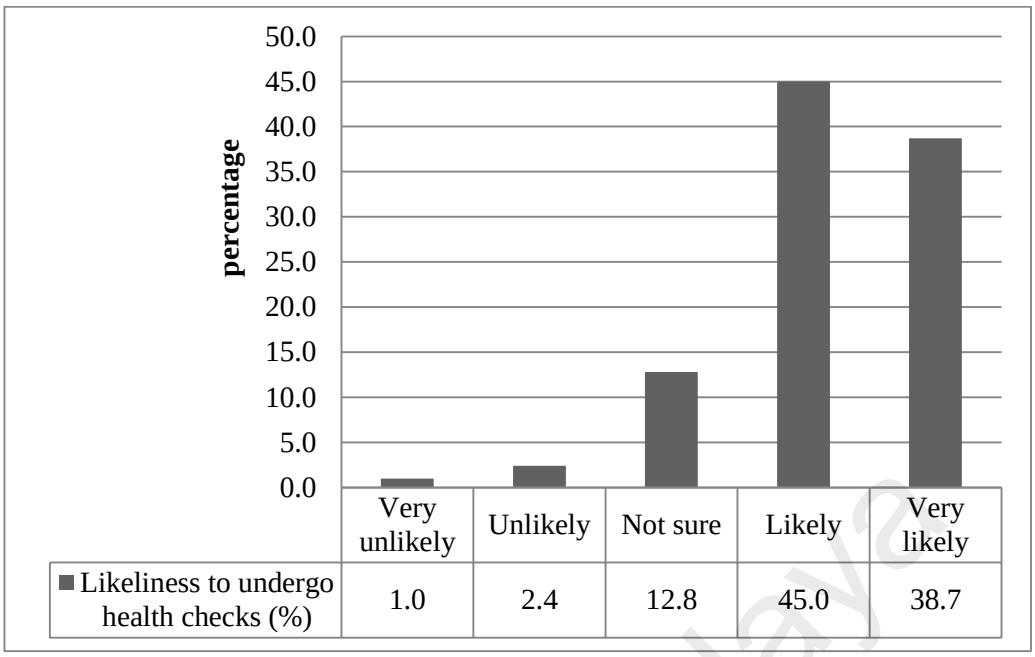


Figure 5.8: Public's degree of likeliness to undergo CVD health checks

(f) ***Likely timeline to undergo health checks***

The earlier the time a participant decided to attend the health checks might indicate the higher degree of intention. About 40.0% of the participants indicated that they were likely to attend the CVD health checks within 3 months. About one fifth of the participants indicated they were likely to attend the CVD health checks within 6 months to 1 year (refer to Figure 5.9).

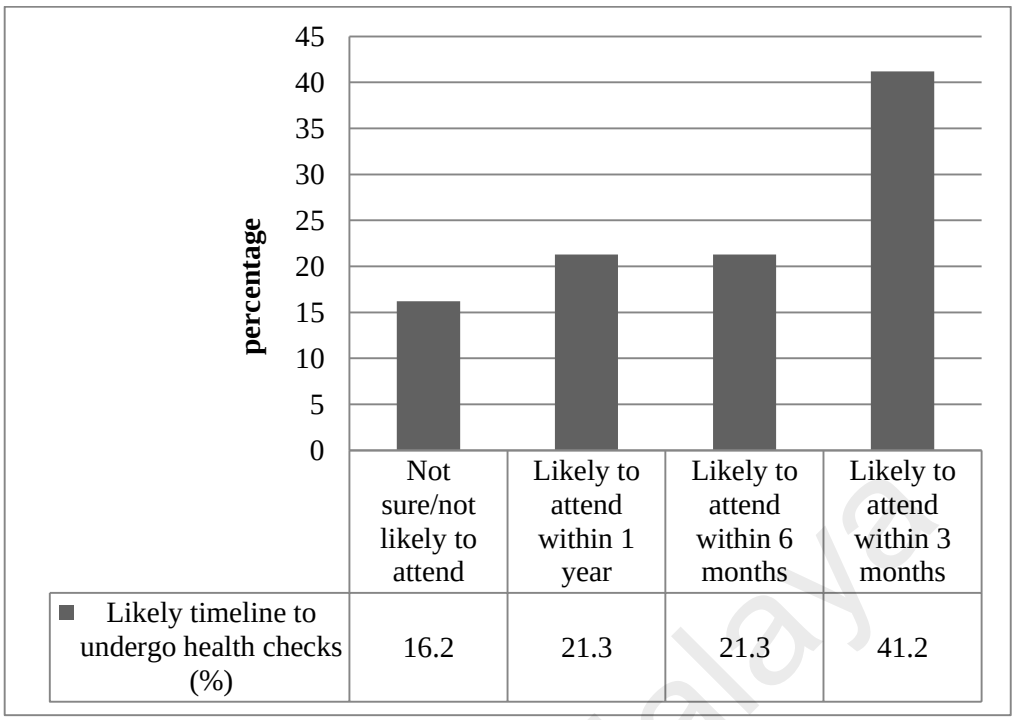


Figure 5.9: Likely timeline of the public to undergo health checks

5.4.2.3 Factors associated with the intention of CVD health checks

Two models (model 1 and 3), included all 413 cases and had the two outcome variables analyzed using ordinal regression. Another two models (model 2 and 4), had 16 cases removed from model 1 and 3 each, to take into account of possible Hawthorne effect. These 16 cases were participants who did not have any past health check experience but indicated the intention to undergo CVD health checks. The Hawthorne effect meant the participant indication of an intention to undergo health checks might not be true, but a consequence of reactivity towards a socially desirable effect. All models had 9 determinants.

The outcome variable of model 1 & 2 was the public's degree of likeliness to undergo CVD health checks (refer to Table 5.27). The categories of 'very unlikely', 'unlikely' and 'not sure' of the Likert scale were combined into one category due to small frequencies. Thus, the outcome variable used in the ordinal regression analysis consisted of 3

categories (very unlikely/unlikely/not sure, likely and very likely). The outcome variable of the third and fourth model was the likely timeline of the public to undergo CVD health checks, which consisted of 4 categories (refer to Table 5.27).

Table 5.27: Outcome variables and their respective models

Outcome variables	Model
Degree of likeliness to undergo CVD health checks. (very unlikely/unlikely/not sure, likely, very likely)	Model 1, n= 413 Model 2, n= 397 (16 cases removed for possible Hawthorne effect)
The likely timeline of the public to undergo CVD health checks. (not sure or not likely to attend, likely to attend within one year, likely to attend within 6 months, likely to attend within 3 months)	Model 3, n= 413 Model 4, n= 397 (16 cases removed for possible Hawthorne effect)

The multicollinearity between the determinant variables was examined using a correlation coefficient. The maximum correlation coefficient between the determinant variables was 0.601 (refer to Table 5.28), which indicated no extreme correlation (correlation coefficient >0.85).

Table 5.28: Correlation matrix for determinant variables in the model

	1	2	3	4	5	6	7	8	9
1	1.000	0.105	0.601	0.431	-0.274	0.394	0.307	-0.311	0.261
2		1.000	0.052	0.200	0.025	0.134	0.044	-0.075	0.163
3			1.000	0.224	0.080	0.074	0.072	0.031	0.168
4				1.000	-0.338	0.496	0.365	-0.314	0.409
5					1.000	-0.484	-0.364	0.364	-0.256
6						1.000	0.483	-0.417	0.377
7							1.000	-0.485	0.349
8								1.000	-0.297
9									1.000

1: Believe that the disease course can be changed for better outcomes
2: Perceived self at risk of CVD
3: Preferred method for CVD prevention
4: Perceived benefits of health checks
5: Perceived drawbacks of health checks
6: Readiness to know the result of health checks
7: Readiness to handle the outcomes following health checks
8: External barriers
9: Influence by significant others

In the ordinal regression analysis, the link function of complimentary log-log was used because the frequencies of the higher outcome categories were more.

In all four models, the model fitting statistic was significant (refer to Table 5.29), which indicated that at least one of the regression coefficients in the model was not equal to zero. Thus, the outcome variables depended on at least one of the explanatory variables. The non-significant goodness-of-fit statistics suggested that the models fitted well with the observed data. However, since the explanatory variables were continuous data, the goodness-of-fit-test was not relevant (Chan, 2005). The test of parallel lines statistic were not significant for all four models (refer to Table 5.29); this indicated that the proportion

odds assumption was met (the slope coefficients were the same across response categories). Thus, the use of the ordinal regression analysis was valid.

The models seemed to explain 22.7%, 24.8%, 16.3% and 17.8% (corresponding to the pseudo-R^2 of 0.227, 0.248, 0.163 and 0.178, respectively) of the observed variance in the publics' intention to undergo CVD health checks (refer to Table 5.29). According to Cohen et al., the value of 0.13 and 0.26 are proposed as medium and large effect sizes for the population R^2 (Cohen et al., 2003) for behavioural science study. The models in this study were useful in explanation of the public's intention to undergo health checks. However, this pseudo R-square value in the logistic regression does not have an equivalent to the R-square value in the ordinary least square regression. Thus, the results need to be interpreted with caution.

Table 5.29: Summary results of pseudo-R^2, model-fitting information and test of parallel lines for four models

Models	Outcome variable	n	Nagelkerke (pseudo-R^2)	Model fitting		Test of parallel lines	
				-2Log-Likelihood χ^2	p	-2Log-Likelihood χ^2	p
1	Degree of likeliness to undergo CVD health checks	413	0.227	90.697	<0.001	7.679	0.567
2	Degree of likeliness to undergo CVD health checks	397	0.248	96.641	<0.001	9.304	0.410
3	Likely timeline of the public to undergo CVD health checks	413	0.163	67.938	<0.001	26.855	0.082
4	Likely timeline of the public to undergo CVD health checks	397	0.178	71.578	<0.001	27.827	0.065

(a) ***Determinants associated with public's degree of likeliness to undergo CVD health checks***

The determinants associated with the public's degree of likeliness to undergo CVD health checks, were examined with models 1 and 2.

In model 1, the significant determinants of public's degree of likeliness to undergo CVD health checks were the public's perception of the benefits of CVD health checks, perceptions regarding drawbacks of these checks and external barriers (refer to Table 5.30). There were two possible relationships based on the positive or negative value of the β of the determinants. A positive value of the β indicates a positive relationship and a negative value indicates a negative relationship. The public's perception of the benefits of CVD health checks has a positive relationship with the public's degree of likeliness to undergo CVD health checks. A higher degree of perceived health check benefits was significantly associated with a higher degree of likeliness of the public to undergo CVD health checks. The perceptions regarding drawbacks of these checks and external barriers have a negative relationship with the public's degree of likeliness to undergo CVD health checks. The lower degree of perception of health check drawbacks and external barriers was significantly associated with a higher degree of likeliness of the public to undergo CVD health checks.

In model 2, after removing the 16 cases for possible Hawthorne effect, four significant determinants were identified (refer to Table 5.30). The previous three determinants (public's perception of the benefits of CVD health checks, perceptions regarding drawbacks of these checks and external barriers) remained significant and the fourth determinant was the public's readiness to handle the outcomes following health checks. This fourth determinant has a positive relationship with the outcome. Thus, the higher

degree of readiness to handle outcomes was significantly associated with a higher degree of likeliness of the public to undergo CVD health checks.

Table 5.30: Estimates of regression coefficient for all determinants of publics' degree of likeliness to undergo CVD health checks

Determinants	Model 1 (n=413)				Model 2 (n=397)			
	β	95%CI	SE	p	β	95%CI	SE	p
Believe that the disease course can be changed for better outcomes	-0.035	(-0.340 to 0.271)	0.156	0.824	-0.025	(-0.342 to 0.292)	0.162	0.878
Perceived self at risk of CVD	-0.004	(-0.212 to 0.204)	0.106	0.967	-0.022	(-0.236 to 0.193)	0.109	0.843
Preferred method for CVD prevention	0.029	(-0.142 to 0.199)	0.087	0.742	-0.010	(-0.187 to 0.167)	0.090	0.914
Perceived benefits of health checks	**0.526**	**(0.168 to 0.884)**	**0.183**	**0.004**	**0.547**	**(0.176 to 0.917)**	**0.189**	**0.004**
Perceived drawbacks of health checks	**-0.265**	**(-0.521 to -0.009)**	**0.131**	**0.042**	**-0.276**	**(-0.538 to -0.014)**	**0.134**	**0.039**
Readiness to know the result of health checks	0.222	(-0.143 to 0.588)	0.187	0.234	0.202	(-0.171 to 0.574)	0.190	0.289
Readiness to handle the outcomes following health checks	0.346	(-0.007 to 0.699)	0.180	0.055	**0.552**	**(0.181 to 0.923)**	**0.189**	**0.004**
External barriers	**-0.489**	**(-0.785 to -0.193)**	**0.151**	**0.001**	**-0.469**	**(-0.784 to -0.154)**	**0.161**	**0.004**
Influence by significant others	0.086	(-0.178 to 0.350)	0.135	0.524	0.113	(-0.159 to 0.385)	0.139	0.415

β: Estimates of regression coefficient; SE: Standard error; CI: Confidence interval

(b) ***Determinants associated with public's likely timeline to undergo CVD health checks***

Next, the determinants associated with the public's likely timeline to undergo CVD health checks were examined in models 3 and 4.

In model 3, significant determinants of the public's likely timeline to undergo CVD health checks were the public's perceived benefits of CVD health checks and external barriers (refer to Table 5.31). The directions of the relationships of these determinants with the outcomes were similar to models 1 and 2, where the public's perceived benefits of CVD health checks has a positive relationship and perception of external barriers has a negative relationship. A higher degree of perceived health check benefits was significantly associated with a higher likelihood of the public to undergo CVD health checks within a shorter timeline. The lower degree of perception of external barriers was significantly associated with a higher likelihood of the public to undergo CVD health checks within a shorter timeline.

In model 4, after removal of the 16 cases, three significant determinants were identified (refer to Table 5.31). These included the two significant determinants identified in model 3 (the public's perceived benefits of CVD health checks and external barriers) and the third determinant was the public's readiness to handle the outcomes following health checks. The directions of the relationships of the first two determinants (the public's perceived benefits of CVD health checks and external barriers) with the outcomes were the same as model 3. The third determinant (the public's readiness to handle the outcomes following health checks) has a positive relationship with the outcome. The higher degree of readiness to handle outcomes was significantly associated with a higher likelihood of the public to undergo CVD health checks within a shorter timeline.

Table 5.31: Estimates of regression coefficients for all determinants of publics' likely timeline to undergo CVD health checks

Determinants	Model 3 (n=413)				Model 4 (n=397)			
	β	95%CI	SE	p	β	95%CI	SE	p
Believe that the disease course can be changed for better outcomes	0.076	(-0.222 to 0.375)	0.152	0.616	0.073	(-0.235 to 0.382)	0.158	0.641
Perceived self at risk of CVD	0.177	(-0.023 to 0.377)	0.102	0.083	0.181	(-0.024 to 0.387)	0.105	0.084
Preferred method for CVD prevention	-0.119	(-0.288 to 0.049)	0.086	0.166	-0.130	(-0.304 to 0.044)	0.089	0.143
Perceived benefits of health checks	**0.442**	**(0.096 to 0.788)**	**0.177**	**0.012**	**0.447**	**(0.090 to 0.804)**	**0.182**	**0.014**
Perceived drawbacks of health checks	-0.147	(-0.399 to 0.105)	0.128	0.252	-0.155	(-0.412 to 0.103)	0.131	0.239
Readiness to know the result of health checks	-0.011	(-0.362 to 0.339)	0.179	0.949	-0.038	(-0.394 to 0.318)	0.182	0.834
Readiness to handle the outcomes following health checks	0.267	(-0.070 to 0.605)	0.172	0.120	**0.386**	**(0.033 to 0.738)**	**0.180**	**0.032**
External barriers	**-0.435**	**(-0.718 to -0.151)**	**0.145**	**0.003**	**-0.467**	**(-0.768 to -0.165)**	**0.154**	**0.002**
Influence by significant others	0.238	(-0.012 to 0.489)	0.128	0.063	0.253	(0.004 to 0.510)	0.131	0.053

β: Estimates of regression coefficient; SE: Standard error; CI: Confidence interval

(c) ***Relative importance of the determinants***

The relative importance of the determinants was examined by comparing the magnitude of the regression coefficient of each significant determinant alongside their standard errors. The standard errors of the determinants for each model were similar (refer to Tables 5.30 and 5.31). In models 1 and 3, which involved 413 participants, the most important determinant was the perception of benefits of CVD health checks, followed by the external barriers. The third most important determinant in model 1 was the perception of the drawbacks of CVD health checks. For model 2, the most important determinant was the publics' readiness to handle the outcomes following health checks, followed by the perception of benefits of CVD health checks, perception of the external barriers and the perception of the drawbacks of CVD health checks. For model 4, the most important determinant was the perception of external barriers, followed by the perception of benefits of CVD health checks, and the publics' readiness to handle the outcomes following CVD health checks (refer to Table 5.32).

Table 5.32: Relative importance of determinants in the four models

Model	Significant determinants arranged from left to right, in descending order of importance			
Model 1	Perceived benefits of health checks (β =0.526)	External barriers (β= -0.489)	Perceived drawbacks of health checks (β=-0.265)	-
Model 2	Readiness to handle the outcomes following health checks (β =0.552)	Perceived benefits of health checks (β =0.547)	External barriers (β = -0.469)	Perceived drawbacks of health checks (β = -0.276)
Model 3	Perceived benefits of health checks (β =0.442)	External barriers (β = -0.435)	-	-
Model 4	External barriers (β = -.467)	Perceived benefits of health checks (β =0.447)	Readiness to handle the outcomes following health checks (β =0.386)	-

In summary, the significant determinants of the publics' intention to undergo CVD health checks were the perception of benefits and drawbacks of CVD health checks, the perception of external barriers and the readiness to handle the outcomes following CVD health checks.

5.5 Discussion

5.5.1 Summary of principal findings

This cross-sectional survey was set up to determine the determinants of the publics' intention to undergo CVD health checks in a population. The determinants for the publics' intention to undergo such checks were derived from the conceptual model constructed based on the findings from phase II.

A questionnaire with 35 items representing 9 concepts was developed based on the conceptual model constructed. This questionnaire underwent an internal validation process, in which it demonstrated good content validity, structural validity and internal consistency. Thus, the use of mean scores of the items was valid for the analysis.

In this validation study, 240 participants were recruited. Although the response rate was 39.7%, the sample size was adequate to address the factor analysis and internal consistency (minimum 180).

The test-retest reliability of the items and degree of intention was less satisfactory. This indicates that the decision-making of health checks was a dynamic process, in which one's perception and readiness towards the concepts being measured and intention to participate in health checks varies from one occasion to the other, depending on the circumstances they were in at that moment. Previous studies used Cronbach's alpha to assess the internal reliability of items for the factors associated with the intention for health checks (Norman, 1993, 1995; Norman & Fitter, 1991; Armitage et al., 2002; Norman & Conner, 1996; Wilson et al., 1997). There was no previous literature found to assess the test-retest of the items. Thus, consistency in test re-test reliability may not be required for future studies.

The studied population encompassed the major ethnic groups in the country, and was based on the appropriate age group recommended for CVD risk factor screening. The study was carried out in an urban population. Almost all of the participants were aware of heart attack and stroke.

About 80% of participants intended to undergo CVD health checks. For the publics' perception of relevance of CVD health checks, a majority of the participants believed that the course of CVD could be changed for better outcomes and perceived that CVD health

checks was beneficial. However, only half of the participants perceived that they were at risk of CVD, and the majority preferred to practice healthy lifestyles rather than medical measures such as undergoing health checks and using medical treatment for CVD prevention. Nevertheless, a high proportion of the participants indicated that they were ready to know the results and handle the outcomes of CVD health checks. Generally, external barriers were not an issue to the participants. However, one fifth of participants indicated that the cost of CVD health checks was a burden. The majority of participants indicated that their decision to undergo health checks could be influenced by doctors, family members, friends or employers.

The proposed models were useful in explanation of the publics' intention to undergo health checks. Any factors that were found to be significant in the four models were likely to be determinants of the publics' intention to undergo CVD health checks. The significant determinants identified were the perception of benefits and drawbacks of CVD health checks, the perception of external barriers and the readiness to handle the outcomes following CVD health checks.

5.5.2 Interpretation of findings and comparison to previous findings

This study used mall intercept interviews as the method for recruitment of participants. This method was chosen in order to capture the public with various backgrounds from the urban setting. The sampling was convenient in nature. To examine the generalizability of the study, the sociodemography of the study population was compared to the population of Federal Territory of Kuala Lumpur, where the studied hypermarket was located and the population of Malaysia (Refer Appendix P).

There were more females than males in the study population, compared to the equal distribution of gender in the Malaysian population as a whole (Department of Statistic Malaysia, 2016a) and the Federal Territory of Kuala Lumpur (Department of Statistic

Malaysia, 2016b), in which the hypermarket was located. The study population had a higher proportion of those from age group 40-49 and a lower proportion of those from age group 60 years and above, compared to the Malaysian population and the population of the Federal Territory of Kuala Lumpur. With respect to ethnicity, there was a smaller proportion of Indians than that seen in the general Malaysian and Federal Territory of Kuala Lumpur populations.

This study aimed to explain generally what determines the publics' intention to undergo CVD health checks. Thus, regression models focusing on exploring explanatory determinants were chosen. The participants' background information such as the sociodemography and experience of health checks were not included in the models because they served as background influences of those determinants. The participants' background information could be included if the objective of the analysis was to develop a predictive model (Keith, 2006). However, this is not the focus of this study.

A high proportion of participants indicated their positive intention to undergo CVD health checks. This finding is consistent with another study, in which most people showed a positive intention towards CVD risk factor screening (Ashida, Wilkinson, & Koehly, 2010). In this study, 45% and 39% of participants reported their level of likeliness to undergo CVD health checks as "likely" and "very likely", respectively. Those with "likely" and "very likely" responses could imply a moderate and high degree of intention, respectively. Locally, the National Health Morbidity Survey in 2011 reported that about 38% of respondents had undergone health checks such as screening of blood pressure and blood sugar over the past 12 months (Institute for Public Health (IPH), 2011b); this figure was similar to the high intention group in the present study. This suggests that people with high intention would translate their intention to the actualization of health checks. In contrast, people with moderate intention may not translate their intention to action.

This was supported by the literature that the attenders for screening were more likely to have a definite intention to attend than non-attenders (Simpson et al., 1997).

A sensitivity analysis was conducted to test possible Hawthorne effect by removing 16 cases where these cases were participants who did not have any past health check experience but indicated the intention to undergo CVD health checks. This analysis had resulted an additional significant determinant (readiness to handle the outcomes following health checks) to the initial analysis. As it is likely that the initial models were affected by the Hawthorne effect, the added factor is likely to be a true determinant.

In the present study, the significant determinants for intention of CVD health checks were the positive perception of benefits and negative perception of drawbacks of CVD health checks, negative perception of external barriers and the readiness to handle the outcomes following CVD health checks. These findings were in line with some of the results found in previous research. For example, the findings of positive perception of benefits of health checks were reported as significant predictors for intention of health checks in surveys based on the health belief model (Norman, 1993, 1995), and the belief in the check could contribute to a higher chance for aging healthily, and was significantly associated with the willingness to participate in health checks in a Dutch Health Care Consumer Panel survey (Petter et al., 2015). Besides, unpleasant screening procedures such as pain from finger stick tests have been reported as a barrier for health check participation (Wilson et al., 1997), which was reflected in perceived drawbacks of health checks in this study. It is important to emphasize the benefits of health checks and address the drawbacks of these checks when disseminating health check educational material to the general public.

External barriers such as time constraints have been reported as significant factors involved in discouraging the public from attending health checks (Norman, 1993; Petter

et al., 2015). However, in the present study, participants were more concerned about cost rather than time, with only 1% indicating that time was a barrier, compared to 20% for cost. In addition, cost was also raised as a concern in the utilization of private practice health care services in the Malaysia National Health Morbidity Survey (Institute for Public Health (IPH), 2015b). The systematic review from the phase I study found that providing financial incentives for screening was an effective intervention to increase uptake of CVD health checks (Cheong, Liew, Khoo, Mohd Zaidi, & Chinna, 2017). This could be a potentially useful measure to improve CVD health checks locally.

Previous research notes that fear of health check results, and perception of health checks as being unnecessary worry, decreased the intention for health check participation (Norman, 1993, 1995; Simpson et al., 1997; Petter et al., 2015). These factors are conceptually similar to readiness to know the result in the present study, in which the concerns could be reflected in a lack of readiness. In the present study, it was demonstrated that the public's readiness to know the results was not found to be a determinant of the intention to undergo health checks, but the public's readiness to handle the outcomes such as preparedness to take medication, preparedness to adjust lifestyle and preparedness to bear the cost of subsequent treatment following abnormal health checks was a significant determinant. This aspect of readiness to handle the outcomes provides further understanding about the factors people consider during the decision-making process, which previous literature has not focused on. There is a need to address people's readiness to handle outcomes when developing interventions to improve CVD health checks.

There were inconsistent findings of the association of people's perception of susceptibility and seriousness of disease with the intention or participation in health checks. In the present study, the perception of self at risk of CVD was not found to be a

significant determinant for intention of CVD health checks. The mean score of this concept was 3.15 which indicated the level of perception of susceptibility was not high, but more than two-thirds of participants indicated they have moderate or high intention to undergo CVD health checks. It was uncertain whether this was the result of volunteer bias of the study or cultural context. Future study using probability sampling would be needed to verify this. In literature, some studies reported that health check attenders had a higher level of perception of susceptibility (Hsu & Gallinagh, 2001), but many studies did not find this association (Norman, 1993, 1995; Norman & Fitter, 1991; Shiloh et al., 1997; Wilson et al., 1997). In addition, intervention studies on sending the health risk appraisal questionnaire to participants showed that most people at risk who received the questionnaire did not turn up for the CVD risk factor screening (Harari et al., 2008; Hutchison et al., 1998). On the other hand, a Cochrane systematic review reported that there was a small effect with low quality evidence that personalized risk communication increases uptake of screening tests, but this is mainly for the topic area of mammography and colorectal cancer (Edwards et al., 2013), in which these disease are probably perceived to be more serious than a cardiovascular risk. Thus, people's perception of susceptibility of CVD may not be a significant factor to influence the uptake of CVD health checks. This was supported by the literature, which found that people who value and believe in health checks will go for such checks even if they feel well (Cherrington, Corbie-Smith, & Pathman, 2007). Thus, the belief of the benefits of CVD health checks seemed to be a more convincing motivator than the risk perception.

There are practical implications from the present results. Implications and recommendations are further discussed in Chapter 6, where the implications of the results from all three phases are discussed together.

5.5.3 Strength and limitations

The strength of this study lies in the fact that the determinants and items measured are grounded from the data, and understanding was obtained from the phase II qualitative study, rather than the hypothesized theory. Thus, these determinants can be easily grasped and the results could be applied for further interventions. This study was conducted in a hypermarket as it allowed the researcher to recruit the public from various background. However, due to the convenience sampling of the survey population, there is a lack of representativeness of the study population to the general population. For example, the Indian ethnic group was under represented, and these results would be difficult to extrapolate to that group. In addition, this study only included those who could speak or read Malay; this would probably exclude a number of people especially those older or of a poorer sociodemographic class. However, there was only one Indian participant who was excluded due to language issue. The response rate would have probably been better if the questionnaire was also available in other languages, such as Tamil and Mandarin. Due to limited resources, the questionnaire was not translated and validated to those languages. Future studies could be conducted for such purpose. Therefore, the results of this phase III study may only applicable to populations with similar sociodemographic characteristics; the model would need to be retested if an explanation were to be required for a population with different characteristics. This study aimed to explain generally what determines the publics' intention to undergo CVD health checks. Thus, regression models focusing on exploring explanatory determinants were chosen. The confounders such as participants' sociodemography and past experiences were not adjusted. Future study have to adjust for confounders when developing a predictive model. Besides, this study only investigated intention as the outcome of the study. Although intention is a good surrogate marker for action, the measurement of participants' action would be more

suitable for evaluating this framework. Because of resource constraints, and as a preliminary work, intention was chosen as the outcome variable.

5.6 Conclusion

The significant determinants identified were the perception of benefits and drawbacks of CVD health checks, the perception of external barriers and the readiness to handle the outcomes following CVD health checks. These are important areas to target when developing strategies to improve the uptake of CVD health checks.

CHAPTER 6: CONCLUSION

6.1 Introduction

The overall aim of this thesis was to explore possible intervention strategies that may be effective for improving health check participation, with a better understanding of the underlying factors which affect the public's decision-making to undergo health checks. In this chapter, summary findings from the three phases are presented and the practical implications and recommendations are discussed.

6.2 Summary and discussion of principal findings from three phases

It is noted that not all the factors identified in the qualitative study (phase II) were significant determinants in the quantitative study (phase III). This is expected, as the framework in the qualitative study was meant to be as comprehensive as possible, in order to encompass all factors voiced by any of the participants. Thus, this framework could explain decisions of participation in health checks at an individual level. These factors are important for health care providers while discussing health checks at clinic encounters. Whereas, the results in phase III give us an average pattern of the determinants for the general public; it represented the normative pattern seen in the study population. These results are useful for public health promotion and policy makers, as they should apply for most people in the population (Tong & Low, 2015). From the systematic review, the interventions examined were mainly targeted at external factors, and was effective for targeting health care providers (significant others) and provide financial incentives (external barriers) to individuals, but the internal factors appeared to be more important from the findings of both qualitative and quantitative studies. This was supported by the performance of the SOCSO programme, where the uptake rate was less satisfactory with interventions targeting external resources (free voucher and easy accessibility).

6.3 Implications/recommendation for practice

To improve the uptake of CVD health checks, the interventions would need to be targeted at both individual and population levels. At the individual level, as has been informed by the conceptual framework in phase II, interventions targeted at multi-factors addressing intention to participate, perception of relevance, and state of readiness to act on or cope with health check findings, as well as having favourable external factors (flexible appointment times, cost, and accessibility) is required. However, at the population level, the four significant determinants found in phase III (i.e. the perception of benefits and drawbacks of CVD health checks, the perception of external barriers and the readiness to handle the outcomes following CVD health checks) could be the priority area to target when developing appropriate strategies.

From the systematic review, there were effective interventions targeted at external factors, where interventions were aimed at health care providers to improve the delivery of health checks and the financial incentives to individuals, in order to decrease external barriers (Cheong et al., 2017). In this study, external barriers were shown to affect participation in health checks, from both an individual and population perspective. The influence of significant others such as health care providers could have a positive effect at the individual level. Thus, these interventions might work also if implemented locally. Free vouchers provided in the SOCSO health screening programme, and community outreach health check programmes such as KOSPEN, were some initiatives provided by authorities to improve the uptake of CVD screening (Community Development Department (KEMAS), 2015; SOCSO, 2016). These programmes help to address the external barriers such as cost and accessibility. For members of the public who do not have this support, the information about availability of CVD health checks in public clinics needs to be made known to the public. Flexible public clinic appointment times, such as having the checks after office hours or at weekends, would probably increase the

participation of the public. However, the challenges for this to be implemented are the availability of resources and manpower. Though decreasing external barriers could be an effective strategy to increase the uptake rate for people who already have a moderate or high degree of intention, it might be less effective for those who have low intention. Looking at the magnitude from the descriptive statistics in phase III, in which the mean score of perceived external barriers was only 2.31 (95%CI 2.26, 2.37), it was apparent that external barriers were not a major concern. The regression model, which had lower beta value in three out of four models (refer to Table 5.31), also suggests this. Thus, internal factors are more important. Strategies targeting internal factors, such as perceived relevance of CVD health checks, and readiness to face screening outcomes, should be considered for inclusion as targets of interventions.

Public perception of health check relevance and readiness to face screening outcomes are internal factors found to influence the public's behaviour in terms of undergoing CVD health checks. The 5As (ask/assess, advice, agree, assist and arrange) approach is recommended and emergingly used for behavioural change in health interventions, such as smoking cessation and weight management (Gudzune, 2016; Papadakis et al., 2010; Sherson, Yakes Jimenez, & Katalanos, 2014; The Royal Australian College of General Practitioner, 2015; Vallis et al., 2013; Whitlock, Orleans, Pender, & Allan, 2002). As a health check is the first step in a health intervention for behavioural change, intervening at this point might benefit subsequent management and optimize the benefits of health checks. Primary care providers could enquire an individual's interest about CVD health checks and explore their perception of health check relevance in clinic consultations. The 5As approach could be adapted, incorporating the factors found in this study. For example, for opportunistic health check invitations, a prompt sheet could be provided to potential participants prior to doctor consultation to determine whether they have any concerns about health checks, which could then be addressed during the consultation.

Next, primary care providers can assess and address the individual's concerns and readiness for health checks objectively, and provide support for them. This step is important to facilitate shared decision-making between individual and primary care providers. The lack of readiness to face health check outcomes could result in non-participation in these checks and failure in subsequent management and follow-up. At the population level, in order to have effective health communication, health materials should contain information that is relevant to the target group (Kreuter & Wray, 2003). When disseminating information to the general public, health messages must emphasize the benefits of health checks and address the drawbacks of these checks, such as concern about the disadvantage of insurance purchased if abnormal results were detected. Besides, common issues such as the side effects of medication, health check procedures or lifestyle management could be included to reduce misconceptions and enhance readiness to face the outcomes of health checks.

The questionnaire developed in this study has the potential to help to assess the concern of an individual when deciding for CVD health checks. Based on their concerns, tailoring messages and appropriate information could be provided to meet their needs to facilitate their decision-making process to undergo health checks. The tailoring of messages is perceived to be personally relevant and could enhance one's receptivity to the information presented (Kreuter & Wray, 2003; Lustria, Cortese, Noar, & Glueckauf, 2009; Rimer & Kreuter, 2006). Tailored message intervention was shown to be beneficial in increasing cancer screening (Hirai et al., 2016; Sohl & Moyer, 2007), though no literature was found regarding this intervention measure in promoting CVD risk factor screening. With the increasing use of the internet in this country, where the proportion of internet users is about 70% (International Telecommunication Union, 2017; Internet Live Stats, 2016), online health communication could be one of the important strategies to reach out to the public and provide widespread disseminations for health education and

promotion. Computing technologies could facilitate the tailoring, whereby the system could be designed to automate the collection of individual information and then provide individualized feedback (Lustria et al., 2009). Systematic reviews and meta-analyses have shown the effectiveness of web-based and computer-based interventions for various health conditions, including self-care for chronic illness, sexual behaviour, physical activity, being overweight and obesity, substance abuse, smoking cessation and eating disorders, where positive outcomes have been achieved, such as increased knowledge and desired behavioural change (Myung, McDonnell, Kazinets, Seo, & Moskowitz, 2009; Portnoy, Scott-Sheldon, Johnson, & Carey, 2008; Wantland, Portillo, Holzemer, Slaughter, & McGhee, 2004). Putting individual and public health interventions together, the questionnaire developed in this study could be designed for a web-based or computer-based application for public use; based on the score of the respondents, the tailored information required could be provided to them, in order to facilitate their decision-making for CVD health checks. For example, if the respondent was concerned about cost and accessibility, a list of government and private clinics nearby the respondent's living area, with their respective CVD health check prices, could be suggested to them. Similarly, if the respondent was worried about other issues such as lack of readiness to handle the health check outcomes, education and explanation material could be linked to them. This web-based and computer-based application could be useful for the public and also for those non-attenders in CVD health check programmes, such as the SOCSO health screening. Further research is required in this area.

6.4 Future directions for research

The generalisation of the current survey results is limited by the representativeness of the study population. Future studies would need to cover a wider population, including those in rural areas, using probability sampling to capture more representative socio-demographic backgrounds. A household survey using multi-stage sampling or random

sampling may be a better approach to have a representative population. There is a need to translate the questionnaire into Mandarin and Tamil for better response rates and coverage of the population. In addition, apart from the intention to participate in CVD health checks, there is a need to follow up the participants and examine their action in health checks participation for a more objective outcome.

The suggestions of measures to improve CVD health checks, as discussed in section 6.3, need to be pilot tested in an experimental design, in order to evaluate the feasibility and effectiveness of those measures.

The adherence to regular health checks and subsequent management are important ways of reducing cardiovascular risk, which would help to reduce the morbidity and mortality of CVD. It is important to investigate the adherence challenges in future studies.

6.5 Conclusion

The use of a sequential mixed-method design in this study has provided a more comprehensive understanding of the factors influencing the public's decision to undergo CVD health checks from the perspective of an individual (in the qualitative study) and the average impact on a population (in the quantitative study). To improve the uptake of CVD health checks for individuals, the explanatory framework in phase II could be used to assess and support an individual's needs, depending on which factors that individual places emphasis on. Further, it would be important to target the significant determinants in phase III when developing interventions at the population level. It is hoped that such measures will lead to an increase in CVD health checks and ultimately offer opportunities to reduce cardiovascular disease incidence in Malaysia.

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LIST OF PUBLICATIONS AND PAPERS PRESENTED

List of publications:

1. Cheong AT, Khoo EM, Tong SF, Liew SM. To Check or Not to Check? A Qualitative Study on How the Public Decides on Health Checks for Cardiovascular Disease Prevention. PLoS ONE. 2016;11:e0159438.

2. Cheong AT, Liew SM, Khoo EM, Mohd Zaidi NF, Chinna K. Are interventions to increase the uptake of screening for cardiovascular disease risk factors effective? A systematic review and meta-analysis. BMC Family Practice. 2017; 18(1):4

List of papers presented:

1. Cheong AT, Liew SM, Khoo EM, Chinna K, Zaidi NFM. Ps 12-23 Effectiveness of interventions to increase blood pressure screening uptake: a systematic review and meta-analysis. Journal of Hypertension. 2016;34:e361–2. The 26th Scientific Meeting of the International Society of Hypertension. 24th-29th September 2016. Coex, Seoul, Korea. Journal of Hypertension. 2016;34:e361–2.

2. Cheong AT, Zaidi F, Liew SM, Khoo EM, Chinna K. What interventions can increase participation in CVD risk factor screening? A systematic review and meta-analysis. 5th Asia pacific Primary Care Research Conference. 4th-6th December 2015. Everly Hotel Putrajaya, Malaysia. Malaysia Family Physician 2015; 10(Suppl 2):26-27.

3. Cheong AT, Khoo EM, Tong SF, Liew SM.Decision making for health checks on cardiovascular disease prevention: A preliminary finding. Joint International Shared Decision-Making and International Society for Evidence-Based Health Care Conference. 19th-22th July 2015. University of Sydney, Australia.

4. Cheong AT, Khoo EM, Liew SM, Chinna.K, Public's views and experiences on health checks for cardiovascular disease prevention: A preliminary finding. WONCA Asia Pacific Regional Conference 2015. 4th-8th March 2015. Taipei International Convention Center, Taipei, Taiwan. (oral presentation)