The Influence of Health Beliefs and Sociodemographic Variables in the Cardiovascular Risk of Saudi Women

BY

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A Dissertation of Doctor of Philosophy Degree in Public Health

Imperial College London
School of Public Health
Doctor of Philosophy
2018

ABSTRACT

Background

Cardiovascular disease (CVD), a major worldwide public health issue, is of significant concern to the government of Saudi Arabia due to its negative impact on morbidity, mortality, and healthcare budgets. Two systematic reviews, published in the course of the development of this study, confirmed and highlighted the high prevalence of CVD risks in Saudi women. However, few studies focused on how cardiovascular risk is affected by health beliefs, in conjunction with sociodemographic variables. This study used the Health Belief Model to identify and compare Saudi women's perceived health beliefs (susceptibility, severity, benefits and barriers) against their calculated Framingham Risk Score to ascertain their risk for a future cardiovascular event.

Aim

This study sought to understand the influence of health beliefs and socio-demographic variables on the high prevalence of cardiovascular risks in Saudi Women, compared to their actual calculated risks using their Framingham Risk Scores.

Method

A cross-sectional study design was conducted to include women attending the primary care clinics at King Saud University Medical City, in Riyadh, Saudi Arabia. A non-random convenience sample was selected of adult women without pre-existing CVD. Health belief and sociodemographic data were collected and Framingham Risk Scores (FRS) calculated.

Results

This study, which involved 503 female participants, suggests that based on their surveyed health beliefs, subjects significantly underestimated their actual risks of CVD, as measured by their individually calculated Framingham Risk Scores. Of the studied group, 43.4% had high calculated CVD risks, though had a low perception of susceptibility. Compounding this, while

63.5% understood the severity of CVD, 75.2% had a low to moderate perception of benefits of healthy behaviours i.e. physical activity and healthy diet. 86.7% did not know how to perform CVD risk-reducing exercises, and 65.9 % disagreed that they had access to exercise facilities. Pearson correlations supported these findings suggesting a weak linear relationship between the FRS and each health belief subscales (perceived: severity, benefits, and barriers). There was a significant relationship between the FRS across the income, marital status, education, occupation and work status categories ($p <= 0.001$) in Chi-Square tests. Significant differences were found in comparing; perceived benefits of healthy behaviours with marital status, perceived severity and benefits with the level of education, perceived severity and benefits with occupation, and perceived severity and benefits in relation to financial income. Of the sample group, 75% were over the age of 45, and 68% declared their occupation as housewives, and 50% were educated at a level below High School.

Conclusion

This study is the first in Saudi Arabia to examine the correlation between health beliefs, calculated CVD risks, and extended socioeconomic and sociodemographic variables. It has significant implications for the public health policies and investment decisions needed to reduce the prevalence of CVD in the country. This study highlights how the social determinants of health are a vital element affecting CVD risk and health beliefs. Focusing policies on the low educational and income level population is required to prevent CVD. Moreover, financial allocations for health in Saudi Arabia should move towards preventive programs that are designed to raise the awareness of health risks. Education regarding the risks lies at the heart of the problem since if the level of perceived susceptibility are low then that will only serve to undermine the whole motivation for them to address exercise routines and diet. Risk awareness on its own would not necessarily lead to changes in behaviour. Any increase in understanding of risk would have to be accompanied with the knowledge of what exercises are appropriate, along with an appreciation of what healthier diets are and how they can be affordable.

AUTHOR'S DECLARATION

I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where states otherwise by reference or acknowledgment, the work presented is entirely my own.

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ACKNOWLEDGEMENTS

Dear Reader,

This PhD research has taken a great amount of time, resources, physical and mental effort to reach completion. In this effort I would like to express my sincere appreciation for their direct or indirect help and support to the following people and institutions.

First of all, I would like to thank all the patients who agreed to participate in this study.

In addition, I would like to express my appreciation to my supervisors Prof. Azeem Majeed, Prof. Salman Rawaf, and Dr Filippos Filippidis for their support during my research work.

I would like to thank my Parents; Khalid, Sanaa and children; Abdulaziz, Juju and Khalid, for being with me when I needed them and supporting me all the way.

I would like to sincerely thank my friends and colleagues for all the help and support, including Mr. Vincent McHugh, Dr. Harumi Quezada-Yamamoto and Ms. Juren Baldove.

A sincere appreciation also to Prof. Ricky Banarsee and Dr. Margaret Coffey for their invaluable insights and suggestions that helps in refining this thesis.

I would like to thank Imperial College for its excellent facilities and staff that contributed to my effort.

Finally, I would like to express my appreciation to the Kingdom of Saudi Arabia that has sponsored me through the King Saud University to perceive excellence and knowledge.

Thank you ALL.
It has been a great journey of knowledge, self-perseverance and dedication to high virtue.

Yours Sincerely,

Mashael K Alshaikh

PUBLICATIONS

The work presented in this thesis has resulted in the following original publications.

Peer Reviewed Conference Papers

- Oral presentation at the 2nd International Conference on Public Health. Presented " Women and CVD risk in Saudi Arabia" that held on 28th - 29th July 2016 in Colombo, Sri Lanka
- Oral presentation in the World Congress on Public Health and Health Care Management & Global Summit on Diabetes and Endocrinology April 03-05, 2017 Dubai, UAE.
- Oral presentation in 11th Geneva Conference on Person-centred Medicine 'Person Centred Women's Health 40 Years after Alma Ata Core Conference' 9 – 11 April 2018, Geneva, Switzerland.

Peer Reviewed Journal Papers

- **Alshaikh MK**, Filippidis FT, Baldove JP, Majeed A, and Rawaf S, "Women in Saudi Arabia and the Prevalence of Cardiovascular Risk Factors: A Systematic Review," Journal of Environmental and Public Health, vol. 2016, Article ID 7479357, 15 pages (p. 1-15) , 2016. https://doi.org/10.1155/2016/7479357.
- **Alshaikh MK**, Filippidis FT, Al-Omar HA, Rawaf S, Majeed A, Salmasi AM. The ticking time bomb in lifestyle-related diseases among women in the Gulf Cooperation Council countries; review of systematic reviews. BMC public health. 2017 Dec;17(1):536.
- **Alshaikh MK,** Rawaf S, Quezada-Yamamoto H. Cardiovascular risk and fruit and vegetable consumption among women in KSA. A cross-sectional study. Journal of Taibah University Medical Sciences. 2018 Jun 29 Online.
  https://www.sciencedirect.com/science/article/pii/S1658361218300635

TABLE OF CONTENTS

ABSTRACT 2

AUTHOR'S DECLARATION 4

COPYRIGHT DECLARATION 4

ACKNOWLEDGEMENTS 5

PUBLICATIONS 6

TABLE OF CONTENTS 7

LIST OF TABLES 11

LIST OF FIGURES 13

LIST OF ABBREVIATIONS 14

CHAPTER 1: INTRODUCTION 15

1.1 Background 15

1.2 Saudi Arabia's Public health system 17

1.2.1 Coverage Eligibility 17

1.2.2 Structure of the Saudi Healthcare System 18

1.2.3 Primary Care Services 19

1.2.4 Health Promotion 20

1.2.5 Challenges Facing the Healthcare System 20

1.2.6 Saudi Arabia's Vision 2030 21

1.3 Health Belief Model 22

1.4 Tools used to assess CVD risks 23

1.5 CVD in the Middle Eastern countries 24

1.6 CVD in the Gulf Cooperation Council (GCC) Countries 25

1.7 Prevalence of cardiovascular risk factors among women in Saudi Arabia 26

1.8 Economic burden of CVDs in Saudi Arabia 27

1.9 Socio-cultural factors impacting women in Saudi Arabia 28

1.10 Gender inequality 31

1.11 Significance of the Study 32
1.12 Aim and Objectives 33
1.13 Research Focus 34
1.14 Research Questions 34
CHAPTER 2: LITERATURE REVIEW 36
2.1 Health literacy in Saudi Arabia 36
2.2 Systematic Reviews on the prevalence of CVD risk among women in GCC and Saudi Arabia 37
2.2.1 Systematic Review Criteria 38
2.2.2 Objectives / Research questions 39
2.2.3 Methodology 39
2.2.4 Key Results 40
2.2.5 Discussion / Commentary: 42
a. Smoking: 42
b. Hypertension: 42
c. Diabetes: 42
d. Overweight and Obesity: 43
e. Hypercholesterolemia: 43
f. Physical Inactivity: 43
g. Metabolic Syndrome 44
h. Conclusions from both systematic reviews 44
2.3 The Health Beliefs Related to CVD (HBCVD) 45
2.4 Framingham Risk Score in KSA 48
2.5 Social Determinants of CVD Risk 49
2.6 Barriers to healthy behaviour focusing on PA and FV consumption among women in Saudi Arabia. 53
a. The barriers to PA reported in the literature among Saudi women 53
b. Healthy diet, and the fruit and vegetable consumption among women in Saudi Arabia 62
2.7 Summary 63

CHAPTER 3: METHODOLOGY and STATISTICAL ANALYSIS 64
Introduction 64
3.1 Study design 64
3.2 Study population and Study Location 65
3.3 Study period and Sample size calculation 66
3.4 Inclusion and exclusion criteria 66
3.5 Ethical Summary 66
3.6 Biomedical information collected from participant's medical records. 67
3.7 Sample Selection and Patient Recruitment 68
3.8 Survey Instrument 72
3.9 Translation process 73
3.10 Pilot Study 74
3.11 Instrument Reliability 74
3.12 Data Coding and Analysis 77
CHAPTER 4: RESULTS 78
4.1 Description of the sample 78
4.2 Results of the research questions 85
Research Question 1 85
Research Question 2 91
Research Question 3 93
Research Question 4 94
CHAPTER 5: DISCUSSION 110
5.1 Health Beliefs of Saudi women regarding CVD 111
5.2 Health Belief subscales and CVD risk (FRS) 114
5.3 Sociodemographic variables and CVD risk (FRS) 115
5.4 Relationship between Health Beliefs and sociodemographic variables. 119
5.5 Perceived barriers 121

5.6 Strengths and Limitations 122
CHAPTER 6: FUTURE PERSPECTIVES 123
6.1 Use of Electronic Medical Record and Assessment tools 123
6.2 Physician - Patient Communications 125
6.3 Promoting PA 127
6.4 Prevention strategies 129
6.5 Improving diets 130
6.6 Campaign planning and design 132
6.7 Educational strategies 132
6.8 Role of primary care in CVD prevention 133
CHAPTER 7: CONCLUSIONS 134
REFERENCES 136
PUBLICATIONS 152
APPENDIX 155
Appendix 1 Permission to use CVD health belief instruments 155
Appendix 2 Questionnaire 156
Appendix 3 Ethical approval from IRB 161
Appendix 4 Fruit and Vegetables Serving Portions 162
Appendix 5 Serving Portion of Saudi Food (Kabsa, Arabic Sweets) 163
Appendix 6 Recommended Food Daily Serving for Saudis (The Healthy Food Palm, 2013) 164

LIST OF TABLES

Table 1.1 The health status of Saudi women: findings from a national survey

Table 2.1 Summary of Key Results from 1st systematic Review. Alshaikh MK et al. 2016

Table 2.2 Summary of Key Results from 2nd systematic Review. Alshaikh MK et al 2017

Table 2.3 Studies that used FRS related to a sociodemographic variable in KSA:

Table 2.4 Barrier to PA among women in Saudi Arabia

Table 3.1 Definitions for anthropometric measurements and risk factors

Table 3.2 Definitions for the risk factors

Table 3.3 Instrument Layout

Table 3.4 HBM Definitions and Health Beliefs Related to CVD scale (HBCVD)

Table 4.1 Baseline respondents' characteristics

Table 4.2 Respondents' medical parameters

Table 4.3 Summary table for constructs of HBM

Table 4.4 Perceived Susceptibility to CVDs

Table 4.5 Perceived Severity of CVDs

Table 4.6 Perceived Benefits regarding CVDs

Table 4.7 Perceived Barriers regarding CVDs

Table 4.8 Chi-Square test: The association between Health Belief Subscales and Framingham Risk scores

Table 4.9 ANOVA Test: The difference in the mean of Framingham risk score (FRS) and Sociodemographic variables

Table 4.10 Standard Multiple regression analysis: Health Belief Subscales and Sociodemographic variables.

Table 4.11 ANOVA Test: The difference in the mean of each health belief construct and Sociodemographic variables

Table 4.12 Logistic Regression Analysis: Association of Perceived barriers to physical activity with age, education, marital status, employment status, income, DM, family history of hypertension, family history of DM, hypertension, body mass index, Framingham classification.

Table 4.13 Logistic Regression Analysis: Examined the effects of age, education, marital status, employment status, income, DM, hypertension, family history of DM and hypertension, body mass index and Framingham scores on the perceived barriers.

Table 4.14 The difference in health belief subscales' means in different PA behaviours

Table 4.15 Summary of findings

LIST OF FIGURES

1.1 Health Belief Model

1.2 Study focus

4.1 Saudi population % age, category

4.2 Comparison of Saudi population age with the study sample

4.3 Lifestyle question 1

4.4 Lifestyle question 2

4.5 Lifestyle question 3

4.6 Summary of health belief subscales

5.1 Average monthly expenditure of Saudi household by monthly income

6.1 Visual aid example linking FRS and health belief

LIST OF ABBREVIATIONS

ACS Acute coronary syndrome

AHA American Heart Association

AHA American Heart Association

ANOVA Analysis of variance

CHD Coronary heart disease

CVD Cardiovascular Diseases

DM Diabetes mellitus

EMR Eastern Mediterranean Region

FRS Framingham Risk Score

FV Fruit and vegetables

GCC Gulf Cooperation Council

HBM Health Belief Model

HBCVD Health Beliefs Related to CVD scale

HTN Hypertension

IDF International Diabetes Federation

KSA Kingdom of Saudi Arabia

KSUMC King Saud University Medical City

ME Middle East

NCEP-ATP III National Cholesterol Education Program-Adult Treatment Panel III

NCD Non communicable diseases

PA Physical activity

PCC Primary Care Centre

SMOH Saudi Arabia Ministry of Health

SPACE Saudi Project for Assessment of Coronary Events Registry

SES Socioeconomic status

UAE United Arab Emirates

WHO World Health Organization

CHAPTER 1: INTRODUCTION

1.1 Background

Cardiovascular disease (CVD) is a group of diseases that include conditions of both the heart and blood vessels, thereby including coronary heart disease (CHD) and acute coronary syndrome (ACS) among several other conditions (E. J. Benjamin et al., 2018). CVDs account for almost half the disease burden of non-communicable diseases (NCDs), and it is one of the leading causes of death worldwide (WHO, 2018). It accounts for 30% of all deaths and almost half of the NCDs that cause deaths worldwide (WHO, 2011). According to the World Health Organization (WHO) in 2013, CVDs accounted for 17.3 million deaths per year, and it is expected that by 2030 this number will rise to more than 23.6 million (WHO, 2016).

Studies have identified a reduction in CVD rates within developed countries, which was attributed to the reductions in risk factors (Centers for Disease & Prevention, 1999; O'flaherty, Buchan, & Capewell, 2012). Both the WHO and the American Heart Association (AHA) state that CVD risk factors, which are the cause of the illness are modifiable (Bitton & Gaziano, 2010; World Health Organization, 2007). According to the INTERSTROKE and the INTERHEART studies, an international multi-centres case-control study of acute myocardial infarction in 52 countries, ten risk factors are associated with 90% of the risk of CVD. CVD and other chronic diseases share common behavioural risk factors such as unhealthy diet, lack of physical activity (PA), smoking, and alcohol use (M. J. O'Donnell et al., 2010; Yusuf et al., 2004). These factors are the most acquiescent to change and have the highest impact on individuals (Chomistek et al., 2015; C. J. O'Donnell & Elosua, 2008; P. W. Wilson et al., 1998). In the past, it was commonly believed that CVDs primarily affected males. However, research has shown that it is the leading cause of deaths in women. In fact, female deaths in the over 60 age group, surpass men's deaths in the same age group, especially within the low- and middle-income countries (WHO, 2011; World Health Organization, 2015). In contrast, high-income countries which have invested more in raising awareness, thus increasing prevention, have significantly reduced the mortality rate (World Health Organization, 2015).

The Kingdom of Saudi Arabia (KSA) belongs on the list of high-income countries. After the discovery and commercialisation of its oil resources, the country underwent an economic

boom that has led to the rise of various risks of CVD behaviours and a transition in nutrition (Mehio Sibai et al., 2010). Indeed, over the past few decades, Saudi Arabia has developed one of the highest prevalence rates of obesity and physical inactivity globally (DeNicola, Aburizaiza, Siddique, Khwaja, & Carpenter, 2015). According to the WHO, CVD is a leading cause of death and morbidity in Saudi Arabian population with a high prevalence rate among Saudi Arabian women (WHO, 2014).

The alarming increase in the incidence and prevalence of CVD in Saudi Arabia and the parallel increase in CVD risk factors are primarily influenced by behavioural factors (Aljefree & Ahmed, 2015; Shara, 2010). These behavioural factors, such as lack of PA, unhealthy diet and smoking, are modifiable and can be prevented (World Health Organization, 2009a).

Improving health behaviour is one of the crucial elements to control CVD. Increasing the number of people engaging in healthy behaviours, such as adherence to PA, has been proven to have an impact on CVD reduction. Lee et al., demonstrated the importance of PA on major NCDs including CVD, by estimating how many diseases could be avoided if inactivity were tackled at the population level (Lee et al., 2012). They estimated population-attributable fractions (PAF) to calculate all-cause mortality associated with physical inactivity using adjusted relative risks. In Saudi Arabia, the impact of physical inactivity was reported to be 11.4% for coronary heart disease, 14.1% for Type 2 diabetes (DM), 19.9% for breast cancer, 20.4% for colon cancer, and 18.4% for all-cause mortality (Lee et al., 2012).

1.2 Saudi Arabia's Public health system

1.2.1 Coverage Eligibility

There are two articles in the Saudi Arabian 1992 Basic Law of Governance, Chapter 5, that relate to the provision of healthcare services in the State. They are as follows:

> Article 27: "The State shall guarantee the rights of the citizens and their families in cases of emergency, illness, disability and old age. The State shall support the Social Insurance Law and encourage organizations and individuals to participate in philanthropic activities"
>
> Article 31: "The State shall look after public health and provide health care for every citizen"(Shura Council, 1992)

As a consequence of these provisions, every Saudi citizen working for the government, and their dependents, are covered for free under their government employee status with services provided through the Ministry of Health (SMOH) facilities. Some government employees and their families, such as those employed in the Saudi National Guard service are covered for free under separate military or ministry systems with their own facilities. Employees of private companies, Saudi nationals and non-nationals alike, and their dependents, are covered under a mandatory insurance scheme, where the employer, chooses the insurance carrier, selects the plan, and pays the premium. The Council of Cooperative Health Insurance (CCHI), an independent government agency which serves as the effective regulator of the private insurance process indicates on its website that there are 11.2 million beneficiaries covered by the private insurance system, through plans provided by 27 insurance companies and 5,248 healthcare providers. The majority of covered beneficiaries, 7.9 million primary and dependent enrolees, under this private employer system are Non-Saudis (Council of Cooperative Health Insurance, 2016).

Tourist and business visitors are required to obtain health insurance coverage from a Saudi carrier at the time of their visa application through the visa process, so that they have medical insurance coverage from the time of their arrival in Saudi Arabia. Additionally, those

who make the annual pilgrimage in the State's holy sites are covered for health services by the Saudi government, for free. In 2016 alone, over 1.75 million pilgrims visited the Kingdom from all over the world (General Authority of Statistics, 2016).

1.2.2 Structure of the Saudi Healthcare System

The SMOH, which was established in 1950, has the responsibility for health policy and for overseeing a developed and complex healthcare system comprising of public sector and private sector facilities providing primary, secondary and tertiary healthcare services. The Ministry is funded from the overall government budget and accounts for between 6% and 7% of the annual State budget. It directly controls 60.0% to 70.0% of the delivery of health services and through twenty other regional directorates-general of health. Health policy is addressed in a series of 5-year development plans and has evolved from a treatment-based emphasis to a balance between treatment and prevention (Almalki, Fitzgerald, & Clark, 2011; Mufti, 2000). The Saudi health system was ranked 26 out of 191-member states in the WHO's the World Health Report 2000, placing it ahead of the United States which was ranked at 37 (World Health Organization, 2000)

The Saudi public sector health services have several components including regionally dispersed public hospitals and primary care clinics, military hospitals covering both the Saudi Arabian National Guard and the Ministry of Defence, as well as facilities covering the employees and their dependents of the Ministry of the Interior and Specialty hospitals which have resources not available elsewhere in the system. In addition, the system includes the Red Crescent First Aid and Ambulance Services. Likewise, some private sector facilities and services are organized by industry groups such as the oil sector (Albejaidi, 2010; Mufti, 2000)

The SMOH website and its Statistical Yearbook provides extensive data on the healthcare systems including services utilized by nationals' status, by region, facility type, speciality, and visit frequency. In 2016, according to this SMOH data, there were over 470 hospitals in the system, including 152 private hospitals, providing 70,844 beds available for patients. The average Saudi resident in 2016 made 4.4 visits per year to a healthcare facility. The 2016 data available on the SMOH website indicated that the ministry and other

government agencies, employed 76.0% of the total 465,938 medical and allied staff providing health care services in the kingdom. Physicians accounted for 16.3% of the total staff, and nurses accounted for a further 38.8%. The Allied Healthcare Personnel category accounted for 36.6% of the total staff employed. The government sector employees have more Saudi nationals than the private medical sector. At the SMOH facilities, 33.4% of the Physician and Dentistry staff category were Saudi Nationals, whilst only 3.3% of that same category in the private medical sector were Saudis. Overall, in the combined public and private sectors employers, 26.7% of Physicians and Dentists, and 36.5% of nursing staff were Saudi Nationals. The Saudi percentage for the Allied Health Personnel category was much higher at 74.4% overall, and 70.0% to 93.2% in the government-controlled providers. (MOH, 2016)

A rate per unit of population is a useful approach for analysing the Saudi Health system. On this basis, in 2016, there were 28.3 physicians per 10,000 of the population in the Kingdom overall, whilst there were 4.4 dentists and 57.0 nurses per 10,000 of population. There were also 22.3 hospital beds available per 10,000 population Kingdom wide. (MOH, 2016)

The government is interested in reducing its budgetary burden in relation to the provision of healthcare services and has signalled its intention to privatize the healthcare system in an orderly way. There are plans to extend the private employer insurance process in a phased way to the government sector. Additionally, it is planned to transfer the ownership of public hospital facilities to the private sector, and pilot projects are being experimented with to develop a model of how to do this effectively. (Vision 2030)

1.2.3 Primary Care Services

In 1980 a ministerial decree was issued which was the initial process in establishing primary care services and related facilities, focused on preventive care services. The decree was the government's response to implement the WHO's Alma-Ata declaration in 1978.

In 2017 alone, SMOH reports that there were 2,361 Primary Health Care Centres (PHCC) in operation throughout the Kingdom with 50,214,862 patient visits. The centres

provide primary healthcare services and treatments, immunization services, control locally endemic diseases, provide essential drugs, nutrition information, patient advice and education, maintenance of patient records, and a referral service to secondary and tertiary hospitals and facilities as needed. There were within the PHCC network, speciality centres such as 55 counselling clinics, and 160 anti-smoking clinics. For patients with overt or unknown CVD risks, the PHCC network is likely their first and on-going point of contact with the medical system in Saudi Arabia (MOH, 2017).

1.2.4 Health Promotion

The Ministry develops educational health campaigns and health promotion campaigns to improve the overall awareness of health issues and promote general patient wellbeing. These have included campaigns on DM awareness, breast cancer, heart disease, and cancer. The SMOH website reported reaching over 3 million targets in these campaigns and it used social media to conduct 15,000 online consultations as part of the campaign process. The PHCC infrastructure is an integral channel for the communication of positive health messages and providing detailed information to visiting patients.(MOH, 2017)

1.2.5 Challenges Facing the Healthcare System

Despite the achievements of the SMOH and the private sector participants in the healthcare system, numerous challenges still exist. These include the condition of some physical infrastructure and facilities, operating efficiency, staffing quality, turnover and shortages. There is potential for a rural-urban divide, given the physical size of the country and its level of urbanisation. It is also a challenge to ensure that high-quality standards are consistently maintained throughout the network. Given the projected growth of the Saudi population to 41 million by 2050 and the levels of CVD risk factors in a large number of Saudi residents, healthcare funding is also a significant concern (United Nations, 2017). This is part of the rationale for the increasing focus on privatisation of the healthcare system where it is expected that the profit incentive will lead to improved performance, innovation, and higher quality of delivery of services.

1.2.6 Saudi Arabia's Vision 2030

The Quality of Life 2020 – Delivery Plan document, which is part of the detailed planning to achieve the Vision 2030 initiative of the Saudi government, was reviewed to gain further insights into future government initiatives. While a full review of the document and the broader 2030 Vision itself is beyond the scope of this present work, it is of significance to mention that the government recognizes some of the limitations such as the current lack of enough parks and public spaces, recreational facilities, the condition of roads and the transportation infrastructure, which impacts the ability of the people to participate in and maintain an active lifestyle. The Quality of Life document, however, outlines targets in a number of specific areas that will likely contribute to the reduction of CVD and CVD risk factors. These include: increased participation in sports, including sports activities for girls, reduction of the rates of DM by the development of a pre-hospital system and establishing nutrition clinics, increased health awareness campaigns, reduction of obesity rates, increased PA including goals of increasing female participation in the workplace, and the introduction of a bachelor's degree program in physical education for girls at the University of Tabuk, among other programs (Council of Economic Affairs and Development, 2018).

The plan document includes a metrics section starting with baseline numbers and then including metric trajectories for the years, 2018, 2019, and 2020. The Number of Steps Taken per Person per Day metric, for instance, starts with a baseline level of 3,807, and increases to 3,850 in 2018, to 4,040 in 2020. Similar metrics are included for DM, Obesity, and Life Expectancy (Council of Economic Affairs and Development, 2018).

1.3 Health Belief Model

The Health Belief Model (HBM) is one of the most commonly used theories in health education and promotion (Karen Glanz, Rimer, & Viswanath, 2008; Jones et al., 2015; Orji, Vassileva, & Mandryk, 2012). It was developed by the US Public Health Service in the 1950s, to understand why medical screening programmes, offered particularly for tuberculosis, were not very successful (Rosenstock, 1960). The model describes a combination of personal risk analysis, followed by an evaluation of the proposed solution and its use. The following perceptions: perceived susceptibility, severity, benefits, and barriers are the main four constructs of HBM (Figure 1.1). Each of these perceptions, individually or in combination, is used to explain health behaviour (Orji et al., 2012). Besides, most successful public health programs and prevention initiatives are based on an appreciation of health behaviours, through understanding how lifestyle affects CVD (Doll, Peto, Boreham, & Sutherland, 2004; Kumar & Preetha, 2012). Research generated by the HBM has often found that women behave more consistently about their health attitudes and beliefs than men (Courtenay, McCreary, & Merighi, 2002; Rom Korin et al., 2013). The HBM has provided a useful theoretical framework for investigating the cognitive determinants of a wide range of behaviours for over three decades and is also one of the most useful tools in illustrating the importance of individual beliefs about health (Orji et al., 2012).

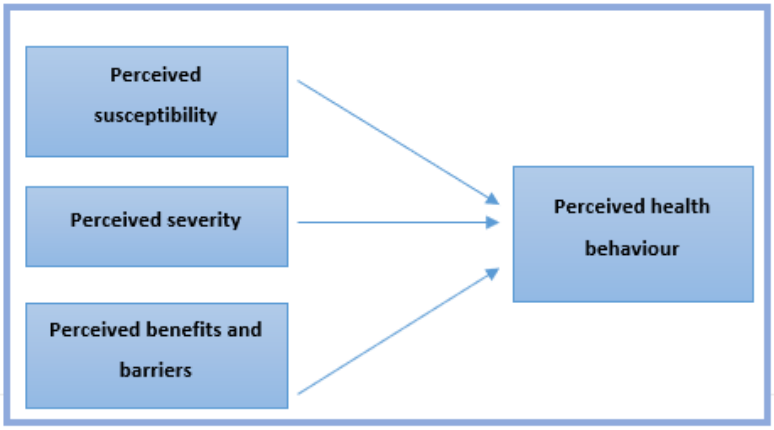


Figure 1.1: *Health Belief Model*

This model has been used in many studies that test behaviours such as in cancer and HIV screening programs (Ma et al., 2013; Nothling & Kagee, 2013).

International studies using HBM have been instrumental in increasing heart disease awareness for the last 15 years (Christian, Rosamond, White, & Mosca, 2007). Awareness of CVD risk factors is important to reduce heart disease. A healthy lifestyle can mitigate and change risk factors that are behaviourally dependent (National Heart & Institute, 2018). Understanding how these health beliefs influence diet and exercise behaviours among women with CVD risk could be an essential contribution to the development of interventions to reduce CVD morbidity and mortality in the public, based on the premise that a change in belief precedes a change in behaviour (K. Glanz & Bishop, 2010). Also, the HBM can offer greater insight into the motivation to engage or not engage in health-promoting behaviours (Rosenstock, Strecher, & Becker, 1988).

1.4 Tools used to assess CVD risks

Several tools, such as Framingham Score (FRS), Pooled Cohort Equations and QRISK, have been developed to assess CVD risk.

The FRS can be useful for both patients and clinicians in determining the best preventive lifestyle option or the range of medical treatments. It also helps in patient education by identifying a person's risk for future cardiovascular events (Yousefzadeh, Shokoohi, Najafipour, & Shadkamfarokhi, 2015). FRS was developed after the Framingham Heart Study, which was conducted to identify the common factors that contribute to CVD (Kannel, Dawber, Friedman, Glennon, & Mcnamara, 1964). The Framingham Heart Study followed a large group of participants who were healthy and had no CVD symptoms (Kannel et al., 1964). After monitoring them over many years, they were able to discover and identify major CVD risk factors, such as high blood pressure, high blood cholesterol, smoking, obesity, and DM (Kannel et al., 1964).

Almost half of CVD-related deaths occur in the intermediate-risk group (Yang et al., 2012). Therefore, many research studies focus on ways to improve the predictive ability of current risk estimation tools (Lloyd-Jones, 2010).

Some researchers express a preference for other tools as they claim they are even more accurate. QRISK, for example, includes two additional parameters, BP-Treatment and Deprivations, that may better account for some of the limitations of FRS (Collins & Altman, 2009). However, Framingham is the most used score chart globally and in Saudi Arabia (Bitton & Gaziano, 2010).

1.5 CVD in the Middle Eastern countries

A high prevalence of CVD, particularly of coronary heart disease, is reported among studies conducted in the Eastern Mediterranean Region (EMR) (K. Turk-Adawi et al., 2018). EMR, one of the six regional WHO-designated geographical areas is comprised of 22 countries (Afghanistan, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates (UAE), and Yemen), with a population of approximately 583 million people.

The rate of death from NCDs in the EMR (654 per 100,000 persons) is higher than the global rate (539 per 100,000 persons) and the primary cause is CVD (Akala & El-Saharty, 2006; Almahmeed et al., 2012; Mehio Sibai et al., 2010; WHO, 2018). Data from the INTERHEART study (an international case-control analysis of the risk factors for a first myocardial infarction conducted in more than 15,000 patients presenting with myocardial infarction in 52 countries) showed that the median age at presentation with myocardial infarction was 51 years in the Middle East (ME) (Yusuf et al., 2004; Yusuf, Reddy, Ounpuu, & Anand, 2001). Additionally, a dramatic increase in CVD risk factors has been observed in the EMR in the past 30 years (Karam Turk-Adawi et al., 2018). Patients admitted with the ACS (ACS) were 7–10 years younger than those in other geographical regions with a rate of one in every four patients younger than 50 years of age (Alhabib et al., 2012; Alhaddad et al., 2017). A recent study conducted in the ME to study the impact of gender variation on patients with ACS indicated that women were represented more in heart failure than men (15 vs 12%; $P = 0.008$) and were more likely to receive blood transfusions (6 vs 3%; $P < 0.001$). Besides, women had higher 1-year mortality than men (14 vs. 11%; $P < 0.001$) (Khesroh et al., 2017).

Furthermore, several studies among Arab populations reported poor dietary habits with high levels of consumption of carbohydrates (e.g. refined sugars) and fats, which is consistent with the high prevalence of obesity, particularly among women (B. Abuyassin & Laher, 2015; Bisher Abuyassin & Laher, 2016; Galal, 2002). A recent analysis of 46 Muslim countries (where the Muslim population represents more than 50% of the inhabitants) which estimated the prevalence of overweight subjects, reported that in the EMR, females were more likely to be overweight than males (42.1% vs 33%). Remarkably, Arab countries were 2.92 (95% CI: 2.86-2.97) times more likely to be overweight compared to non-Arab Muslim countries (D Kahan, 2015).

1.6 CVD in the Gulf Cooperation Council (GCC) Countries

The Gulf Cooperation Council (GCC) is a political and economic alliance of six Middle Eastern countries that includes the KSA, Bahrain, Oman, Qatar, the United Arab Emirates (UAE) and Kuwait. The GCC was established in 1981 to ensure mutual investment and free trade between its member countries. This agreement also contributed to the improvements of several fields including education, culture, tourism, social opportunities, and health among member states (GCC, 2016). Life in the GCC has changed dramatically since the discovery of oil. Rapid urbanisation, fast economic growth, and modernisation have brought a significant conversion in dietary patterns and unfavourable consumption choices, and consequently a dramatic nutritional transition, adopting behaviours that are associated with increased risk of specific diseases (Mehio Sibai et al., 2010; Sherif & Sumpio, 2015). According to the most related studies in the specific area, around fifty per cent of the deaths of those aged below 70 in the ME countries were found to be attributed to CVD deaths, while the highest proportion of CVD deaths was in GCC including Saudi Arabia (Akala & El-Saharty, 2006; Almahmeed et al., 2012; Dalen, Alpert, Goldberg, & Weinstein, 2014; Yusuf et al., 2001).

Oil became the primary revenue source for financing health care services especially in Saudi Arabia, Kuwait, and Qatar (A. Alkhamis, Hassan, & Cosgrove, 2014). However, the recent fluctuation in the price of oil has affected healthcare budgets. Although, the GCC countries are examining different options to finance health care services, up to this point, there is no clear alternative and no intervention has been implemented to achieve this goal (A. Alkhamis

et al., 2014; Sturm, Strasky, Adolf, & Peschel, 2008). In 2013, Chahine et al., calculated that the direct and indirect cost of five selected NCDs in the GCC was $36.2 billion, where the cost of CVD and DM reached over $11 billion (Gabriel Chahine, 2013). This cost is estimated to increase to $67.9 billion by 2022 (Gabriel Chahine, 2013). However, despite these health care expenses, the current healthcare systems of some GCC countries were seen to be underdeveloped compared to some middle-income countries (A. Alkhamis et al., 2014), in the sense that their focus is still on a therapeutic approach instead of prevention (BLAIR & SHARIF, 2013).

The second Gulf Registry of Acute Coronary Events (Gulf RACE-2) during the year 2008–2009, was a multicenter study conducted in 65 hospitals from the six GCC countries released alarming results. Patients in GCC countries who presented with a high prevalence of metabolic syndrome (MetS) present at a relatively young age (Alhabib et al., 2012). Apart from smoking, CVD risk factors, including obesity, hypertension (HTN), hyperlipidaemia and DM are more prevalent in Middle Eastern women with ACS than in men (Alhabib et al., 2012).

Al-Bahilani and Mabry, investigated the legislation and policies issued by the GCC regarding the behavioural risk of NCD. Most of them were related to tobacco control, and only six policies addressed the prevention of NCDs (Al-Bahlani & Mabry, 2014). By year 2012-2013, the GCC Secretary General implemented short and long-term action plans to tackle NCDs. While short-term actions included incentives and disincentives such as taxes on tobacco, regulations in limiting the availability of unhealthy food in schools, and clinical interventions such as screening the population for risk factors, the long-term programs focus on behavioural change at the individual level and the healthcare system level to alter ingrained unhealthy lifestyles (Gabriel Chahine, 2013).

1.7 Prevalence of cardiovascular risk factors among women in Saudi Arabia

In Saudi Arabia, the prevalence of CVD including ACS, according to the Saudi Project for Assessment of Coronary Events Registry (SPACE) is also alarming. The registry highlighted the common denominators among the patients. More than 5,000 patients were enrolled with a mean age of 58 years. The results showed that more than half of the patients also had DM

and around half had HTN. Also, patients diagnosed with ACS in Saudi Arabia are 8 to 11 years younger than the homologous patients in ACS registries found in developed countries (Alhabib et al., 2011). The prevalence of CVD appeared to be age-related.

The last Saudi Health Interview Survey of individuals aged 15 years or older was conducted in 2013 (Daoud et al., 2015) (Table 1.1). From the interviewed sample, 32.5% had completed primary school or less, and 78% consumed less than 1-2 serving per day of fruit and vegetables (FV). It was concluded that women needed to improve their health behaviours to reduce the burden of chronic diseases in the Kingdom.

Table 1.1 The health status of Saudi women: findings from a national survey *Adapted from* (Daoud et al., 2015)

Age (Female)	DM (%)	Obesity (%)	High Cholesterol (%)	Hypertension (%)
15-24	5.4	13.9	2.9	2.5
25-34	5.9	33.2	5.6	4.2
35-44	10.5	49.5	8.7	13.4
45-54	22.6	57.6	12.1	26.9
55-64	41.6	63.1	19.5	48.6
65+	48.2	43.6	30.5	61.0

Note: overall prevalence was provided to both physical activity and smoking as the flowing:

- 15- 65+ old was Physical Inactivity = No activity 46.5%
- 15- 65+ old was Current Smoker- 1.5%

1.8 Economic burden of CVDs in Saudi Arabia

Saudi Arabia is the most prominent country on the Arabian Peninsula, extending over an area of 2,150,000 km^2, with a population of more than 31 million consisting of more than 13 million women and 17 million men (General Authority for Statistics, 2016). It is one of the rapidly developing countries with an oil-rich economy, and a population adopting new urban lifestyle changes (Soofi & Youssef, 2015). Saudi Arabia, a member of the GCC shares characteristics with both high-income and low-income countries (A. Alkhamis et al., 2014).

The impact of a rapidly urbanized lifestyle has been documented in many Saudi studies (Klautzer, Becker, & Mattke, 2014). Conclusive results have identified decreasing levels of PA

and increased availability of unhealthy food (Al-Nozha et al., 2007; Al-Nozha et al., 2005; El Bcheraoui et al., 2015) that are consequences of rapid urbanization. The Saudi diet has also significantly changed. It is increasingly common to have food with high sugar and fat content both at home and through the catering industry. This has led to an increase in the prevalence of CVD risk factors among Saudi women (Aljefree & Ahmed, 2015). Likewise, the financial liability for the treatment of CVD and its risks is enormous (Gabriel Chahine, 2013). One of the tertiary hospitals has conducted a survey and the average direct medical costs per patient with ischemic heart disease was equated to approximately 40,164 Saudi Riyals (SAR) ≃ (US$10,710) (Osman, Alsultan, & Al-Mutairi, 2011).

DM is one of major risk factors for CVD. Saudi Arabia, in particular, has one of the world's highest incidence rates of DM; according to the International Diabetic Federation (IDF), there were 3.4 million DM cases in 2015, with the prevalence of DM on both genders aged between 20-79 is estimated at 17.6 % (IDF, 2015). In 2010 the SMOH budget for expenditure accounted for over $9.4 billion dollars, from which approximately $0.9 billion was spent only on DM, with 45% of DM costs was spent among the ages of 45-60 (Alhowaish, 2013). This indicates that focusing on prevention might decrease the cost and increase the life expectancy among Saudis in the future, but it requires improving and changing the social norm in adopting a healthier lifestyle.

Saudi Arabia's public health services, provided by SMOH are free of charge to everyone (Almalki et al., 2011). However, with the economy being significantly impacted by oil/petrol price fluctuations and rapid growth in the population, the government is moving towards healthcare privatisation to offset fiscal deficits and to facilitate health services across the country (A. A. Alkhamis, 2017; Walston, Al-Harbi, & Al-Omar, 2008). Governments across the region have been criticised for insufficient prioritisation of public health and for reacting in a therapeutic approach rather than preventive (Almalki et al., 2011; BLAIR & SHARIF, 2013).

1.9 Socio-cultural factors impacting women in Saudi Arabia

Many social factors prevent women in Saudi Arabia from practicing healthy living. Women in Saudi Arabia live in a more restrictive environment than their male counterparts.

Restrictions based on cultural aspects and traditions have become barriers and social constraints. Saudi women are more limited in terms of freedom of movement including access to treatment and the courts, in comparison with women from other GCC countries (Mobaraki & Soderfeldt, 2010). Historically, PA has not been well promoted, and girls are not allowed to exercise in public spaces, universities and schools and there was no active policy or provision for women participating in sports activities (Al-Eisa & Al-Sobayel, 2012; Mobaraki & Soderfeldt, 2010). Moreover, the availability and opportunity for women to attend private fitness centres has been limited to a privileged number and those who have the support of their male guardian under a guardianship system, sometimes referred to as the mahram system. Under this system, women are considered as legal minors under the control of their mahram (closest male relative, e.g., father, brother, grandfather, father's brother, husband, or son) and are subject to legal restrictions on their personal behaviour that do not apply to men (Tønnessen, 2016). Saudi women were forbidden until June 2018 from driving cars. However, while this change was well received, women still need the permission of their male guardian to undertake other activities such as travelling outside the country. The lack of available transportation not only acted as a barrier for most women from attending facilities like gyms/health clubs (Amin, Suleman, Ali, Gamal, & Al Wehedy, 2011) but also as one of the main reasons for not attending hospital and clinic appointments (Kasem, Althobaiti, Al-Jeaid, & Al-Osaimi, 2015). In 2017, the Saudi government announced plans to introduce PA programs for girls in public schools, the implementation process has recently started. Nevertheless, it will take several years to be fully implemented in most areas of the Kingdom.

Socio-cultural factors such as the restrictions on movement and self-transportation, have contributed to unhealthy lifestyles, which have become part of the social norms within the Saudi society. Thereby, cultural constraints may explain the alarming prevalence of a sedentary lifestyle and obesity in women living in Saudi Arabia(Adam, Osama, & Muhammad, 2014). However, Saudi Arabia's new intervention law allowing women to drive, and the introduction of PA programs offer significant promise towards a new direction of a healthier lifestyle. Also, the Saudi government is facilitating, and moving towards a plan of empowering women to result in a healthier lifestyle. This was evident when in August 2016, the Saudi Arabian government appointed Princess Nura in a leadership position for Sports, and the

introduction of physical education for female students in public schools, which was not previously included in its curriculum (Arab News, 2016).

1.10 Gender inequality

According to the WHO, gender inequality affects the health of millions of women across the world (UNITED NATIONS, 2018; WHO, 2010)

In Saudi Arabia, various studies have reported significant differences in the prevalence of behavioural CVD risks between men and women such as PA and eating habits (Iqbal et al., 2014; Mahfouz, Shatoor, Hassanein, Mohamed, & Farheen, 2012; Soofi & Youssef, 2015). Also, the data from the last two national household surveys recognised gender-specific trends in the prevalence of CVD risk, especially in the obesity rate and PA levels (Z. A. Memish et al., 2014; World Health Organization, 2005). Furthermore, there are two more studies in Saudi Arabia that highlight fruits and vegetable consumption differences between men and women (Alzeidan, Rabiee, Mandil, Hersi, & Fayed, 2016; Midhet, Al Mohaimeed, & Sharaf, 2010).

The WHO has specified that gender inequity is not only a threat to economic development but also to public health, including that of future generations (Sen & Östlin, 2008). Due to socioeconomic inequalities and sociocultural norms in many countries, women still have less access to health care services and resources (World Health Organization, 2010). Consequently, women are at higher risk, especially in Arab countries (Yusuf et al., 2011). Furthermore, the negative impact of gender inequality factors, such as income, education, healthcare, nutrition and political participation have been found to be strongly related to poor health and well-being in the Arab world (World Health Organization, 2009b). From the above-mentioned gender inequality factors, there are adequate data to suggest that the lack of education seems to be in parallel with increasing CVD risk among women in Saudi Arabia. Illiteracy rates among women in the Saudi population older than 10 years are higher compared to males. According to a 2016 demographic survey, illiteracy rates were found to be 3.4 times higher at 10.9 % women and 3.2 % men, respectively (General Authority for Statistics, 2016). The same applies to the older age groups. Indeed, illiteracy rates increase with age among women as one moves from younger age groups towards older age groups. The highest levels were recorded within the over 65-year-old group. The gap in literacy rates between genders has been found to be predominantly less in the kingdom's capital city, Riyadh, but wider in all other regions (General Authority of Statistics, 2016). It should be noted that the employment rate among women at all levels of education in Saudi Arabia

remains low compared to other countries according to the Organisation for Economic Co-operation and Development (OECD) and partners, which affect their income and access to wealth (OECD, 2017).

1.11 Significance of the Study

This study contributes to the research on CVD risks in the several ways. It is the first study, focusing on women in Saudi Arabia, to examine the relationship between health beliefs, actual CVD risks calculated using the FRS, and comprehensive socioeconomic and sociodemographic variables. Since primary prevention is the key to controlling CVD, and it depends largely on the awareness and perception of personal risk (C. J. O'Donnell & Elosua, 2008) the study has implications for public health policies, and health investment decisions. This study also focuses on how the social determinants of health impact CVD risk and health beliefs. The treatment of CVD ranks among the highest in healthcare expenditure in the GCC, and reached $25 billion US dollars in 2013 (Gabriel Chahine, 2013). To decrease the growing economic CVD burden in the Saudi society, and to fight against this number one killer, multiple prevention strategies should be implemented.

This should start with the understanding of health beliefs by using the health belief model (HBM) to explain and predict health-related behaviours. The result of this study could help in designing intervention programs for CVD prevention. In addition, investigating the influence of SES factors on CVD risk and health beliefs will provide basis for recommendations to improve women's lives in Saudi Arabia. This study is theory based and has tested the constructs of HBM regarding CVD while adding information to the literature about women's health beliefs regarding CVD. Furthermore, many research studies generated by the HBM have found that women behave more consistently about their health attitudes and beliefs than men (Courtenay et al., 2002; Rom Korin et al., 2013). Glanz et al, elaborated on the importance of understanding the construct of the HBM, because people (i.e. women) will generally adopt a new healthy behaviour or product (in this case, CVD health belief) if they: consider themselves susceptible to a condition (CVD), think it will lead to potentially dangerous consequences (CVD and its complication), believes that a course of action available to them would be beneficial in reducing either their susceptibility or the severity of the

condition, and if they believe that the estimated barriers (or cost) of taking action are prevailed over by its benefits (Karen Glanz et al., 2008).

This study was conducted among women who were Saudi citizens. Women represent 43% of the overall Saudi population (General Authority of Statistics, 2016). This percentage reflects the fact that there is a high proportion of males relative to females due to the non-Saudi residents in the country. In the Saudi-only group, women are 49% of the population. Having a better understanding of women's beliefs will help in the design of future health campaigns and initiatives to help them adopt and adhere to a healthier lifestyle. The prevention of CVDs mainly depends on people's health behaviour, and health behaviour is linked to being dependent on their health beliefs, including their perception of susceptibility, severity, benefits and barriers (Chen, Yu, & Glaser, 2009; Vaidya, Aryal, & Krettek, 2013).

1.12 Aim and Objectives

This study aimed to examine cardiovascular health beliefs among Saudi women attending Primary Care Centres (PCC) in Riyadh and how sociodemographic variables influence their cardiovascular risk using FRS.

Specific objectives:

1) To explore cardiovascular health beliefs among women in Saudi Arabia attending PCCs, in Riyadh.
2) To assess the relationship between each health belief subscale, and personal CVD risks expressed in FRS, among women attending PCC.
3) To determine the relationship between socio-demographic variables (including SES) and cardiovascular risk determined by FRS.
4) To investigate the association of socio-demographic variables (including SES) with women's health beliefs.

1.13 Research Focus

This study is focused on the intersection of the Health Beliefs of Saudi women, their actual CVD risks, as measured by FRS, and the context of their lives SES as measured by socioeconomic and sociodemographic indicators (Figure 1.2). Based on the review of the research literature on Saudi women, this approach is new and has not been implemented before. It compares actual risks with perceived risks, analyses the gap between them and examines the extent to which SES indicators may contribute to this gap. It also contributes with public policy recommendations, in regards to the gap reduction between perception and reality.

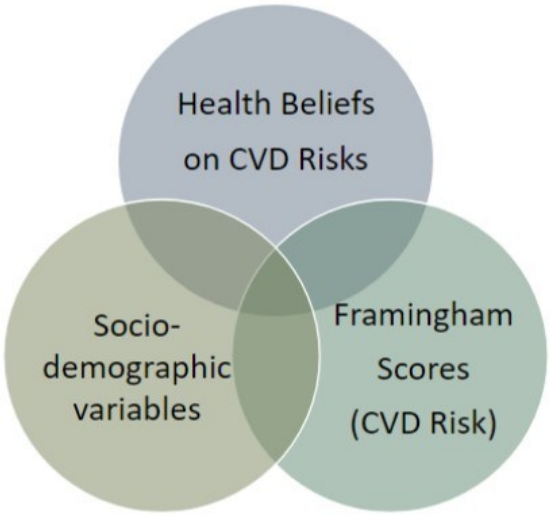


Figure 1.2: Study focus

1.14 Research Questions

1. What are the general health beliefs of Saudi women regarding CVD?
2. What is the association between the mean FRS and four subscales of health beliefs (HBM) (perceived susceptibility, perceived severity, perceived benefits and perceived barriers)?
3. What is the impact of sociodemographic variables on CVD risks (FRS)?

4. What is the relationship between the health belief subscales (Perceived susceptibility, Perceived Severity, Perceived Benefits and Perceived Barriers) and the different sociodemographic variables?

CHAPTER 2: LITERATURE REVIEW

The purpose of this study is to examine cardiovascular health beliefs among Saudi women attending PCCs in Riyadh and how sociodemographic variables influence their cardiovascular risk using FRS.

This chapter provides more details about CVD risk factors. First, it presents a profile of health literacy in Saudi Arabia. Second, it presents a systematic review of previous studies on the prevalence of CVD risk among women in GCC and specifically Saudi Arabia. Third, it discusses the use of HBM in Saudi Arabia and the rationale' behind the use of the tool in this current study. It then talks about the rationale for using FRS, the social determinants of health focusing on SES, and finally it gives an overview of the barriers to healthy behaviour focusing on the PA and FV consumption among women in Saudi Arabia.

2.1 Health literacy in Saudi Arabia

Health Literacy is defined as the degree to which individuals have the capacity to obtain, process, and understand the basic health information and services needed to make appropriate health decisions (Ratzan & Parker, 2006). The person's capacity is both their innate potential as well as his or her skills mediated by education, and its adequacy is affected by culture, language, and the characteristics of health-related settings, that channels between literacy, other skills and abilities of the individual, and the health context (Kindig, Panzer, & Nielsen-Bohlman, 2004; Rudd, 2003)

Understanding the patient's health literacy status is very helpful to healthcare professionals in the management of disease (Wolf et al., 2009).

A recent cross-sectional study (n=500) was conducted to assess health literacy levels in the Saudi population (Abdel-Latif & Saad, 2017). This study demonstrated that majority of individuals had basic to intermediate health literacy, and that low health literacy was associated with poor knowledge of health information and health screening tests. It also

showed that a high percentage of individuals have difficulty in understanding written medical information. As far as gender variability is concerned, it was reported that women had a higher percentage at the proficient and intermediate health literacy levels, while men had a higher score for basic health literacy level than women. The results from this study highlighted the need to raise the awareness of health literacy among the Saudi population and suggested that this can be accomplished through the educational system of the country (Abdel-Latif & Saad, 2017).

Health literacy has an important role in explaining the relationship between a low level of education and poor health. Several studies confirmed that a low level education is a predictor of having low self-reported health and is also associated with low health literacy. In turn, low health literacy is associated with low self-reported general health, low self-reported physical health, and low self-reported mental health. Thus, the improvement of health literacy may be a beneficial strategy to reducing the gap in health related to education (Kakarmath, Denis, Encinas-Martin, Borgonovi, & Subramanian, 2018; van der Heide et al., 2013). The current study is in line with the same idea and attempts to contribute to increasing the awareness of the stakeholders, and the Saudi population as a whole, the importance of health literacy.

2.2 Systematic Reviews on the prevalence of CVD risk among women in GCC and Saudi Arabia

Two papers, which systematically reviewed the research literature, were published in the course of the development of this study, and both focus on CVD risk factors for women. The first paper, “Women in Saudi Arabia and the Prevalence of Cardiovascular Risk Factors: A Systematic Review” Journal of Environmental and Public Health, 2016 is a systematic review of 61 published papers and studies related to the prevalence of CVD risks among women in Saudi Arabia. The second paper, “The ticking time bomb in lifestyle-related diseases among women in the GCC countries; review of systematic reviews”, BMC Public Health, 2017 is a review of 11 systematic reviews highlighting the impact of the lifestyles of women in GCC countries on their CVD risks. Both systematic reviews summarize a context which poses

significant challenges for policy makers in relation to how to reduce CVD risks for women in the GCC countries and specifically in Saudi Arabia.

CVD is a major cause of death globally, causing 17.3 million deaths in 2018 according to the WHO (WHO, 2018). Many known risk factors contribute to the development of CVD. These include obesity, DM, HTN, hypercholesterolemia, physical inactivity, smoking, and MetS, some of which are related to patient behaviours and lifestyle. Saudi Arabia and other Gulf States neighbours have some of the highest incidences of CVD risk factors in the world and CVD related deaths constitute 50% of all deaths under age 70, in the region. Effective health education and promotion can lead to modifications in at-risk patient behaviours and thus reduce their CVD risks and ultimately the development of CVD itself. Developed countries using this approach have seen age-adjusted CVD deaths cut in half. Saudi Arabia has the second highest level of proven oil reserves in the world at 266.2 billion barrels (OPEC, 2017). According to the SMOH data, funding of the Saudi healthcare system amounted to 3.45% of GDP from oil exports, the major source of national revenue for economic expansion and development of the country. Economic progress has also led to increased urbanization and the adoption of a sedentary lifestyle and increasing consumption of fast-foods. These practices compound the existing cultural and religious restrictions on women; exercising, personal freedom of movement, and the requirement that they need the permission of a guardian to visit a doctor, which creates a unique context for Saudi women that increases CVD risk factors, such as high level of obesity. While there are published research studies on CVD risks in the Kingdom, none were exclusively focused on women. The systematic reviews in this study were intended to isolate and extract the elements of research that applied to GCC and Saudi women in the research literature.

2.2.1 Systematic Review Criteria

The reviews in the two published papers listed above, were systematic because in both cases a process was applied which clearly defined a review question, identified relevant databases, applied a three-step search strategy, selected studies using defined selection criteria, applied inclusion and exclusion parameters, incorporated data extraction and quality assessment approaches, and produced clear results and conclusions.

2.2.2 Objectives / Research questions

In the case of the first published study the review question posed was: "What is the prevalence of obesity, DM, HTN, hypercholesterolemia, physical inactivity, and MetS among women living in Saudi Arabia?". In the case of the second published paper the review focus was on identifying from the selected systematic reviews, the modifiable CVD risk factors of women in GCC countries to provide better information to policymakers and physicians on the scale of the CVD risk reduction challenges they face, relative to women.

2.2.3 Methodology

In the case of the first paper which was a systematic review of published papers (Mashael K. Alshaikh, Filippos T. Filippidis, Juren P. Baldove, Azeem Majeed, & Salman Rawaf, 2016), the search focus was on research studies published in English and Arabic languages for the 15 years from January 2000 to December 2015. It examined the CVD risk factors in Saudi Arabia. The search sources used for this period were Medline, Embase, and PsycINFO. Specific pre-selected keywords were used in the searches and abstracts were reviewed by the researchers against defined inclusion and exclusion criteria. As a final step in the search process, the reference lists of the selected articles were reviewed to identify any additional studies that were relevant.

Two researchers reviewed the full text of each identified article to determine the final inclusion or exclusion status. The inclusion criteria included studies carried out in Saudi Arabia including rural and urban locations, general population of citizens and residents aged 15 and above, and studies containing the keywords, obesity, body mass index (BMI), HTN, dyslipidaemia, and physical inactivity. (See the Publications page 148)

In the case of the second published paper (Alshaikh et al., 2017), the period used for search purposes was from January 2000 to February 2016 and focused on all systematic reviews of CVD risks in women in the GCC countries. The Medline database was also used for this paper in addition to Google Scholar and the Cochrane database. In this case, no language restrictions were used. The search process sought to identify studies where the terms HTN, DM, obesity, MetS, smoking, and physical inactivity were used. While diet is a known CVD risk factor, it was not included in the search criteria due to lack of an acceptable definition of

healthy, and the lack of consistency of focus on diet components in the studies examined. Systematic studies which focused on CVD risk factors among women in GCC countries were included in the review. Where studies did not include prevalence data for women separately, they were excluded from consideration.

The same two researchers reviewed abstracts of the published systematic reviews, and the full text of those reviews whose abstracts seemed to meet the inclusion criteria were examined in detail to make a final determination on inclusion. Studies were evaluated for quality using the Multiple Systemic Review Tool (AMSTAR) (see Publications page 149).

2.2.4 Key Results

The first paper, which was a systematic review of 61 selected studies, reported prevalence data for Saudi women on selected CVD risk factors as summarized in the table following: (Table 2.1)

Table 2.1 Summary of Key Results from 1st systematic Review. Alshaikh MK et al. 2016

CVD Risk	Number of Studies	Prevalence for Saudi Women
Smoking (Cigarettes)	17	1.1% - 9.1%
Hypertension (BP 140/90mmHg)	17	21.8%
Diabetes	12	9.6% - 28.0%
Overweight	13	16.2% - 38.4%
Obesity	12	21.13% - 71.0%
Hypercholesterolemia (>5.2mmol/L)	9	24.0%
Physical Inactivity	7	53.2% - 98.1%
Metabolic Syndrome (NCEP ATP III)	6	13.6% - 55.0%

The results of second paper, which was a review of 11 systematic reviews out of the 88 studies initially examined, are summarized in the table below. The majority of the included studies were conducted in Saudi Arabia. The included studies were also evaluated using the AMSTAR tool, as in the first review. (Table 2.2)

Table 2.2 Summary of Key Results from 2nd systematic Review. Alshaikh MK et al 2017

CVD Risk	Number of Studies	Prevalence - GCC Women
Smoking (Cigarettes)	3	0.5% - 20.7%
Hypertension (BP 140/90mmHg)	4	7.8% - 53.0%
Diabetes	5	6.0% - 44.0%
Overweight	-	-
Obesity (BMI >=30.0 Kg/m2)	6	29.2% - 45.3%
Hypercholesterolemia (>5.2mmol/L)	-	-
Physical Inactivity		50.7% - 98.7%
Metabolic Syndrome (NCEP ATP III)	1	23.0% - 42.7%

2.2.5 Discussion / Commentary to the systematic reviews:

Both systematic reviews confirm that CVD risks are a serious cause of concern in Saudi Arabia and its Gulf State neighbours, based on the prevalence results. Each of the risk factors identified in the reviews are briefly discussed below.

a. Smoking:

In the context of both systematic reviews; smoking includes direct smoking of cigarettes and cigars, secondary or indirect smoking, and Hookah (water pipe) smoking. There is some prevalence variability within the Gulf relative to smoking by women, with a prevalence range of 0.5% to 20.7% overall. Qatar and Bahrain had higher reported levels of smoking compared to much lower levels in Oman, Kuwait and Saudi Arabia. However, Saudi women's rate of water pipe smoking approached 10%. Saudi Arabia has traditionally had a more conservative culture, with social restrictions on women, the study suggests that women may underreport their rate of smoking to avoid any social stigma related to the practice.

b. Hypertension:

In the systematic review of research studies table mentioned-above, the average prevalence of HTN in Saudi women is 21.8%. The systematic review of reviews indicated that the more recent studies of HTN prevalence in Saudi women ranges from 23.9% to 33.5%. The summary also indicated that when self-reporting of HTN is used, it tends to be understated or overstated than the actual levels. This may be explained by the HTN being non-symptomatic and factors such as: time since last medical examination, age, and lack of awareness of the condition due to medical illiteracy.

c. Diabetes:

GCC countries have some of the highest prevalence of DM in the world. In Saudi Arabia the rate even increased by 15% between 1987 and 2011. Further, age and marital status (separated, divorced, or being a widow) increases the prevalence of DM. The systematic review reported that diabetic Saudi women, get fewer routine medical examinations and reported poorer health overall. 27.8% of diabetic women have uncontrolled DM. There were over 3 million cases of DM in Saudi Arabia in 2015. In Saudi

Arabia, the practice of consanguinity is at 60.0%, the highest in the world. Consanguinity has been posited as a contributor to the high levels of DM. Since DM is a known risk for CVD, this is a serious concern.

d. Overweight and Obesity:

Obesity and being overweight are very serious problems in the GCC countries, including Saudi Arabia and is at a rate that is in higher levels than European countries and others in the region, such as Iraq. In the cited Saudi Arabian National Health Survey, 33.5% of Saudi women were reported as obese. Married women have higher rates than single women in the GCC. Furthermore, the rate of female obesity is higher than that of males. The practice of hiring domestic helpers, high consumption of fast foods, natural weight gain from multiple pregnancies, being hypertensive or pre-hypertensive, having a home-based sedentary lifestyle, and the lack of physical educational curriculum for girls, all contribute to the prevailing high levels of obesity in women. The prevalence of Saudi women being overweight ranges from 16.2% to 38.4% in the systematic review.

e. Hypercholesterolemia:

In evaluating the studies in the systematic review for the first paper, it was noted that two different definitions of Hypercholesterolemia were used, one was a 6.2 mmol/L as a cut off, while the second was at a lower (5.2 mmol/L) level. The prevalence range reported in that review was 9% to 53.2% with an average of 24% as listed in the table above. These values are influenced by factors such as age, the type of fat consumed, and the level of inactivity.

f. Physical Inactivity:

The two systematic reviews produced very similar physical inactivity prevalence ranges, 53.2% to 98.1% in the case of the systematic review of studies, and 50.7% to 98.7% in the case of the systematic review of systematic reviews. Both ranges are very high and should be a major cause for concern. While Saudi Arabia may have unique cultural aspects relative to women, inactivity is widespread in the GCC region. Bahraini women for instance, were reported to walk less than 1 km per day and in the UAE, women were reported to walk for 20 minutes or less per day. In Saudi Arabia, special religious and cultural restrictions have been imposed on women relative to physical exercise and movement, including no or limited

physical education for girls while at school, limited availability or access to gyms catering to women, the requirement to have the permission of a guardian, and other restrictions. Some social progress is being implemented including the removal of restrictions on women driving since June 2018.

g. Metabolic Syndrome

Metabolic syndrome is a group of risk factors that includes obesity, dyslipidaemia, HTN and hyperglycaemia, which is used to predict CVD in patients. Two primary definitions used in the studies which were part of the systematic reviews were those of the National Cholesterol Education Program's Adult Treatment Panel III (APT III) and the International Diabetes Federation (IDF). In the systematic review of systematic reviews using the APT III, the prevalence levels in GCC countries were in the range 23.0% to 42.7%. The lowest level on the range was in Oman, whilst the highest was reported in the UAE. The APT III prevalence rate for Saudi women was reported at 42.0%. In the systematic review of 61 studies, the prevalence rate for Saudi women was in the range of 13.6% to 40.3% using the APT III definition, and 25.5% to 55.0% using the IDF definition.

h. Conclusions from both systematic reviews

The results of both systematic reviews show a high prevalence of CVD risk factors among women in GCC countries generally, and in Saudi Arabia in particular. The systematic review of research studies focused exclusively on CVD risk factors for Saudi women was the first such review of its kind and provides focused insights on the subject. Since CVDs are primarily modifiable lifestyle-related issues, they can be reduced through effective behavioural change. Change at the level of an individual woman can be supported by their respective governments in the region through; health education, investments in public infrastructure promoting a healthy more active lifestyle and through medical policy changes which place more emphasis on prevention than on treatment. Whilst such changes should apply to both genders, given the overall risks, specific emphasis should be placed on improving the unique challenges faced by women given their cultural context in Saudi Arabia. The level of risk prevalence makes this an urgent matter for policymakers to address.

2.3 The Health Beliefs Related to CVD (HBCVD)

The previous studies helped to show that interventions to improve health behaviour can be best designed with an understanding of relevant theories of behavioural change and the ability to use them skilfully because the function of theory is promoted as an integral step in intervention design, evaluation and evidence synthesis. As the precursors of behaviour and the causal determinants of change can be properly identified and targeted by the intervention as well as the component behaviour change techniques can be selected, polished and custom-made. Increasing evidence suggests that public health and health promotion interventions that are based on social and behavioural science theories are more effective than those lacking a theoretical base (Bergeron et al., 2017; Davis, Campbell, Hildon, Hobbs, & Michie, 2015; K. Glanz & Bishop, 2010; Kwasnicka, Dombrowski, White, & Sniehotta, 2016).

In this research the HBM was used as a theoretical framework model. HBM is one of the most commonly used theories in health education and promotion (Orji et al., 2012). The use of the HBM tool to identify women's perceived beliefs (susceptibility, severity, benefit and barrier) for their risks of heart disease will be beneficial in constructing effective future interventions and designing future campaigns. The HBM has been used in some studies among Saudi women to test their beliefs around breast cancer and osteoporosis (Abolfotouh et al., 2015; H. Al-Otaibi, 2015; Al Seraty & Ali, 2014), but there are only a limited number of studies that address the relationship between health beliefs and CVD. One study investigated the PA and health beliefs, using the Health Locus of Control (HLC) and Self-Efficacy Assessment Scale, specifically among young, educated Saudi women with a mean age of 26.3 years. This study concluded that there were high levels of inactivity among Saudi women relative to the internationally recommended levels (Al-Eisa & Al-Sobayel, 2012). While this conclusion is useful, it does not provide a comprehensive understanding of all the variables contributing to other risk factors, partly attributable to the use of the HLC. The HLC has been found to be a weak predictor of health behaviour (Conner & Norman, 2005). In contrast, for over three decades, the HBM has been found to provide a useful theoretical framework for investigating the cognitive determinants of a wide range of behaviours and is also one of the most useful tools because of its illustration of the importance of individual beliefs about

health (Orji et al., 2012). However, up to this point, no previous research has investigated this approach in gathering information about Saudi women's beliefs relative to CVD.

The Health Beliefs Related to CVD scale (HBCVD) was designed by Tovar et al., in 2010 (E. G. Tovar, Rayens, Clark, & Nguyen, 2010) (see Table 2.1). In 2014 Tovar tested the health beliefs of 212 adults with Type 2 DM in the United States. Among the HBM subscale, perceived benefits and barriers were significantly associated with heart disease knowledge. The study concluded that knowledge of heart disease risk had a positive relationship with benefits of diet and exercise and a negative relationship with barriers to diet and exercise. It implies that as knowledge increases, perceived benefits also increase and perceived barriers decrease and warrants the value of highlighting the advantages of diet and exercise and approaches to overcome barriers in educational interventions targeting CVD knowledge in adult patients with type 2 diabetes. (E. Tovar & Clark, 2015). Another study focused on 314 adults with CVD from outpatient clinics in Korea found that the health belief variables to be significantly related to health behaviours (Goong, Ryu, & Xu, 2016). The instrument was also tested among adults in Nepal showing variation between different sociodemographic variables and the HBCVD construct. The results showed that adults who performed more than two activities for health promotion had better knowledge of CVDs and perceived more susceptibility. Thus, a person who engages in more physical activities is perceived with higher levels of knowledge of CVDs than those who do not so engage. Among all the HBM subscales, perceived susceptibility and severity were very low among Nepalese adults and their knowledge of CVD is limited. The authors emphasized the need to address these misconceptions to increase awareness (Poudel & Sumi, 2017).

Perceived susceptibility is a psychosocial construct in several health behaviour theories, such as social-cognitive theory and the theories of reasoned action, and it has been suggested as an important motivating force behind precautionary behaviour (Janz & Becker, 1984). Most of the studies using the HBM approach have tested the perceived susceptibility for breast cancer. Low perceived susceptibility to breast cancer has been reported among Saudi women (Abolfotouh et al., 2015). In addition, Al Searty and Ali have investigated the impacts of HBM based intervention for osteoporosis prevention among female students of a medical sciences college. 93% of the participants reported low susceptibility (Al Seraty & Ali,

2014). Evaluating women's perceived susceptibility to CVD in Saudi Arabia is important to help improve healthy behaviour.

However, the HBM is not without its limitations (Orji et al., 2012). Criticism of the model has tended to focus on three core issues (Wayne W. LaMorte, 2018). The first issue is that it does not define the relationship between the variables nor provide clear rules for combining them, leaving researchers to develop their own groupings. Some might argue that this limitation could be seen as an advantage as the model can be applied flexibly and adapted in a wide variety of research situations and may explain its use in many studies as cited above. The second issue is the small size effect and its low predictive ability ($R < 0.21$), suggesting that almost 80 percent of the variation is explained by other variables. The third issue is that it is an incomplete model requiring researchers to add variables to the model. The first additions were the inclusion of Cue to Action and Self Efficacy. The model assumes that such cues are key drivers of health behaviors. The model further assumes that people have equal access to available information on diseases, which is not always the case. The model also does not consider habitual behaviors, such as smoking, which may limit health directed behaviors. Others constructs were added later to apply to very specific situations such as the inclusion of High Blood Pressure, HIV Stigma, Consideration of Future Consequences, or Concern for Appearance variables. The use of the Concern for Appearance variable is an attempt to address the criticism that the HBM does not take account of behaviours that are performed for reasons other than health. Additionally, the HBM does not incorporate environmental or socioeconomic dimensions which may serve as stimuli or barriers to desired health behaviours (Orji et al., 2012).

Critics do not deny that the HBM model is useful and its variables are associated with desired health behaviours, rather they suggest that it is most effectively applied when it is used along with other models that include the variables that may be missing from it. Since this study was not focused on predicting health behaviours based on a campaign or related initiative, the socioeconomic and sociodemographic information was collected in addition to the HBM variables. Thus, the model was deemed to be adequate to meet the aim of the study despite the identified limitations. The use of the HBM was also balanced by the use of the FRS to measure actual CVD risks to contrast with the Susceptibility variable results of the HBM.

2.4 Framingham Risk Score in KSA

In Saudi Arabia, Framingham Risk Score (FRS) is the most commonly used assessment tool for predicting a person's chance of developing CVD (40-45). It can be useful for both patients and clinicians in determining the best preventive lifestyle options or the range of medical treatments. It also helps in patient education by identifying a person's risk for future cardiovascular events (Yousefzadeh et al., 2015).

Alzeidan et.al, evaluated the risk factors and calculated CVD risk using FRS among university employees and their families at a teaching hospital in Riyadh. However, they only determined a no significant difference in FRS categories based on nationality (Alzeidan et al., 2016). AlQuaiz et.al, conducted a study investigating CVD risk among 291 women with mean age of 40.1 (SD ± 8.8) years from three shopping malls in Riyadh in February 2011 and found that FRS scores ranged from 0.50 to 21.9. Only 2.7% had a high FRS score (>20), 5.5% (n = 16) had intermediate scores (11–20), and 91.8% (n = 267) of women had low scores (<10) CVD risk scores (AlQuaiz et al., 2015). Both Soofi, Youssef and Ibrahim et.al, highlighted the gender difference in CVD risk using FRS among younger populations (Ibrahim et al., 2014; Soofi & Youssef, 2015). Ibrahim et.al., found that male medical students had significantly higher mean scores for CVD risk factors compared to females ($p < 0.05$), while Soofi, Youssef and Ibrahim assessed the FRS among Saudis who attended the 2010 traditional cultural festival held in Riyadh, 50% of the participants were women, and only 9 % of these women were above the age of 40 (Soofi & Youssef, 2015). There was a significant difference in FRS, with men having a higher risk than women as the risk increased with age. Similarly, Al Dahi et.al., conducted a FRS study but reported on males only (Al-Dahi et al., 2013).

As with the HBM above, some limitations were also associated with FRS. Some scholars such as Fiscella et.al., argued that FRS might underestimate CVD risk for persons of lower socioeconomic status (SES) (K. Fiscella, D. Tancredi, & P. Franks, 2009). The reason is often attributed to reduced health-care access or poor adherence to treatments such as smoking cessation or medication. The authors' recommended including SES in the Framingham risk assessment (K. Fiscella et al., 2009).

The SES of individuals is another important risk aspect that determines health, including CVDs and its related risks. Many research studies over the past decade showed the impact of SES on health including CVD health, (Franks, Tancredi, Winters, & Fiscella, 2010; Giles-Corti & Donovan, 2002; McLaren, 2007; Psaltopoulou et al., 2017). Besides, the existing knowledge internationally suggests that there is a gradient in the incidence, morbidity and even mortality of CVD across the spectrum of SES. This is defined by educational level, occupation or income (Psaltopoulou et al., 2017). Evidence from large epidemiologic studies has proposed that CVD risk factors are synergistic and compound the total risk rather than act as simple additions to the number of risks (Peter WF Wilson, Kannel, Silbershatz, & D'agostino, 1999; Zannad, 2008). It has been internationally identified that social deprivation (i.e. low socio-economic status) predicts CVD, independently of traditional risk factors. Nevertheless, social deprivation is not a component included in the FRS (Fiscella & Franks, 2004; Kevin Fiscella, Daniel Tancredi, & Peter Franks, 2009; Franks et al., 2010).

The FRS algorithm is used in Saudi Arabia as a tool to identify high-risk patients and then prescribe preventive treatments (Al-Dahi et al., 2013; Alissa, Bahjri, Al-Ama, Ahmed, & Ferns, 2006; AlQuaiz et al., 2015; Alzeidan et al., 2016; Ibrahim et al., 2014; Soofi & Youssef, 2015). Despite FRS being used in Saudi Arabia, the previous studies have only focused on one or a limited number of factors of the SES element, and they address gender and age differences (further details in chapter two; literature review section). Also, only a limited number of studies in Saudi Arabia highlighted the relationship between CVD risk and SES, especially among women.

2.5 Social Determinants of CVD risk

According to the WHO the social determinants of health are “the circumstances in which people are born, grow, live, work, and age, and the systems put in place to deal with illness”(Marmot et al., 2008). Social determinants of health, such as low SES, are mostly responsible for health inequities (Davis et al., 2015). Many researchers and public health authorities seek to identify the social determinants of health to improve health and prevent diseases (Davis et al., 2015; J. H. Flaskerud & DeLilly, 2012). CVD risk factor behaviours include

poor nutrition, lack of exercise, and smoking are more common in lower SES groups (J. H. Flaskerud & DeLilly, 2012).

The SES measures included occupation, education, and income, which depicts its conspicuous aspect and can be correlated with other measures. For instance, education is the most extensively used indicator and the most basic component of SES. It has several possible mechanisms to influence health status. Those with higher education may have developed better information processing and critical thinking skills, skills in navigating bureaucracies and institutions, and the abilities required to interact effectively with healthcare providers. Additionally, they may be more exposed to health-promoting behaviours and lifestyles, and have better work and economic conditions and psychological resources (Shavers, 2007). SES has been identified as a fundamental cause of disease, along with age and sex (Jacquelyn H Flaskerud, DeLilly, & Flaskerud, 2012). Many studies have documented that lower SES is associated with poorer health (Sommer et al., 2015), including NCDs like CVD (Havranek et al., 2015). There is a well-established inverse relationship between SES and health in high-income nations. Individuals of lower SES have higher mortality rates than individuals of higher status. Obesity is influenced by SES especially among women, since the number of chronic diseases is increased in obese persons of low SES and the less physically active (Erasmus, 2007). Furthermore, comparative analyses across Europe have shown that there is an inverse social gradient of smoking, physical inactivity, and unhealthy diet (Stringhini et al., 2011).

Currently, CVDs is one of the leading causes of death in Saudi Arabia (WHO, 2014), and women have higher CVD risk than men (Iqbal et al., 2014; Mahfouz et al., 2012; Soofi & Youssef, 2015). The data from the last national household survey recognized that women who had lower education levels (less than high school) were more likely to become obese (Z. A. Memish et al., 2014). AlQuaiz et al., in February 2011, conducted a cross-sectional study on 291 women in three shopping malls in Riyadh. Lack of educational attainment was associated with higher risk for CVD. The inverse association between the educational level of participants and CVD risk scores was significant ($p < 0.01$) (AlQuaiz et al., 2015).

Another study was conducted by Mandil et al, in 2016 (Mandil, Alfurayh, Aljebreen, & Aldukhi, 2016). In this case, the engagement of Riyadh's physicians in healthy behaviours,

such as PA was assessed and the prevalence of NCD risk was reported. Overall, the prevalence of NCD was much lower compared to the general population as reported in the STEPwise WHO surveillance, for example DM prevalence study among physicians was reported at 4.2%, which is a much lower percentage compared to the STEPwise WHO surveillance that was reported at 18.3%. Also, the results showed that physicians were more physically active (63%), compared to the general Saudi population (32.4%) (World Health Organization, 2014). This may be explained by better health awareness and healthier lifestyles by physicians because they are highly educated and are fully aware of the benefits of PA. Moreover, the working lifestyle of most physicians makes them more physically active (Mandil et al., 2016).

Most of the previous studies involving CVD risk have focused on only one or two sociodemographic elements. In addition, some of these studies have addressed gender and age differences, but others were conducted exclusively for men (Alissa et al., 2006; Sabra, Taha, Al-Sebiany, Al-Kurashi, & Al-Zubier, 2007). For example, Alzeidan et al., conducted a cross-sectional study among employees and their families aged ≥ 18 years old in a Saudi university hospital which only included education and occupation as social variables (Alzeidan et al., 2016).(Table 2.3

Table 2.3: Studies that used FRS related to a sociodemographic variable in KSA:

No.	Author/date	Population/ sample size	SES & CVD risk factors	Comments
1	(Alzeidan, Rabiee et al. 2016) (Alzeidan et al., 2016)	Cross-sectional approach for a sample of employees and their families aged ≥ 18 years old, in a Saudi university (Riyadh in Kingdom of Saudi Arabia; KSA). The mean age of participants was 39.3±13.4 years.	• Education & occupation were not statistically significant with the number of risk factors. • Marital status was significant in the divorced and widowed (more than 3 times the risk factors than being single) p=0.01, OR= 2.1 (1.3-4.0) 2.1 (1.3-4.0). Also, married reported more than = 3 risk factors p= 0.02, OR=1.5(1.1-2.1)	Education, occupation and nationality had no conclusive evidence of association with clustering risk factors
2	(AlQuaiz, Kazi et al. 2015) (AlQuaiz et al., 2015)	A cross-sectional study using a self-administered questionnaire was conducted on 291 women aged ≥30 years. Information was collected on socio-demographics and physical health status.	Educational level of participant (in years) statistically significant (β=−0.08 P value <.01) with the FRS as dependent variables	Univariate analyses revealed an inverse association between educational level of participants and CVD risk scores, with a one-unit increase in education related to a 0.23 (p < .01) decrease in CVD risk score
3	(Soofi and Youssef 2015) (Soofi & Youssef, 2015)	A cross-sectional observational study was conducted on a Saudi population. Saudis aged more than 20 years who had no history of coronary heart disease and who attended the 2010 cultural festival in Riyadh were included in the study. A total of 4,932 subjects (2,215 men and 2,717 women) were examined,	There was significant different in FRS, men had a higher risk than women and that the risk increased with age. However, the diabetic prevalence which was more among women p <0.001	They only compared among age groups and gender.
4	(Ibrahim, Mahnashi et al. 2014) (Ibrahim et al., 2014)	A cross-sectional study was done during the educational year 2012-2013 at King Abdulaziz University (KAU), Jeddah. Ethical standards were followed, and a multistage stratified random sample method was used for selection of 214 medical students.	Male medical students had significantly higher mean scores for most of CHD risk factors compared to females (p < 0.05). Systolic Blood pressure was higher among males (119.47 ± 11.17) compared to females (112.26 ± 9.06).	They looked at gender and the prevalence of risk factors of Coronary Heart Diseases among medical students,

2.6 Barriers to healthy behaviour focusing on PA and FV consumption among women in Saudi Arabia.

Both a healthy diet and PA, are known behaviours to decrease CVD morbidity and mortality (Lin, O'Connor, Whitlock, & Beil, 2010). Notwithstanding, some societies present obstacles towards them. Many studies explain how the perceived barrier beliefs are significant contributors to the prevention of CVD (Folta et al., 2008; Mc Morrow, Ludbrook, Macdiarmid, & Olajide, 2016). Indeed, when identified they could help in designing future prevention and intervention programs to help women to overcome them. In addition, this can help decision makers to support public policies that will help women to engage in a healthier lifestyle.

2.6.1 The barriers to PA reported in the literature among Saudi women

PA is one of the crucial primary prevention methods of CVDs, along with reductions in smoking, HTN, and high blood cholesterol (Stensel, 2009). Insufficient PA, defined as less than 150 minutes of moderate PA per week, increases the risk of many adverse health conditions, including CVD, DM and shortens life expectancy (Lee et al., 2012). It has been identified as the fourth leading risk factor for global mortality causing an estimated 3.2 million deaths annually. According to the WHO report, around 23% of adults were not active enough in 2010, and the prevalence of physical inactivity was higher among women than men (World Health Organization, 2016).

The problem is more apparent across Muslim countries, where the overall prevalence of physical inactivity and sedentary lifestyles is higher among females (35.5%) than males (28.8%), especially among Arabs. Arab women are much more likely to be physically inactive compared with non-Arab women (D. Kahan, 2015); particularly within the GCC region, documented to have one of the lowest rates of PA in the world(108). The prevalence of insufficient PA among women in Saudi Arabia ranges between 53-98.1%, and it is considered one of the highest globally (Al-Nozha et al., 2007; Allam, Taha, Al-Nozha, & Sultan, 2012; Amin et al., 2014; Khalaf et al., 2013; Koura, Al-Dabal, Rasheed, Al-Sowielem, & Makki, 2012; Rehmani et al., 2013; Soofi & Youssef, 2015).

A recent review study that investigated the PA barriers among women in the GCC, including Saudi Arabia, (K. Benjamin & Donnelly, 2013) (2013) identified lack of time as a critical factor hindering women from engaging in PA. One of the barriers addressed were traditional or cultural roles, i.e. traditional dresses (abayas), guardian approval and supervision to leave their houses, lack of social support and reliance on housemaids for domestic tasks (K. Benjamin & Donnelly, 2013). This study looked further by systematically reviewing the literature that addressed women's PA levels and the barriers to PA. The study limited its search review to studies that were published from January 2005 to January 2017, which addressed PA, the barriers to PA, and healthy lifestyles among women in Saudi Arabia. Studies were identified by searching PubMed and Google Scholar. Only English language articles that reported on women were included. Seven out of 1,253 articles reviewed were included in this review. Two studies were undertaken in Riyadh, the capital of KSA, while two were in the eastern region, one in the southeast region and the final one in the southwest region (Table 2.4)

Table 2.4 Barrier to PA among women in Saudi Arabia-Social/cultural/Organizational, and Environmental

#	Author/ year	Q*	Type of study/ Sample method/setting/ Tool	RR/ Sample size/ women % /mean age ±SD	**Individual (Internal)**	**Social/cultural/Organizational (External)**	**Environmental**	Conclusion
1	Mandil, 2016 (Mandil et al., 2016)	G	A cross-sectional approach was used for this study conducted on 370 randomly-selected outpatient physicians of both genders working at 4 leading healthcare institutions/ Riyadh from December 2013 and January 2014/ STEPwise questionnaire	Total 360, women n=138 (38.3%). standard deviation age was 33.11 ± 9.27	Lack of time (58.1%), work duties (22.5%), lack of interest and motivation (12.4%),	Lack of suitable facilities (3.9%),	Hot weather (1.6%),	Most participants (77.2%) reported earning a monthly-income that ranged from 5,000 to 25,000 Saudi Riyals. relatively high among the participants; a total of 227 (63.1%) participate in PA. Inactive group (36.9%).
2	Albawardi NM, et al. 2016 (Albawardi, Jradi, & Al-Hazzaa, 2016)	G	Cross-sectional/working in office based jobs in eight worksites in Riyadh/ ATLS, MET, PASS	72 % / 420 / 100%/ 31.7 ±8.3	Reasons for not being physically active among the high/low PA total (n= 418. N (%) high-PA, N (%) low-PA. 1. Lack of time* 148 (71.2%), 124 (59.0%) 2. Too tired to exercise 93 (44.7%), 80 (38.1%). 3. Due to health reasons (other diseases) 19 (9.1%) 19 (9.0%)	Reasons for not being physically active among the high/low PA total (n= 418. N (%) high-PA, N (%) low-PA. 1. Facilities are too far 65 (31.2%), 57 (27.1%) 2. No transportation 46 (22.1%), 48 (22.9%)	Not reported	The reasons participants with “low or “intermediate/high.” reported PA gave for being active or inactive found all participants reported ‘health reasons’ as the most important reason for being active while ‘maintaining their weight’ was second but significantly more important for the higher PA group (p = .027). Both PA groups reported ‘not having time’ and being ‘too tired’ as the most frequent reasons for not being PA, & significantly in the low PA group (p = .009) reported ‘lack of time’ was the main obstacle for being active. PA being ‘socially unacceptable’ was the least frequently mentioned reason for being inactive by both groups.

Table 2.4 Barrier to PA among women in Saudi Arabia-Social/cultural/Organizational, and Environmental. Continuation……1

#	Author/ year	Q*	Type of study/ Sample method/setting/ Tool	RR/ Sample size/ women % /mean age ±SD	Individual (Internal)	Social/cultural/Organizational (External)	Environmental	Conclusion
					4. No motivation (lack of willpower) 12 (5.8%), 4 (1.9%) 5. Lack of skills sports 10 (4.8%), 10 (4.8%) 6. No will power 39 (18.8%), 28 (13.3%).	3. No one to exercise with (lack of social support) 50 (24.0%), 40 (19.0%) 4. Facilities are too expensive 31 (14.9%), 30 (14.3%)		
3	Samara et al., 2015 (Samara, Nistrup, Al-Rammah, & Aro, 2015) Data collected between 2014-2015 Academic Year	F	Cross-section/ 1st year students at (PNU), health sciences, Riyadh/ ALTS, BARSE & EBBS * BARSE Scale assesses participants' perceived capabilities to exercise regularly in the face of commonly identified barriers to participation (e.g., bad weather, schedule conflicts). For both measures, higher scores reflect greater self-efficacy (range: 0–100).	94/100%/ mean age 20+/-0.7	1. Lack of interest (63%) would stop exercising if the activity or program makes them feel bored 2. Fear of injury (62%) will not continue to exercise if pain occurs. 3. Dislike exercising (61%) would stop exercising if it was not fun and enjoyable. 4. Lack of time (65%) do not exercise due to a tight schedule.	1. Social/cultural (61%) would exercise during vacation) This could indicate the effect of the society on the acceptance of PA. 2. Lack of transportation (56%) think it is difficult to get to the location. - Also, 66% agreed that it is easier for men to be more physically active than for women. - This clearly indicates that there is a lack of facilities for women to exercise because 92.3 of female students exercise at home.	Weather (64%) if the weather were too bad wouldn't exercise 3 times per week.	The lack of facilities and lack of encouragement from the university, but not a lack of knowledge (a high level of knowledge is to be expected given their health and well- being studies backgrounds) and/or restrictions from families and society, seem to hinder female students' PA, at least young Saudi students. Among the barriers to PA, family discouragement was one of the least considered. Another study, however, showed that norms and traditions could be significant barriers to PA in the KSA.

Table 2.4 Barrier to PA among women in Saudi Arabia-Social/cultural/Organizational, and Environmental. Continuation…… 2

#	Author/ year	Q*	Type of study/ Sample method/setting/ Tool	RR/ Sample size/ women % /mean age ±SD	Individual (Internal)	Social/cultural/Organizational (External)	Environmental	Conclusion
					5. Lack of self-confidence (54%) If not conscious of the benefits of the exercise would stop. 6. Lack of motivation (54%) would not exercise without the encouragement of the instructor. - 98% of the women agreed that it is important for a woman to have a fit and healthy body. - There is a high understanding of the benefits of PA among women for its health benefits (71.8%) as well as loss of weight (50.0%)			
4	Al-Otaibi, 2013 (H. H. Al-Otaibi, 2013a) Data collected between September 2012-October 2012	F	Cross-sectional/ Convenience sample/ 8 PCC's, Eastern region / 12 items questionnaire-based on previous studies	n/a/242/ 51.2%/ mean age 31 +/- 7.8	1. Lack of time to exercise (7.2±1.4) Internal barriers lack of self-confidence was the most important barriers Among females (7±1.6)	1. Lack of resources to exercise (6.3±1.5), 2. Lack of social support (6.6±1.7)	Not reported	There was a significant difference between the groups: males had scores of self-efficacies higher than females. Also, they had a higher mean score of exercising when feeling sad or under stress. However, of the internal barriers, lack of self-confidence was one of the most important barriers among females, can't……

Table 2.4 Barrier to PA among women in Saudi Arabia-Social/cultural/Organizational, and Environmental. Continuation…… 3

#	Author/ year	Q*	Type of study/ Sample method/setting/ Tool	RR/ Sample size/ women % /mean age ±SD	Individual (Internal)	Social/cultural/Organizational (External)	Environmental	Conclusion
					Also reported: Lack of energy. Lack of motivation. Lack of self-confidence. This study reported the mean score and comparison between. Lower mean scores on the questions indicated lower internal and external barriers. A Five-point Like type scale was used to rate the Items			While the lack of energy score was higher in males. Regarding the total score of external barriers in the three categories (Lack of resources to exercise, lack of social support & lack of time to exercise) females had higher scores than males with a significant difference between them.
5	Khalaf A et al., 2013 (Khalaf et al., 2013)	F	Cross-sectional/ convenient sample from females at a university centre in the south-western KSA, ALTS & MET	95%/663/100%/ 20.4 yrs. ± 1.5	1. Lack of time: 34% of those with a low level of activity, 31% of those who were moderately active and 35% of the highly active participants.	1. Lack of a suitable place for exercise (lack of facilities): 38% of those with a low level of activity, 36% of those who were moderately active and 26% of the highly active participants.	Not reported	The public health authorities in KSA need to continue their efforts to educate people on the importance of PA and a healthy lifestyle. Efforts to improve the educational system, including the implementation of physical education classes for females should be made, and a larger number of public facilities for sports and exercise should be established specifically for women and adolescent girls.

Table 2.4 Barrier to PA among women in Saudi Arabia-Social/cultural/Organizational, and Environmental. Continuation……4

#	Author/ year	Q*	Type of study/ Sample method/setting/ Tool	RR/ Sample size/ women % /mean age ±SD	Individual (Internal)	Social/cultural/Organizational (External)	Environmental	Conclusion
						Lack of company to do the activities: 31% of those with a low level of activity, 40% of those who were moderately active and 29% of the highly active participants.		
6	Amin et al., 2011 (Amin et al., 2011) *No indication of the time period study has been conducted	G	Cross-sectional/ Random from multiple PCC /PCC in Al-Hassa (eastern region)/ GPAQ	91%/ 2176/ 44%/ 32.7 ±9.8	1. Lack of time (50.7%) (domestic chores for women) 2. Lack of interest (21.5%) 3. Lack of money (15.4%)esp. among the younger age group 4. Fear of injury (15.4%) 5. Dislike exercising (12.2%) 6. Internet/TV use (9.6%) 7. Chronic illness (10.2%) 8. Old age (3.4%)	2. Tradition*(approval from male guardian) (80.6%)*leading barrier 3. Lack of facilities (67.9%) 4. Lack of company (20.2%) Especially among women cannot go outdoors to exercise alone must be escorted by a male guardian.	1. Weather (68.8%) *2nd leading barrier	A high level of PA was more common among men (20.2% vs. 11.3% for women, P = .001) (CI = 18.0–22.5). Although the weather as an environmental barrier has been classified in this study as a leading barrier towards PA, traditions and customs (listed approval of the male guardian) and lack of appropriate facilities for exercising was the modifiable barriers that could be targeted to obtain healthier lifestyles.

Table 2.4 Barrier to PA among women in Saudi Arabia-Social/cultural/Organizational, and Environmental. Continuation…… 5

#	Author/ year	Q*	Type of study/ Sample method/setting/ Tool	RR/ Sample size/ women % /mean age ±SD	Individual (Internal)	Social/cultural/Organizational (External)	Environmental	Conclusion
7	AlQuaiz and Tayel, 2009 (AlQuaiz & Tayel, 2009) Data collected between 1st March- 30 April 2007	G	Cross-sectional/Randomly multiple PCC /PCC in Al-Hassa (eastern region)/ CDC questionnaire	n/a /450/ 68%/ 33.28 ±13.3	1. Lack of willpower (78.9%*) 2. Lack of energy (77% *) 3. Lack of skills (48.9%*) 4. Fear of injury (22.9%) 5. Lack of time (41.8%). **P* value < 0.01 than men	1. Lack of social support (82.6% *) leading barrier. 2. Lack of resources (82.2% *) second leading barrier Higher in female and lower income class. *P value < 0.01 than men *Limited funding for Saudi women to join sports clubs. *High cost of gym memberships. Lack of social support (higher in females than males).	1. Weather (68.8%) 3rd leading barrier	Lack of Social support (limited funding) was the leading barrier for PA. Followed by lack of resources (Women, lower income class), while lack of will-power influenced adherence to PA.

In Table 2.4, the perceived barriers to PA were categorized into three categories – individual (internal), socio-cultural (external) and environmental. These categorizations are based on similar studies that aimed to identify barriers to healthy lifestyles (Amiri et al., 2011; Evenson, Moos, Carrier, & Siega-Riz, 2009; Korkiakangas, Alahuhta, & Laitinen, 2009). The top internal barriers that have been reported in all six studies to PA among women were lack of time, fatigue, including feeling unconcerned to the benefits of exercise, followed by a lack of motivation and other health issues, such as chronic diseases. The external barriers refer to factors beyond an individual's control, whereas internal barriers are factors determined by an individual's personal decision (Korkiakangas et al., 2009). Environmental barriers include factors such as the weather. While the leading external barriers that were reported in these studies were lack of facilities and lack of social support. Two studies reported transportation as a barrier to being physically active (Albawardi et al., 2016; Samara et al., 2015). In one study, 80% of participating women agreed that tradition, approval of their male guardian, and custom were their main barriers to PA (Amin et al., 2011). Three out of five studies reported the weather as an environmental barrier to PA (AlQuaiz et al., 2015; Amin et al., 2011; Samara et al., 2015). Overall, the most frequently reported external barriers to PA were lack of facilities, lack of social support and lack of resources/equipment besides the socio-cultural barriers; tradition and social norms (H. H. Al-Otaibi, 2013a; AlQuaiz & Tayel, 2009; Amin et al., 2011; Samara et al., 2015).

Two studies conducted by Alamin et al. and AlQuaiz et al., also concur that the lack of facilities affected women within the PCC setting to a considerable extent (AlQuaiz & Tayel, 2009; Amin et al., 2011). They add the expensive cost of a gym membership (registration and monthly fees), on these establishments as well as commuting to those facilities as barriers among working women (Albawardi et al., 2016). The previous prohibition on women driving motor vehicles contributed to physical inactivity in Saudi Arabia. According to Samara et al., 56% of female university students (mean age 20) reported that lack of transportation contributed to the level of inactivity among them, as they depended upon male drivers to transport them (Samara et al., 2015). Educational level was also found to contribute significantly towards the understanding and awareness of PA barriers.

2.6.2 Healthy diet, and fruit and vegetable consumption among women in Saudi Arabia

One way of preventing cardiovascular, and other, diseases is a high consumption of fruits and vegetables (FV), vital elements of a healthy diet (Gan et al., 2015; Hartley et al., 2012). The risk of serious health problems can be reduced by daily minimum consumption of five portions (400g) of FV (Appendix 4). FV are considered to be nutrient sources of minerals, fibre and antioxidants, which all protect against CVD and its risk factors (Slavin & Lloyd, 2012). Based on the WHO report (World Health Organization, 2003), more than 2.7 million deaths per year globally are caused by low FV intake. Thus, increasing the consumption of FV has an important role in saving lives and improving the well-being of societies. However, the barriers to consumption affect dietary choices regardless of perceived benefits (Pollard, Kirk, & Cade, 2002).

Despite the health benefits of consuming FV, the intake is under the minimum daily recommendation in many countries (World Health Organization, 2003). In the ME and North African regions, it is asserted by the WHO that the intake of FV does not meet the target recommendation. For example, 96.7% in Egypt (WHO, 2012a), and 91.1% in Qatar (WHO, 2012b) consume less than five serving a day. In Saudi Arabia, data from last national health survey shows that 97.4%, of adults, were consuming less than recommended FV amounts and only 2.6 % of adults met consumption guidelines (El Bcheraoui et al., 2015). Moreover, two studies reported a significant statistical difference in FV consumption between genders; women were found to consume less FV than men ($p = 0.001$) (Alzeidan et al., 2016; Midhet et al., 2010).

Summary

This chapter identified the gaps in the literature, related to the research questions. One of the most important steps in CVD prevention is the implementation and maintenance of healthy lifestyle behaviours. Most of the NCD that cause premature death and illnesses could be prevented if people make changes to their risky behaviours to reduce their chances in developing these illnesses. Thus, it is important to identify and address the high-risk groups especially among women and to implement more effective preventive strategies in the future.

This chapter addressed the need for increasing health literacy as the level of literacy is low among Saudis. It also covered the results of both systematic reviews which reveal a high prevalence of CVD risk among Saudi women, especially in physical inactivity levels. In addition, it discussed the use of the HBM tool in CVD research. The rationale for using the FRS as a common CVR risk assessment tool was also explored, as well as the negative relationship between different levels of sociodemographic variables and women's CVD risks. Finally, this chapter covered the commonly reported barriers to PA in addition to the consumption habits of Saudi women relative to FV.

CHAPTER 3: METHODOLOGY and STATISTICAL ANALYSIS

Introduction

This chapter provides an overview of the methods that were used to complete this study. This chapter includes the purpose of the study, research design, research questions, the study sample, a detailed description of the instruments (including validity and reliability information), data collection procedures, and statistical analyses.

3.1 Study design

This quantitative study used a cross-sectional, descriptive, and correlational survey design. Although, in cross-sectional design it is difficult to derive causal relationships from cross-sectional analysis, it allows the researcher to measure the outcome and the exposures in the study participants at the same time. In addition, it is an instrument that saves time and money and is useful for public health planning, monitoring, and evaluation (Setia, 2016). Descriptive studies are useful in describing the characteristics and facts of the population or area of interest of the study in an accurate way. Correlational studies are adopted for investigating the extent to which variations in a factor correspond with variations in one or more factors on the basis of correlation coefficients (Isaac & Michael, 1995).

This study aimed to address health beliefs among women living in the city of Riyadh, Saudi Arabia. The women were recruited in the PCCs of King Khalid University Hospital (KKUH) one of the hospitals in the King Saud University Medical City (KSUMC). This hospital serves mostly patients from the capital city of Riyadh. To obtain the required data for the study from the participating women, data from surveys and individual medical records were used.

All participants were interviewed face-to-face using a structured questionnaire. The survey study tool enquired about: socio-demographic information (age, level of education, marital status, occupation, income and behavioural habits including tobacco use, fruit/vegetable consumption, PA), as well as their medical history specifically about HTN, DM and hyperlipidaemia.

For assessing FV consumption, the usual intake of FV per serving/day was considered. Images of serving dishes, cups, bowls, spoons and photos of vegetables and fruits were provided to help the participants in estimating fruit and vegetable serving. (Appendix 4)

Regarding PA, the patients were asked how many minutes they regularly engage in a variety of PA, and if they were involved in at least 150 minutes/week of moderate intensity PA or at least 75 minutes/week of vigorous PA, meeting the WHO recommendation for adults aged 18–64 (World Health Organization, 2016).

3.2 Study population and Study Location

According to the General Authority for Statistics in the KSA (2016), the population of Saudi Arabia was estimated to be 31 million people. In this estimation, about 13 million (44.8%) were Saudi women living inside the country. The larger male population is mainly due to the large number of migrant workers, of whom the majority are males. This study was carried out in the City of Riyadh (capital city of Saudi Arabia), which according to the latest government statistics report has an estimated population of 7.3 million (General Authority for Statistics, 2016).

This cross-sectional descriptive and analytical study targeted women attending the PCCs at KKUH-KSUMC. The PCCs offers the best opportunity to identify people with high risk of CVDs and to administer preventive action (Hobbs, 2004).

The medical city has a wide range of services with an average of 42,000 patient visits per year, with a 1,075-bed capacity. It provides free primary, secondary, and tertiary care services to all Saudi patients, though mainly from the Riyadh area. Its tertiary care service is provided to all Saudi citizens on a referral basis. Medical services for all King Saud University employees and students are also free of charge. The PCCs were located in the Out-Patient Building of KKUH-KSUMC.

3.3 Study period and Sample size calculation

This cross-sectional descriptive and analytical study targeted women attending the PCCs at KKUH-KSUMC, from the period of January 2016 to June 2016. The sample size calculation was based on an 18% of CVD risk expected frequency amongst women in Saudi Arabia (Ziad A Memish et al., 2014). Following the general sample size determination procedure for health science research, the probability level alpha was set at 0.05 level of significance which means a confidence interval (CI) of 95% (5% chance of making Type (I) error or rejecting a null hypothesis when it is in fact true), the power of statistical test (1-β) was set at 0.80, which means a 20% chance of making Type II error or incorrectly accepting a null hypothesis when in fact it is false, and the effect size (degree of association between two variables, population and sample) of 0.3 was set. The total sample size of (n= 389) was calculated using the FluidSurveys© (2014) software ("Sample Size Calculator," 2017), with a CI of 95% with an error margin equal to 0.05. To handle any missing data, the sample size was increased by 30-40% moving the total number to 600.

3.4 Inclusion and exclusion criteria

The study aimed to assess CVD risk factors and understand the related health beliefs. A non-random convenience sample was selected among Saudi adult women who attended the PCCs of KKUH-KSUMC and had a regularly updated medical records at the hospital. Specifically, the inclusion criteria were: (1) Saudi Women, (2) aged 15 years and above as this is the age used to define adults in Saudi Arabia in the National Health Survey (3) attending the primary health care clinics, (4) having a regularly updated medical record, (5) having expressed interest in participating in the study. Women with pre-existing CVDs, i.e. coronary artery disease were excluded (using patients' medical records to rule out any CVD diseases).

3.5 Ethical Summary

Ethical approval was obtained from the Institutional Review Board (IRB) at KSUMC. Research project no. # E-15-1678, Ref. No. 15/0438/IRB. (See appendix 3). This study did not involve any clinical intervention. One research assistant was recruited to help in interviewing the participants. Then, both researchers (Primary investigator, and research assistant)

explained to the participants the purpose of the study, the procedure for data collection, potential risks and benefits, time commitment, their right as participants, and the strategies to protect privacy and anonymity. The potential participants were given written consent forms when they agreed to participate. The researchers were available to answer any questions before the participants signed the consent forms. Participation by the women included in this study was voluntary, and participants were free to withdraw at any time without penalty. Written consent from participants was gained before participation. The questionnaire used was shared with all the participants of the study. All information taken from the subjects, whether through the questionnaire or their medical records was coded and kept confidential. All records were kept in one computer and a file cabinet for storage and safekeeping. Only the primary investigator and the research assistant were allowed to collect, analyse and synthesize the data.

Following the rules and the policy of IRB at KSUMC, where the study was conducted, the researcher could not interfere in patients' health plan or report in their files. The researcher was not entitled to interfere even in the cases of high risk. The final results of the study would be shared with the IRB.

Concerning the adaption of instruments of HBCVD, the researcher contacted the author via email to ask for permission to use the instrument (see Appendix 1). After obtaining the permission, the instrument was adapted to accomplish the aim of the current study.

3.6 Biomedical information collected from participant's medical records.

Estimates of the 10-year CVD risk were calculated for each of the included participants, using the FRS (Bitton & Gaziano, 2010). The Framingham equation to estimate 10-year CVD is the most common scoring system that Saudi studies use for CVD estimation (Al-Dahi et al., 2013; AlQuaiz et al., 2015). The FRS has the advantage of being simple to use by clinicians and has been proven to be applicable to a wide variety of patients, although it is limited by the fact that it does not include variables such as exercise or deprivation levels (Rodondi, N. et al., 2012). Data extracted from each participant's medical records included demographic information, cardiovascular risk factor details, and prescribed medication for blood pressure or cholesterol-lowering therapy. A recent lipid profile (total cholesterol, high-density HDL, LDL and triglyceride) 5 years prior was also obtained from the medical records.

The body weight and height were measured to calculate BMI, waist and hip in (cm) to calculate waist and hip ratio, were also obtained. Each subject's 10-year estimated risk was calculated based on the assumptions underlying the FRS (C. J. O'Donnell & Elosua, 2008).

These are derived multivariable mathematical functions that are used to estimate CVD risk in the next 10 years, and include gender, age, blood pressure, total cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C) and smoking behaviour.

3.7 Sample Selection and Patient Recruitment

The sample was collected in a convenience sample technique. A non-random convenience sample of 503 women were selected from the 600 women who attended the PCC for a regular appointment. The questionnaire used sequential steps, starting with a survey (Step I), physical measurements (Step II) followed by biochemical measurements (Step III), and CVD scores calculation for the participants using FRS (Step IV):

Step I.

After obtaining written informed consent, all participants were interviewed face-to-face using a structured questionnaire. The survey study tool enquired about: socio-demographic information (age, level of education, marital status, occupation, income and behavioural habits including tobacco use, fruit/vegetable consumption, PA), as well as their medical history specifically about HTN, DM and hyperlipidaemia.

Step II.

Anthropometric measurements were extracted using the patient's record number including their height and weight to calculate the Body Mass Index (BMI). The BMI was calculated using the formula: BMI = weight (kg) /height (m2). Based on the BMI, the study population was divided into five groups: underweight (<18.5), normal weight (18.5–24.9), overweight (25–29.9), obese and morbidly obese (> above 30). Waist and hip were measured in centimetres to the nearest 0.1 cm and the ratio was calculated. Blood pressure was measured using an automated standard digital sphygmomanometer (Mindary Datascope

Accutorr Plus, USA 2010), placed on the subject's left arm during a relaxed and seated position. Two readings of both systolic and diastolic pressures were taken, five minutes apart; the average of the two readings was used.

Step III.

Biochemical tests: The laboratory investigations were taken from patient's medical records including lipid profile and glycated haemoglobin (HbA1c).

Step IV.

Estimated CVD risk was calculated using FRS; then cohorts were sub-divided according to their scores into three categories: low-risk score (<10%), intermediate (10–20%), and high-risk score (>20%) (P. W. Wilson et al., 1998). For the definitions of anthropometric measurements used in this see (Table 3.1).

After obtaining the ethical approval from the Institutional Review Board (IRB) from KSUMC, including getting permission to access the PCCs from the head of the department, who appointed two physicians to help in the process of recruiting the participants who met the inclusion/exclusion criteria. Two research assistants were also appointed by the head of the department to help the principal investigator in the process of data collection. The research assistants were given training by the principal investigator so that they became familiar with the survey tool and what type of data would be collected from the participants. Participants that fulfilled the inclusion criteria read (or were read) the informed consent statement, and the researcher explained any information that was not clear. Participants were also informed that their participation was voluntary, and on that basis, they could decline to answer questions or withdraw from the study at any time. After the informed consent was obtained, the survey took approximately 20 minutes to complete.

Since permission had been obtained to review the electronic medical records of each participant, medical parameters such as blood pressure, lipid profile, height/weight, hip and waist ratios and HbA1c were collected directly from those medical records (See Table 3.1). Finally, all the completed survey questionnaires were returned to the principal investigator for data management and analysis. (Table 3.2)

Table 3.1: Definitions for medical parameters used in this study

Cardiovascular Risk	Definition	Measure
Cigarette Smoker	One or more cigarettes per day in the previous 12 months.	Current smoker = 0 Previous smoker = 1 Non-smoker = 2
Hypertension	Systolic blood pressure > than140 mm Hg or a diastolic blood pressure > 90 mm Hg.	The subject sat in an upright position for 2 minutes then blood pressure was obtained
Elevated Cholesterol Levels **High LDL** **Low HDL** **Elevated Triglyceride**	A total cholesterol level > 5 mmol/l High LDL level > 3 mmol/l Low HDL level < 1 mmol/l. Triglyceride level > 1.7 mmol/l	Following a 12-hour fasting blood sample, phlebotomy was done to obtain total cholesterol, LDL, HDL, triglyceride levels measured by using the Siemens Dimension RxL Max Integrated Chemistry System
Obesity **Overweight**	Body Mass Index (BMI) =/> 30 kg/m2. Waist/hip ratio Body Mass Index (BMI) of 25 to 29.5 kg/m2.	Height was measured in centimetres using a standard wall mounted height scale. Weight was measured in kilograms using the Seca ultrasonic measuring station for height and weight
Elevated Blood Glucose	HbA1c >7 or a known diagnosis of DM	Siemens Dimension RxL Max Integrated Chemistry System

Table 3.2 Definitions for the risk factors (Kalaf et al., 2016):

Risk factor	Definition
Hypertension:	HTN was defined as having a systolic blood pressure (SBP) elevated above 140 and diastolic blood pressure above 90.
Hyperlipidaemia:	Participants reported on the medical history form whether they had been told by a physician that they had any form of hyperlipidaemia. Patients typically receive a diagnosis with the presence of elevated levels of cholesterol (total cholesterol greater than 240 mg/dl). For this study data was only considered as yes/no for a previous diagnosis of hyperlipidaemia.
Type 2 DM:	Participants reported on the medical history form whether they had been told by a physician or available in patients' medical record.
Obesity:	BMI value greater than or equal to 30 was obese. Prevalence of normal (18 to 25) and overweight (25 to 30) BMI were also reported.
Physical Inactivity:	Being sedentary was defined as less than 40 minutes of activity per week (<2 weekly exercise sessions of at least 20 minutes each).
Framingham Risk Score:	The tool used for the assessment of risk level of CAD over ten years (Bitton & Gaziano, 2010). The FRS considers six coronary risk factors, including age, gender, total cholesterol (TC), high-density lipoprotein cholesterol (HDL), smoking habits, and systolic blood pressure (C. J. O'Donnell & Elosua, 2008). Type 2 DM was considered to be a CAD risk equivalent; a patient with Type 2 DM was therefore considered to be at high risk of suffering hard coronary events (Soofi & Youssef, 2015).

3.8 Survey Instrument

The final questionnaire consisted of 40 questions and can be found in the Appendix 2. Questions were divided as follows (Table 3.3):

Table 3.3: Instrument Layout

Part one: Socio-demographic *	Socio-economic status (education, income, occupation and marital status)	Q1-Q5
Part two: Healthy behaviour*	Smoking, PA level, FV consumption	Q6-Q9
Part three: History of CVDs *	Family history of DM, HTN and hyperlipidaemia.	Q10- Q12
**Part four: Socio-cultural ** **	Driving, daily food servings, social gatherings	Q13-Q15**
Part five: Health Belief Related to CVD (HBCVD) Scale	Perceived susceptibility and severity subscales, perceived benefits subscale, and perceived barriers subscale.	Q16-Q40

*WHO STEPwise based

Social economic status were measured by three elements: educational level, income, and occupation status (Shavers, 2007).

Images were provided in some part of the questionnaire, such as in the FV question, of serving dishes, cups, bowls, and spoons, for assessing FV consumption, the usual intake of FV per day per serving was considered. Also, in the cultural questions, such as questions 14, and 15, pictures were provided to reflect the large food portion sizes that are a norm of Saudi culture i.e. large plates of kabsa and Arabic sweets (see Appendix 5). Studies suggest the use of images can improve the quality of the interviews in many ways by prompting memory, reducing misunderstandings, and eliciting higher quality and more comprehensive interviews (Harper, 2002).

Regarding PA, the patients were asked how many minutes they regularly engage in a variety of PA, and if they were involved in at least 150 minutes/week of moderate intensity PA or at least 75 minutes/week of vigorous PA, meeting the WHO recommendation for adults aged 18–64 (World Health Organization, 2016). Adherence was self-reported by asking the number of days/hours per week engaged in vigorous PA. Frequency is one of the dimensions of PA, which is defined as the number of sessions per day or week (Strath et al., 2013).

The HBCVD is a 25 item self-reported scale. Each scale includes five response options (strongly agree, agree, neutral, disagree, and strongly disagree) to measure the perceptions of susceptibility, severity, benefits and barriers. Item response weighted scores indicate: 0=neutral, 1=strongly disagree, 2=disagree, 3=agree and 4=strongly agree, so that higher scores indicated higher level of perception. The two items coded so that: (a) the higher the score, the greater the tendency to feel susceptible to CVD, (b), the higher the score, the greater the tendency to perceive CVD as serious, (c) the higher the score, the greater tendency to perceive benefits as important for CVD, and (d) the higher the score, the greater the barriers to engaging into healthy behaviours.

3.9 Translation process

A Cross-cultural translation and adaptation process (Beaton, Bombardier, Guillemin, & Ferraz, 2000) was used to translate the HBCVD questionnaire. Implementation of this method included the following steps:

1) Forward translation,
2) Expert panel Back-translation,
3) Pre-testing,
4) Final version.

Two independent bilingual translators made the initial translation from the original questionnaire to the Arabic language. One of the translators was aware of the concepts the questionnaire was intended to measure in order to provide a translation that more closely resembled the original instrument. While the second translator, who was unaware of the objective of the questionnaire, produced the second translation. Discrepancies between the

two translations were discussed and resolved by the primary investigator. Then, the agreed translation underwent back-translation, to ensure the accuracy of the translation. An expert committee was established to produce the pre-final version of the translation. The pre-final version of the translated questionnaire was pilot tested on a small sample.

3.10 Pilot Study

A pilot study was carried out before the actual data collection process. This was a pre-condition of the IRB to approve the ethics application.

It was also vital to carry out the pilot study to examine the suitability of the survey tool in terms of language consistency, duration and clarity. The pilot study was carried out with 23 Saudi women from the target population whom were not included in the actual data collection process. Following the pilot study, a few changes were made to the wording and some images were also enlarged to be more understandable for the participants, such as the portion size of daily FV recommended for consumption.

3.11 Instrument Reliability

The HBCVD consisted of a 25-item scale which had four subscales: susceptibility (n=5), severity (n=5), benefits (n=6), and barriers (n=9). Exploratory factor analysis has been conducted and the results showed an overall Cronbach's alpha of 0.76 for the scale and 0.82 for the susceptibility subscale, 0.61 for the severity subscale, 0.93 for the benefits subscale, and 0.70 for the barriers subscale (E. G. Tovar et al., 2010). Cronbach alpha scores for the health belief subscales were calculated to find the internal consistency of the instrument. Overall Cronbach alpha for the entire 25-item health belief questionnaire was 0.85. A score of more than 0.7 indicated that this instrument was reliable. The definitions used are described in Table 3.4.

Table 3.4: HBM Definitions and Health Beliefs Related to CVD scale (HBCVD)

Study Variables	Conceptual Definitions: (Glanz et al., 2008) (Karen Glanz et al., 2008)	Health Beliefs Related to CVD scale (HBCVD) which was designed by (E. G. Tovar et al., 2010) Tovar et al. (2010)	Scoring instructions
Perceived susceptibility	Belief about the chances of experiencing a risk of getting a condition or disease	1. It is likely that I will suffer from a CVD in the future 2. My chances of suffering from a CVD in the next few years are great 3. I feel I will have a CVD sometime during my life 4. Having a CVD is currently a possibility for me 5. I am concerned about the likelihood of having a CVD in the near future	0=neutral, 1=strongly disagree 2=disagree 3=agree 4=strongly agree The higher the score, the greater the tendency to feel susceptible to CVD
Perceived severity	Belief about how serious a condition and its consequences are.	1. Having a heart attack or stroke is always fatal 2. Having a heart attack or stroke will threaten my relationship with my significant other 3. My whole life would change if I had a heart attack or stroke 4. Having a heart attack or stroke would have a very bad effect on my sex life 5. If I have a heart attack or stroke, I will die within ten years	0=neutral, 1=strongly disagree 2=disagree 3=agree 4=strongly agree The higher the score, the greater the tendency to perceive CVD as serious,
Perceived benefits	Belief in efficacy of the advised action in reducing a disease threat.	4. Increasing my exercise will decrease my chances of having a heart attack or stroke 5. Eating a healthy diet will decrease my chances of having a heart attack or stroke 6. Eating a healthy diet and exercising for 30 minutes most days of the week is one of the best ways for me to prevent a heart attack or stroke	0=neutral, 1=strongly disagree 2=disagree 3=agree 4=strongly agree

Table 3.4: HBM Definitions and Health Beliefs Related to CVD scale (HBCVD). Continuation…

Study Variables	Conceptual Definitions: (Glanz et al., 2008) (Karen Glanz et al., 2008)	Health Beliefs Related to CVD scale (HBCVD) which was designed by (E. G. Tovar et al., 2010) Tovar et al. (2010)	Scoring instructions
		7. When I exercise, I am doing something good for myself 8. When I eat healthy, I am doing something good for myself Eating a healthy diet will decrease my chances of dying from CVD	The higher the score, the greater tendency to perceive benefits as important for CVD, and
Perceived barriers	Belief about the tangible and psychological costs of the advised action, Although the belief may exist that a given action may have effectiveness in decreasing the seriousness of a disease, the individual may simultaneously view the action as painful, upsetting, expensive, or inconvenient.	1. I do not know the appropriate exercises to perform to reduce my risk of developing CVD 2. It is painful for me to walk for more than 5 minutes 3. I have access to exercise facilities and/or equipment 4. I have someone who will exercise with me 5. I do not have time to exercise for 30 minutes a day on most days of the week 6. I do not know what is considered a healthy diet that would prevent me from developing CVD 7. I do not have time to cook meals for myself 8. I cannot afford to buy healthy foods 9. I have other problems more important than worrying about diet and exercise	0=neutral, 1=strongly disagree 2=disagree 3=agree 4=strongly agree The higher the score, the more are barriers for engaging into healthy behaviours.

This instrument the" Health Belief Related to CVD" was adapted with the Permission from the author see Appendix 1.

3.12 Data Coding and Analysis

The completed surveys were coded, and all the independent variables included in the logistic regression models were dummy coded into 1/0. Before the dummy coding was executed, a reference category in each variable was chosen and excluded. The remaining categories were coded into separate variables with 1 representing a case in a specific category and 0 representing a case that is not in the specific category.

Data cleaning was carried out by running frequencies and identifying data entry errors. A few variables were found to be missing and entered from the original survey. Once the initial cleaning was completed, 50 random surveys (constituting about 10% of the all the surveys) were selected and examined for data entry errors as well as consistency. No data entry errors were found, and all the codes were found to match with what had been entered in the SPSS. Descriptive and inferential statistical data analyses were conducted using SPSS, version 25. Missing data were transcribed or excluded from the analysis.

Descriptive statistics, one sample T-test, measures of central tendency, frequencies, Pearson Correlation, and Multiple Linear Regression were used for statistical analyses.

Summary

In this quantitative study, a descriptive correlational survey design has been utilized. The Health Belief Related to CVD (HBCVD) Scale survey instrument was used to examine the awareness, perceived risk, and perceptions of heart disease among women in Saudi Arabia.

CHAPTER 4: RESULTS

Introduction

This chapter provides detailed findings of the study to examine cardiovascular health beliefs among Saudi women attending PCCs in Riyadh and to see how these beliefs and selection of sociodemographic variables influence their cardiovascular risk as measured by the FRS. The first section of this chapter (4.1), profiles the study sample and compares it with the age distribution of the overall Saudi Arabian population. Additionally, this section describes the FRS scores with an emphasis on the high and intermediate risk groups. This is followed by a discussion of results related to behavioural risks, including FV intake, smoking, PA and watching TV. The final part of the first section deals with the cultural practices specific to the sample. The second section describes the comprehensive findings of each of the research questions, which were: What are the general health beliefs of Saudi women regarding CVD?, What is the association between the mean FRS and four subscales of health beliefs (perceived susceptibility, perceived severity, perceived benefits, and perceived barriers)? What is the impact of sociodemographic variables on CVD risk (FRS)? What is the relationship between the health belief subscales (Perceived susceptibility, Perceived Severity, Perceived Benefits and Perceived Barriers) and the different sociodemographic variables?

4.1 Description of the sample

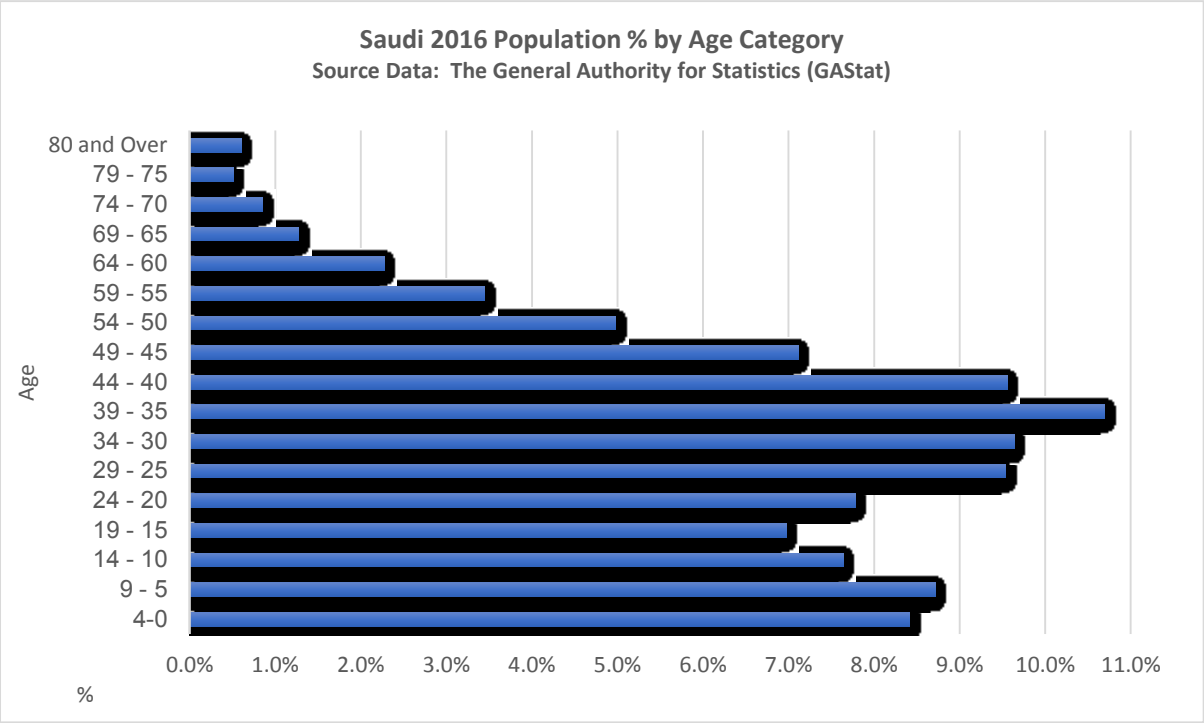
A convenience sample included 503 participants out of 600 approached, representing a response rate of 83.3%. From the 503 participants, 480 were eligible to have their FRS calculated due to availability of the information in their records. Most of the surveys were collected during morning working hours from Sunday to Thursday. All surveys were entered in the SPSS program by the investigator and research assistant. Demographic backgrounds are describe below.

4.1.1 Sociodemographic variables description

The age of respondents ranged between 15 and 65 years with 62% of them above the age of 45. Most of them were married (73.5%), 66% of the participants had an education level below high school, and 70% were housewives. The age group 15 – 34 represents only 10.7%.

In the age distribution of the Saudi population below, the highest age group was those aged 35-39 years at 10.7%, followed by those aged 40-44 years at 9.6% (see Fig 4.1) (General Authority of Statistics, 2016). A comparison of the sample age distribution against that of the same age groups of the Saudi population, is shown in the side by side graph Fig 4.2, below. The study sample is older than the overall Saudi population age distribution.

Fig 4.1: Saudi population % Age category



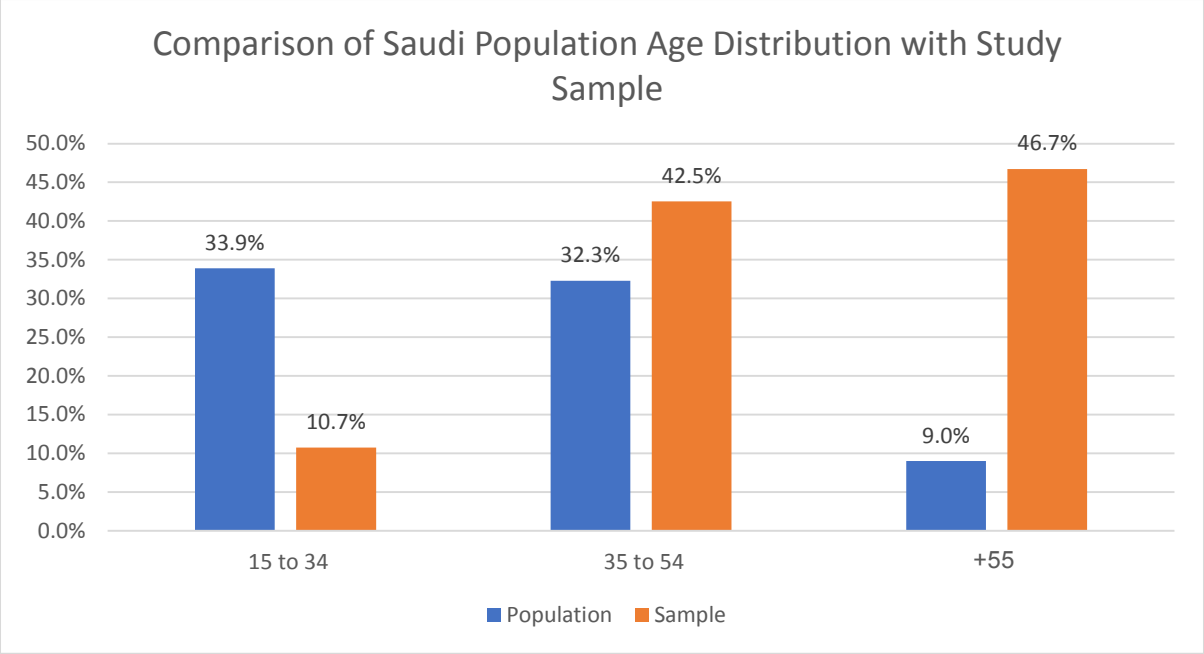


Fig. 4.2 Comparison of Saudi population age with study sample

4.1.2 Framingham risk score among the sample

The high (22.4%) and intermediate risk (30.3%) groups. 52.7% of study participants had intermediate or higher FRSs. Participants had a mean systolic blood pressure of 130mmHg (SD ±17) and a mean diastolic blood pressure 75mmHg (SD ± 9.6).

Body mass index (BMI) and waist to hip ratio (WHR) were calculated and the results indicated that 64% were obese, with a mean BMI and WHR of 33 kg/m2 SD± 6.7 and 0.948 SD± 0.063, respectively. See Table 4.1 Baseline respondents' characteristics.

4.1.3 Behavioural risk factors (FV intake, smoking, PA and watching TV)

Only 13.1 % of participants declared that they exercised more than 3 times per week (meeting the WHO criteria), while 63.1% were physically inactive. The majority of the participants (59.6%) did not engage in any exercises, while only 7.6% engaged in daily exercise. 23.7% reported exercising one to two times a week, 5.6% three to four times and 3.6 % exercise once a month.

Nearly all the participants (99.4%) reported that they have never smoked, while only 0.4% were current smokers and 0.2% were ex-smokers. Most of the women, 97%, reported getting 1-3 servings of FV, 1% reported getting none, while another 1% indicated that they get +3-5 servings, while only 0.4% reported getting more than 5 servings per day. Regarding time spent on watching TV, the majority (49.2%) of the subjects reported that they watch TV for one hour or less, while 14.8% reported watching TV for more than 5 hours per day. A further 29% indicated that they watch from one to three hours, while 7% reported watching for three to five hours. Regarding culture and health beliefs, most of the women (61%), despite their age, strongly disagreed that being allowed to drive would support them attending gym and health clubs. The majority of the subjects reported not having a family history for CVD risk factors such as DM (33.9%), HTN (41%) and hyperlipidaemia (74.6%) See Table 4.1 and 4.2.

Table 4.1 Baseline respondents' characteristics (n=503)

Variables	n	%
Age		
15-34	54	10.7
35-54	214	42.4
55 +	235	46.5
Marital status		
Married	371	73.5
Never married	32	6.3
Separated/ Divorced/widowed	100	19.9
Education level		
Elementary or less	251	49.8
Intermediate/ High School	129	25.6
Diploma/ College Degree or Postgraduate	123	24.4
Employment condition		
Government, Semi Government, Private	88	17.4
Student, Retired, Not Working	59	11.7
Housewife	356	70.5
Monthly Income		
<2,000 - 4,999 SR	174	34.5
5,000 - 9,999	161	31.9
10,000 - 17,999	120	23.8
18,000 and above	48	9.5
Reported chronic disease status		
Hypertension	191	37.9
DM	275	54.6
150 minutes/week of moderate PA or at least 75 minutes/week		
YES	185	36.7
NO	318	63.1
Smoking status		
Never smoked	497	98.6
Ex-smoker	1	0.2
Current smoker	2	0.4
Daily servings of FV		
None	5	1
1-3 servings	489	97
+3-5 servings	5	1
more than 5 servings	2	0.4
Daily hours spending in watching TV		
1 hour or less	246	48.8
1-3 hours	145	28.8
>3 to 5 hours	35	6.9
more than 5 hours	74	14.7
BMI		
Underweight/ Normal	38	7.5
Overweight	138	27.4
Obese	308	61.1
Waist-to-hip ratio (WHR)		
< 0.8	7	1.4
> 0.8	497	98.6
Family history of DM		
Yes	170	33.7
No	332	65.9
Family history of HTN		
Yes	269	58.8
No	206	40.9
Framingham risk score classification		
Low	217	43.0
intermediate	153	30.3
High	113	22.4

DM: diabetes mellitus, HTN: hypertension, BMI: Body Mass Index

Table 4.2 Respondents' medical parameters

Variables	N	Mean	±SD
Systolic BP	492	130.86	17.393
Diastolic BP	492	72.54	9.64
Weight	486	80.3165	17.50634
Height	484	155.595	7.49296
Waist	503	111.5	14.872
Hip	503	117.51	13.539
HgbA1c	502	7.7227	2.07057
HDL	500	1.5294	5.36448
TG	503	1.4513	0.85446
LDL	500	2.9115	0.93284
BMI	484	33.2022	6.77417

Cultural questions and CVD risk

Three cultural questions were asked regarding how food portion size and food type, influence body weight. These questions were formulated in relevance to the unique Saudi culture, Saudi traditions, and social norms that affect the lifestyle of Saudi women.

Sixty-eight percent of the respondents agreed that the size of the portions of daily food servings affected their health and body weight, while 65% agreed that their food choices during social gatherings affected their health and body weight. Chi-square analysis showed there is a significant difference between the group and FRS categories with a *p* value= 00.003 and 0.007 respectively. (Figures 4.3-4.4) Only 36.5% of the participating women agreed with the statement "not allowing me to drive is one of my barriers to attending the gym or sporting clubs". (Figures 4.5)

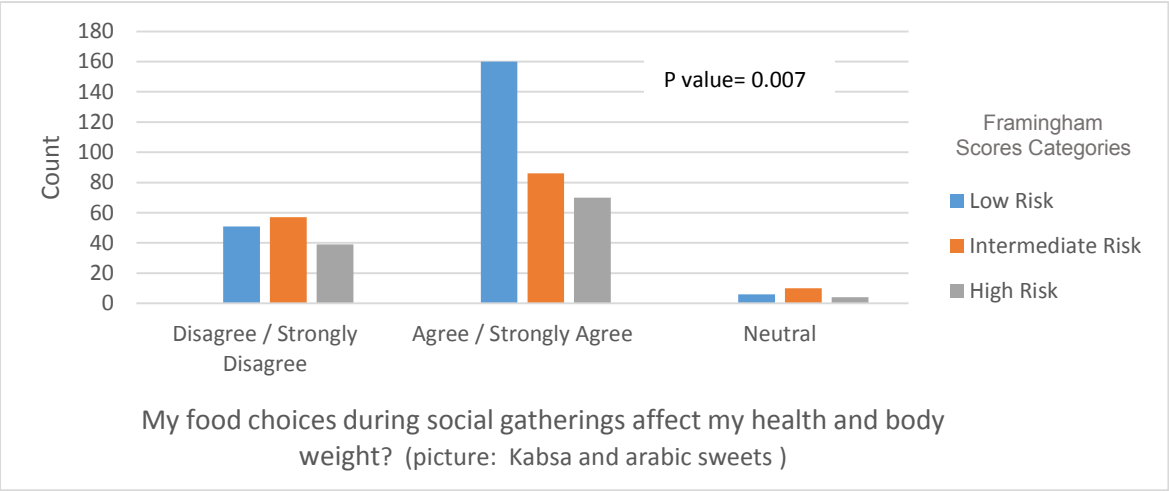


Fig. 4.3: Lifestyle questions 1: My portion of daily food servings affects my health and body weight?

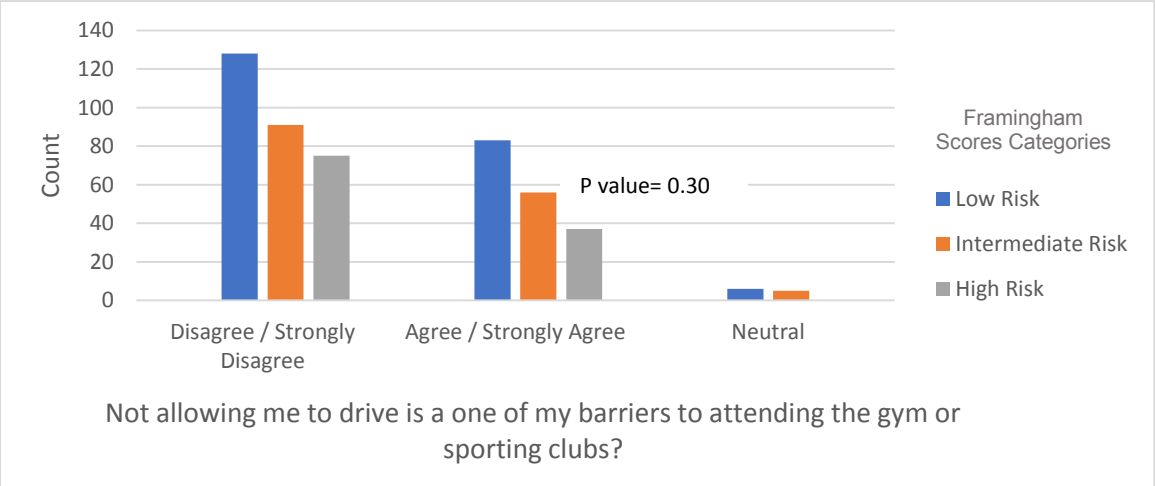


Fig. 4.4: Lifestyle questions 2: My food choices during social gatherings affect my health and body weight?

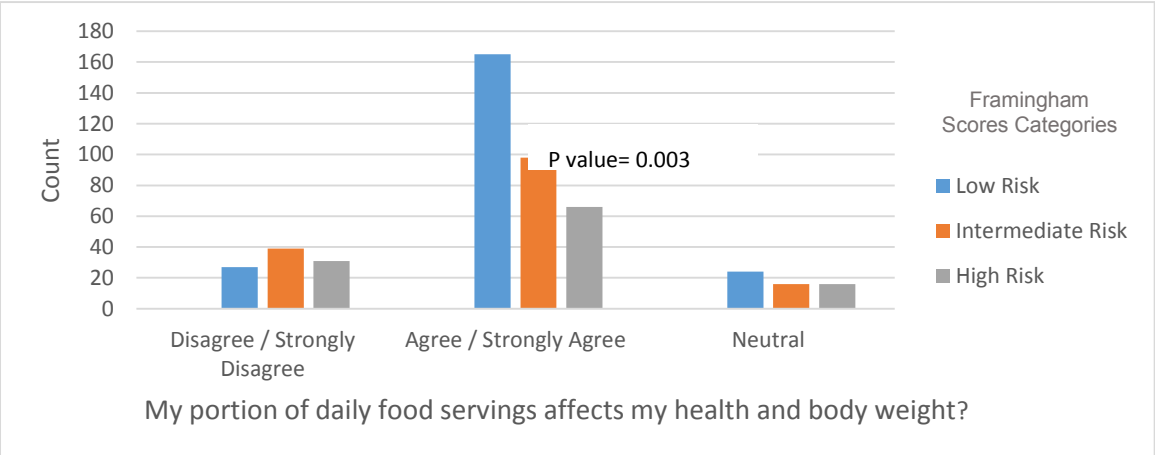


Fig. 4.5: Lifestyle questions 3: not allowing me to drive is a one of my barriers to attending the gym or sporting clubs

4.2 Results of the research questions

Prior to discussing the research questions, the results were checked for normality of distribution. The distribution was found to be a symmetric bell-shaped curve. Skewness was within the range of ±2 and kurtosis within the range of ±7. Chi-square testing was used for categorical data and Pearson's correlation and ANOVA were used for continuous data such as the mean of Framingham scores.

Research Question 1

What are the general health beliefs of Saudi women regarding CVD?

Health beliefs about CVD were measured by 25 health belief questions. These 25 questions were divided into four subscales: perceived susceptibility (5 items), perceived severity (5 items), perceived benefits (6 items), and perceived barriers (9 items). The perceived susceptibility was the lowest score among all the subscales. While the perceived benefit mean score was the highest among all the subscales.

A summary of the HBM constructs with the calculated grand mean of the subscale score is presented in Table 4.3. Overall the lowest mean score was among perceived susceptibility sub-scale and the highest mean score among women were in the perceived benefit scale. Further details were discussed under each subscale of HBM in the next section.

The percentage of responses to the questions in each of the HBM subscales were combined into three groupings: Disagree (a combination of Strongly Disagree and Disagree), Neutral, and Agree (a combination of Agree and Strongly Agree) to determine the overall intensity of the pattern of responses. These patterns are illustrated in Figure 4.6 Overall Grouped Mean Responses to Health Belief Subscales, below.

Further descriptive statistics (frequencies, percentages, mean, and standard deviation) of each subscale scores are presented in Tables 4.4- 4.7.

Table 4.3: Summary Table for Constructs of Health Belief Model

	MEAN-SUBSCALE SCORE	SD
HBCVD-SUS a	1.7	0.93
HBCVD-SEV b	2.5	1.4
HBCVD-BEN c	3.2	0.93
HBCVD-BAR d	2.6	1.1
HBCVD-GRAND MEAN	2.5	

Note: Strongly Agree = 4, Agree = 3, Disagree = 2, Strongly Disagree = 1, Neutral=0.
a. The higher the score, the greater the tendency to feel susceptible to CVD.
b. The higher the score, the greater the tendency to perceive CVD as serious.
c. The higher the score, the greater tendency to perceive benefits as important for CVD.
d. The higher the score, the more are barriers for engaging into healthy behaviours

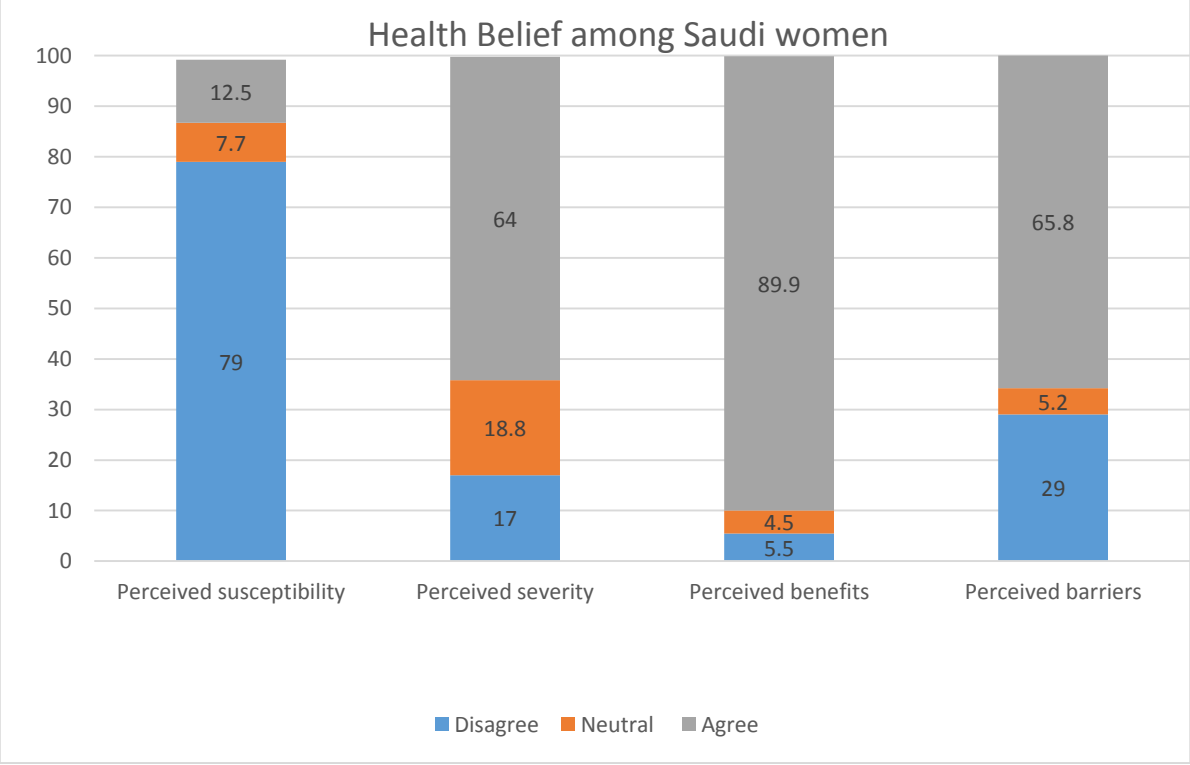


Fig. 4.6: Overall Grouped Mean Percent Responses to Health Belief Subscales

*Note: Both disagreed and strongly & disagreed combined % and agreed and strongly agreed were combined.
*Disagree, Neutral and Agree with the statements regarding the category. (E.g. Perceived susceptibility: It is likely that I will suffer from a CVD in the future.) See Appendix 2 Q16-Q40 to see all the statements.

a. Perceived susceptibility

Perceived susceptibility measured participants' beliefs about their personal susceptibility to CVD; the higher the score, the greater the tendency to feel susceptible to CVD. Grand mean score on the perceived susceptibility subscale was 1.7 with the standard deviation of 0.93. This indicates that 79 % of the women did not feel themselves susceptible to CVD. Only 12.5% of the women participants believed that they are susceptible to CVD (see Table 4.4).

Table 4.4: Perceived susceptibility to CVDs

ITEM	1 SD n (%)	2 D n (%)	0 N (%)	3 A n (%)	4 SA n (%)	Mean Score	SD
It is likely that I will suffer from a CVD in the future	180 (35.6)	222 (44.0)	39 (7.7)	33 (6.5)	30 (5.9)	1.67	0.93
My chances of suffering from a CVD in the next few years are great	172 (34.1)	217 (43.0)	39 (7.7)	32 (6.3)	29 (5.7)	1.67	0.93
I feel I will have a CVD sometime during my life	172 (34.1)	217 (43.0)	39 (7.7)	32(6.3)	29 (5.7)	1.67	0.93
Having a CVD is currently a possibility for me	172 (34.1)	218 (43.2)	38 (7.5)	32 (6.3)	29 (5.7)	1.67	0.93
I am concerned about the likelihood of having a CVD in the near future.	173 (34.3)	216 (42.8)	38 (7.5)	33 (6.5)	29 (5.7)	1.67	0.93

Note: SD (Strongly Disagree) = 1; D (Disagree) = 2; A (Agree) = 3; SA (Strongly Agree) = 4; Neutral (N)=0.
Perceived Susceptibility Grand Mean Score = 1.7, Standard Deviation = 0.93. The higher the score, the greater tendency to feel susceptible to CVD. The perceived susceptibility to CVDs was low among all women mean 1.67.

b. Perceived severity

Perceived severity measured participant's belief about the seriousness of developing CVD; the higher the score, the greater tendency to perceive CVD as serious. Grand mean scores on the perceived severity subscale were 2.5 with the standard deviation of 1.4. Almost 65% of the women participants agreed or strongly agreed that they would die within ten years if they had a heart attack or stroke see Table 4.5.

Table 4.5: Perceived severity to CVDs

ITEM	1 SD n (%)	2 D n (%)	0 N n (%)	3 A n (%)	4 SA n (%)	Mean Score	SD
Having a heart attack or stroke is always fatal	24 (4.8)	60 (11.9)	93 (18.4)	185 (36.6)	128 (25.3)	2.47	1.4
Having a heart attack or stroke will threaten my relationship with my significant other	23 (4.6)	57 (11.3)	92 (18.2)	191 (37.8)	129 (25.5)	2.49	1.4
My whole life would change if I had a heart attack or stroke	24 (4.8)	56 (11.1)	93 (18.4)	190 (37.6)	129 (25.5)	2.48	1.4
Having a heart attack or stroke would have a very bad effect on my sex life	23 (4.6)	56 (11.1)	93 (18.4)	191 (37.8)	131 (25.9)	2.49	1.4
If I have a heart attack or stroke, I will die within ten years	22 (4.4)	56 (11.1)	89 (17.6)	191 (37.8)	130 (25.7)	2.51	1.4

Note: SD (Strongly Disagree) = 1; D (Disagree) = 2; A (Agree) = 3; SA (Strongly Agree) = 4; Neutral (N) =0. Perceived Severity Grand Mean Score =2.5, Standard Deviation = 1.4. The higher the score, the greater tendency to perceive CVD as serious.

c. Perceived Benefits

Perceived benefit measured a participant's belief about the benefits of healthy behaviours to prevent CVD; the higher the score, the greater tendency to perceive benefits as good for preventing CVD. As shown in Table 4.6. The overall grand mean score on the perceived benefit scale was 3.5, and the standard deviation was 0.9. Perceived benefit mean score was the highest among all the subscales see Table (4.6).

Table 4.6: Perceived Benefits regarding CVD

ITEM	1 SD n (%)	2 D n (%)	0 N n (%)	3 A n (%)	4 SA n (%)	Mean Score	SD
Increasing my exercise will decrease my chances of having a heart attack or stroke	3 (0.6)	24 (4.8)	22 (4.4)	255 (50.5)	185 (36.6)	3.18	0.91
Eating a healthy diet will decrease my chances of having a heart attack or stroke	3 (0.6)	57 (11.3)	22 (4.4)	256 (50.7)	184 (36.4)	3.18	0.91
Eating a healthy diet and exercising for 30 minutes most days of the week is one of the best ways for me to prevent a heart attack or stroke	24 (4.8)	56 (11.1)	93 (18.4)	190 (37.6)	129 (25.5)	3.19	0.92
When I exercise, I am doing something good for myself	3 (0.6)	24 (4.8)	22 (4.4)	257 (50.9)	185 (36.6)	3.18	0.91
When I eat healthy, I am doing something good for myself	3 (0.6)	24 (4.8)	23 (4.6)	256 (50.7)	186 (36.8)	3.18	0.91
Eating a healthy diet will decrease my chances of dying from CVD	3 (0.6)	24 (4.8)	22 (4.4)	258 (51.1)	184 (36.4)	3.18	0.90

Note: SD (Strongly Disagree) = 1; D (Disagree) = 2; A (Agree) = 3; SA (Strongly Agree) = 4. Neutral (N) =0. Perceived Benefits Grand Mean Score =3.2, Standard Deviation =0.93. The higher the score, the greater tendency to perceive benefits as good for preventing CVD

d. Perceived Barriers

Perceived barriers measured participants' beliefs about the barriers towards health promoting behaviours preventing CVD; the higher the score, the higher were the barriers. The mean score of all perceived barrier subscale was 2.6 and the standard deviation was 1.1. From the individual subscale barrier questions, most women 86.7%, agreed or strongly agreed that they do not know the appropriate exercises to perform to reduce the risk of CVD. Also, 65.9 % of participants disagreed and strongly disagreed they have access to exercise facilities and equipment". Interestingly, almost two third of the participants 66.8% agreed or strongly agreed that they could not afford to buy healthy foods. See Table 4.7.

Table 4.7: Perceived Barriers regarding CVD

ITEM	1 SD n (%)	2 D n (%)	0 N n (%)	3 A n (%)	4 SA n (%)	Mean Score	SD
I do not know the Appropriate exercises to perform to reduce my risk of developing CVD	4 (0.8)	24 (4.8)	23 (4.6)	255 (50.5)	183 (36.2)	3.17	0.91
It is painful for me to walk for more than 5 minutes	189 (37.4)	57 (11.3)	12 (2.4)	149 (29.5)	59 (11.7)	2.11	0.91
I have access to exercise facilities and/or equipment	251 (49.7)	82 (16.2)	12 (2.4)	149 (29.5)	58 (11.5)	2.88	0.92
I have someone who will exercise with me	252 (49.9)	82 (16.2)	12 (2.4)	151 (29.9)	58 (11.5)	2.88	1.12
I do not have time to exercise for 30 minutes a day on most days of the week	3 (0.6)	24 (4.8)	23 (4.6)	256 (50.7)	186 (36.8)	2.10	1.31
I do not know what is considered a healthy diet that would prevent me from developing CVD	189 (37.4)	81 (16.0)	13 (2.6)	149 (29.5)	58 (11.5)	2.79	1.31
I do not have time to cook meals for myself	45 (8.9)	67 (13.3)	38 (7.5)	171 (33.9)	168 (33.3)	2.79	1.12
I cannot afford to buy healthy foods	45 (8.9)	68 (13.5)	39 (7.7)	169 (33.5)	168 (33.3)	2.78	1.22
I have other problems more important than worrying about diet and exercise	47 (9.3)	68 (13.5)	42 (8.3)	175 (34.7)	172 (34.1)	2.77	1.23

Note: SD (Strongly Disagree) = 1; D (Disagree) = 2; A (Agree) = 3; SA (Strongly Agree) = 4. Neutral (N) =0. Perceived Barriers Grand Mean Score = 2.6, Standard Deviation =1.1. The higher the score, the more are the barriers to participating in healthy behaviours.

Research Question 2

What is the association between the mean FRS and four subscales of health beliefs (perceived susceptibility, perceived severity, perceived benefits, and perceived barriers)?

A Pearson correlation test was run to gauge the association between the mean FRS and four subscales of health beliefs using Cohen's (1988) guideline for operational definition assigning the strength of association as small, medium or large (J. Cohen, 1988). Overall, the Pearson analysis disclosed a small correlation (negative) between the independent variables (FRS) and the dependent variable (each HB subscale - perceived susceptibility, perceived severity, perceived benefits, and perceived barriers).

- Pearson correlation between Perceived Susceptibility and FRS: No relation was found between perceived susceptibility and FRS. Correlation (r=-0.04) is small, and not statistically significant, p=0.384.
- Pearson correlation between Perceived Severity and FRS: There was a small correlation (negative) r= -0.1, between perceived severity and FRS, but was statistically significant, p=0.05 (2-tailed).
- Pearson correlation between Perceived Benefits and FRS: There was a small correlation (negative), r = -0.13 but statistically significant, p=0.05 between perceived benefits and FRS.
- Pearson correlation between Perceived Barriers and FRS: There was a small correlation (negative), r = -0.13 but statistically significant, p=0.05 between perceived barriers and FRS.

Significant relationships between Framingham scores and perceived susceptibility scores were found, Chi-Square (χ^2) = 11.777, *p*=0.05 (Table 4.8). Women who were found to have high FRSs were more likely to report low perceived susceptibility scores compared to women with low and intermediate Framingham scores. There was a significant difference between the FRS categories and perceived susceptibility. Women with the highest FRS have the highest percentage in perceived low susceptibility (*p*=0.019). Regarding perceived severity, no significant results were found (*p*=0.12).

In examining the relationship between Framingham scores and perceived benefits, results showed that women with high Framingham scores reported moderate perceived

benefits of diet and/or exercise, Chi-Square (χ^2) = 11.202, p=0.05. No significant difference was found between FRS category and the perceived barrier category (p=0.23).

Table 4.8: Chi-Square test: The association between Health Belief Subscales and Framingham Risk scores

Variables	Framingham Risk Scores						d.f.	χ^2	p-value
	Low (N = 217)		intermediate (N = 153)		High (N = 113)				
	N	%	N	%	N	%			
Perceived Susceptibility									
Low	77	35.5	52	34.0	49	43.4	4	11.78	.019*
Intermediate	108	49.8	63	41.2	38	33.6			
High	32	14.7	38	24.8	26	23.0			
Perceived Severity									
Low	67	30.9	58	37.9	51	45.1	4	7.13	0.12
Intermediate	92	42.4	57	37.3	35	31.0			
High	58	26.7	38	24.8	27	23.9			
Perceived Benefits									
Low	21	9.7	24	15.7	15	13.3	4	11.20	0.02*
Intermediate	107	49.3	73	47.7	70	61.9			
High	89	41.0	56	36.6	28	24.8			
Perceived Barrier									
Low	83	38.2	50	32.7	33	29.2	4	5.3	0.25
Intermediate	70	32.3	54	35.5	34	30.1			
High	63	29.5	49	32.0	46	40.7			

d.f.-degrees of freedom

Research Question 3

What is the impact of sociodemographic variables on CVD risk (FRS)?

Further, the analysis of one-way ANOVA (Table 4.9) represents the difference in FRS means to selected socio-demographic variable groups. There was significant differences in the mean of FRS and between all the SES constructs i.e. (income, education level, and occupation) (Table 4.9) Women who reported not exercising or that only did it once monthly, had a high mean FRS and was significantly different from women who were not physically active.

Table 4.9. ANOVA Test: The difference in the mean of Framingham risk score (FRS) and Sociodemographic variables (n=480)

		Framingham risk CVD score			
Variables	**N**	**Mean**	**SD**	**F**	***P value****
Income					
<2,000-4,999 SR	168	14.92	8.83		
5,000-9,999	154	11.34	8.993	6.23	0.001*
10,000-17,999	119	11.04	8.59		
<18,000	42	11.83	9.30		
Education					
Elementary and/or less	243	15.51	8.95		
Intermediate and/or High School	126	10.49	7.70	31.44	0.001*
Diploma, Degree, Post Graduate	114	8.52	8.22		
Occupation					
Gov. , Semi Gov. , Private	80	8.20	7.75		
Student, Retired	58	8.30	7.50	24.34	0.001*
Housewife	345	14.27	8.92		
Marital status					
Currently married	359	12.24	8.78		
Never married	30	5.77	6.71		
Separated	2	1.25	.35	12.83	0.001*
Divorced	26	11.33	8.92		
Widowed	66	18.15	8.09		
Frequency of Exercise					
Daily, 3-4 times per week	61	9.98	8.95		
1-2 per week	117	10.60	7.70	8.50	0.001*
No Exercise, once a month	305	13.81	8.22		
FV consumption					
None	5	4.50	4.23		
1-3 servings	470	12.67	9.02	2.86	.058
+3- 5 servings and over	6	7.93	4.45		

Gov. = Government

Research Question 4

What is the relationship between the health belief subscales (Perceived susceptibility, Perceived Severity, Perceived Benefits and Perceived Barriers) and the different sociodemographic variables?

Standard multiple regression analyses were conducted to examine how sociodemographic variables such as age, frequency of exercise; family history of HTN, DM and hyperlipidaemia; body mass index and television consumption predicted the scores on the various sub-scales of the Health Belief Model (HBM). The F-value was computed that explained the significant amount of variance in the outcome variable. Likewise, R^2 or the coefficient of determination was computed as the percentage of variance in the outcome variable. Then after computing the F-value and the R^2, the beta coefficient was computed to see the degree of change in the outcome variable. If the beta coefficient is negative every one-unit increase in the predictor variable, the outcome variable will decrease by the beta coefficient value; and if beta coefficient is positive for every one-unit increase in the predictor variable, the outcome variable will increase by the beta coefficient value (Freedman, 2009).

- Perceived susceptibility, no significant differences were found between the women with different social demographic variables and perceived susceptibility, only 12.5% of them strongly agreed or agreed. Basically, all felt the same regardless of background.
- Perceived severity, those aged 15-34 had, on average, 0.63 points higher score than those aged 55+ with a P value= 0.001 with B-coefficients equal to 2.78 and 1.32 respectively. Women who were employed reported higher scores of perceived severities than those who were housewives with a P value= 0.001. Women who had a higher degree of education (Tertiary Education) had significantly higher B-coefficient than women with the lower education with a p-value = 0.01.
- Perceived benefits were significantly higher among employed women compared to housewives with *p* value =0.01. Women with moderate income had higher Perceived benefits with a *p* value =0.03.
- Perceived barrier; women who declared engaging in PA had higher scores than women who did not engage in PA, with *p* value=0.01. See Table 4.10

Table 4.10. Standard Multiple regression analysis: Health Belief Subscales and sociodemographic variables.

Variables	Perceived Susceptibility Score		Perceived Severity Score		Perceived Benefits Score		Perceived Barrier Score	
	B(95% CI)	*p*-value	B(95% CI)	p-value	B(95% CI)	*p*-value	B(95% CI)	*p*-value
Age	8.79 (6.39 to 11.19)		17.663 (15.10-20.23)		23.77 (21.26-26.27)		29.403 (26.62-32.19)	
55 year and older (ref.)	-		-		-		-	
35-54 years	-0.76 (-1.86 to 0.35)	0.18	1.315 (0.14-2.49)	0.03*	1.29 (-0.60 to 3.17)	0.18	-1.42 (-2.70-(-0.13)	0.03*
15-34 years	-1.63 (-3.43 to 0.02)	0.08	2.78 (0.86-4.71)	0.01*	0.62 (-0.53 to 1.78)	0.29	-1.65 (-3.74-0.44)	0.12
Marital status								
Married (ref.)	-				-		-	
Never Married	-1.04 (-3.09 to 1.01)	0.32	0.66 (-1.512 to 2.84)	0.55	-1.50 (-3.62 to 0.62)	0.16	-0.99 (-3.37 to 1.38)	0.41
Sep/Divorced	0.37	0.74	2.10 (-.18 to 4.38)	0.07	-0.27 (-2.49 to 1.95)	0.81	2.13 (-.36 to 4.62)	0.09
Widowed	-0.01	0.99	-0.18 (-1.72 to 1.35)	0.82	-2.22 (-3.71 to -0.73)	0.01*	0.86 (-.81 to 2.53)	0.31
Income								
<5000 (ref.)	-				-		-	
5,000 - 9,999SR	0.04(-1.18 to 1.25)	0.95	1.168 (-.12 to 2.46)	0.07	1.42 (0.16 to 2.69)	0.03*	0.18 (-1.39 to 1.75)	0.82
10,000 - 18,000SR and above	-0.76(-1.96 to 0.4)	0.22	0.13 (-1.15 to 1.4)	0.84	1.07 (-0.18 to 2.32)	0.09	-0.69 (-2.33 to 0.96)	0.41
Occupation								
Housewives (ref.)	-		-		-		-	
Not Working (student, retired)	.77 (-0.78 to 2.34)	0.33	1.33 (-0.45 to 3.12)	0.14	0.96 (-.78 to 2.71)	0.28	1.70 (-.27 to 3.67)	0.09
Private Employment	-.77 (-4.33 to 2.79)	0.67	2.20 (0.67 to 3.73)	0.01*	2.65 (1.16 to 4.14)	0.01*	-0.30 (-1.98 to 0.38)	0.72
Government - Employment	-.73 (-2.11 to 0.66)	0.31	1.71 (0.41 to 2.99)	0.01*	1.78 (.52 to 3.04)	0.01*	0.21 (-1.22 to 1.62)	0.78
Education level								
Low level of Education (ref.)	-		-		-		-	
Intermediate Education	-0.09 (-1.79 to 1.60)	0.92	1.46	0.08	0.32 (-1.31 to 1.95)	0.70	0.34 (-1.48 to 2.15)	0.72
High School Education	-0.46 (-1.91 to 0.98)	0.53	-1.19	0.54	0.51 (-3.212 to 4.23)	0.79	-2.63 (-6.77 to 1.52)	0.21
Tertiary Education	-0.72 (-1.94 to 0.51)	0.25	1.936	0.01*	0.83 (-.623 to 2.28)	0.26	-0.34 (-1.95 to 1.28)	0.68
Family history of hypertension								
No (ref.)	-	-	_	_	-		-	
Yes	1.68 (0.51 to 2.86)	0.06	-.76 (-2.01-.49)	0.24	-0.40 (-1.62-0.08)	0.53	0.33 (-1.04-1.69)	0.64

Table 4.10. Standard Multiple regression analysis: Health Belief Subscales and sociodemographic variables. Continuation….

Variables	Perceived Susceptibility Score		Perceived Severity Score		Perceived Benefits Score		Perceived Barrier Score	
	B(95% CI)	*p*-value	B(95% CI)	p-value	B(95% CI)	*p*-value	B(95% CI)	*p*-value
Family history of DM			-	-				
No (ref.)	-	-	1.70 (0.36-3.02)	0.01*	1.32 (0.02-2.61)	0.05	0.82 (-0.618-2.26)	0.26
Yes	0.19 (-1.05 to 1.43)	0.76						
Family history of hyperlipidaemia								
No (ref.)	-	-	-	-				
Yes	0.01 (-1.23 to 1.24)	0.99	-1.44 (-2.76-(-0.12)	0.03*	-.77 (-2.07-0.52)	0.24	-0.353 (-1.79 to 1.08)	0.63
Body Mass Index			-	-				
Underweight/Normal (ref.)			0.19 (-1.27-3.15)	0.84	1.39 (-0.77-3.55)	0.21	1.51 (-0.90 to 3.91)	0.22
Overweight	0.91 (-1.16 to 2.99)	0.39	-0.58 (-1.65-2.63)	0.50	1.04 (-1.05- to -3.13)	0.33	1.26 (-1.07 to 3.59)	0.28
Obese	0.51 (-1.50 to 2.51)	0.62						
Frequency of Exercise								
No Exercise (ref.)	-		-		-		-	
1-2 times per week	0.78 (-0.47 to -2.02)	0.22	.073 (-1.26-1.40)	0.91	1.32 (0.02-2.62)	0.05*	2.00 (0.56 to 3.45)	0.01*
3-4 times per week or daily	-1.37 (-2.94 to -0.20)	0.09	.085 (-1.59-1.76)	0.92	1.24 (-0.41-2.87)	0.14	2.98 (1.16 to 4.81)	0.01*
Model summary	F, (11, 458) = 1.874, p < 0.05, R^2 = .043		, F, (11, 458) = 1.908, p< 0.05, R^2 = .044		F, (11, 458) = 2.2, P<.06		F, (11, 458) = 2.209, p < 0.05, R^2 = .050.	

The difference in the mean of each health belief subscale and personal socioeconomic variables that includes marital status were examined. There was a statistically significant difference in the mean between groups' perceived severity, and perceived benefits. The highly educated women reported a high mean of perceived severity *p* value <0.001, whilst low income reported a lower mean on both perceived severity and perceived benefits, with significant (*p* values 0.02 & 0.01) respectively. There were no statistically significant differences between means score of perceived susceptibility, perceived Barriers and socioeconomic variables. Meanwhile, women with high levels of education and income reported higher perceived severity and perceived benefits. Housewives reported the lowest severity score among the occupation category (Table 4.11).

Table 4.11: ANOVA Test: The difference in the mean of each health belief construct and sociodemographic variables

Variables		Perceived susceptibility Mean score (±SD)	Perceived Severity Mean score (±SD)	Perceived Benefits Mean score (±SD)	Perceived Barriers Mean score (±SD)
Marital status	Married (N=371)	8.49 (±4.70)	12.58 (±6.84)	19.63 (±4.92)	30.18 (±6.72)
	Never married (N=32)	8.17 (±4.32)	13.17 (±6.95)	18.70 (±5.07)	29.18 (±6.62)
	Widow/divorce/separated (N=100)	7.94 (± 4.71)	11.06 (±7.99)	16.63 (±7.38)	31.41 (±5.09)
	***p* value**	0.63	0.182	0.0001*	0.146
Level of education	Elementary or less (N=251)	8.30 (±4.97)	11.32 (±7.60)	17.93 (±6.36)	30.18 (±6.82)
	Intermediate / High School (N=129)	8.45 (±4.15)	13.06 (±6.7)	20.01 (±4.34)	31.88 (±5.54)
	Diploma, Degree, Post Graduate (N=118)	8.42 (±4.52)	14.03 (±5.76)	20.47 (±3.77)	30.1(±6.78
	***p* value**	0.951	0.001*	0.0001*	0.173
Occupation	Gov. , Semi Gov. , Private (N=84)	8.29 (±4.22)	14.35 (±5.46)	20.3 (±3.94)	24.21 (±7.92)
	Student, Retired, Not Working (N=58)	9.55 (±4.64)	14.31 (±5.31)	19.16 (±5.06)	30.70 (±7.11)
	Housewife (N=346)	8.19 (±4.74)	11.66 (±7.49)	18.78 (±5.79)	30.43 (±6.92)
	***p* value**	0.117	0.001*	0.073	0.30
Monthly income	<2,000-4,999 SR (N=174)	8.44 (±4.75)	11.42 (±7.74)	17.79 (±6.72)	30.63 (±6.33)
	5,000-9,999 (N=161)	8.72 (±4.65)	13.62 (±6.58)	19.95 (±3.91)	30.41 (±7.04)
	10,000-17,999 above (N=168)	7.79 (±4.77)	12.36 (±6.73)	19.62 (±4.99)	30.04 (±6.57)
	***p* value**	0.442	0.02*	0.01*	0.69

*p ≤ 0.05, % are within the Framingham risk group Gov. = Government

Determinants of Reporting of Perceived Barriers to PA

Logistic regression was conducted. Age, education and income were associated with perceived lack of skills, as personal health issues, lack of facilities, lack of social support and lack of time for physical activities. The analysis did not generate any statistically significant relationships between these variables and the remaining outcome variables, including lack of money, lack of knowledge, other priorities and ability to drive (Table 4.14).

Women with a high school educational level had higher odds of reporting lack of knowledge about the appropriate exercise to reduce their risk of developing CVD (OR=2.28) than women with elementary education. Additionally, women with postgraduate education were nine times more likely to report lack of knowledge related to appropriate exercises to perform, compared to their peers with lower level of education. 55% of the participants reported lack of facilities as a barrier to adopting a healthy lifestyle, and women with a postgraduate education had higher odds for lack of access to facilities (OR=3.76), than women educated at the other levels of education including high school levels or less. Postgraduate education was also aligned with higher odds of respondents reporting lack of time (OR=3.73).

Women with high-income levels demonstrated higher odds (the higher the score mean, the greater the barriers to participating in healthy behaviours) of reporting lack of facilities (OR=2.14); lack of social support (OR=2.16); lack of time to exercise (OR=2.19); and personal health issues (OR=2.16). Results showed that age also contributed to barriers to social support. When it came to lack of social support, younger women (15-34 years) were more likely to indicate higher odds of lacking social support (OR=2.74) when compared to women aged 55 years and older. Education also contributed to explaining changes in lack of social support as those with postgraduate education reported higher odds of a lack of social support (OR=3.93) when compared to women with elementary education. Women aged 35 to 54 were more likely to report a lack of skills. Women aged 15-34 years reported greater odds of personal health issues (OR=2.24) than older women (55 years old and above) (Table 4.12 and 4.13).

Table 4.12: Logistic Regression Analysis: Association of Perceived barriers to physical activity with age, education, marital status, employment status, income, DM, family history of hypertension, family history of DM, hypertension, body mass index, Framingham classification.

Variables	Lack of Skills			Personal health issue			Lack of Facilities			Lack of Social Support			Lack of Time		
	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value
Age															
55 years and older (ref.)	86.8	-	-	27.9	-	-	72.3	-	-	72.7	-	-	27.6	-	-
35-54 years	92.3	0.82 (0.35-1.96)	0.662	50.7	1.782 (1.03-3.09)*	0.040	50.2	1.69 (0.98-2.92)	0.057	50	1.833 (1.06-3.19)*	0.031	50.2	1.799 (1.037-3.121)*	0.037
15-34 years	90.6	0.66 (0.11-3.89)	0.650	71.7	2.24 (0.86-5.86)	0.100	28.3	2.19 (0.84-5.75)	0.109	26.4	2.746 (1.03-7.27)*	0.044	18.9	2.445 (0.938-6.373)	0.067
Education															
Elementary (ref.)	85	-	-	22.7	-	-	77.2	-	-	-	77.7	-	22.7	-	-
Intermediate	84.6	1.28 (0.45-3.61)	0.642	53.8	3.068 (1.52-6.20)*	0.002	46.2	3.12 (1.54-6.30)*	0.002	46.2	3.15 (1.56-6.39)*	0.001	53.8	3.068 (1.516-6.209)*	0.002
High School	98.7	2.281 (2.26-3.99)*	0.008	60.5	2.981 (1.54-5.79)*	0.001	39.5	3.01 (1.56-5.83)*	0.001	39.5	3.01 (1.55-5.84)*	0.001	61.0	3.036 (1.566-5.884)*	0.001
Postgraduate	94.9	9.31 (1.92-45.18)*	0.006	65.5	3.831 (1.83-8.04)*	0.000	35.3	3.76 (1.79-7.88)*	0.000	33.9	3.93 (1.86-8.27)*	0.000	65.3	3.739 (1.779-7.862)*	0.001
Marital Status															
Never Married (ref.)	87.1	-	-	81.3	-	-	19.4	-	-	19.4	-	-	80.6	-	-
Married	93.3	0.98 (0.12-8.15)	0.984	42.7	0.35 (0.10-1.19)	0.094	57.6	0.38 (0.11-1.29)	0.121	57.3	0.45 (0.13-1.55)	0.205	42.9	0.396 (0.115-1.361)	0.141
Separated /Divorced	82.8	0.34 (0.03-3.33)	0.352	44.8	0.48 (0.11-2.05)	0.323	55.2	0.52 (0.12-2.25)	0.382	55.2	0.61 (0.14-2.63)	0.507	44.8	0.542 (.126-2.327)	0.410
Widowed	74.3	0.28 (0.03-2.77)	0.277	21.4	0.29 (0.07-1.19)	0.084	78.6	0.31 (0.07-1.30)	0.110	78.9	0.37 (0.09-1.55)	0.174	21.4	0.324 (0.077-1.361)	0.124

Table 4.12: Logistic Regression Analysis: Association of Perceived barriers to physical activity with age, education, marital status, employment status, income, DM, family history of hypertension, family history of DM, hypertension, body mass index, Framingham classification. *Continuation….1*

Variables	Lack of Skills			Personal health issue			Lack of Facilities			Lack of Social Support			Lack of Time		
	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value
Employment Status															
Not Working (ref.)	87.9	-	-	66.1	-	-	34.5	-	-	32.8	-	-	65.5	-	-
Government	94.7	1.54 (0.28-8.50)	0.620	64	0.90 (0.38-2.15)	0.820	36	0.93 (0.39-2.22)	0.878	35.9	0.79 (0.33-1.89)	0.598	64	0.913 (0.384-2.172)	0.836
Private	100	1.43 (.000)	0.999	44.4	0.59 (0.09-3.56)	0.564	60	0.47 (0.09-2.55)	0.380	55.6	0.57 (0.09-3.44)	0.539	44.4	0.603 (0.100-3.649)	0.582
Housewife	88.4	5.08 (0.92-27.96)	0.062	33.5	1.23 (0.53-2.83)	0.633	66.6	1.24 (0.54-2.86)	0.609	67	1.09 (0.47-2.54)	0.830	33.7	1.246 (0.541-2.871)	0.605
Income															
Low (ref.)	82.4	-	-	24.1	-	-	75.9	-	-	76.4	-	-	24.1	-	-
Middle	94.9	2.58 (0.98-6.79)	0.054	48.1	1.89 (1.06-3.37)*	0.031	52.5	1.88 (1.06-3.33)*	0.032	51.6	1.96 (1.09-3.49)*	0.023	48.1	1.89 (1.062-3.383)*	0.031
High	92	1.30 (0.51-3.31)	0.584	55.8	2.16 (1.20-3.98)*	0.010	44.8	2.14 (1.19-3.86)*	0.012	44.2	2.16 (1.20-3.93)*	0.010	55.8	2.19 (1.216-3.959)*	0.009
Diabetic															
No	88.7	-	-	50.2	-	-	50.7	-	-	50	-	-	50	-	-
Yes	90.3	1.36 (0.59-3.13)	0.467	36.1	1.06 (0.63-1.81)	0.819	64.3	1.07 (0.63-1.80)	0.813	64.5	1.05 (0.62-1.77)	0.856	35.8	1.054 (0.622-1.788)	0.844
Family history of hypertension															
No (ref.)	89	-	-	41.5	-	-	58.6	-	-	58.6	-	-	41.5	-	-
Yes	89.5	0.51 (0.23-1.14)	0.102	43.5	0.82 (0.49-1.36)	0.437	57	0.77 (0.47-1.28)	0.317	56.8	0.83 (0.50-1.38)	0.472	43.5	0.817 (0.492-1.355)	0.433

Table 4.12: Logistic Regression Analysis: Association of Perceived barriers to physical activity with age, education, marital status, employment status, income, DM, family history of hypertension, family history of DM, hypertension, body mass index, Framingham classification. *Continuation….2*

Variables	Lack of Skills			Personal health issue			Lack of Facilities			Lack of Social Support			Lack of Time		
	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value
Family history of DM															
No (ref.)	84.8	-	-	40.2	-	-	60.7	-	-	59	-	-	40.2	-	-
Yes	91.9	1.81 (0.81-4.07)	0.151	43.6	0.95 (0.56-1.61)	0.844	56.4	1.04 (0.61-1.75)	0.896	57.1	0.89 (0.52-1.51)	0.672	43.6	0.949 (0.558-1.613)	0.845
Hypertensive															
No (ref.)	86.7	-	-	31	-	-	70		-	70.2	-	-	30.5	-	-
Yes	91.1	1.46 (0.62-3.40)	0.386	45.7	1.25 (0.69-2.27)	0.462	54.7	1.29 (0.711-2.33)	0.406	54.5	1.31 (0.73-2.37)	0.366	45.6	1.256 (0.692-2.279)	0.453
Body Mass Index															
Underweight/Normal (ref.)	83.7	-	-	59.4	-	-	40.5	-	-	42.1	-	-	59.6	-	-
Overweight	90.5	1.80 (0.54-6.03)	0.339	48.9	0.69 (0.28-1.70)	0.424	51.8	0.68 (0.28-1.66)	0.396	50.7	0.79 (0.33-1.93)	0.616	48.2	0.69 (0.282-1.694)	0.420
Obese	90.2	2.21 (0.71-6.89)	0.174	37.4	0.50 (0.21-1.19)	0.118	63.1	0.49 (0.21-1.15)	0.102	63.5	0.55 (0.23-1.27)	0.158	37.4	0.505 (0.214-1.191)	0.119

***p < .05**

Table 4.13. Logistic Regression Analysis: Examined the effects of age, education, marital status, employment status, income, DM, hypertension, family history of DM and hypertension, body mass index and Framingham scores on the perceived barriers.

Variables	Lack of Knowledge			Lack of Money			Other Priorities			Lack of Social Support (Driving)		
	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value
Age												
55 years and older (ref.)	73.2	-	-	73.2	-	-	72.3	-	-	30.5	-	-
35-54 years	65.7	0.70 (0.41-1.22)	0.208	65.2	0.690 (0.40-1.20)	0.185	65.9	0.72 (0.41-1.21)	0.207	41.6	1.77 (1.06-2.96)	0.030*
15-34 years	66.0	1.12 (0.43-2.91)	0.825	64.2	1.01 (0.39-2.60)	0.990	64.8	1.02 (0.40-2.57)	0.973	40.7	2.13 (0.85-5.34)	0.105
Education												
Elementary (ref.)	71.1	-	-	71.1	-	-	70.1	-		35.7	-	-
Intermediate	76.9	1.73 (0.78-3.83)	0.179	76.9	1.75 (0.79-3.88)	0.168	76.9	1.77 (0.80-3.92)	0.156	38.5	1.07 (0.53-2.14)	0.855
High School	59.2	0.71 (0.37-1.37)	0.302	59.2	0.73 (0.38-1.42)	0.354	59.7	0.76 (0.39-1.44)	0.384	40.3	1.25 (0.66-2.39)	0.490
Tertiary	68.6	1.17 (0.55-2.47)	0.688	66.9	1.10 (0.52-2.31)	0.804	68.3	1.19 (0.57-2.48)	0.650	35.0	1.00 (0.48-2.07)	0.999
Marital Status												
Never Married (ref.)	61.3	-	-	61.3	-	-	62.5	-		28.1	-	-
Married	67.6	1.78 (0.57-5.55)	0.321	67.0	1.30 (0.43-3.99)	0.642	72.0	1.28 (0.43-3.87)	0.659	37.0	1.45 (0.46-4.64)	0.527
Separated/Divorced	79.3	3.63 (0.85-15.44)	0.081	79.3	2.78 (0.67-11.7)	0.159	79.3	2.69 (0.66-11.03)	0.169	42.9	2.19 (0.56-8.58)	0.260
Widowed	77.1	2.91 (0.76-11.20)	0.119	77.1	2.13 (0.56-8.06)	0.264	76.1	2.05 (0.55-7.57)	0.283	35.2	1.66 (0.44-6.18)	0.453

Table 4.13. Logistic Regression Analysis: Examined the effects of age, education, marital status, employment status, income, DM, hypertension, family history of DM and hypertension, body mass index and Framingham scores on the perceived barriers. Continuation …..1

Variables	Lack of Knowledge			Lack of Money			Other Priorities			Lack of Social Support (Driving)		
	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value
Employment Status												
Not Working (ref.)	70.7	-	-	67.2	-	-	67.8	-		28.8	-	-
Government	62.7	0.56 (0.22-1.43)	0.228	62.7	0.77 (0.31-1.89)	0.570	64.1	0.77 (0.31-1.89)	0.570	39.7	1.26 (0.52-3.05)	0.616
Private	66.7	0.32 (0.51-1.98)	0.219	66.7	0.39 (0.06-2.40)	0.311	70.0	0.58 (0.10-3.27)	0.540	30.0	0.29 (0.03-2.85)	0.289
Housewife	70.5	0.72 (0.29-1.78)	0.477	70.5	0.95 (0.40-2.27)	0.906	69.9	0.96 (0.40-2.23)	0.926	37.3	1.35 (0.58-3.19)	0.487
Income												
Low (ref.)	73.5	-	-	73.5	-	-	73.0	-		37.6	-	-
Middle	67.3	0.99 (0.56-1.75)	0.985	66.7	0.98 (0.56-1.74)	0.968	66.5	0.98 (0.57-1.71)	0.951	42.5	1.20 (0.71-2.01)	0.502
High	66.7	0.92 (0.51-1.66)	0.786	66.0	0.93 (0.52-1.67)	0.803	66.7	0.94 (0.53-1.67)	0.825	29.8	0.62 (0.35-1.09)	0.097
Diabetic												
No (ref.)	62.0	-	-	61.5	-	-	61.6	-		34.4	-	-
Yes	75.4	1.97 (1.17-3.32)	0.111	75.0	1.876 (1.12-3.14)	0.017	74.9	1.938 (1.71-3.21)	0.010*	38.2	1.43 (0.88-2.33)	0.155

Table 4.13. Logistic Regression Analysis: Examined the effects of age, education, marital status, employment status, income, DM, hypertension, family history of DM and hypertension, body mass index and Framingham scores on the perceived barriers. Continuation …..2

Variables	Lack of Knowledge			Lack of Money			Other Priorities			Lack of Social Support (Driving)		
	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value	%	OR (95% CI)	p-Value
Family history of hypertension												
No (ref.)	66.5	-	-	66.0	-	-	65.0	-		33.8	-	-
Yes	71.2	1.11 (0.68-1.80)	0.68	70.9	1.116 (0.69-1.81)	0.657	71.5	1.19 (0.74-1.91)	0.474	38.4	0.93 (0.58-1.48)	0.759
Family history of DM												
No (ref.)	65.2	-	-	64.6	-	-	63.5	-		30.4	-	-
Yes	71.3	1.46 (0.88-2.42)	0.141	70.9	1.482 (0.90-2.45)	0.125	71.4	1.52 (0.94-2.49)	0.091	39.5	1.368 (0.84-2.24)	0.211
Hypertensive												
No (ref.)	68.8	-	-	68.8	-	-	67.9	-		33.1	-	-
Yes	69.4	1.14 (0.64-2.02)	0.663	68.9	1.160 (0.65-2.06)	0.613	69.0	1.16 (0.66-2.03)	0.608	37.5	0.96 (0.55-1.67)	0.891
Body Mass Index												
Underweight/Normal (ref.)	56.8	-	-	56.8	-	-	57.9	-		26.3	-	-
Overweight	69.3	1.30 (0.58-2.95)	0.523	67.9	1.18 (0.52-2.64)	0.696	68.1	1.19 (0.54-2.66)	0.663	38.2	1.85 (0.77-4.41)	0.166
Obese	70.6	1.36 (.63-2.98)	0.435	70.6	1.32 (0.61-2.88)	0.484	70.1	1.29 (0.60-2.78)	0.512	36.7	1.72 (0.74-3.98)	0.207

***$p < .05$**

Is there a difference between women who engage in PA on the health belief subscale, BMI, and the FRS?

Table 4.14. shows the measured difference in the mean of the dependent variables: perceived susceptibility, perceived severity, perceived benefit, perceived barriers, BMI, and FRS between women who engage in PA and women who do not.

Table 4.14: The difference in health belief subscales' means in different PA behaviours

	Women engaging in PA			
	Yes	**No**	**t**	**Sig.**
	N (Mean score, ±SD)	**(N, mean score, ±SD)**		
Perceived susceptibility	185 (9.82, 5.59)	318 (10.00, 5.67)	-0.34	0.738
Perceived severity	185 (18.34, 5.95)	318 (17.86, 6.07)	0.86	0.005*
Perceived benefit	185 (25.56, 4.83)	318 (24.15, 6.38)	2.60	0.010*
Perceived barriers	185 (31.62, 5.87)	318 (29.63, 6.85)	3.43	0.001*
Body Mass Index	178 (32.23, 7.32)	305 (33.78, 6.38)	-2.436	0.015*
Framingham Risk Scores	178 (10.39, 8.19)	305 (13.81, 9.20)	4.23	.000*

Independent t-test

There are significant differences in the mean of: perceived severity, perceived benefit, perceived barriers, BMI, and FRS between women who are physically active and women who are not (Table 4.14). Women who declared they engaged in PA had a higher mean score in perceived severity, benefit, and barriers, also they have lower risk factors FRS and BMI. There were no significant differences on the perceived susceptibility mean score.

Summary

This chapter provided an overview of the results by answering each research question along with a description of the demographics of the sample. The majority of the participants were 55 years old and above with majority as housewives, and having a low level of education, and multiple significant risk factors. Perceived susceptibility had the lowest mean whilst perceived benefits had the highest mean. Most of the participants did not feel susceptible to CVD, whilst most of them also did not perceive the severity of the disease. Moreover, most of the participants knew about the benefits of eating healthy along with the advantage of participating in exercise to prevent CVD, and they felt good about it. Responses to the perceived benefit subscale indicate that participants did not know the appropriate exercises to perform to reduce the risk of developing CVD, which was a significant barrier for this population.

A negative, statistically significant, correlation was found between CVD risk as calculated by FRS and the health belief subscales, except for perceived susceptibility. Most of the participants had more than one risk factors for developing CVD. Women who had healthy behaviours and adhered to PA perceived more severity, benefit and barriers, but not susceptibility, compared to adults who did not ($p=0.05$). Additionally, they had a lower CVD risk.

Table 4.15 Summary of findings

Research question	Objective	Data analysis	Results	Interpretation
1. What are the general health beliefs of Saudi women regarding CVD?	To explore cardiovascular health beliefs among women in Saudi Arabia attending primary care centres, in Riyadh, Saudi Arabia.	Descriptive statistics frequency and percent. Continuous variables were presented as mean ± Standard Division (SD) and the percent.	1. Perceived Susceptibility: 1.7, SD +/- 0.93 2. Perceived Severity: 2.5 +/- 1.4 3. Perceived Benefits: 3.2, +/- 0.93 4. Perceived Barriers: 2.6, +/- 1.1	1. Susceptibility subscale was 1.7 with the standard deviation of 0.93. This indicates that majority 79 % of the women participants did not feel themselves susceptible to CVD. Only 12.5% of the women participants believed that they are susceptible to CVD 2. Seriousness of developing CVD; the higher the score, the greater tendency to perceive CVD as serious. Grand mean scores on the perceived severity subscale were 2.5 with the standard deviation of 1.4. More than 65% of the women participants disagreed or strongly disagreed that they will die from CVD within ten years. 3. Perceived benefit measured the participant's belief about the benefits of healthy behaviours to prevent CVD; the higher the score, the greater tendency to perceive benefits as good for preventing CVD. 4. The mean score of all perceived barrier subscales was 2.6 and the standard deviation was 1.1. From the individual subscale barrier questions, most women 86.7%, agreed and strongly agreed that they do not know the appropriate exercises to perform to reduce the risk of CVD. Also, 65.9 % of participants disagreed and strongly disagreed they have access to exercise facilities and equipment". Interestingly, almost two third of the participants 66.8% agreed or strongly agreed that they could not afford to buy healthy foods
2. What is the association between the mean Framingham risk score (FRS) and four subscales of health beliefs HBM?	Assess the relationship between each health belief subscale, and personal CVD risks expressed in FRS, among women attending PCC.	Pearson Correlation P <0.05 was considered as statistically significant.	• Perceived susceptibility/FRS: r=-0.04, p=0.384. • Perceived Severity/FRS: r= -0.1, P= 0.05 • Perceived Benefits/FRS: r = -0.13, P = 0.05. • Perceived Barriers /FRS: r = -0.13, P= 0.05.	Perceived susceptibility/FRS: Very weak negative Person correlation and a not statistically significant P value. Perceived Severity/FRS: A significant difference with low negative correlation with P value set significant at the 0.05 level (2-tailed). Perceived Benefits/FRS: Low negative correlation and this correlation is statistically significant Perceived Barriers /FRS: Low negative correlation and this correlation is statistically significant

Table 4.15 Summary of findings. Continuation… 1

Research question	Objective	Data analysis	Results	Interpretation
		Chi-Square analyses identified significant relationships between Framingham scores and perceived susceptibility scores	• Perceived susceptibility: X^2 (4) = 11.777, p <0.05. • Perceived severity: X^2 (4) = 7.13 p=0.12 • Perceived benefits: X^2 (4) = 11.202, p <0.05. • Perceived barriers X^2 (4) = 5.4, p=0.25	Women who were found to have high Framingham risk scores were more likely to report low perceived susceptibility Belief scores, compared to women with low and intermediate Framingham scores. Women with high Framingham scores reported moderate perceived benefits of diet and/or exercise.
3. What is the impact of sociodemographic variables on CVD risk (FRS)?	To determine the relationship between socio-demographic variables (including SES) and cardiovascular risk determined by FRS.	Chi-square One-Way ANOVA (difference in FRS means) Multiple regression (mean FRS as independent variable)	P=0.001 for income, marital status, education, work status P=0.020 Physical Activity P value 0.001 for income, education, occupation, marital status, frequency of exercise P=0.058 for FV consumption Negative beta coefficients for income, education, marital status, occupation, activity level and BMI with p=0.001	Higher FRS was statistically significant for low income, low education, married (vs. never married), housewives (vs. government employment or not working/retired), not active and obese.
4. What is the relationship between the health belief and the different sociodemographic variables?	To investigate the association of socio-demographic variables (including SES) with women's health beliefs.	Multiple regression	**Age** Perceived severity 0.03 (55+) Perceived barriers 0.03 (55+ vs 35-54) **Marital Status** Perceived benefits 0.01 (married vs. widowed) **Income** Perceived benefits 0.03 (low vs middle) Occupation Perceived benefits 0.01 Perceived severity 0.01 (housewives)	Women with high levels of education and income reported higher perceived severity, and perceived benefits. Housewives reported the lowest severity score among the occupation category.

Table 4.15 Summary of findings. Continuation… 2

Research question	Objective	Data analysis	Results	Interpretation
			Education Perceived severity 0.01 (low vs tertiary) **Exercise** Perceived barrier 0.01 (no vs 1-2 times per week)	
		One-Way ANOVA	Marital status - Perceived benefits p= 0.0001 Education - Perceived Severity p= 0.001 - Perceived benefits p= 0.001 Occupation - Perceived Severity p= 0.001 Income - Perceived Severity p= 0.02 - Perceived Benefits p= 0.01	Highly educated women reported a high mean of perceived severity p value <0.001, whilst low income reported a lower mean both perceived severity, perceived benefits with significant (P value 0.02 & 0.01) respectively

CHAPTER 5: DISCUSSION

This chapter is dedicated to providing a summary of the results, and a discussion of the health beliefs of Saudi women regarding CVD, health belief subscales and CVD risk (FRS) and the relationship between Health Beliefs and sociodemographic variables. Strengths and Limitations are also discussed in-depth in this chapter.

The major aim of this study was to examine cardiovascular health beliefs among Saudi women attending PCC in Riyadh and how sociodemographic variables influenced their cardiovascular risk using FRS.

The rate of CVD in Saudi Arabia is increasing, and the Saudi women are the most vulnerable as they face many sociodemographic barriers in participating with prevention activities. Preventive approaches to CVD can lower the mortality rates by changing or avoiding modifiable risk factors (Schwalm, McKee, Huffman, & Yusuf, 2016; Stuart-Shor, Berra, Kamau, & Kumanyika, 2012). If women are aware and have a good understanding of risk factors, this in turn will help them adopt a healthier lifestyle. Saudi Arabia, with its rapidly increasing population, including the rise of elderly, needs to implement preventive CVD strategies. This study which was carried out among women and was based on the HBM, aimed to measure health beliefs affecting their perceived susceptibility to, and severity of CVD, as well as the benefits regarding diet and physical exercise as preventive approaches for CVD risk reduction. The perceived benefits and barriers in undertaking healthy actions to prevent CVD were also addressed. Moreover, the impact of different sociodemographic variables on the health beliefs and FRS were identified.

As presented in the literature review, perceived barriers is one of the important elements in determining behaviour. This study is unique in that it examined not only the health beliefs of women regarding CVD, but it also examined the relationship between health beliefs and FRS results, along with the impact of sociodemographic variables on the HBM and FRS models. The study evaluated the perceived susceptibility of developing CVD, perceived severity of CVD, perceived benefits and barriers in undertaking health actions to prevent CVD.

The relationship between selected demographic variables and modifiable risk factors was described. Differences between modifiable risk factors and perceived barriers in undertaking health actions to prevent CVD was also examined.

Summary of the results

Most of the women studied had multiple risk factors including the presence of DM and HTN, along with a high prevalence of obesity. Among 52.7% of the respondents have intermediate or high FRS. Of the women with multiple risk factors, only 12.5% believed that they were susceptible to CVD. This observation raises important issues for both the women at risk, and for public policymakers regarding health awareness, intervention, and related communications materials and messaging themes.

In this study, the women had multiple CVD risk factors, as presented in their demographic characteristics, including family history of DM and HTN, physical inactivity, low consumption of FV, obesity, HTN and DM. These factors were associated with an increased risk of developing CVD.

The difference in the mean of each health belief subscale and personal sociodemographic variables was examined. Highly educated women reported a high mean of perceived severity, *p*-value <0.001, while low-income participants reported a lower mean both on perceived severity, and perceived benefits with significant *p* values (0.02 & 0.01), respectively. There were statistically significant differences in the means between perceived benefits with marital status, and between perceived severity with occupation.

5.1 Health Beliefs of Saudi women regarding CVD

Perceived susceptibility had the lowest mean score measured using the HBCVD tool indicating that 79 % of the participating women did not feel themselves susceptible to CVD. Among the individual questions on perceived susceptibility, most of the participants disagreed or strongly disagreed that they will suffer from CVD in the future. A little less than half of the participants disagreed or strongly disagreed with the statement that “their chances of developing CVD in the future are great”. Only 12.5% of the women believed that they were

susceptible to CVD, thus indicating that most of the participants were not seriously concerned about their CVD risk. This may be influenced by cultural factors arising from religious beliefs and practices. A study conducted to review the Arab Muslims' health beliefs and priorities for health care in the United States (Odeh Yosef, 2008), highlighted important misinterpretations of the concept of predestination suggesting that some Muslims might not participate in health prevention activities because they do not believe that they can prevent something from happening, if God has preordained it for them. Another example are illness causation misconceptions such as the belief in the notion of "the evil eye" impacting the occurrence of disease (Al-Habeeb, 2003). Recognizing these misconceptions and integrating this knowledge into future health and health promotion campaigns is crucial to obtaining successful health outcomes.

In contrast, in a Jordanian study from 2004, female patients who had history of myocardial infarction had high mean scores for susceptibility (Al-Ali & Haddad, 2004). This may suggest that after having a first heart attack there is a more continuous perception of susceptibility and a greater willingness to take preventive measures.

Perceived severity is described as an individual's perceptions of the seriousness of a disease to cause complications regarding their wellbeing (Karen Glanz et al., 2008). The mean score on the levels of participants' perceived severity to CVD was 2.5 out of 4. This score was more than the susceptibility scores. A higher score indicates a greater tendency to perceive CVD as serious. In this study, 65% of the female participants declared that heart disease would have a negative impact on their life. More than 65% of the women participants agreed or strongly agreed that they would die from CVD within ten years if they had a heart attack or stroke. This is an indication that most of the women thought that heart disease would have an altering impact on their life after these events, should they occur. While 35% (17% disagreed and 18.8% neutral) were not particularly worried about the severity of CVD (Figure 4.3).

The current study found that the perceived benefit mean score was the highest among all the subscales of the HBM (3.2 out of 4), which suggests that these participants were more aware of the benefits of healthy behaviours. Overall, 89% of the participants knew that eating

healthy and exercising regularly is beneficial in preventing the development of CVD, yet they were not participating in healthy behaviours, e.g. increase FV consumption. Interestingly, almost two thirds of the participants (66.8%) agreed or strongly agreed that they could not afford to buy healthy foods. Most of them strongly agreed that they felt good when they exercised and ate healthy foods. Some authors exploring the association of CVD risks faced with this type of contradictory findings, thought that this could be due to the fact of the high level of seriousness involved in heart disease may inhibit or block the person in responding appropriately, particularly in patients who already had some sort of CVD (Al-Ali & Haddad, 2004). For example, patients who exercise regularly before having a heart attack might conclude that they cannot prevent or control heart disease after having the episode.

The perceived barriers is one important element in the HBM and many studies highlight that their identification can contribute significantly to the prevention of CVD (Folta et al., 2008; Mc Morrow et al., 2016). The mean score on the perceived barrier subscale in this study was 2.6 out of 4.0 with a standard deviation of 1.1. From the individual subscale barrier questions, most women (86.7%) agreed or strongly agreed that they do not know the appropriate exercises to perform to reduce the risk of CVD. Also, 65.9 % of participants disagreed or strongly disagreed that they have “access to exercise facilities and equipment”.

In the background section, the study highlighted some socio-cultural factors that contribute to low PA behaviour among Saudi women. For example, PA was restricted and not well promoted or even allowed in girls’ public schools and universities. Also, there was no active policy or provision for women’s participation in sports. Moreover, the availability and opportunity for women to attend fitness centres was limited (Al-Eisa & Al-Sobayel, 2012; Mobaraki & Soderfeldt, 2010). Likewise, women were not allowed to drive cars or to travel or commute without the permission of a male guardian. However, since June 2018, the government finally allowed females to drive. In other studies, around 56% of female university students had reported that lack of transportation contributes to the level of inactivity among them, as they depend upon male drivers to transport them [Mehio-Sibal et al 2010]. Surprisingly, this study had 36% of the respondents indicating that limitations placed on transportation constituted a barrier to PA, a response that was more frequent among young women.

The unavailability of transportation was not the only reported barrier leading to women not attending a gym or a health club (Amin et al., 2011). Overall, 55% of the participants in this study agreed that the lack of facilities was one of the most critical external barriers that hindered engaging in PA participation. Both Amin et al., and AlQuaiz et al. concur that the lack of facilities affects women within PCC settings to a considerable extent (AlQuaiz & Tayel, 2009; Amin et al., 2011). The shortage of facilities, membership fees for gyms, recreational facilities, fitness classes among other establishments, as well as commuting to those facilities, can prevent women from exercising (Albawardi et al., 2016). Therefore, supporting new fitness facilities to expand to non-commercial areas, improving transportation and expanding recreational public areas designed to encourage PA related activities (i.e. fitness classes), may have an impact on the levels of PA in this population. Studies conducted by Samara et al, demonstrated that 92% of students from a Riyadh university exercised at home due to a lack of facilities were knowledgeable on the importance of exercising for fitness and personal appearance (Albawardi et.al, 2016). The data also exposed that a further 6% of the students, despite having the same knowledge as the students that exercised at home, did not embark on any PA. Furthermore, only 71% of the students were fully aware of the health and wellbeing benefits of PA and 50% of students understood the relationship between body weight and PA (Samara et al., 2015).

Some studies have identified weather conditions as main environmental barrier to PA, which can either support, or hinder PA behaviours (Humpel, Owen, & Leslie, 2002; Tucker & Gilliland, 2007). Most of the participants from studies included in this current review agreed that the weather is one of the leading barriers that prevent them from being active (AlQuaiz & Tayel, 2009; Amin et al., 2011; Samara et al., 2015). Looking at the ME and more specifically in the GCC, which is noted for its hot summer climate (more than 50 degrees Celsius in some areas), outdoor activities like walking, cycling and jogging are restricted among both genders who live within these regions (K. Benjamin & Donnelly, 2013).

5.2 Health Belief subscales and CVD risk (FRS)

Interestingly, since this study uniquely measured both health beliefs and calculated FRS for participants, 30.3% of the women were in the intermediate FRS risk category and

22.4% were in the high-risk category, yet they did not perceive themselves susceptible to CVD. Low perception to susceptibility has been reported not only in this study but among women with multiple risk factors internationally, according to Christian et al, most individuals tend to underestimate their susceptibility to heart disease (Christian, Mochari, & Mosca, 2005). In a study conducted in 26 Danish PCCs, researchers found that most of the patients who perceived themselves at low risk of cardiac disease were actually estimated to be at high risk by their physicians (Bjerrum, Hamm, Toft, Munck, & Kragstrup, 2002). A study conducted by DeSalvo et al, among black women in the USA, reported that the participants, even with multiple CVD risk factors, still considered themselves to be at low or no risk for heart disease (DeSalvo et al., 2005).

Further comparisons regarding health belief subscales are not possible as, at the moment, no other study has analysed these specific relationships for FRS.

5.3 Sociodemographic variables and CVD risk (FRS)

Studies have proven the synergism between sociodemographic variables and CVD risk factors like the ones embedded in the FRS (Peter WF Wilson et al., 1999). In this study population, 52.7% had an intermediate to high FRS. Although, this scoring tool has been widely used, almost half of all CVD deaths occur in individuals at intermediate -risk and a proportion of individual variance in risk remains unexplained (Kannel et.al, 1964). Some researchers like Fiscella et al, have argued that the FRS underestimates the CVD risk for people of low SES (K. Fiscella et al., 2009). Overall, this study found that low SES women were more likely to have worse cardiovascular health (higher mean FRS) compared to women with high SES.

The impact of SES also matched other screening campaigns that were conducted in the Eastern province of Saudi Arabia. Their results showed the prevalence of CVD in relation to SES. In both genders it was lower as the level of education and income rose CVD ($P<0.0001$) (Al-Baghli et al., 2010). These results also match those observed in the international data, where the imbalances in the social determinants of health have been attributed to the inequities in health observed between and within countries (Kreatsoulas & Anand, 2010).

Thus, ignoring SES in risk stratification and treatment goals may result in under-treatment of low SES women who are at a higher risk for CVD than their FRS suggests. Indeed, some studies suggest that adding individual-based SES measure to CVD risk assessment reduces the underestimation among low SES persons (K. Fiscella et al., 2009; Franks et al., 2010). It can be concluded from the above discussion that there is a continued interest in the search for other methods and markers to improve the predictive ability of current risk estimation tools.

In this study, women who declared themselves physically inactive had a high mean FRS, which produces significant difference compared to women who are more physically active (Table 4.9). The effects of PA are well-documented as a form of CVD prevention (Li et al., 2006). In Finland for example, PA was observed, regardless of the CHD risk level, to reduce CHD events. That study was obtained from a population cohort study to investigate genetic and environmental risk factors for chronic disorders. The conclusion was that intermediate to high levels of occupational or leisure-time PA, and daily walking were significantly and independently associated with a reduced 10-year risk of incident CHD events among women (Hu, Tuomilehto, Borodulin, & Jousilahti, 2007). Other researchers, Arsenault et al, recommended taking into account PA levels of patients in the overall assessment of CHD (Arsenault et al., 2010). They suggested that adding patients' PA levels to FRS as this could result in a more precise CHD risk estimation.

Saudi women have reported a high prevalence of obesity (Mashael K Alshaikh, Filippos T Filippidis, Juren P Baldove, Azeem Majeed, & Salman Rawaf, 2016). In this study, age, education level and a history of HTN significantly correlated with the mean BMI. This was also reported in the last National Household Survey 2013, where increased age, being married or previously married, compared with those never married, diagnosed with chronic disease, and being pre-hypertensive or hypertensive influenced BMI (Iqbal et.al., 2014). Women who had more education than high school level, were less likely to be obese than those who had a primary school educational level or less (Z. A. Memish et al., 2014).

Around 65% of the women in the present study were diabetic. Several research studies have shown that a lower education, income and certain occupations lead to diabetic complications (Everson, Maty, Lynch, & Kaplan, 2002; Rabi et al., 2006; Stelmach,

Kaczmarczyk-Chalas, Bielecki, & Drygas, 2005). Various studies have examined the relationships between SES and NCD, such as CVD, cancer, and Type 2 DM. One of these was a 24 years prospective study of 1,462 Swedish women. They found that women who are married to men of lower occupational status had an increased risk of CVD mortality with a relative risk (RR) = 1.60; 95% confidence interval (95% CI) = 1.09-2.33. The SES convincingly correlates with the health outcome as it may reflect a woman's dependency on her husband's income (Cabrera, Helgesson et al. 2001). Likewise, women with low SES had a higher risk of CVD (RR = 1.37; 95% CI = 1.01-1.84). This is because of the lower SES environments that are more likely to pose greater health risks (e.g. pollution, higher crime, more occupational exposures) for the residents (Niederdeppe et al. 2008; Lawlor et al. 2003).

It has been concluded that higher SES was associated with decreased CVD mortality while low SES had the complete opposite effect (Cabrera et al., 2001). SES continues to be a fundamental cause of health issues and health inequalities among the most vulnerable in societies. Four key features can be identified as primarily present in poorest SES populations (Link & Phelan, 1995). Firstly, SES is not limited to one disease outcome as people with limited incomes are prone to a variety of diseases and health issues. Secondly, the lower the income in the individual's background, the more health risk factors are present (i.e. smoking, malnutrition and inadequate PA levels). Thirdly, the lack of access to medical health resources and treatment, increases health inequality. Moreover, marginalisation, overcrowded living conditions, poor sanitation, lifestyle and health beliefs misconceptions have been prevalent among the poorest in society.

The Saudi National Household Survey 2013 described the average monthly household expenditure and highlighted that most Saudis spend 30 % from their total monthly average expenditure on meat products, while they only spend 8.9% and 8.3% on FV respectively. When the average monthly expenditures of Saudi Households, by major expenditure group and monthly income from the national health survey were calculated, the results showed that the low-income group spent a higher percent of their income in food and beverages (Fig.5.1).

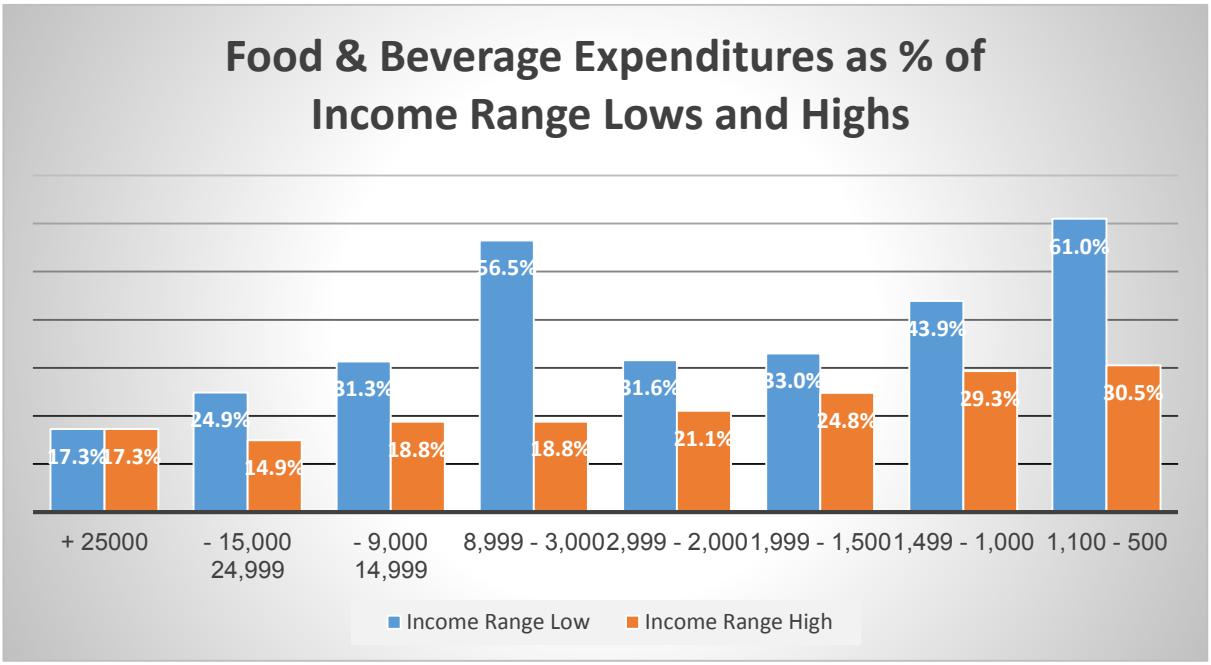


Figure 5.1: Average monthly expenditure of Saudi household by major expenditure group and monthly income adopted from Saudi National Household Survey (General Authority for Statistics, 2016)

The current study found that low consumption of FV was dominant among all the participants. The majority of women (97%) consumed 1–3 servings per day, and only 1.4% of them were consuming the recommended five and more servings per day. Several researchers have also reported low consumption among the Saudi population. In Alzeidan et al, they measured the CVD risk among university employees and their families, and FV consumption was documented. They reported that more than 87% consumed less than 5 servings per day (Alzeidan et al., 2016). Likewise, two national household surveys reported low-level consumption. The first one was conducted between August 2004 and 2005, and showed that only 5% consume 5 servings daily (Garawi, Ploubidis, Devries, Al-Hamdan, & Uauy, 2015). The second one was in 2013 with only 8 % consuming 5 servings daily (8%) (El Bcheraoui et al., 2015).

In addition, university studies like Alsunni and Badar's (2015) report, that despite more than 78 % of the university students being aware of WHO FV recommendation, 83% consumed less than one serving per day (Alsunni & Badar, 2015). Also, in Al-Otaibi (2013) 78% of university students were consuming less than 5 servings daily and only 22% consumed 5 or more servings. In this case, the higher consumption group was more knowledgeable about

the daily recommendation of FV (H. H. Al-Otaibi, 2013b). While, in Epuru et al. (2014), nearly half the study population did not know the potential health benefits of consuming FV on a daily basis, and about one fourth did not believe that it was important to consume fresh FV (Epuru, Eideh, & Alshammari, 2014).

5.4 Relationship between Health Beliefs and sociodemographic variables.

In this study, no further association was discovered between the different socio-demographic variables and the perceived susceptibility score, since most of the participants reported a low score. Nevertheless in another study from West Virginia when the sample was stratified by income, the relationship between perceived susceptibility to CVD and family history was only statistically significant ($p<.05$) in women with an annual household income of less than $20.000 and the relationship between perceived susceptibility to CVD and body mass was only statistically significant ($p<.05$) in women with an annual household income of greater than $40,000.(Humphries, Krummel, Rye, & Simon, 1997) However, this evidence was considered too old and from another socio-cultural context, and could not, therefore, be transferred to the Saudi population. Further studies need to be done in this area.

Perceived susceptibility is one of the important motivating forces behind precautionary behaviour (Janz & Becker, 1984). Although only a limited number of studies in Saudi Arabia have tested the health beliefs around CVD, it has been tested in breast cancer and osteoporosis studies, which also showed a very low perceived susceptibility among women regardless of their socio-demographic variations (Abolfotouh et al., 2015). One of the possibilities regarding this, is that misconceptions and lack of knowledge have been shown to influence people's behaviour.

There was a significant difference in the Odds ratio between the age groups. Women between (24-54) and (15-34) years of age perceived more severity than the elderly group (55 and above).

These results are contrary to a study of health beliefs among Nepal's adults, where elder participants aged between 41 and 60 years perceived more severity than younger age groups (p = 0.01) (Poudel & Sumi, 2017).

Regarding education levels, Saudi women with higher education and monthly incomes had more positive Odds ratio, which indicates a better level of severity perception. The present study highlights the need for innovative educational strategies to increase knowledge about risk factors and awareness levels among at-risk individuals, especially, among women over age 40. According to Glanz et al., if individuals perceive a health condition to have negative and serious consequences for their lives, they are more likely to change their health behaviour in order to reduce their risk for the disease (Karen Glanz et al., 2008). However, it will be very challenging to change the perception of those with a lower level of education within the elderly group. According to the Demographic Survey 2016, the illiteracy rate among Saudi with low education is higher in the elderly with the highest level recorded within >65-year-old group (General Authority of Statistics, 2016).

Moreover, this study found that women who engage in PA have a higher mean perceived severity score compared to women not engaged in PA (p=0.005). There was a statistically significant difference between women who declared engaging in PA than women not engaging in PA. This is supported by McClendon (2012) who also, reported that higher perceived CVD severity was associated with greater level of PA (McClendon, 2011).

There was a statistically significant result in perceived benefits, P= 0.01, found among women who engaged in PA compared to women not engaging in PA. This indicates that the active group had a higher level of perception of benefit. There was also a low association but significant difference with income, and a positive family history of DM with P=0.03 and 0.05. In contrast, the other Nepalese study did not find differences regarding the perceived benefit in different demographic variables among adults (Poudel & Sumi, 2017).

Despite knowing the benefits of a healthy diet, Saudi women's FV consumption was under the minimum WHO requirement (World Health Organization, 2003) as only 0.4% consumed more than 5 servings per day. However, most of them did not know what is considered a healthy diet for CVD prevention. This suggests that addressing the knowledge

gap in FV daily consumption may contribute positively to an adequate intake of FV for the prevention of CVD. The more knowledge an individual gains the more likely that individual is to act upon that knowledge (Pem & Jeewon, 2015). An example can be seen in Al-Bannay et al (2015). In the intervention group of that study, the participants showed that they had benefited from the intensive education program with resulting improvements in blood sugar, PA, nutritional behaviours and choices (Al-Bannay et al., 2015).

5.5 Perceived barriers

In the current study, educational levels as a proxy for SES had a direct impact on effective reporting regarding PA barriers, where a lack of facilities was emphasized. Women with elementary or basic education were less likely to report exercise facilities as a PA barrier. The discrepancy in reporting facilities as PA barriers among the different levels of educated women, suggests that women with higher education may identify the barriers more effectively due to cognitive skills that are acquired through academic study (Ritchie, Bates, & Deary, 2015).

Although high education levels may be linked to high levels of income regardless of gender (Giles-Corti & Donovan, 2002), a study performed in Japan demonstrated that PA barriers are complex and depend on many variables e.g. culture and social customs, independently of income and education (Ishii et al., 2009). This indicates that in order to identify and understand PA barriers, culture and social customs need to be considered as well.

Additionally, results from the regression analysis of this study showed that Saudi women between ages 35-54 years compared to women age 55 and older were more likely to report that not being able to drive represented a barrier to access to exercise facilities ($p<0.03$). One of the possibilities about this trend can be associated with the increasing access to education through the schooling system, and general access to the Internet. Younger generations are becoming more self-aware of their health and education and try to participate in the process of making a better future for themselves in a more interconnected and globalized world (Nielsen, 2015). However, their elders may not care as much, due to upholding their customs and traditions and preserving their traditional way of life.

5.6 Strengths and Limitations

There are five strengths of this study:

- The main strength of the study is that it combined the health belief model with the FRSs and the main sociodemographic variables that can contribute to CVD risk.
- Two systematic reviews were made, illustrating not only Saudi Arabia alone but the complete scene in the six GCC countries.
- It thoroughly analysed the barriers towards healthy behaviours.
- The participants were recruited in a primary care clinic, which is considered to be one of the best places available to promote health through preventive medicine, health screenings, and health education (Hobbs, 2004).

There are also four main limitations of this study:

- This study was conducted in only one of the primary care centres in the capital and most of the participants were older than 45 years of age, which can limit the generalizability of the findings.
- The study sample was a non-randomized convenience sample, resulting in the risk of selection bias.
- The main limitation of the study is the recall bias that could have occurred especially in measuring behaviours like FV consumption. Many responses depended on the participant's memory. Nevertheless, responder bias can be unintentional due to poor or incomplete memory recall.
- This study is questionnaire based.

CHAPTER 6: FUTURE PERSPECTIVES

In addition to research findings, this study identifies some areas in which some changes may contribute to improved outcomes for women with CVD risks, as follows:

6.1 Use of Electronic Medical Record and Assessment tools

One of the selection criteria for inclusion in this study was that participants did not have an existing diagnosis of CVD. Permission was granted to examine the medical files of each participant. In addition to the collection of the health beliefs of participants, using the HBM, FRS were calculated for each participant, based on the examination of data in their file. When reviewed, the FRS indicated that multiple participants, 52.7%, had intermediate to high risk for CVD, yet their medical files did not include this observation. This gap between the calculated FRS and the absence of a recorded risk profile in the medical records suggests techniques and processes may need to be examined, to more closely align the records with the real CVD risks of the records. All the inputs used for the FRS calculations were drawn from the file information, yet this step had not been undertaken at the PCC and recorded in the file, prior to this research. Consequently, participants were unaware of their actual CVD risk, as measured by FRS, and self-reported a perceived low susceptibility as commented on above. The medical software used to record file information had the capacity to derive an FRS, yet this did not seem to have been a routine calculation. The absence of an existing FRS risk score in the file could be explained by several things including: the absence of a defined protocol to require its calculation, the non-symptomatic stage of the patient in the CVD development cycle, the volume of patients, the time a physician has available for each patient, and a possible lack of a case management approach to patient care, among other factors. Another potential challenge is that physicians may tend to treat only the patient's presenting condition, in isolation, rather than connecting it with other indicators in the file that would suggest a broader perspective (Torley, Zwar, Comino, & Harris, 2005).

The implementation of a protocol that would require the calculation of an FRS as a matter of routine, or even automation of the calculation based on the patient's blood test

results, blood pressure, etc. may help in the identification of at-risk patients, earlier in the process than currently.

Such an approach could allow for prompt lifestyle modifications which might halt the CVD conditions, or slow its progress, as CVD is responsive to such early modifications. Physicians could be reminded through in-service training of the importance of generating FRS scores. For example, a visual aide could be developed to help both the physician and patient understand the urgency of the need to act on patient communications, treatment and related care. Figure 6.1 outlines such a visual where FRS are stratified into Low, Intermediate and High on one axis, offset against Susceptibility Belief (Strongly Disagree and Disagree, Neutral, And Agree and Strongly Agree) on the other. Patients with a High calculated FRS who indicated a Strongly Disagree or Disagree on Susceptibility Beliefs would fall in the critical classification on the grid prompting the physician to develop a communications plan and treatment protocol for that patient.

Susceptibility Belief	FRS Low	FRS Intermediate	FRS High
Str. Disagree & Disagree	Monitor	Serious	Critical
Neutral	Monitor	Somewhat Serious	Urgent
Str. Agree & Agree	Monitor	Somewhat Serious	Serious

Fig 6.1: visual aid example linking FRS and Health Belief

The primary care centre where this study was conducted showed that the primary care doctors were not using risk assessment tools to estimate CVD risk. It raises the question if the doctors understand how to accurately assess a patient's risk? Barriers to effective absolute CVD risk assessment can include lack of understanding of the concepts of absolute and relative risk, the need for guidance on how to use CVD risk tools in clinical management, or the lack of incorporation of risk tools in practice software. There is a discrepancy in studies regarding the accuracy with which doctors use CVD risk assessment tools, most mention that they are not always used correctly, but other research has shown high levels of accuracy (Isles, Ritchie, Murchie, & Norrie, 2000; Webster & Heeley, 2010). But it is important to notice that the incorporation of CVD risk assessment tools will only be useful if the indicators are

understood by the physicians and if they know how to communicate its implications to the patient (Webster & Heeley, 2010). Understanding of the patient's risk should also consider sociodemographic variables and health beliefs especially among Saudi women.

A simple approach is needed to identify individuals at high risk of CVD using routine data in the patient's electronic system. The software must include clear indicators of risk and adherence to healthy behaviours. It is important to present a more elementary approach in measuring obesity levels by reporting central obesity with the combination of BMI, waist circumference and waist/ hip ratio to obtain more accurate results.

Ideally the electronic medical record should integrate an alarm for the physician connected to the indicators mentioned above. Only those at the highest risk should be invited for further assessment. This might reduce the economic costs involved (Chamnan et al., 2010). Behavioural change education programs can be useful after identifying early stage risk factors of CVD (Sabzmakan et al., 2014). This might eventually decrease the prevalence of the disease and the mortality among women in Saudi Arabia.

6.2 Physician - Patient Communications

The majority of the participant population in this study of Saudi women was over 40 years of age, with a relatively low level of education, and with other socio-economic indicators at the lower end of the spectrum. It is vitally important that all patients have clear information relative to both CVD risks factors and the optimal treatments for those with developed CVD, delivered in language and formats that are easily understandable. Physicians are highly trained individuals, who have invested years in the development of their education and skills. They are typically at the high end of the socioeconomic spectrum and are generally much respected individuals. This gap between the status and education of the patient and their physician presents a potential communication challenge in the prevention and treatment of CVD. This situation may be amplified when patient load, and available time per patient, are factored into this scenario. The vocabulary used by the physician, though perfectly appropriate and accurate, may not be well understood by a patient with an education level equivalent to primary school or less. The reliance on verbal instructions, even

if supplemented by written materials, may limit the patient's understanding. The clinic or hospital setting, where the information is delivered to the patients, is not their natural environment and may have an intimidating impact that may curtail their willingness to ask questions (Bonner et al., 2014; Navar, Stone, & Martin, 2016).

The physicians may come away with the feeling that they have fulfilled their obligation in a professional manner and the patient at this educational level, may come away from the same interaction confused, with little practical recall or understanding of what was being communicated. CVD is a serious and costly a condition and health institutions cannot allow gaps and voids in the communication between the patient and physician (Bonner et al., 2014).

Some older patients may also present with vision or hearing impairments, which may compound the communication barrier. Consideration should be given to the development of CVD materials in multiple formats, including the use of more visual and multimedia formats, font sizes that are large enough for those with visual impairments to read, and the use of numeric metrics to supplement terms like "Low Risk" or "Intermediate Risk" which patient's may have difficulty in interpreting for themselves (Lipkus, 2007; Paling, 2003). Tools such as iPads with interactive software on the anatomy of the heart and blood vessels may increase the patient's understanding of the mechanism of the disease.

Additionally, providers should demonstrate sensitivity to the cultural perspectives and religious beliefs to ensure that the patient is respected while they are persuaded to modify longstanding behaviours and attitudes relative to food type and volumes, exercise, use of medicines, and other items that may require significant behavioural modification to address CVD risks.

6.3 Promoting PA

The biggest challenge is how to target older women who, in the majority, are housewives with lower education levels compared to younger women. (General Authority for Statistics, 2016). Introducing women's wellness programmes targeting 40 and over who a special need focus to help them improve their self-awareness regarding PA, is highly recommended.

It is vital for policy makers to propose interventions that could help women to be more active. These interventions should reflect the preferences and cultural values of women. The provision of childcare and social support strategies is also important to help women engage in PA regularly.

Women's lack of available free time, lack of knowledge and lack of access to facilities can be overcome through different strategies such as media campaigns in schools, advertisements in State television as well as through social media networks which will further enhance women's knowledge and awareness about the risks of physical inactivity. Regarding access to facilities, the prohibition on women driving has, in the past, limited their participation due to the lack of public transport. In this study, 36% of the participants reported that transportation was one of the barriers that limited them from been physically active, a finding that is supported in two other studies (Albawardi et al., 2016; Samara et al., 2015). Fortunately, since June 24th, 2018, the prohibition on females driving no longer exists in Saudi law. This recent change will provide more access to transportation for those with the resources to afford a private car who will now be able to access specialized venues, more easily. It may have less impact on older women in a lower SES, who may not be able to afford a car or have difficulties in passing the license testing requirements. The impact of lifting the driving ban on PA may be a fruitful area for future research.

The lack of facilities was seen as a barrier for women to engage in PA in Saudi Arabia. In this regard, local authorities should focus on providing public spaces such as parks that have sports fields, swimming pools and walking trails and gyms. The availability of such facilities has been found to have a positive correlation with PA patterns in adults (Brownson,

Baker, Housemann, Brennan, & Bacak, 2001). A recent study on data for more than 20,000 adults aged 18–64 was taken from the representative Eurobarometer survey of 28 European Union countries and found that participants who agreed that the area where they live offers many opportunities for PA were more likely to meet the WHO guidelines for PA (AOR = 1.56; 95% CI: 1.38 to 1.76) compared to those who tended to disagree or disagreed with this statement (Filippidis & Laverty, 2016).

Public parks are limited in Saudi Arabia. Governments need to invest more in parks and green zones. Park accessibility is paramount for a healthy society as it increases PA engagement which improves the health and wellbeing of the population. It is also important to ensure that these public facilities are well maintained and can provide access for all, young and old. If green zones and parks were made available to every neighbourhood they will be an asset to society in general (Bedimo-Rung, Mowen, & Cohen, 2005; D. A. Cohen et al., 2013).

Protecting and promoting the health of women is a basic human right, it is also crucial for the health and economic development in all nations. Countries with better gender equality have better health outcomes (World Health Organization, 2009c). Hence, it is essential for policy makers in Saudi Arabia to consider proposing public health policies that aim to empower women, promote PA and reduce the barriers that hinder women from engaging in physical activities. Schools, PCC, and local authorities can play a vital role in implementing these policies at the local level. Saudi Arabia is moving towards gender equality especially when it comes to working opportunities. Written in the MOH official website in the awareness section, is an article on Women's Health with the title “Work in the Lives of Women” which highlights the advantages of women's work (Health, 2018). As from the Hosseinpoor et al study, there was a significant association with better health for both women and men among those in paid employment compared with those not being in paid employment (Hosseinpoor et al., 2012). The Saudi government has lately started to give women more control over their lives through study, work and hospital treatment. Additionally, the granting of the right to drive to women further reinforces these empowerment initiatives. Women should also be supported by their partners and the wider community as this increases their likelihood of engaging in PA (Miller, Trost, & Brown, 2002).

A positive and effective process to address the issues of gym membership fees, in all kinds of PA facilities, is to allow the price mechanism of supply and demand to influence competition and drive high quality of services. The supply of PA services can be increased by easing the licensing process; thus, allowing wellbeing, fitness and sports businesses to expand to more areas. Government support for transportation and expansion on public recreational areas can be designed to encourage PA related activities, including i.e. fitness classes and wellbeing activities.

Different stakeholders need to work together to introduce effective public health policies that promote PA. It is vital that public health policies and governmental interventions focus on educating the population at large, about the health risks of inactivity. Schools and higher education institutions should enhance opportunities for students, irrespective of their gender, to be appropriately active. Employers should innovate new ways to enhance PA. Finally, throughout the community, the built environment should be made friendly for a greater proportion of the population.

Simple interventions such as the walking groups from the "Small goal: 10-minute brisk walk" campaign by the NHS could make a difference in the cardiovascular health of women (NHS, 2016).

6.4 Prevention strategies

Health budgets should be reallocated to focus on a preventive strategy to help women to adopt a healthier lifestyle. This could be made by introducing a targeted Health Check-up to identify risk factors and tackle their beliefs. One of the successful primary prevention programs globally is the UK's National Health Service (NHS) Health Check. It started in 2008, and it aims to reduce the huge burden of CVD on the NHS by both assessing and managing CVD risk in the eligible population in England (people between 40-74 years old with pre-existing CVD). A recent study in 2018, showed the cost-effectiveness of the NHS Health Check (Kypridemos et al., 2018). This type of initiative is highly recommended for Saudi Arabia, especially among the low-income population, since it is one of the big challenges for the healthcare sector. Introducing a health check-up to start the preventive program could reduce

future costs for the system. In accordance with the present study results, it is also highly recommended that campaigns targeting women age 40 and above are designed, to understand the factors that influence their perception about the severity of CVD.

6.5 Improving diets

In this study a very low consumption of FV was documented among most of the participants, a result which matched many studies in Saudi Arabia including The National Health Survey 2013 (El Bcheraoui et al., 2015). In 2012 the SMOH dietary guideline "Healthy Food Palm" was released (Dkheel, 2012). The Healthy Food Palm aims to educate and raise awareness to improve the well-being and lifestyle of Saudi individuals (Dkheel, 2012). The guideline promotes an adequate consumption of FV, meat, and grains, among others (see Appendix 6). This is especially relevant in a country where women have an elevated prevalence of risk factors such as DM (9.6%), HTN (21.85) and obesity (40.23%) (12). The latter could be partially attributed to the large daily intake of fast food like fried chicken, or traditional foods that involve large quantities of meat. It is important to note that consumption of grains has been found to be at an adequate level in this country (El Bcheraoui et al., 2015). It is recommended that the dietary guidelines be updated to prioritise and focus on FV intake with a simple, clear message about the serving amounts. For example, in 2003 the UK's Department of Health started a national campaign on FV consumption with the slogan "5 a day". The objective was to increase FV consumption. After four years they evaluated the efficacy of the campaign, which documented an increase of more than 0.3 servings per person per day (Capacci & Mazzocchi, 2011).

The "5 a day" campaign is an excellent example of an effective national public health campaign, with a simple message, conveyed visually in a straightforward manner. Consuming the right food choices can be complex, and therefore empowering women in making good decisions for their own health is highly recommended and will have an echo in their society. One of the promising approaches is the use of the Nudge Theory, based on positive reinforcement and indirect suggestions (Thaler & Sunstein, 1999). This theory which was proposed by Thaler and Sunstein in their 2008 book (Thaler & Sunstein, 1999), provides a useful and practical public health strategy in encouraging healthier eating choices in adults. A

recent systematic review was conducted in 2016 to determine whether Nudge strategies are successful in changing adults' dietary choices for healthier ones. It found that the application of the theory resulted in an average 15.3 % increase in healthier dietary or nutritional choices (Arno & Thomas, 2016).

Recently, in January 2018, Saudi Arabia introduced a 5% value-added tax (VAT) on food and beverage items (General Authority of Zakat and Tax, 2017). Low social status individuals may be impacted the most. At least two studies have reported that healthier food was perceived as more expensive, even before this taxation (254,255). In Al-Otaibi's 2013 study, students reported they consumed less than 5 FV servings a day, as they believed that FV were expensive, in addition to the unavailability of FV in university restaurants (H. H. Al-Otaibi, 2013b). Later, in Epuru et al. (2014), around 40 % of the subjects felt that eating fresh FV was costly (Epuru et al., 2014). Regarding this, an international systematic review showed a positive effect of subsidizing healthy foods, tending to be effective in modifying dietary behaviour (An, 2013). The PCCs could distribute healthy food subsidy vouchers for the vulnerable groups including low-income. In general, introducing food subsidies could improve the FV consumption especially in households with low and middle income in Saudi Arabia. Further study is recommended to investigate the effect of VAT on consumption behaviour, relative to food choices.

There is a high requirement for diet control and awareness in regard to total daily calorie intake to maintain a healthy lifestyle. Although food labelling was introduced by the GCC customs union, the labelling requirements are basic and do not regulate the nutrition content of processed foods, such as sodium content and trans-fat that play a role in CVD (Al-Bahlani & Mabry, 2014). Additionally, the direct and indirect costs of care and treatment of patients suffering from these diseases are significant and will become more burdensome as the price of oil has declined and is likely to remain at lower levels due to the increased global supply. The study results suggest that applying preventative measures for DM and CVD would potentially save 54% of the direct costs and 31% of the total cost of treatment. This results in not only a significant savings, but improved quality of life for the patients (Gabriel Chahine, 2013) and magnifies why the healthcare sector needs to focus more on preventable measures, such as healthy lifestyles. Implementing the health belief model and understanding

health-related behaviour among the female population in the GCC countries in regard to CVD, and its risk factors, would help in better understanding why women are not adopting a healthier lifestyle. This information could help consumers to make more informed decisions at the time of purchase.

6.6 Campaign planning and design

Health campaigns conducted in Saudi Arabia mainly measure risk factors and educate the participants. They are not based on a theoretical model. One example is "The Heart Protection Campaign" in the Al-Qassim region. The general objectives of this campaign were to increase public awareness of CVDs and its risk factors, among Saudi women aged 20 to 40. Women were selected from universities and shopping malls in a convenient manner. Like previous research conducted in Saudi women, most of the risk assessment studies showed a high prevalence of obesity and particularly physical inactivity. Further, the number of risk factors increased proportionally with age (Kalaf et al., 2016) but no evaluation of the effectiveness of this campaign was conducted. Success in conveying health messages as a tool for health promotion to large populations depends largely on strategy and adequate use of theories for effective communication (Fox, Sixsmith, Doyle, & Barry, 2014). However, studies have shown that the most effective campaigns require not only the use of tested theories and evidence-based methodologies, but also evaluation strategies (Signorelli et al., 2006). Nevertheless, it is a challenge to choose the appropriate indicators (Initiative, 2004).

6.7 Educational strategies

As expressed in the discussion section, women are at a very high risk of CVD and their health beliefs show that there is a lack of knowledge among most of them. Also, support for a preventive lifestyle is very limited.

Innovative educational strategies are needed to increase risk factor knowledge and awareness among at-risk individuals and to intensify educational programs regarding healthy behaviours (diet, exercise) that can assist citizens in modifying the lifestyle of the population. Providing healthy living education and supporting systems to measure lifestyle improvement

can be more effective and less expensive. A more active society with a healthier life style will have fewer patients to treat at the secondary and tertiary medical facilities (Khoja et al., 2017).

A study showed that the main source of information among Saudi women in 2015 was the TV (40%) (Abolfotouh et al., 2015) and this medium could be used to positively target housewives having limited education. Mass media interventions could increase Saudi Arabian women's awareness of the relationship between cardiovascular health and adopting healthy lifestyle behaviours.

6.8 Role of primary care in CVD prevention

There is a need for the development and implementation of new approaches in tackling the emerging health care challenges in GCC states. The importance of supporting and promoting the role of primary health care (PHC) in NCDs and proper positioning of the extended medical care should be a significant strategy (Alzaied, T.A.M. and Alshammari, A., 2016). An overall health system reform is needed to change to a preventive and patient centred care (Tinetti, M.E., Naik, A.D. and Dodson, J.A., 2016.). The KSA has a well-connected network of PCC facilities and has made noteworthy investment in secondary and tertiary medical facilities, however, more attention on the possibilities of primary care delivery is required (Khoja et al., 2017).

CHAPTER 7: CONCLUSIONS

CVDs are a leading cause of death globally, including the countries of the GCC region, in general, and Saudi Arabia, in particular. This comes with the parallel increase in CVD risk especially among women in Saudi Arabia.

Previous studies conducted in Saudi Arabia tackled CVD to prevent it. However, no study up to the time of the current research investigated the relationship between health beliefs and CVD risks. HBM was used in Saudi Arabia by some studies targeting women, however, they targeted illnesses other than CVD. The focus of this study was to fill the gap in the previous studies and to target CVD among Saudi women.

It was expected that Saudi women would have a high CVD risk due to behavioural risks, especially because of high levels of physical inactivity and lack of FV consumption. It was also anticipated that there would be high levels of perceived barriers to engaging in a healthy lifestyle because of the unique cultural context of Saudi Arabia which has significant restrictions on women. It was also expected that income and education would play an important role in the different subscales of health belief.

This study showed high levels of CVD risk influenced by different factors like obesity, low FV consumption, low perception of susceptibility, as well as barriers related to income, education and culture. The participants lacked knowledge on their actual level of risk, definition and preparation of healthy food, and proper types of exercise for CVD prevention. Additionally, lack of sufficient access and transportation to exercising facilities was considered a perceived barrier to PA.

This study showed that the lowest score was found in perceived susceptibility compared to other HBM subscales. The Saudi women who participated in this study perceived themselves to have a low risk of CVD, yet the majority, 53%, had actual risks in the intermediate to high range, when their FRS score was calculated. The uniqueness of this study lies in its collection of beliefs on CVD risks in Saudi women, using the HBM, its contrasting of

beliefs with actual CVD risks as measured by FRS scores, and its integration of the impact of multiple sociodemographic variables on CVD risks. This was the first time that this type of CVD related research was done in a population of Saudi women. It must be said that the study also explored more barriers and sociodemographic variables than other studies.

Among the strongest findings there was a significant relationship between the FRS across the income, marital status, education, occupation and work status categories. Additionally, there was a significant association between perceived susceptibility and FRS, with low levels of perception being associated with higher FRS.

This study also confirms prior findings relative to actual cardiovascular risk factors and perceived barriers that are real and deep rooted and therefore cannot be eliminated overnight. The impact of sociodemographic variables such as income and education on health beliefs and behaviours was also shown. Ultimately, it highlighted the gap between perceived susceptibility and actual CVD risks (HBM vs. FRS).

The results point the direction for additional areas for research including barrier elimination, risks arising from the centrality of food in home-based social interactions, and the impact of lifting driving restrictions that can affect participation in PA (such as going to the gym).

Furthermore, the outcomes point out an urgent need for increasing awareness of CVD risk factors due to the perceived susceptibility gap, and for creating public policy specific to women. It also raises the question if clinical practices may need to be changed so that doctors assess FRS earlier than they do now. Lastly, it suggests a shift in health budgets towards prevention as opposed to a curative model is needed. While this study dramatically strengthens research support for the value of prevention, this evidence has yet to translate into successful public health policies that demonstrate a reduction in the population burden of CVDs. Evidence alone is insufficient to effect change.

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Hindawi Publishing Corporation
Journal of Environmental and Public Health
Volume 2016, Article ID 7479357, 15 pages
http://dx.doi.org/10.1155/2016/7479357

Hindawi

Review Article

Women in Saudi Arabia and the Prevalence of Cardiovascular Risk Factors: A Systematic Review

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Received 9 May 2016; Revised 9 August 2016; Accepted 23 August 2016

Academic Editor: Stephen Leeder

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Background. Cardiovascular disease (CVD) is one of the leading causes of death in Saudi Arabia. Saudi women in particular are more susceptible as there are sociocultural restrictions on female physical activities that may lead to high prevalence of CVD risks, especially obesity, and physical inactivity. This study aims to systematically review the published articles related to the prevalence of CVD risk among women in Saudi Arabia. The search strategy covers all published articles that assess the risk factor of CVD in Saudi Arabia from January 2000 to December 2015, using the following sources: Medline, Embase, and PsycINFO. A total of 61 studies were included. *Results*. Prevalence among Saudi women of smoking ranged from 1.1% to 9.1%, hypertension was 21.8%, diabetes ranged from 9.6% to 27.6%, overweight was 27%, and obesity was 40.23%, and physical inactivity ranged from 53.2% to 98.1%. Hypercholesterolemia prevalence on Saudi women on average was 24.5%, while metabolic syndrome ranged from 13.6% to 40.3%. *Conclusion*. The prevalence of CVD risk factors is high among women in Saudi Arabia especially in obesity and physical inactivity. Public health authorities must implement solutions from a gender specific aspect to reverse the trend and decrease the prevalence of CVDs among Saudi women.

1. Introduction

Cardiovascular disease (CVD) is a major public health problem, and one of the main causes of death globally [1]. According to the World Health Organization (WHO) in 2011, CVD accounted for 17.3 million deaths per year, and by 2030 this number is expected to grow to more than 23.6 million [1, 2].

There are a number of established measurable risk factors, for example, diabetes, hypertension, and obesity that may lead to the development of CVD events. These risk factors are aspects of a patient's style of living that can be modified. Knowing the risk factors is a useful approach for identifying people at high risk who will most benefit from counselling and clinical management of their risk factors [3]. In recent years, age-adjusted CVD mortality has been cut in half in factors [4]. Therefore, focusing on reducing risk factors is a major improvement in terms of developing strategies for preventing CVD [5], and this can explain the decline in CVD mortality and morbidity [6].

The WHO has developed specific strategies to have a paradigm shift from CVD treatment to CVD prevention; this approach is recommended for CVD prevention worldwide [5]. Effective, integrated health promotion policies and programmes are one of the best tools to counteract the epidemic of obesity, diabetes, and other CVD risks that are emerging worldwide [7]. Applying these recommendations helps to shift the focus towards the prevention of primary risk factors, and in the long term it can lead to health improvement and decrease CVD [4].

However, in the Arab Gulf region, around 50% of the deaths of those aged below 70 years found to be attributed

RESEARCH ARTICLE Open Access

The ticking time bomb in lifestyle-related diseases among women in the Gulf Cooperation Council countries; review of systematic reviews

Mashael K. Alshaikh[1,2*], Filippos T. Filippidis[1], Hussain A. Al-Omar[2], Salman Rawaf[1], Azeem Majeed[1] and Abdul-Majeed Salmasi[3]

Abstract

Background: This study aims to review all published systematic reviews on the prevalence of modifiable cardiovascular disease risk factors among women from the Gulf Cooperation Council countries (GCC). This is the first review of other systematic reviews that concentrates on lifestyle related diseases among women in GCC countries only.

Method: Literature searches were carried out in three electronic databases for all published systematic reviews on the prevalence of cardiovascular disease risk factors in the GCC countries between January 2000 and February 2016.

Results: Eleven systematic reviews were identified and selected for our review. Common reported risk factors for cardiovascular disease were obesity, physical inactivity, diabetes, metabolic syndrome and hypertension. In GCC countries, obesity among the female population ranges from 29 to 45.7%, which is one of the highest rates globally, and it is linked with physical inactivity, ranging from 45 to 98.7%. The prevalence of diabetes is listed as one of the top ten factors globally, and was reported with an average of 21%. Hypertension ranged from 20.9 to 53%.

Conclusions: The high prevalence of lifestyle-related diseases among women population in GCC is a ticking time bomb and is reaching alarming levels, and require a fundamental social and political changes. These findings highlight the need for comprehensive work among the GCC to strengthen the regulatory framework to decrease and control the prevalence of these factors.

Keywords: Cardiovascular disease, Noncommunicable diseases, Obesity, Diabetes, Hypertension, Smoking, Physical inactivity, Metabolic syndrome, Systematic review

Background

Cardiovascular diseases (CVD's) remain the leading cause of death worldwide [1], resulting in more than 17.9 million mortalities in 2015. More than 3 million of such deaths occurred in people under the age of 60, which could have been largely prevented [1, 2]. The World Health Organization (WHO) and other organizations such as the American Heart Association (AHA) have recognized many risk factors, some of which are modifiable. These include hypertension (HTN), diabetes, obesity and metabolic syndrome (MetS) [3, 4]. In addition, many unhealthy lifestyles like smoking, physical inactivity, high consumption of carbohydrates and fatty foods have been identified as factors that increase the risk of CVD [5]. Rapid economic growth as well as urbanization have been also associated with higher consumption of unhealthy foods and lower physical activity, which may increase the risk of CVD [6].

The Gulf Cooperation Council (GCC) is a political and economic alliance of six Middle Eastern countries that includes the Kingdom Saudi Arabia (KSA), Bahrain,

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Journal of Taibah University Medical Sciences

www.sciencedirect.com

Original Article

Cardiovascular risk and fruit and vegetable consumption among women in KSA. A cross-sectional study

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Received 19 April 2018; revised 2 June 2018; accepted 4 June 2018; Available online ■ ■ ■

الملخص

أهداف البحث: تهدف هذه الدراسة إلى استكشاف مدى استهلاك الفاكهة والخضروات بين النساء السعوديات لتحديد الفوائد والعقبات المرجوة المرتبطة بالنظام الغذائي الصحي في الوقاية من مخاطر أمراض القلب والأوعية الدموية، ولربط نتائج مقياس فرامنغهام بالعقبات المتصورة.

طرق البحث: تم تطبيق استبيان مستوحى من المعتقدات الصحية المتعلقة بمعدل الأمراض القلبية الوعائية، وتم تطبيقه على النساء اللواتي يراجعن مراكز الرعاية الأولية في المملكة العربية السعودية. بالإضافة إلى الإحصاءات الوصفية، تم استخدام اختبار مربع كاي والانحدار الخطي المتعدد لتحديد الارتباط بين تصورات الاستفادة والعقبات باستخدام فئات نتائج فرامنغهام، وبين متوسط نتائج مقياس فرامنغهام والعقبات المتصورة.

النتائج: تم استقطاب ما مجموعه ٥٠٣ امرأة في هذه الدراسة، في حين كان ٧٥٪ منهن أكبر من ٤٥ سنة. كان أكثر من ٦٠٪ من النساء بدينات و٩٧٪ يستهلكن حصة إلى ٣ حصص يوميا من الفواكه والخضراوات، وفقط ١.٤٪ يستهلكن خمس حصص أو أكثر في اليوم. كانت غالبية النساء على دراية بفوائد اتباع نظام غذائي صحي للوقاية من الأمراض القلبية الوعائية. ولم يتم تحديد أي اختلاف كبير بين نتائج مقياس فرامنغهام والمنفعة الملموسة أو العقبات. وقد شملت العقبات عبر المجموعات المنخفضة المخاطر إلى العالية المخاطر، نقص المعرفة بالـ "النظام الغذائي الصحي"، وعدم توفر الوقت الكافي للطهي، وتحمل التكاليف، ووجود مشاكل أكثر أهمية. وكان لدى النساء اللاتي اختلفن في العقبات، معاملات بيتا سالبة على متوسط نتائج مقياس فرامنغهام.

الاستنتاجات: كان تناول الفواكه والخضروات في هذه المجموعة الدراسية أقل مما هو موصى به في القواعد الإرشادية. وعلى الرغم من الوعي بفائدة اتباع نظام غذائي صحي في الوقاية من الأمراض القلبية الوعائية، فإن عددا قليلا من النساء كان يعرف ما هو "النظام الغذائي الصحي". لذا لا يمكن التحقق من وجود ارتباط مباشر بين نتائج مقياس فرامنغهام والتصورات/ والعقبات. ولكن يمكن التعامل مع العقبات المتصورة من خلال دمج الحملات التعليمية المستحدثة مع النماذج الموجودة للخطة الغذائية الصحية.

الكلمات المفتاحية: أمراض القلب والأوعية الدموية؛ النظام الغذائي؛ نمط الحياة؛ النساء؛ المملكة العربية السعودية.

Abstract

Objectives: This study aims to assess fruit and vegetable consumption among Saudi women to identify perceived benefits and barriers associated with a healthy diet in cardiovascular disease (CVD) risk prevention and to correlate Framingham risk scores (FRSs) with the perceived barriers.

Methods: A questionnaire adapted from the Health Beliefs Related to Cardiovascular Disease Scale was administered to women attending a primary care centre in KSA. In addition to descriptive statistics, a chi-square test and multiple linear regression analysis were used to determine the association between perceptions of benefit and barriers with FRS categories and between mean FRS and perceived barriers.

Results: A total of 503 women were included in this study, and 75% of the women were older than 45 years. More than 60% of women were obese, and 97% consumed 1–3 fruit and vegetable servings per day, whereas only 1.4% consumed fruits and vegetables 5 or

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Peer review under responsibility of Taibah University.

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APPENDIX

Appendix 1 Permission to use CVD health belief instruments

Permission to use your cardiovascular of health belief instrument

Tovar, Elizabeth [elizabeth.gressle@uky.edu] Actions

To: Alshaikh, Mashael

Attachments: HBCVD Instrument - for use~1.pdf (72 KB)

Wednesday, September 23, 2015 11:37 PM

- Flag for follow up. Start by Thursday, September 24, 2015. Due by Thursday, September 24, 2015.

Dear Mashael,

Thank you for your email and interest in using the HBCVD. I have attached the file and you have permission to use it. Please do keep me informed of the results. Good luck with your research and dissertation process!

Sincerely,

Elizabeth

Elizabeth G. Tovar, PhD, APRN
Associate Professor
University of Kentucky
537 College of Nursing
Lexington, KY 40536-0232
Phone: 859-323-6611

Appendix 2 Questionnaire

1. How old are you? (Years)
    - 15-24
    - 25-34
    - 35-44
    - 45-54
    - 55-64
    - +65
2. What is your Marital Status?
    - Currently married
    - Never married
    - Separated
    - Divorced
    - widowed
3. What is your Education level?
    - Elementary or less
    - Intermediate
    - High school
    - College degree
4. What is your Employment condition?
    - governmental
    - Semi-governmental
    - Private Sector
    - Student
    - Housewife
    - Retired
    - Unemployed
5. What is your Family Income level?
    - Less than 2,000 SR
    - 3,000 - 4,999 SR
    - 5,000 - 6,999 SR
    - 7,000 - 9,999 SR
    - 10,000 - 14,999 SR
    - 15,000 - 17,999 SR
    - 18,000 SR or above University Degree or higher
6. How frequent you do Physical Exercise? Meeting WHO recommendations of moderate-intensity PA (150 minutes/week),
    - Daily / 3-4 times a week
    - 1-2 times a week
    - few times / once a month
7. What is your Smoking status?
    - Never smoked
    - Ex-smoker
    - Current smoker

Appendix 2 Questionnaire. Continuation…1

9. What is your daily servings of Fruit & Vegetables? (pictures, see Appendix 4)
    - None
    - 0 - 3 servings
    - 3 - 5 servings
    - More than 5 servings

9. How many daily hours you spent watching TV?
    - 1 hour or less
    - 1 - 3 hours
    - 3 - 5 hours
    - More than 5 hours

1. What is your Family History of Hypertension?
    - None
    - Mother
    - Father
    - Sibling

2. What is your Family History of Diabetes?
    - None
    - Mother
    - Father
    - Sibling

12. What is your Family History of Hyperlipidaemia?
    - None
    - Mother
    - Father
    - Sibling

13. Not allowing me to drive is a one of my barriers to attending the gym or sporting clubs?
    - Strongly Agree
    - Agree
    - Neutral
    - Disagree Strongly
    - Disagree

14. Portion of our daily food serving's habit affect our health and body weight? (Pictures, see Appendix 5)
    - Strongly Agree
    - Agree
    - Neutral
    - Disagree Strongly
    - Disagree

15. My nature of activities in social gatherings affect my health and body weight?
    - Strongly Agree
    - Agree
    - Neutral
    - Disagree Strongly
    - Disagree

Appendix 2 Questionnaire. Continuation 2……

Please respond to the following 25 brief statements by placing choosing the appropriate box below

	Strongly Agree	Agree	Neutral	Disagree	Disagree Strongly
Q16 : It is likely that I will suffer from a CVD in the future					
Q17: My chances of suffering from a CVD in the next few years are great					
Q18: I feel I will have a CVD sometime during my life					
Q19: Having a CVD is currently a possibility for me					
Q 20: I am concerned about the likelihood of having a CVD in the near future					
Q 21: Having a heart attack or stroke is always fatal					
Q 22: Having a heart attack or stroke will threaten my relationship with my significant other					
Q 23: My whole life would change if I had a heart attack or stroke					
Q 24: Having a heart attack or stroke would have a very bad effect on my sex life					
Q 25: If I have a heart attack or stroke, I will die within ten years					

Appendix 2 Questionnaire. Continuation 3……

	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
Q 26: Increasing my exercise will decrease my chances of having a heart attack or stroke					
Q 27: Eating a healthy diet will decrease my chances of having a heart attack or stroke					
Q 28: Eating a healthy diet and exercising for 30 minutes most days of the week is one of the best ways for me to prevent a heart attack or stroke					
Q 29: When I exercise, I am doing something good for myself					
Q 30: When I eat healthy, I am doing something good for myself					
Q 31: Eating a healthy diet will decrease my chances of dying from CVD					
Q 32: I do not know the Appropriate exercises to perform to reduce my risk of developing CVD					
Q 33: It is painful for me to walk for more than 5 minutes					
Q 34: I have access to exercise facilities and/or equipment					
Q 35: I have someone who will exercise with me					

Appendix 2 Questionnaire. Continuation 4……

	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
Q 36: I do not have time to exercise for 30 minutes a day on most days of the week					
Q 37: I do not know what is considered a healthy diet that would prevent me from developing CVD					
Q 38: I do not have time to cook meals for myself					
Q 39: I cannot afford to buy healthy foods					
Q 40: I have other problems more important than worrying about diet and exercise					

Appendix 3 Ethical approval from IRB

Kingdom of Saudi Arabia
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المملكة العربية السعودية
جامعة الملك سعود (٣٤)
ص.ب ٧٨٠٥ الرياض ١١٤٧٢
هاتف: ٤٦٧٠٠١١ ١١ ٩٦٦+
فاكس: ٤٦٧١٩٩٢ ١١ ٩٦٦+

جامعة الملك سعود
King Saud University
1957

المدينة الطبية الجامعية

26.11.2015 (14.02.1436)
Ref. No. 15/0438/IRB

To: **Dr. Mashael Alshaikh**
PhD Candidate
Department of Primary Care and Public Health
Imperial College – London, UK

Clinical Pharmacist
King Khalid University Hospital
Riyadh, Kingdom of Saudi Arabia

Subject: **Research Project No. E-15-1678**

Project Title: "Cardiovascular Risk Factors in Women Attending Primary Care Centers: Tackling Socio-Economic, Socio-Cultural and Health Beliefs in Saudi Arabia"

Dear Dr. Mashael Alshaikh,

I am pleased to inform you that your above-mentioned research project was reviewed by the Institutional Review Board on 26 November 2015 (14 Safar 1437). The project was **approved**. Work on this project may begin.

We wish you success in your research and request you to keep the IRB informed about the progress and final outcome of the study in a regular basis. Please quote the project number shown above in any future correspondence or follow-ups related to this study.

If you have any question, please feel free to contact me.

Thank you!

Sincerely yours,

Prof. Khalid M. Al-Faleh
Chairman, Institutional Review Board
King Saud University College of Medicine
P.O. Box 7805 Riyadh 11472 K.S.A.
E-mail: kfaleh@ksu.edu.sa

لجنة أخلاقيات البحوث الطبية
كلية الطب
College Medicine
Institutional Review Board (IRB)

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Appendix 4 Fruit and Vegetables Serving Portions

Appendix 5 Serving Portion of Saudi Food (Kabsa, Arabic Sweets)

Appendix 6 Recommended Food Daily Serving for Saudis (The Healthy Food Palm, 2013)

No.	Food Groups	Serving numbers	The amount of serving size
1	Cereal &bread	6-11	= 25 grams of bread = 1/4 Arabic bread medium size = one slice of toast. =1/2 cup of cereals such as rice
2	Vegetables	3-5	1 cup of raw leafy vegetables = 1/2 cup of other vegetables, cooked or chopped raw = 3/4 cup of vegetables juice
3	Fruits	2-4	= 1 medium apple, banana, orange. = 1/2 cup of chopped or canned fruits.= 3 medium dates = 3/4 cup of vegetables juice
4	Milk and products	2-4	= 1 cup of milk or laban or yogurt = 3 spoon of milk powder = 60 gram of processed cheese.
5	Meat & substitute	2-3	= 60-90 grams of cooked lean meat, poultry or fish.= One egg. =1/2 of cooked dry beans. =4- 6 tablespoon of peanut butter
6	Fat & sugar	.....	Lower amount posible
7	Water	6	At least 6 cups daily.