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The Influence of Medical Education on Knowledge, Beliefs and Preventive Behaviours Related to Type 2 Diabetes Mellitus Among Medical Students in Saudi Arabia

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ABSTRACT

The purpose of this study was to assess the influence of academic medical education on knowledge, beliefs and preventive behaviours related to Type 2 Diabetes (T2D) among medical students at Qassim University, Saudi Arabia, and to explore the underlying factors. This study adopted the Health Belief Model as a theoretical framework and followed an explanatory sequential mixed-methods study design. Three study phases were applied, in addition to a systematic literature review. In the first phase, questionnaires were distributed among 195 first- and final-year medical students to assess and compare their knowledge, beliefs and preventive behaviours related to T2D. The second phase aimed to explain the reasons behind phase one's findings by interviewing 25 final-year medical students. The third phase complemented the phase two findings and provided a complete picture of the medical education role in promoting medical students' health behaviours. This phase involved analysing 38 medical education-related documents from three medical institutions in Saudi Arabia using the documentary content analysis approach. Although medical students were aware of the magnitude of T2D and believed in the severity of and their susceptibility to T2D, the following T2D preventive behaviours were below the recommended standards. The first phase of the study showed a lack of medical education's influence on the first- and final-year medical students' T2D preventive behaviours. In the second phase, final-year medical students justified this outcome based on the limited resources and students' wellbeing services. They highlighted the positive influencing role of social and religious values in promoting their health behaviours. The third phase revealed the great emphasis placed on these values compared to students' wellbeing strategies in medical curricula. In conclusion, medical education in Saudi Arabia did not influence the medical students' T2D preventive behaviours, and there is a need to consider medical students' wellbeing through the medical curriculum.

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed .... [redacted]

Date ....17/11/2021....................................

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

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STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter-library loan, and for the title and summary to be made available to outside organisations.

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GLOSSARY OF TERMS

Axiology	Beliefs about the role of values and morals in research (Kaushik & Walsh, 2019).
Boxplot	A common method used for summarisng and effectively displaying values viz. the minimum and maximum range values, the upper and lower quartiles, and the median (Potter et al., 2006).
Epistemology	An assumption about how we know the world, how we gain knowledge, and the relationship between the knower and the known (Kaushik & Walsh, 2019).
Medical education	Is a process of teaching, learning and training of students with an ongoing integration of knowledge, experiences, skills, qualities, responsibility and values which qualify an individual to practice medicine. It is divided into undergraduate, postgraduate and continuing medical education, but increasingly there is a focus on the (lifelong) nature of medical education (McKimm et al., 2017).
Methodology	Is the understanding of the best means for gaining knowledge about the world (Kaushik & Walsh, 2019).
Ontology	Assumptions about the nature of reality (Kaushik & Walsh, 2019).
PROSPERO	An international prospective register of systematic reviews (Booth et al., 2012).
Rhetoric	An understanding of the language of research (Kaushik & Walsh, 2019).

TABLE OF ABBREVIATIONS

ADA	American Diabetes Association
AMC	Australian Medical Council
BMI	Body Mass Index
CVD	Cardiovascular Diseases
GMC	General Medical Council
GSE	General Self-Efficacy
HBM	Health Belief Model
HPLP2	Health Promoting Lifestyle Profile2
IDF	International Diabetes Federation
KSAU-HS	King Saud Bin Abdulaziz University for Health Sciences
MBBS	Bachelor of Medicine, Bachelor of Surgery
MENA	Middle East and North Africa
MOH	Ministry of Health
MOHE	Ministry of Higher Education
NCAAA	National Commission for Academic Assessment and Accreditation
PBL	Problem-Based Learning
PRISMA	Preferred Reporting Items for Systematic Review and Meta-Analysis
PROSPERO	International prospective register of systematic reviews
QU	Qassim University
QUMS	Qassim University Medical School
RR	Relative Risk
SCFHS	Saudi Commission for Health Specializations
SEM	Social Ecological Model
SUMS	Swansea University Medical School
T2D	Type 2 Diabetes
WHO	World Health Organization
WHR	Waist to Hip Ratio
WMA	World Medical Association

CHAPTER 1 INTRODUCTION

1.1 Diabetes Mellitus

Type 2 Diabetes (T2D) has been defined as “a chronic endocrine disorder characterised by abnormalities in glucose metabolism due to abnormalities in the production and utilisation of the hormone insulin” (Gonder-Frederick et al., 2002, p. 612). This condition is a significant cause of long-term complications such as retinopathy, nephropathy, neuropathy, and cardiovascular disease (CVD) (IDF, 2019). The most common form of Diabetes is Type 2 Diabetes Mellitus, which correlates closely with obesity and ageing (IDF, 2019). It is regarded as a global epidemic: In 2019, the International Diabetes Federation (IDF) estimated that 9.3% of the worldwide adult population (aged between 20 and 79 years of age) were living with one type of diabetes and that the number of people with diabetes is projected to increase to beyond 578 million by 2030 (Saeedi et al., 2019). The IDF estimates that 12.2% of the population living in the Middle East and North Africa (MENA) region are living with diabetes (Saeedi et al., 2019).

Economically, T2D is a costly disease, as it is associated with diffuse complications and an increased risk of premature death, imposing enormous pressure on national healthcare systems and economies. The IDF reports that 11.3% of global deaths are related to diabetes (Saeedi et al., 2020). Almost half of these deaths (46.2%, 1.9 million) are estimated to occur in adults younger than 60 years (Saeedi et al., 2020). The overwhelming costs of diabetes care are also exceeding the complications of the premature mortality (where diabetes is either the underlying or an associated cause of death) to the significant economic impact on countries through the healthcare systems and the social support systems for people with diabetes and their families. In 2019, IDF estimated that the total global diabetes-related health expenditure reached USD 760 billion, representing a 4.5% increase on the 2017 estimate (IDF, 2019). Moreover, IDF projects that the expenditure on diabetes will reach USD 825 billion by 2030 and USD 845 billion by 2045 (IDF, 2019).

1.2 Lifestyle factors associated with Type 2 Diabetes

Epidemiological studies have intensively investigated the roles of environmental and lifestyle factors on T2D incidence and prevalence (Chatterjee et al., 2017; Kolb & Martin, 2017; Neuenschwander et al., 2019). Generally, researchers believe that an energy-dense western-style diet in conjunction with a sedentary lifestyle are the primary risk factors for developing T2D (Chatterjee et al., 2017; Kolb & Martin, 2017). Other factors such as exposure to residential traffic, noise, and air pollution have also been investigated but have been found not to have as consistently significant a relationship with T2D as diet and sedentary lifestyle (Kolb & Martin, 2017; Sørensen et al., 2013).

In terms of the role of high calorie dietary habits in relation to T2D prevalence, research studies have significantly linked high Body Mass Index (BMI) and Waist to Hip Ratio (WHR) with an increased risk of T2D (Lv et al., 2017). Moreover, dietary patterns that are low in plant-based food and dietary fibre have a Relative Risk (RR) of increasing the incidence of T2D (Jannasch et al., 2017). It has been suggested that a healthy diet is the one that is dominated by vegetables and fruit over animal food and whole grains over refined carbohydrates (Kolb & Martin, 2017; Vasto et al., 2014).

There is a strong correlation between sedentary time as well as obesity with the incidence of T2D (Kolb & Martin, 2017; Yates et al., 2015). Wilmot and colleagues (2012) conducted a systematic review and meta-analysis to examine the association of sedentary time with diabetes. They found a 112% increase in RR of diabetes associated with long versus short amounts of hours per day of TV time. Furthermore, increased duration of sedentary behaviour may double the risk of T2D (Kolb & Martin, 2017). Every hour television watching increased the risk of developing diabetes over 3.2 years by 3.4% (Rockette-Wagner et al., 2015). As part of their 2020 Standards of Medical Care in Diabetes, the American Diabetes Association (ADA), recommended undertaking 150 minutes per week of moderate-intensity physical activity, such as brisk walking, to prevent T2D. Moderate-intensity physical activity has been found to improve insulin sensitivity and reduce abdominal fat among children and adults (ADA, 2020).

Tobacco smoking is well known for its significant contribution to a range of health complications (Eliasson, 2003). Some research has shown that passive and active exposure to cigarette smoke is also associated with increased risk of T2D (Eliasson, 2003; Pan et al., 2015). The RR of smoking increases by approximately 30% to 60% based on the dose of smoking; whether light, moderate, or heavy smoking dose (Pan et al., 2015). The ADA has emphasised that smoking might play a leading role in increasing the risk of T2D and recommends that doctors refer smokers for smoking cessation therapy, especially those at risk of T2D (ADA, 2020). There is, however, some evidence which suggests that smoking does not increase the risk of T2D. In one example of this (Keith et al., 2016), a multi-ethnic cohort study was carried out among 5931 participants who were smokers, and were free of diabetes at the baseline, as well as after 10 years of follow up. The study concluded that there was no independent association between smoking and the incidence of T2D.

In addition to diet and other lifestyle factors, there has been widespread interest in the role of how psychological factors, such as depression and stress, are related to the onset of T2D. Number of studies had provided evidence on the association between stress and T2D (Pouwer et al., 2010; Virtanen et al., 2014). Furthermore, a 35-year longitudinal study of the influence of perceived stress on Swedish men (n= 7251), who had reported permanent stressful conditions at work or home for a period of over one to five years in the past at baseline, showed a significant association with later diagnosis of T2D (Novak et al., 2013). The findings of the above studies all share one main conclusion – they all recommend promoting the public's psychological wellbeing to prevent T2D (Kolb & Martin, 2017; Novak et al., 2013; Pouwer et al., 2010; Virtanen et al., 2014).

Loef and Walach (2012) have described a healthy lifestyle as a lifestyle that includes "…parameters: non-smoking (currently not or never), optimal weight (BMI 18.5–25kg/m2), physically active (3.5 hours/week), a healthy diet (a healthy diet score including fruit and vegetable consumption), and the moderate consumption of alcohol (5–15g per day for women and 5–30g per day for men)" (Loef & Walach, 2012, p. 164). These researchers have demonstrated that the adoption of four of these lifestyle factors is associated with a reduction of all-cause mortality risk by 66%, including that from diabetes (Loef & Walach, 2012).

T2D has been shown to be a preventable condition. Health promotion and prevention interventions play a vital role in controlling obesity and influence outcomes in T2D

(Knowler et al., 2002; Lindström et al., 2006). One way in which T2D is preventable is a healthy low-calorie diet (Knowler et al., 2002; Montonen et al., 2005). The National Prevention Program in Finland was a longitudinal cohort study assessing the extent to which diet affected the risk of T2D onset among Finnish citizens spanning a period of 23 years (Montonen et al., 2005). The study authors concluded that subjects who ate calorie-rich foods were more likely to develop T2D than those who reported high consumption of fruit and vegetables (Montonen et al., 2005). However, that study is missing data about level of physical activity at the baseline. The researchers had assumed that if a person is following a healthy diet, it is most likely that they would be more physically active than other people. Therefore, the lack of physical activity data in this study may have confounded the results. Another intervention, conducted by the Diabetes Prevention Program in the United States, has also proven that T2D can be prevented or delayed among high-risk individuals after following a healthy diet and practising physical activities (Knowler et al., 2002).

1.3 Type 2 Diabetes in Saudi Arabia

The prevalence of T2D has increased dramatically in the IDF MENA regions in recent years (IDF, 2019; Majeed et al., 2014). This is due to several factors, including a decrease in physical activity and a rise in obesity resulting from economic development and urbanisation (Alharbi et al., 2014; Majeed et al., 2014). The highest levels of T2D prevalence are to be found in five countries in the MENA region, one of which is Saudi Arabia (see Table 1.1). The IDF estimates that Saudi Arabia is the fifth top country in the MENA region with the highest age-adjusted diabetes prevalence (IDF, 2019). Prevalence among the Saudi population is rapidly growing by 0.8% for men and 0.6% for women annually (Alharbi et al., 2014).

Table 1.1: Top five countries with the highest age-adjusted diabetes prevalence in the MENA region (IDF, 2019)

Rank	Country	Age-adjusted prevalence (%)
1	Sudan	22.1
2	Pakistan	19.9
3	Egypt	17.2
4	United Arab Emirates	16.3
5	Saudi Arabia	15.8

T2D onset results from the interaction of genetic determinants with lifestyle habits (Gonder-Frederick et al., 2002). Although genes play an essential role in the onset of T2D, environmental factors and behaviours also play important roles (Schwarz & Reddy, 2013). The Saudi population is particularly at risk of developing T2D because of genetic predisposition and environmental factors such as sedentary lifestyle (Al-Hazzaa et al., 2012; Al-Nozha et al., 2007; El Mouzan et al., 2010).

During the foundation of the Kingdom of Saudi Arabia by King Abdul Aziz Al-Saud in 1932, the Saudi population faced a number of challenges that might account for the current T2D 'epidemic' (Gosadi, 2016). During its formative years, Saudi Arabia was classed as a low-income country, suffering from lack of food, water and other strategic resources. Many people succumbed to starvation (Gosadi, 2016). However, during the 1970s, the largest global oil reserve in the world was discovered in the Eastern Province of Saudi Arabia. Subsequently, Saudi citizens experienced an unprecedented increase in the availability of commodities and wealth, which induced lifestyle changes correlated with an increased frequency of obesity.

According to Gosadi (2016), the increased prevalence of overweight and obese among the Saudi population could be partially explained by the thrifty genotype hypothesis. In 1962 Neel claimed that the thrifty genotype hypothesis might justify the variation of obesity and diabetes incidence rates among different ethnic groups. As he argues, "certain genotypes were advantageous during periods of starvation and low food availability in the past, the natural selection might have led to an increased frequency of favoured genotypes, which later became risky genotypes in periods when food was abundant" (Gosadi, 2016, p. 17; Neel, 1962). A study conducted among 3,212 Saudi families showed that 57.7% of marriages were consanguineous, with married couples being first cousins, reflecting cultural and social norms (El-Hazmi et al., 1995). This increases the susceptibility of the Saudi population to T2D.

1.4 Health awareness of diabetes in Saudi Arabia

Increasing awareness of the potentially devastating effects of diabetes is important for bringing the problem under control (Schwarz & Reddy, 2013). The rising rate of T2D incidence might be due to the lack of awareness of the condition and its prevention. Some evidence for this comes from a study of 288 primary healthcare centre attendees in the Eastern Province of Saudi Arabia that demonstrated that most individuals were ignorant of the risks associated with T2D and how to prevent them (Aljoudi & Taha, 2009). Lack of awareness was also reported among secondary school students, whereby it was found that the majority of the students did not recognise the severe complications resulting from T2D, and consequently did not regard T2D as a severe condition (Al-Mutairi et al., 2015).

At the same time, healthcare professionals seemed to lack motivation in their duty to prevent and control T2D in Saudi Arabia. For example, a study conducted in Alhasa district showed that 86.8% of the doctors surveyed disagreed that diabetes self-management education is an essential part of diabetic care (Khan et al., 2011). Moreover, only 24% of general practitioners in Riyadh city were educating their patients about the benefits of engaging in physical activities as a preventive measure and 45% of doctors themselves were undertaking sufficient physical activities (Al-Shahri & Al-Almaei, 1998). Such evidence displays a general lack of effort among the medical profession in Saudi Arabia to educate the public about diabetes.

1.5 Medical education at a glance

Around the world, including in Saudi Arabia, medical education extends across both undergraduate and postgraduate education and includes the continuing professional development of established doctors. The aim of medical education has been described as "… to supply society with a knowledgeable, skilled and up-to-date cadre of professionals (doctors) who put patient care above self-interest and undertake to maintain and develop their expertise throughout a lifelong career" (Swanwick, 2011, p. 3).

Prior to the early twentieth century, medical education in its current form was revolutionised from an apprenticeship model, largely as a result of Abraham Flexner's report, Medical Education in the United States and Canada (1910)'. which was written after his visits to 155 medical schools in the United States and Canada. The report began to resemble the current model. Flexner recommended closing many standalone medical schools based in hospitals and the embedding of medical education in universities (Ludmerer, 2010).

Medical education along these lines is comparatively recent in Saudi Arabia. King Saud University was the Kingdom's first medical college s established in 1967. Four more such colleges were founded during the next three decades. These five colleges adopted the same seven-year traditional (Pre-clinical: Clinical) curriculum, characterised by an initial three years of basic medical science courses, followed by three years of clinical training, including a one-year internship. Subsequently, in the space of 10 years, the number of medical schools rose dramatically, with more varied curricula, ranging from traditional courses to more progressive, problem-based, and community-based programmes (Telmesani et al., 2011).

Medical and healthcare professionals are educated according to their professional specialism and mission. However, T2D is a health problem that needs multi-professional efforts to manage it and prevent it (Schwarz & Reddy, 2013). Understanding public health promotion and prevention strategies is an important part of knowledge for all healthcare professionals. One of the suggested strategies to improve community health is improving wellbeing and promoting a health-promoting lifestyle among medical and healthcare professions (Dyrbye & Shanafelt, 2016; Dyrbye et al., 2019; Frank et al., 2013). Therefore, assessing the influence of formal and informal medical education on students' health behaviours seems to be essential. Doctors who have sufficient knowledge and who adopt healthy lifestyles may act as positive role models for patients and the public and can substantially influence the beliefs held and practices adopted by their communities and patients (Hart., 2020; Kenny et al., 2003).

1.5.1 Types of medical education curricula

The term ‘formal curriculum’ is generally understood by scholars to denote the more formalised material or prefigured aspects of an academic course (Swanwick et al., 2019). These educational courses should include planned content, syllabus, pedagogical approach, methods of assessment, formalised policy statements and regulations, and any other type of tool or context needed, and the spaces that have been specially adapted for learning, such as lecture halls and science laboratories (Swanwick et al., 2019; Wear & Skillicorn, 2009).

Conversely, the ‘informal curriculum’ is a term used by theorists to refer to more spontaneous types of knowledge transfer that might occur both inside and outside the formalised course context (Swanwick et al., 2019). Tutors can play various healthcare professional roles, and physical contexts for learning tend to be extraneous to those solely designed to deliver formalised curricula – for example, faculty offices and hallways interactions, or other settings in which tutors interact with students (Wear & Skillicorn, 2009). In contrast to formalised course instruction, the informal curriculum reflects a more subjective or localised set of skills, values, and attitudes that tutors in a particular educational setting believe students must acquire to gain professional competency (Swanwick et al., 2019; Thistlethwaite & McKimm, 2015; Wear & Skillicorn, 2009).

The 'hidden curriculum' is the third type of learning process understood by theorists. It refers to that which is learned unintentionally in the context and duration of an academic course but has nevertheless been instigated, however tangentially, by the course in question. The hidden curriculum can be delivered via human action and institutionalised practices (Wear & Skillicorn, 2009). At present, the concept of the hidden curriculum is better understood and investigated in general education and curriculum theories than in medical education. Yet researchers nevertheless argue that it is only when course leaders attempt to shape or construct a hidden curriculum, as opposed to accepting the inevitability of an emergent hidden curriculum, that effective learning can take place (Shaw, 2006).

1.5.2 The influence of the medical curricula on students

A number of studies have been carried out on medical students' knowledge (Mehmood et al., 2017), beliefs (Woloschuk et al., 2004) and performance (Alsaggaf et al., 2016). The findings of these studies have been contradictory. For instance, Woloschuk et al. (2004) argued that institutionalised pedagogical practices could lead to a decline in beliefs that were most conducive to delivering effective healthcare, but other studies have produced evidence showing that students maintained desirable beliefs throughout their course durations (Dornbush et al., 1985). It was difficult to determine why there should be a negative change; however, they speculated that students become less idealistic and more realistic as they progressed through their education and their empathy degrades (Neumann et al., 2011; Woloschuk et al., 2004). It has been suggested that students' beliefs and behaviours deserve considerably more scholarly attention than has been previously given. This is because there is evidence to suggest that students' attitudes and behaviours provide a means of understanding exactly how students convert their professional knowledge and skills into their performance as practitioners (Newble, 1992).

Professionalism might not be the only factor affected by the formal and informal medical curricula (Jalil et al., 2020; White et al., 2009; Woloschuk et al., 2004). Students' own health and wellbeing might also be affected (Dunn et al., 2008). Given the evidence highlighted, one can argue that promoting a healthy lifestyle and the development of resilience are fundamental aims of medical training (Dunn et al., 2008). The aim of this thesis was to explain how the medical curriculum influences the extent to which students' lifestyles are health-promoting, particularly in relation to T2D onset risks.

1.6 The theoretical framework of this study

The theoretical framework used here has been developed based on the Health Belief Model (HBM) (see Figure 1.1) (Rosenstock et al., 1988). The HBM is a well-established concept that was developed in the 1950s by a group of social psychologists (Hochbaum et al., 1952). The HBM was developed to explore and explain people's perceived unwillingness to undergo screening and prevention procedures for asymptomatic diseases (Becker & Janz, 1985). The findings from a study of behaviours associated with the acceptance or resistance to tuberculosis screening conducted by Hochbaum et al. (1952) was used to develop a model for the HBM (Hochbaum et al., 1952).

According to Becker and Janz in 1985, the HBM has been used to understand risky health behaviours and ways to prevent them by gaining a better understanding of individuals' health behaviours in relation to preventive health measures (Becker & Janz, 1985). A number of researchers have proposed multiple variations of the model but the most widely accepted is Rosenstock's (1974), who proposed six variables that governed whether an individual would engage in healthy behaviour (Becker & Janz, 1985; Rosenstock, 1974). These variables are: (1) the individual's perceived susceptibility to being exposed to certain diseases; (2) the perceived severity of that disease; (3) the perceived benefits of engaging in promoting or preventing behaviours associated with that disease; (4) perceived barriers to participating in recommended health promotions or prevention behaviours; (5) the perceived self-efficacy was added to the model to explain better discrepancies between outcome expectations and behaviours; and (6) Rosenstock also believed that some stimulus of behaviour, which he referred to as a ‘cue to action’ was required. (Rosenstock et al., 1988).

The HBM is one of the few models that incorporates a triggering element that induces the change process. Such triggers come in different forms (Meillier et al., 1997). Cues to action can be both internal (e.g., symptoms of the disease) or external (e.g., affected family members or a media campaigns) (Becker & Janz, 1985), or can take the form of knowledge, experiences, social influences, and habits (Meillier et al., 1997).

The utility of the HBM as an essential research tool has been well established. Janz and Becker published the first review carried out to assess the effectiveness of the HBM in 1984. They reviewed 46 studies conducted between 1974 and 1984, which they grouped into three categories: preventive health behaviours, sick role behaviours, and clinic utilisation. These studies examined a diverse array of issues, such as flu inoculation, smoking behaviour, breast self-examination practice, and compliance with treatment for a variety of different conditions. This review promoted the ability of the HBM to explain and predict individuals’ health-related behaviours (Janz & Becker, 1984).

Numerous studies have examined the effect of health beliefs on behaviours related to diabetes self-care. For example, a survey of 70 patients living with T2D in Iran was undertaken in 2014. The sample had been selected to be part of an educational intervention that was based on the HBM. The researchers found that the post score of the means of each of the HBM variables had improved. Consequently, the patients’ self-care behaviours had significantly increased compared to the pre-intervention score (Shabibi et al., 2017). Interventions that were supported by behaviour models and theories were described as more successful than those based on intuition, such as HBM, which suggests that health-related behaviours are largely attributable to cognitive decision-making processes (Costa et al., 2015; Finfgeld et al., 2003). Although most of the interventions were missing control groups, these works supported the effectiveness of using the HBM as an evaluation and an assessment tool for the willingness to follow self-care behaviours.

The HBM has been used in many contexts. It has been widely used among patients (Becker & Janz, 1985; Skinner et al., 2015) and people at risk of certain health problems (Adams et al., 2014), and recently, as suggested guiding tool for patient communication during the novel coronavirus disease (COVID-19) pandemic (Sheppard & Thomas, 2021). In relation to medical students, it has been used to assess their perceptions of certain health behaviours, such as implementing self-breast examination, as a precaution behaviour to prevent breast cancer (Henning et al., 2011; Mohamed et al., 2016), and following sun protection behaviors to prevent skin cancer (Pearlman et al., 2020). The current study employs the HBM construct to understand how and when medical students make decisions to promote their health and prevent T2D.

When utilising the HBM model, it can be assumed that medical students will adopt preventive health behaviours that lower their chance of getting T2D, if they believe that they are susceptible to the risk of T2D to a greater extent than other people, and to the degree in which they believe T2D is a severe health condition. Furthermore, it is assumed that following certain health behaviours, as described by the Health Promoting Lifestyle Profile2 (HPLP2), medical students will reduce their susceptibility to T2D given their perceived benefits. It is assumed through the HBM construct that these perceived benefits can offset any perceived barriers given the severity of the T2D condition. Moreover, students should be more confident in their ability to successfully perform these health behaviours if their self-efficacy is high (Rosenstock et al., 1988; Glanz et al., 2008). Finally, the HBM suggests that, in adopting these preventive behaviours, a trigger or cue is required.

For medical students, these cues can come from internally or from the outside environment. An example of internal cue could be through feeling a pain or from an internal desire to be a good role model for patients. An external cue could be experiencing the daily struggles with one or more family members who live with diabetes. External cues can also be those learned from the medical curriculum (e.g., medical knowledge related to the severity if T2D) or advice and motivation from faculty staff or colleagues (Cao et al., 2014; Meillier et al., 1997).

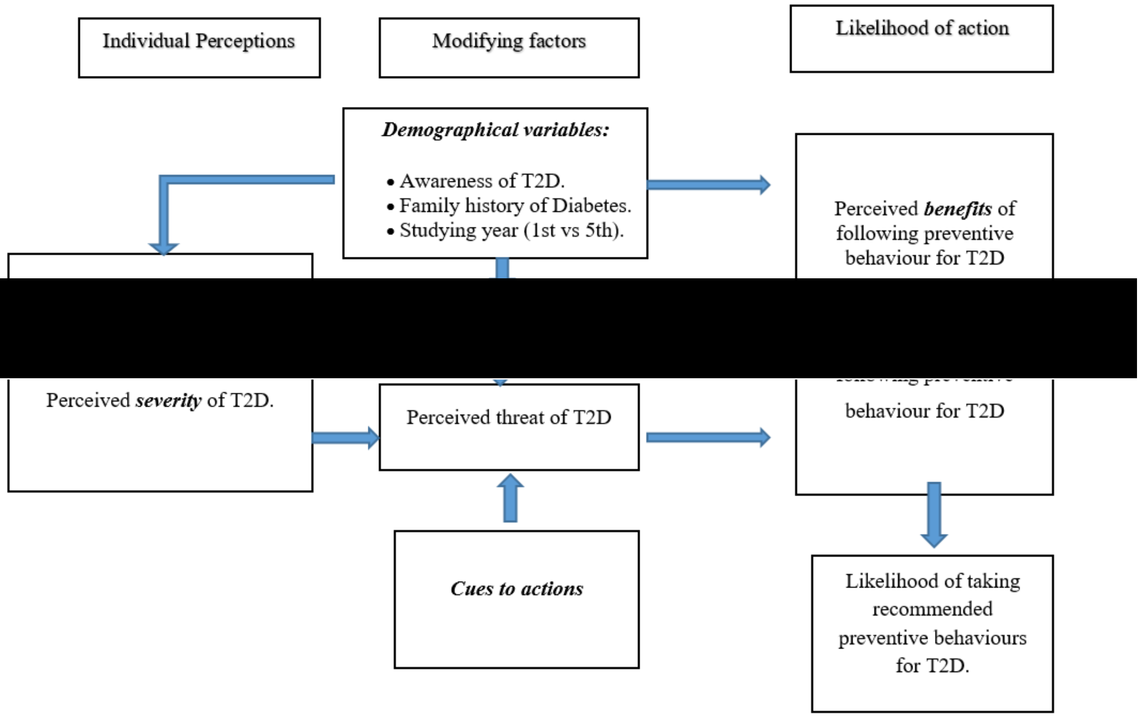

Figure 1.1: The study theoretical framework, based on the Health Belief Model (Rosenstock et al., 1988)

1.7 The significance of this study

To date, there has been no formal study of the influence of academic medical education on the extent to which medical students' lifestyles are health-promoting in Saudi Arabia. Information regarding health awareness and health-promoting behaviours as predicted by the HBM should provide a strong foundation for future community awareness and prevention interventions of T2D in general, and among medical and health professionals specifically.

1.8 Research aim and objectives

This research aims to assess medical education influences on knowledge, beliefs and preventive behaviours related to T2D among medical students at Qassim University Medical School (QUMS), Qassim city in Saudi Arabia.

The research aim is achieved through:

1. Identifying and comparing levels of T2D knowledge among students in the first and final years of the undergraduate medical curriculum.

2. Assessing and comparing health-promoting lifestyle choices (T2D preventive behaviours) among students in the first and final years of the undergraduate medical curriculum in QUMS.
3. Measuring the relationships between knowledge, beliefs, and the adoption of a health-promoting lifestyle among medical students in QUMS.
4. Explaining the means of influencing the medical students' preventive behaviours related to T2D during the academic medical education process in QUMS.
5. Investigating the potential influence of the undergraduate medical curriculum in Saudi Arabia on medical students' beliefs and prevention behaviours related to T2D.

1.9 Research questions

1. Does formal academic medical education influence the knowledge, beliefs and preventive behaviours related to T2D among medical students in QUMS?
2. How does the medical education curriculum influence beliefs and health behaviours related to T2D prevention among medical students in QUMS?

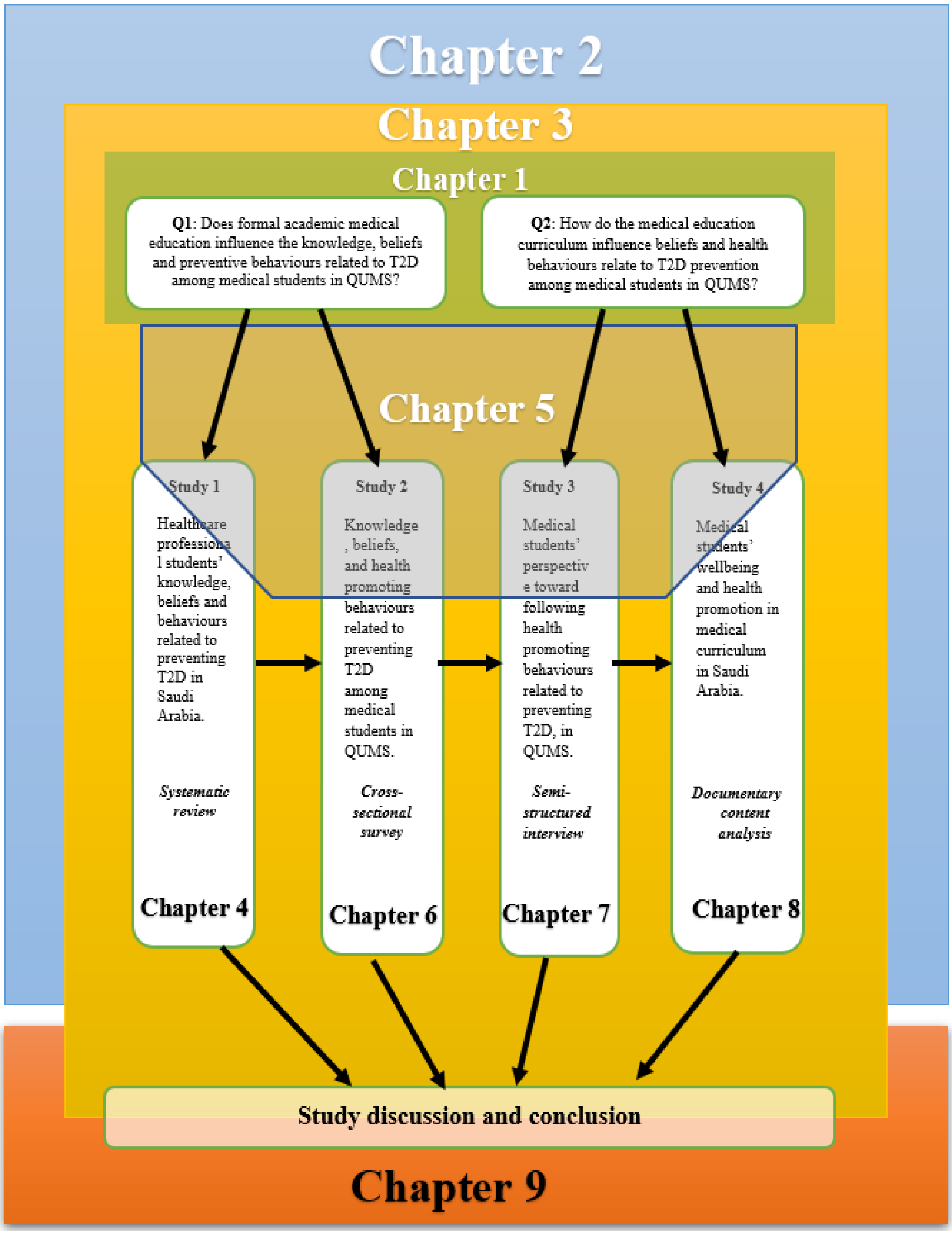

Figure 1.2: Thesis structure and data overlap across the chapters

1.10 Thesis structure

Figure 1.2 shows the scope of each chapter of the thesis and how they overlap. Chapter 2 establishes wider contexts for the thesis and is divided into two parts: the first part provides general information regarding the social and cultural context of Saudi Arabia and its medical education system; the second part provides an overview of students' wellbeing in the higher education sectors.

Chapter 3 reviews existing literature relating to the research questions. It consists of three parts. The first two parts discuss the relationship between medical education and medical students' wellbeing and how that might reflect on their health and performance in the future. The third part looks deeper into medical education's influence on the medical students' knowledge, beliefs and preventive behaviours related to T2D.

Chapter 4 provides a systematic literature review related to the medical and healthcare students' knowledge, beliefs and preventive behaviours around T2D in Saudi Arabia, and investigates the influencing role of medical education on those three domains. The chapter starts by describing the systematic review methodology, then the characteristics and the findings of the included studies. At the end, a list of the influencing factors is reported. In addition to describing the current status of medical students' knowledge, beliefs, and health preventive behaviours in Saudi Arabia, the findings of this review helped in developing part of the questionnaire used in the second study of this thesis; barriers and benefits of following health-promoting behaviours among medical students.

The methodological approaches that were undertaken in each phase of the study are presented in Chapter 5. The chapter describes the explanatory mixed-methods design that was employed to answer the research questions. It begins by outlining the overall study design and research setting. Then it is divided into three sections, which correspond with the first, the second and the third phases of the study. Each section describes the sample, the instruments used, and the specific data analysis undertaken, in detail. The chapter concludes with a summary of the ethical considerations relevant to the study.

In Chapter 6 the findings of the first phase of the thesis (cross-sectional survey) are presented. Using multiple tables, figures and explanatory comments, the statistical results are presented. The chapter begins by identifying the characteristics of the study participants. Then, this thesis's benchmark data are submitted: knowledge, beliefs, and health-promoting behaviours of QUMS. The last part of the chapter reports the significant relationships between the medical students' knowledge, beliefs, and health-promoting behaviours.

Twenty-five (25) medical students were interviewed to explain the result of the first phase of this thesis. The interviews were analysed using the thematic analysis approach. The findings of this second phase of the thesis are described in Chapter 7. The chapter starts by describing the characteristics of the interviewed participants. Then, the three emerged themes are highlighted to show the potential channels that influenced the health-promoting behaviours among medical students in QUMS. However, the medical curriculum's role in encouraging medical students to be a healthy role model for patients and community needs further explanation. The third phase of the study aims to clarify that issue, and is explained in Chapter 8.

The medical curriculum documents of QUMS and the medical education regulations that apply in Saudi Arabia, were analysed using a documentary content analysis approach and are presented in Chapter 8. The documentary analysis phase aims to add a complementary understanding and build on the second phase's qualitative data results (Chapter 7). This chapter reports the findings of the third phase of the thesis in the forms of both quantitative and qualitative data.

Discussion of the study's findings, together with a conclusion, is presented in Chapter 9. In this chapter, a summary of the main findings is presented, followed by a discussion. The discussion includes an exploration of the study's outcomes in the context of the extant literature and on the background of the theoretical framework used in this study. Finally, the implications, strengths and limitations of the study's various phases are identified and concluding recommendations and ideas for future research are provided.

CHAPTER 2 BACKGROUND AND CONTEXT OF MEDICAL EDUCATION IN SAUDI ARABIA

This chapter outlines general facts about the study populations and settings. The first part is a demographic description of the Kingdom of Saudi Arabia, including its significance for millions of Muslim pilgrims who visit the Kingdom every year. Then the chapter moves on to discuss the higher education system, the history of medical education and the relevant regulatory bodies in the country.

2.1 Kingdom of Saudi Arabia

The Kingdom of Saudi Arabia is the largest territory among the Arab Gulf States and one of several large states occupying the Middle East region. With a land area of approximately 2,149,690 km², Saudi Arabia is geographically the second largest territory in the Arab world (after Algeria). In terms of terrain, Saudi Arabia is mostly desert 90% including the largest sand desert across the globe, Alrub' Alkali (WorldAtlas, 2019); however, the southwest region of Saudi Arabia is mountainous. Saudi Arabia is situated on the Arabian Peninsula and is flanked by Syria, Jordan, Iraq, Kuwait to the north, and Oman and Yemen on its southern borders. The Red Sea forms Saudi Arabia's western border, while its eastern border is shared with Bahrain, the United Arab Emirates, Qatar, and the Arabian Gulf. Both geographically and in many other regards, Saudi Arabia is very much at the centre of the Middle East region, situated as it is at the crossroads of Europe, Asia, and Africa (see Figure 2.1).

Figure 2.1: Map of the Kingdom of Saudi Arabia. (GAFS, 2019)

In 1932, Abdul Aziz Ibn Abdur Rahman Al Saud brought about the unification of several regions to form the country of Saudi Arabia as it is known today and was subsequently proclaimed the country's king (GAFS, 2019). The ensuing discovery of large reserves of oil within six years of his reign gave rise to the commercial production of oil in the country. The unprecedented wealth generated by this discovery and enterprise propelled Saudi Arabia into industrial modernity. Today Saudi Arabia possesses a 25% share of the total Arab gross domestic product and holds an entire international reserve of US$737,797 billion (GAFS, 2019). The present monarch, King Salman, came to power in 2015 following the death of his brother and former reigning monarch, King Abdullah.

The current population of Saudi Arabia is estimated to be 33,413,660 and is annually growing at a rate of 2.54%. Saudi citizens represent 63.2% of the community, with non-Saudis make up the remaining 36.8%. Children aged 15 years and under make up 24.8% of the population, those aged between 15 and 64 represent 72%; while a mere 3.2% are 65 years of age or older (GAFS, 2019). The prevailing ethnicity in Saudi Arabia is Arab, while the population of the Hijaz region bordering the Red Sea displays a greater mix of ethnicities having mostly migrated to the area, including Indonesians, Indians, and Africans. Arabs originating in neighbouring countries often seek employment in Saudi Arabia. A substantial number of Asian expatriates, mostly from India, Pakistan, Bangladesh, Indonesia, and the Philippines, also reside in the Kingdom (GAFS, 2019).

Saudi Arabia is widely recognised as the country in which the religion of Islam originated. After the Prophet Muhammad's death in 632 A.D, the religion flourished, toward Spain in the west and toward India in the east. Islam obligates an adherent to the faith to make a pilgrimage to Makkah (also known as the Hajj) at least once in their lifetime, providing they are fit to make the journey. Saudi Arabia is thus a sacred place for Muslims globally, and the holy cities of Makkah and Medina are visited by millions of Muslims annually. In 2018 Saudi Arabia accommodated 2,371,675 pilgrims during the Hajj season (GAFS, 2019).

2.1.1 Qassim City

Qassim Province, where this study takes place, is located geographically in the middle of Saudi Arabia and lies roughly 400 km northwest of the capital city of Riyadh. In terms of population size, it ranks seventh out of all Saudi Arabian regions, following Jizan. It includes over 400 cities, towns and villages, and Bedouin settlements populate the province. Roughly 49% of the region’s population resides in its capital city, Buraydah (GAFS, 2019).

Qassim is a conservative region whose inhabitants are predominantly farmers. Most of the students in Qassim University (QU) came from different regions within the Qassim district. Some of these regions are described as having a rural culture. Qassim is quite a distinct region regarding gender attitudes and Islamic regulations (Alqefari, 2016). Le Renard (2008) found that central regions of Saudi Arabia are much stricter and more conservative about the enforcement of restrictions surrounding gender segregation and other requirements of Islam than the Eastern or Western Provinces are.

2.2 **Medical education in Saudi Arabia**

Following the unification of Saudi Arabia under King Abdul Aziz in 1932, health services developed away from a reliance on traditional medicine, such as cupping, herbs, or skin cauterisation (Mohammad et al., 2015), toward the establishment of a modern healthcare system (Telmesani et al., 2011). Opening in 1967, King Saud University was the first medical school established in Saudi Arabia and was affiliated with the University College of London Medical School. The year 1975 saw the opening of a further two medical schools; King Abdul-Aziz University and King Faisal

University, and in 1980 a branch of King Saud University was established in Abha, a city in the southern region of Saudi Arabia. In 1996 a further medical school was established in the western region (Alshehri, 2001; Telmesani et al., 2011). The establishing of these five schools still did not, however, meet the population's needs, yet they were the only institutions in the country able to provide qualified doctors for three decades. During this time, all five medical schools adhered to the same traditional pre-clinical and clinical seven-year curriculum: three years taking basic and medical science courses; three years of clinical training and ending with a year-long internship. There were minor differences between the schools in terms of how they administered their courses (Telmesani et al., 2011).

In 2006, national statistics showed that the percentage of the Saudi nationals possessing a medical degree and practising medicine in the public health sector was less than 20% of all the working doctors in Saudi Arabia. This was regarded as inadequate and led to the issuing of a Royal Decree by King Abdullah bin Abdulaziz, to the Council of Ministers and Higher Education Board, to expand medical education in the country, resulting in the opening of new medical schools across the country and new branches of existing institutions (Abdulrahman & Saleh, 2015). This expansion issued ushered in a new phase of Saudi medical training. The expansion was part of a wider initiative to expand higher education by the Ministry of Higher Education (MOHE) focusing particularly on medical education. The private sector was also invited to invest in the sector (Abdulrahman & Saleh, 2015; Telmesani et al., 2011). By 2008, 10 new medical schools affiliated with the MOHE had been established, as well as three private medical schools (Abdulrahman & Saleh, 2015). The Ministry of Health (MOH) and the National Guard separately funded their medical schools, bringing the total number of medical training institutions in the country to 21 (Abdulrahman & Saleh, 2015). Currently, there are 28 public universities and 30 private universities in Saudi Arabia, including 24 public medical schools and 11 private medical schools (MOE, 2021)

This phase of expansion in Saudi medical education also entailed implementing innovative programmes of learning coupled with a drive to achieve excellence and international recognition. The majority of newly established medical schools adhere to innovative medical programmes and have formed international partnerships with elite educational institutes (Abdulrahman & Saleh, 2015). The educational strategies adopted include a more integrated curriculum, a focus on Problem-Based Learning (PBL), and the development of community-oriented and community-based learning. For example, King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) includes both graduate and undergraduate entry to a PBL programme, while QU follows a PBL and community-oriented programme. Older medical colleges, such as the medical school at King Saud University, have mostly replaced traditional forms of learning with hybrid, integrated, community-oriented, community-based, and problem-oriented curricula. Curriculum content as well as pedagogical styles or methods are devised internally at each institution. The academic committees decide on course content, method of learning (for example, the proportion of lecture-based learning to small-group and PBL), educational objectives, content, and forms of assessment (Alshehri, 2001; Bin Abdulrahman, 2008; Telmesani et al., 2011). With the revival of medical education in Saudi Arabia, calls for establishing quality indicators are increasing (Alshehri, 2001; Bin Abdulrahman, 2008; Telmesani et al., 2011). The experiences of the first innovative medical schools at QU and KSAU-HS have gained scholarly acknowledgements. Innovations at these two institutions were applauded by international institutions such as the World Federation for Medical Education and were also accredited by the National Commission for Academic Assessment and Accreditation (NCAAA) (Telmesani et al., 2011).

Admission to medicine programmes in Saudi Arabia is assessed according to a student’s high-school grades, performance on a national aptitude test, score on a summative examination in science, and an interview. However, some institutions have dispensed with the interview due to lack of evidence of its objectivity and reliability (Telmesani et al., 2011). The student’s overall English score is also taken into consideration (Alrebish et al., 2020). As far as is known, there is a lack of demographic descriptive information on medical students and graduates in Saudi Arabia (Althubaiti & Alkhazim, 2014). Students at the public universities receive a monthly allowance of USD 213 to USD 266 based on their subject, and the allowance is raised to USD 2000 during the internship period for medical students. Therefore, they have less of a financial burden compared to the students at private universities.

Saudi medical schools have two professional outputs: medical education and healthcare. In terms of how medicine is taught, institutes of higher education, including medical schools, did not originally require accreditation. Today, however, there are two regulatory bodies for medical schools. The first one was established in 2005, when the Council of Higher Education approved the establishment of NCAAA. The NCAAA is financially and administratively independent and aims to maintain the quality of higher education nationwide (Al Mohaimeed et al., 2012; Telmesani et al., 2011). The aims of NCAAA include:

- Setting standards, criteria and procedures for accreditation.
- Reviewing and evaluating performance of existing and new institutions.
- Accrediting institutions and programmes.
- Supporting improvements in quality.

Currently, it is compulsory for each institute of higher education to receive accreditation by the NCAAA. The accreditation criteria are comprehensive and incorporate all components of the institute, including teaching and learning. The accreditation is valid for seven years and the institute will need reassessment for further accreditation (Al Mohaimeed et al., 2012).

Concerning medical institutions' practical (as opposed to didactic) function, institutions are regulated by the Saudi Commission for Health Specializations (SCFHS), a body established by a Royal Decree in 1993 (Telmesani et al., 2011). It has 13 branches around Saudi Arabia (SCFHS, 2021). The SCFHS is the second regulatory body for medical schools in Saudi Arabia. This independent body aims to accredit postgraduate programmes, board examinations, professional classification, and registration. The Commission administers a national examination, the Saudi Licence for Practising Medicine. It is mandatory for both national and international doctors to possess such a licence to join residency programmes or practise medicine in Saudi Arabia (Telmesani et al., 2011; SCFHS, 2021).

The expansion of medical education in Saudi Arabia has also led to calls for greater regulation of standards of competency, leading to an initiative that seeks to guarantee minimum standards or benchmarking in undergraduate medical education at the national level. In 2009, the newly established committee of deans of medical schools in Saudi Arabia launched a taskforce that aimed to construct a national competency framework for Saudi doctors and to standardise the Saudi Medical Higher Education sector (Zaini et al., 2011). The first phase of this initiative took two years to complete

(2009 to 2011). The results were published under the title *SaudiMEDs: A competence specification for the Saudi medical graduates* (Shadid et al., 2019; Zaini et al., 2011). The SaudiMEDs framework is a four-level model:

- Level I comprises six themes identified as integral to the successful completion of a medical programme (see Figure 2.2).
- Level II comprises seventeen key competencies (learning outcomes) that a doctor should achieve.
- Level III comprises eighty enabling competencies deemed by the committee to be essential attainments for all undergraduate medical students in Saudi Arabia.
- Level IV comprises learning outcomes specified by a joint committee between the Saudi deans and education evaluation commission – Higher Education sector in order to fulfil minimum required standards for all Saudi medical schools (SaudiMED, 2017).

Figure 2.2: The six themes of SaudiMEDs in level I (SaudiMED, 2017).

2.2.1 Qassim University

Out of the public universities in Saudi Arabia, Qassim University (QU) is one of the highly regarded universities in Saudi Arabia (Qassim University, 2020). It was established in 2004, and since its foundation it has experienced rapid growth. It currently incorporates 38 colleges, 13 deanships, and over 5,000 members of staff.

Around 68,444 students currently attend the institution, representing 75 nationalities (Qassim University, 2020). QU was founded as part of an initiative to expand higher education and universities. In terms of its foundation and evolution it is one of the first modern universities in Saudi Arabia. QU offers national and international students a variety of post-secondary degrees, including the various disciplines of Sharia and Islamic studies, Arabic and humanities, science, engineering, and health (Qassim University, 2020).

2.2.2 Qassim University Medical School

The faculty of Qassim University Medical School (QUMS) began teaching its first cohort of students in 2000 (Alrebish et al., 2020; Qassim University, 2020). It was initially intended to be a branch of King Saud University in Qassim city, to meet the needs of the population of the region and surrounding areas, as well as to address the shortage of doctors. The QUMS was incorporated into QU when it was founded in 2004 (Qassim University, 2020).

The medical school’s original aim was to provide an advanced and unique educational programme through which doctors are equipped with the knowledge, behaviours, and skills required to comprehend and meet Saudi society's needs (Alrebish et al., 2020; Jahan et al., 2014). The QUMS situates students in the community's broader needs and through practice-led research (Qassim University, 2020).

The QUMS curriculum is designed to nurture competence in students in all areas of medicine, from preventive and promotive, to curative and rehabilitative forms of care. Students develop a comprehensive understanding of biological, psychological, and social mechanisms and processes related to medical care. Furthermore, the curriculum incorporates approaches to learning adapted from cognitive psychology (Alrebish et al., 2020; Qassim University, 2008).

By the end of study, the programme aims to ensure that students have achieved the following:

- Proficiency in the practise of holistic medicine, demonstrating competence in promotive, preventive, curative, and rehabilitative approaches to treating common diseases.

- Possession of both the scientific knowledge and practical experience needed to promote a healthy lifestyle.
- Ability to demonstrate the attributes expected of a model citizen, both through the upholding of medical ethics and fulfilling social and professional duties, and following national laws and requirements (Qassim University, 2008).

The learning approach used by the QUMS's course is primarily PBL: starting in the first year of the second phase, small groups of students (8-12) work on pre-selected challenges together with a tutor. Students are encouraged to approach the problem from a wide variety of angles and to use their questions and pre-conceived opinions as starting points for investigation. Students may engage with a variety of platforms and tools for learning, including lectures, tutorials, practical clinics, libraries, and information technology (Qassim University, 2008).

Students are formally assessed according to how well they perform in the activities mentioned above, as well as in devised tests undertaken at the end of the course. They are assessed according to their problem-solving skills, proficiency in communication skills, ability to interact in group-learning scenarios, and general conduct. Under the direction of academic deanship, the Medical Education Department monitors the learning tools provided by the simulation unit, e-learning unit, and learning resources unit to continuously improve the learning experience.

Stages of the curriculum:

The Bachelor of Medicine, Bachelor of Surgery (MBBS) in QUMS is divided into 12 levels of learning, takes six years to complete, and is implemented in three stages:

- The initial phase is the Foundation Year, where all the medical and other healthcare students are taught and evaluated together through the Deanship of the Foundation Year.
- Phase II the pre-clinical phase: this phase consists of three years. During the three years, students are taught about the system of decisions based on the integration of basic and clinical sciences. It occurs through sequential courses on the integrated human body, which include all disciplines of basic science according to the body's vital organs, in addition to the learning skills, professional medical and communication skills and introduction in clinical medicine courses, beside the ethics and the Islamic courses.

- Phase III clinical training phase: Students learn basic clinical courses in the fourth and fifth years in this phase. It includes internal medicine and surgery such as general surgery, paediatrics, gynaecology, obstetrics, ophthalmology, dermatology, nose, ear and throat, orthopaedics, primary healthcare, and psychiatry.
- The Internship phase: completion of this phase is required for the graduates to obtain the graduation certificate and licence to practise from the SCFHS. The student should enrol on the internship year that lasts for 12 months, after completion of all graduation requirements. The programme of the internship includes practical training in public hospitals.

The total credits for the Medicine Programme are 199 credited hours.

2.2.3 Higher education in Saudi Arabia and the students' wellbeing

The Higher Education Department in the Ministry of Education is a centralised authority responsible for directing university education under the adopted policy, supervising the development of university education in all sectors, coordinating universities in the field of scientific degrees, encouraging research, and formulating rules and regulations for compliance by all institutions of higher learning (Alamri, 2011). During the past decade, the higher education sector in Saudi Arabia has undergone tremendous growth. This improvement is related to several factors. The new economic strategy is one of the most influential factors (Alharbi, 2016). In 2016, the Kingdom of Saudi Arabia's crown prince Mohammed bin Salman adopted a new vision and strategies for the development of Saudi Arabia to become one of the most advanced countries in the world in terms of its economy and education by 2030. As a consequence of this new vision, it has become more challenging to meet the country's higher education expectations (Alharbi, 2016). Researchers believe that university leaders in the Kingdom have to overcome the main challenges of higher education in Saudi Arabia to meet the new vision. The major challenges facing Saudi universities are research productivity, accreditation, and improving quality (Alamri, 2011; Alharbi, 2016). The student's wellbeing is one of the critical issues in terms of the quality of education in universities (see Chapter 4). Researchers have acknowledged the need to consider this issue in higher education in general and in medical education in particular (Jahan et al., 2014).

The Higher Education Department in the Ministry of Education has acknowledged the importance of promoting students' wellbeing through student support services (Smith & Abouammoh, 2013). The extent and depth of these services vary from one university to another in Saudi Arabia. The educational institution might provide students with advice on how to manage their finances, where to obtain suitable places to live, how to keep healthy and potential sources of employment, along with counselling on a range of matters related to student life, advice on study techniques, and help with how to approach writing essays (Smith & Abouammoh, 2013). In parallel with these supportive services, the NCAAA has included the institution's health service availability among the main requirements for accreditation, under the students' safety and risk assessment criteria (see Chapter 8).

CHAPTER 3 LITERATURE REVIEW

This chapter consists of three sections. The first section is a narrative review of background research in the area of medical education, to contextualise and justify the research to be undertaken in this thesis. The second section explains the importance of the medical student's lifestyle habits for the future healthcare system. The third section provides evidence on the influence of the medical curriculum on medical students' knowledge, beliefs, preventive behaviours, and how these impact on the students' wellbeing.

3.1 Medical education and medical students' health status

The medical education research field is somewhat eclectic in terms of the range of pedagogical practices, educational philosophies, and conceptual frameworks that fall under its remit and 'as such' can be potentially confusing to navigate (Swanwick et al., 2019). Nevertheless, it holds much potential to inform various government divisions, given that the ultimate aim of the field is to understand and support public health and clinical practice (Swanwick et al., 2019). Medical education has been defined by the International Institution of Medical Education (IIME) as "a process of teaching, learning and training of students with an ongoing integration of knowledge, experiences, skills, qualities, responsibility and values which qualify an individual to practice medicine, it is divided into undergraduate, postgraduate and continuing medical education, but increasingly there is a focus on the (lifelong) nature of medical education" (McKimm et al., 2017, p. 3). This definition contextualises medical education according to the global and local needs and expectation, also, it gives a chance for new responsibilities to emerge for the future doctors. From their own standpoint, public health providers see the potential importance and cost-effectiveness of this domain in improving medical students' wellbeing and improving the quality of patient care through the health promotion consultation. Recently, the importance of medical students' wellbeing has had been recognised globally (AMSA, 2011; Kemp et al., 2019). Medical education developers acknowledged that promoting medical students' wellbeing requires dedicated resources and effective strategies (AMSA, 2011; Swanwick et al., 2019).

Medical education is more than simply learning the content of a given medical curriculum (Monrouxe, 2010). Planning a medical curriculum involves two main domains: the cognitive epistemological basis, such as medical knowledge, and the skills relating to diagnosis and treatment. Confirming the presence of both domains would provide a context in which broader sets of ideas, values, and beliefs may thrive (Byrne et al., 2012). Learning to be and to act as a healthy role model for patients could be one of these achievable beliefs. However, Wear and Skillicorn (2009) argued that a disconnection to some degree usually exists between what students are supposed to learn and the learning that takes place (Wear & Skillicorn, 2009). In other words, it is how they reflect their knowledge in practice. The reflective practitioner concept is at the centre of the epistemology of professional practice (Schön, 2017; Swanwick et al., 2019). The reflection consists of a constant relaying back and forth between theory and practice on the part of the practitioner and can be thought of as a bridge linking the two (Schön, 2017). Practitioners assess and continually revise theories because they understand that knowledge is rooted in practice. This research aims to explain how medical students reflect the medical knowledge they gain onto their lifestyle behaviours. Moreover, much of the current literature on medical students' health pays particular attention to their emotional and psychological health (Aktekin et al., 2001; Dunn et al., 2008; Peterson et al., 2011; Sani et al., 2012; Slonim et al., 2015). Very limited research has investigated their health behaviours related to preventing noncommunicable diseases, such as T2D, the foremost epidemic health problem in Saudi Arabia.

Gaining entry to medical school is widely seen as a privilege and an achievement in itself. The pressure to succeed during the years that follow is inevitable. Previous studies have noted the high volume and wide range of academic and clinical demands placed on students due to increasingly crowded curricula (Dyrbye & Shanafelt, 2016). Medical students have stated that the academic load and busy schedules are among the top reasons for their stresses. Promoting medical students' wellbeing and preventing the effects of stress and lifestyles that lead to poor health is increasingly recognised as a serious health challenge (Carrieri et al., 2019; Kemp et al., 2019; Wallace et al., 2009), although tracking the effects of medical education on students' preventive behaviours with respect to T2D has been largely unstudied. A considerable amount of literature has investigated and described the health behaviours that might lead to T2D among medical students in the long term, such as stress, obesity, physical inactivity, and certain dietary habits (Bertsias et al., 2003; Desouky et al., 2014; Stephens et al., 2012).

Dyrbye and Shanafelt (2016) reviewed studies investigating burnout among medical students and residents, which were published between 1990 and 2015. The review showed a high prevalence of burnout among medical students and residents due to their academic and learning environment (Dyrbye & Shanafelt, 2016). Despite the comprehensive analysis of the medical students' psychological wellbeing that is presented in Dyrbye and Shanafelt's work, and the welcome recommendation for new strategies to promote students' wellbeing, the medical culture and other contextual factors that drive burnout and stresses among students were out of the scope of the review. Thus, tracking and exploring the influencing factors on the medical students' behaviours seem to be valuable.

Medical schools also had a positive influence on students' lifestyles. For example, the literature has shown that medical students' wellbeing can be better than the general population where they live. A longitudinal study of 97 medical students in the USA showed a modest change in students' lifestyles since joining the medical school and after four years of studying medicine (Brehm et al., 2016). Brehm and colleagues followed medical students for six years and found that their clinical measures at the baseline were at or near healthy values and did not change over time. Similarly, their physical activity and self-reporting dietary intake were acceptable and did not change over time. The prevalence of obesity among the study participants was low; only 6.2% at the baseline and 5.1% at the fourth-year visit were considered as obese. This figure is significantly lower than the 30.3% prevalence among young adults in the USA (Brehm et al., 2016). Even with the high responses in this study, these findings cannot be generalised as all the participants were from one university, and their lifestyle might have been influenced by common factors specifically relevant to one specific university setting.

Researchers in Colombia attempted to overcome this limitation by invited 450 medical students from 50 medical schools in the country to participate in a study that aimed to assess their risk to CVD and T2D. That study assessed the risks in terms of; age, BMI, systolic and diastolic blood pressure, and pathological backgrounds such as existing diabetes and tobacco consumption (Enriquez et al., 2018). Their findings were consistent with the USA study of Brehm et al. (2016); they found that the vast majority of medical students (92%) were at low risk of CVD and T2D and only 2% were at high risk (Enriquez et al., 2018). Even though this is a satisfactory result, this study only used eight questions to validate the risk of CVD and T2D. There were no clinical nor anthropometric measures. Moreover, both studies had omitted factors which go beyond the immediate medical students' lifestyle behaviours. Hence, the totality of influences on medical students' lifestyles is still unclear. Tracking students' lifestyles is an effective way to assess the impact of studying medicine on the medical students' behaviours, but then again, it cannot fully identify the factors shaping these behaviours whether positively or negatively without exploring the beliefs and attitudes of the students directly.

3.2 Promoting healthy lifestyles among medical students

More recent attention has focused on promoting medical students' lifestyles. If students live under stressful conditions, their medical schools have a responsibility to prevent the consequences of this situation on individual students' health and capacity to learn. They are also responsible for preventing any potential adverse consequences for patient care (Grant et al., 2013). In a consensus statement, Australia and New Zealand have outlined recommendations to enhance medical students' lifestyles and wellbeing in medical schools (Kemp et al., 2019). Their main recommendations are to:

- Design curricula that promote peer support and progressive levels of challenge to students.
- Employ strategies to promote positive outcomes from stress and to help others in need.
- Design assessment tasks to foster wellbeing as well as learning.
- Provide mental health promotion and suicide prevention initiatives.
- Provide physical health promotion initiatives.
- Ensure safe and health-promoting cultures for learning in on-campus and clinical settings.
- Train staff on student wellbeing and how to manage wellbeing concerns.

As highlighted above, implementing personal physical health promotion intervention in medical education programmes was one of the main recommendations. The consensus statement highlighted the importance of supporting students' healthy lifestyles through the curriculum or extracurricular activities, such as healthy cooking classes (Kemp et al., 2019). The current evidence suggests that living a healthy lifestyle, such as exercising regularly, was significantly associated with a better quality of life and lower burnout (Dyrbye et al., 2017). Another benefit of promoting healthy lifestyles among medical students is achieving better academic success (Goss et al., 2010; Malatskey et al., 2017). A cross-sectional study conducted among 4,402 medical students showed that practicing aerobic exercise and weight training activities led to a better quality of life compared to those who did not practice exercise. Also, they faced significantly lower burnout (Dyrbye et al., 2017). Furthermore, living a healthy lifestyle encouraged medical students to be a healthy role model for their patients in the future (Koen et al., 2018). All these benefits might be reflected in improving the healthcare system for patients and the wider public (Wallace et al., 2009).

There is a gap in the evidence on the feasibility and the impact of implementing these recommendations on medical students' wellbeing and academic success. A call for longitudinal studies after applying interventions has come from leaders in medical education (Kemp et al., 2019). Likewise, there is limited literature assessing the medical curriculum's influence on students' wellbeing, even among commonly investigated health problems, e.g., psychological health.

A systematic review of 40 studies carried out among US and Canadian medical students assessing depression, anxiety and other indicators of psychological distress showed the lack of evidence explaining how the medical curriculum influences medical students' lifestyles (Dyrbye et al., 2006). Only three studies examined the influence of the type of curriculum on students' health, and none of them could find a clear relationship between the medical curriculum characteristics and students' wellbeing (Dyrbye et al., 2006).

3.2.1 How medical students live today is how they live tomorrow

Lifestyle behaviours developed during the university years are likely to be continued in the years to come, which would increase the risk of T2D and CVD if they were not healthy (Koen et al., 2018) and might affect careers in the future. All health professionals, particularly doctors, have great responsibilities, and the job itself is demanding both physically and mentally. Thus, doctors' performance and wellbeing require special attention and effort (Wallace et al., 2009). A healthy lifestyle among health professionals has been associated with good self-rated physical and mental health wellbeing (Kasila et al., 2018; Tountas et al., 2007) and, thereby, with various positive work-related indicators such as good workability, low sickness absence (Peterson et al., 2011), and less early retirement intentions (Heponiemi et al., 2008).

Health professionals who have lived an unhealthy lifestyle for a long time might not recognise their susceptibility to T2D and other non-communicable diseases and so might not be willing to change their lifestyle (Kasila et al., 2018). Kasila and colleagues (2018) assessed the relationship between health status and the willingness to change risk behaviours among 1,233 doctors and nurses in Finland. They found that the majority of the participants (70%) had at least one T2D risk factor, such as high BMI, low physical activity, smoking or risky alcohol drinking. Moreover, living an unhealthy lifestyle was significantly associated with reporting unwillingness to change their risky behaviours (Kasila et al., 2018). The researchers recommended establishing health interventions to promote health worker wellbeing in an early stage, such as at medical school stage (Kasila et al., 2018).

In response to these calls, the World Medical Association (WMA) statement on doctor wellbeing emphasised the importance of early prevention and health promotion strategies (WMA, 2017). They recommend that such strategies be implemented in cooperation between medical schools and workplaces. Medical students should be able to gain access to health promotion resources, as well as the support provided within and outside of the workplace. Such provision may include counselling, a support network, occupational rehabilitation, and primary prevention programmes that promote a healthy lifestyle (WMA, 2017).

3.2.2 How medical students live today will affect the future of healthcare

In order to provide quality of patient care that emphasises wellbeing, it seems that doctors providing that care should be well themselves. Doctors’ wellbeing has been found to positively impact on the delivery of the care. This manifests itself in the following ways: health promotion counselling, referral to prevention clinics such as smoking cessation clinics, and by being and acting as a healthy role model. Lobelo and de Quevedo (2016) investigated the relationship between doctors' wellbeing and compassionate care. Their study provided interesting evidence on the nature of this relationship. Lobelo and de Quevedo's review, which included 47 studies, described in 24 analytical studies how healthcare providers' own physical activity habits correlated with the physical activity counselling they provided to their patients. Out of these 24 studies, 19 reported a significant positive association between the healthcare providers' physical activity habits and counselling frequency, self-efficacy, or perceived importance. The remaining five studies did not indicate any degree of association (Lobelo & de Quevedo, 2016). However, the majority of the studies included in that literature review had limitations because of their self-reported nature.

The potential impact doctors can have to motivate patients' behaviour has been researched in the last decade (Dresner et al., 2019; Frank et al., 2013; 2010; Lobelo et al., 2009). The studies showed that doctors tend to lead by example, even though such guidance is not necessarily intended and happens spontaneously. Furthermore, the doctors themselves tend to underestimate the effect this has on patients' health. Doctors who live a healthy lifestyle are more confident to counsel their patients about healthy habits. Frank was one of the first researchers who shed light on this health promotion strategy (Frank et al., 2010; 2013; Lobelo et al., 2009). She invited 3,213 Canadian medical practitioners to participate in a cross-sectional study and found a consistent and strong correlation between personal and clinical prevention practices. Frank et al. (2010) found that doctors who do not smoke were much more likely to offer patients guidance regarding smoking cessation. Also, doctors who consumed alcohol infrequently were more likely to advise patients on alcohol consumption. The same trend also applies to exercise, healthy eating, and weight management. Similar significant evidence was found among 1,886,791 patients and 1,488 doctors, whereby both groups were registered in a health maintenance organisation in Israel (Frank et al., 2013). The researchers gained access to complete vaccination and screening records for both primary care doctors and patients working in and attending the same care setting. The study's findings showed that patients of doctors who complied with recommended screening or vaccination practices were themselves much more likely to undergo screening or vaccination compared with patients of non-compliant doctors (Frank et al., 2013). Despite the study's strength in using medical documented data, not self-reported data, the mechanism behind this significant correlation is unclear. It might be related to the confounding factor common to the practitioners and patients such as attitudes or beliefs.

The role of patients’ perceptions toward their doctors’ lifestyle has been omitted in previous studies. Because nonverbal messages are influential and can convince to a greater extent than words, these might also affect the quality of patient care (Lorié et al., 2017). Patients might be sometimes reluctant to accept lifestyle modifications, particularly if they are highly educated and belong to higher economic classes (Harsha et al., 1996). Moreover, a patient might find a doctor, who is of ideal body weight, a non-smoker and takes regular exercise a potential healthy role model (Frank et al., 2000; Harsha et al., 1996). In a behavioural experimental study, two cohorts of participants were asked to watch two health educational videos while sitting in the clinic waiting area. Both videos featured a doctor giving health advice to patients, the difference being, however, that in the first video, the doctor dictated the advice, and in the other video, the doctor offered insights into how they themselves went about maintaining their own health. The second video also featured a bicycle helmet and an apple on the desk at which the doctor sat. Participants exposed to the second video reported greater motivation to follow the featured doctor’s health advice and they thought they were a more credible source of advice than did the patients who watched the first video (Frank et al., 2000).

Bandura’s (1977, 1986) research in social learning and the role of observational learning on behaviour modification might be suitable to explain the above findings. Bandura argued that when people see others similar to them, or who they admire, succeeding because of a perceived behavioural change or practice, they are likely to attempt such change themselves. Patients who observe healthy practices or see evidence of living a healthy lifestyle embodied in their doctors are more likely to try to improve their health than if they cannot see such evidence. However, it might also do the opposite. A Delphi study, carried out among six groups of nursing stakeholders from different departments, explored areas of their opinion toward other roles that nurses might play for patients. One of the investigated regions was being a healthy role model for patients. Thematic analysis of the study's data found a common agreement among the groups' participants that statements such as ‘nurses should be a healthy role model’ were unrealistic and unhelpful. They also believed that role modelling healthy behaviours is not a reasonable professional expectation (Kelly et al., 2017). Therefore, it is expected that some doctors also might not accept these responsibilities.

Some researchers suggested that doctors are in a great enhancing position (a role model) to encourage patients to live healthily (Hart., 2020; Teutsch., 2003; Cardinal et al., 2002; Frank et al., 2000; Harsha et al., 1996). It is therefore, perhaps, important to know something about how medical schools attempt to prepare their students to be tomorrow's role models within their role as medical doctors, but unfortunately this has not been clearly investigated in the literature.

3.3 The influence of medical curriculum on medical students' knowledge, beliefs, preventive behaviours, and wellbeing

3.3.1 Knowledge

Researchers have addressed how medical curricula influence medical students' understanding of health issues outside of the clinical therapeutic scene, such as in global health (Parsi & List, 2008), public health problems (Gurpinar et al., 2005; Koo & Lapp, 2014) and social determinants of health (Emadzadeh et al., 2016). Public health systems try to maintain and improve communities' health by promoting healthy lifestyles at both the individual and community levels (Mehling & Jeong, 2018). The latter include school communities, elderly people, or medical students' communities. The 1910 Flexner report recommended greater integration between medical and public health practices which immediately led to reform (Mehling & Jeong, 2018).

How students comprehend the severity, the vulnerability, and the epidemiological implications of several health problems, including diabetes, at both the local and the global levels, has attracted ever-increasing focus from many medical education scholars and in both national and international academic debates. For example, in Turkey, problems of medical education curriculum's inability to overlap with the health requirements of the Turkish community led the Turkish Parliament and the Turkish Medical Association to report these difficulties and to recommend offering training and educational opportunities for their medical students on their community's health needs (Gurpinar et al., 2005).

In Belgrade, researchers suggested enhancing the medical curriculum with more basic knowledge related to CVD and its risk factors such as obesity and diabetes

(Maksimović et al., 2017). Maksimović and colleagues (2017) used self-administered questionnaires to assess the knowledge and beliefs of a large group of medical students in relation to CVD risk factors. Students in the final year were significantly more knowledgeable about CVD risk factors than first-year students, yet over half of the final-year students could not respond accurately regarding CVD risk factors. Furthermore, some of the final-year students answered incorrectly regarding the extent to which physical inactivity, obesity, T2D, and smoking are related to CVD (Maksimović et al., 2017). Maksimović and colleagues recommended improving knowledge related to CVD prevention measures in the medical curriculum.

Several researchers have shared similar recommendations for medical education curricula after conducting similar studies related to CVD (Amruth et al., 2015; Suryawanshi & Sonawane, 2019) and other health issues such as salt intake (Magalhães et al., 2015), iron deficiency (Kanchana & Pushpa, 2019), cervical cancer (Singh & Baliga, 2021) and physical inactivity (Radenkovic et al., 2019). Nonetheless, these results are not very encouraging, as they failed to integrate what medical students learnt into their daily lifestyle.

3.3.2 Beliefs

Beliefs can influence health behaviours (Becker & Janz, 1985). For medical educators, it is important to consider medical students' beliefs because they work as a mediating connector between medical knowledge and performance (Woloschuk et al., 2004). Therefore, beliefs might influence the way a doctor delivers healthcare to the patients. Consequently, some researchers have acknowledged the need to measure the doctors' beliefs on healthcare outcomes.

Schwartz and Loten (2003) assessed the influence of the type of medical curricula on students' beliefs toward social issues, such as doctor-patient relations. That study was conducted in Otago Medical School, New Zealand, after the curriculum was revised over a period of years, to examine the effect of the revised curriculum. The survey questionnaires were sent to the last cohort of students who studied the old (previous curriculum) and to the first three cohorts of students who studied the new curriculum with an innovative PBL approach. The questionnaires were administered at the start and the end of the academic year to assess the effect of the type of curriculum within the same class and to compare the findings between the two groups. Schwartz and

Loten (2003) found that students following the PBL curriculum scored significantly higher in two of the four subscales assessing the students' beliefs toward social issues in medicine compared to their peers who were following the traditional curriculum (Schwartz & Loten, 2003). The experience of Otago Medical School in establishing the PBL was new, which might have led to the presence of confounding factors such as the tutors' enthusiasm in implementing the innovative curriculum, which might affect the reliability of these findings.

Another three-year longitudinal study showed the influence of medical education on students' attitudes toward social issues declined during the years for reasons that were unclear (Woloschuk et al., 2004). It might be related to the students' motivation and enthusiasm as the first batch of students. However, due to the nature of these cross-sectional studies, it is difficult to measure the improvement and the difference in medical students' beliefs. Moreover, beliefs are hard to measure in isolation from other factors, such as knowledge and behaviours.

Researchers have also examined the influence of medical education on students' attitudes and beliefs in relation to their own wellbeing. In the USA, medical students' attitudes towards health promotion, disease prevention, and physical activities were one of the main predictors of their physical fitness levels (Liang et al., 1993). They also predicted their alcohol consumption and their willingness to counsel their patients about alcohol consumption (Frank et al., 2008). Despite the importance of health promotion to provide healthy lifestyle counselling for patients (Lobelo et al., 2009), topics related to a healthy lifestyle – e.g., physical activity, nutrition and smoking – were rarely mentioned in the formal medical curriculum (Barss et al., 2008).

In Saudi Arabia, researchers have also investigated medical students' beliefs towards healthy lifestyle habits and recommended improving the medical curriculum to address these topics (Alissa et al., 2015). Moreover, Saudi medical students have requested the inclusion of physical activity education in their medical curriculum (El-Gilany & El-Masry, 2011). It might be the type of health promotion intervention they believe matches their needs (Alissa et al., 2015; El-Gilany & El-Masry, 2011). Factors beyond the Saudi medical students' health beliefs, which are expected to influence their behaviour, need to be deeply investigated and reviewed.

The above researchers have suggested that medical educators consider developing a lifestyle curriculum early in students' training to raise awareness of population health issues, provide a professional approach and practical skills for lifestyle assessment, and improve students' lifestyles. Since population health and student lifestyle determinants vary by culture, values, norms, religion, and education, the leaders of medical schools should consider their national public health priorities when developing a lifestyle curriculum (Barss et al., 2008)

3.3.3 Preventive behaviours

The impact of joining the medical school on the students' lifestyles was the core concern for several medical education researchers, particularly those who found evidence of unhealthy lifestyles among medical students. Ball and Bax (2002) were two of the first researchers to study the influence of joining a medical school on students' lifestyles. Via questionnaires, 54 medical students were asked to disclose their health habits, alcohol consumption, depressive symptoms (if any), and satisfaction in different areas of life at the beginning, in the middle, and at the end of a semester. The findings of this research revealed an extensive change in the first-year students' lifestyles: they consumed more alcohol and stopped exercising and socialising as much. These changes also correlated with changes in academic performance and emotional wellbeing. In particular, students who became more socially withdrawn became more depressed when they came to sit their final examinations (Ball & Bax, 2002). Regardless of the strong evidence this study provided, it is to be expected that joining a medical school, particularly in the first year, would bring rapid changes in emotional wellbeing and social life. These findings would be more representative if the researchers remeasured students' life habits in the mid and final years of medical school rather than over one semester. In agreement with Ball and Bax's findings, other researchers have concluded that the characteristics of the medical curriculum, such as intensity and content, may have unintended negative consequences with a high incidence of complaints of stress and unhealthy lifestyles among medical students (Dyrbye & Shanafelt, 2016; Dyrbye et al., 2006; Eisenberg & Burgess, 2015).

Researchers have suggested promoting health behaviours among students through tailored health promotion lifestyle courses (Alissa et al., 2015; Barss et al., 2008; El-

Gilany & El-Masry, 2011). The curriculum developer at the University of Medicine and Dentistry, New Jersey, developed a 60-hour ‘Health Beliefs and Behaviour module’. This module was designed to educate third-year medical students regarding the effects of unhealthy behaviours on health and wellbeing and provide medical students with the tools to facilitate health behaviour changes among patients. Upon completing the module, students reported greater confidence in their ability to counsel patients on how to lead a healthier lifestyle (Moser & Stagnaro-Green, 2009). Although this study did not measure the impact of the curriculum on the lifestyles, the findings positively influenced students’ self-confidence and improved their ability to recommend health promotion and behavioural strategies to their patients. However, it is not clear whether this intervention's effectiveness would translate into students’ own behaviours.

At Harvard Medical School, Conroy et al. (2004) reported significant improvement in second-year medical students’ health habits resulting from engagement with an innovative curriculum of preventive medicine and nutrition guidance. The study assessed the impact of the curriculum on students’ lifestyles as well as their confidence in counselling patients about diet and physical activity. One hundred and eighteen students participated and completed a written survey before and after the course. The students’ confidence in their ability to counsel regarding diet and physical activity significantly improved after completing the course. The course's completion also correlated with a substantial decrease in students’ self-reported consumption of saturated fat and fatty acids. Seventy-two per cent of the students reported an improvement in their diet but only 18% perceived an improvement in physical activity habits (Conroy et al., 2004). This study gave clear evidence of the effectiveness of tailoring the health promotion curriculum to the students’ wellbeing. Number of researchers showed similar positive evidence after following the impact of health promotion curricula on medical students’ dietary habits and their ability to counsel patients on nutrition (Monlezun et al., 2018; Razavi et al., 2020). Furthermore, a health promotion curriculum also significantly improved the healthy lifestyle of qualified health professionals (Shahar et al., 2009).

3.3.4 Promoting medical students' wellbeing

The studies discussed above show that recent innovations in medical curricula not only seek to impart knowledge but also to positively impact attitudes, develop counselling skills, and encourage students themselves to lead healthy lifestyles. These practical developments indicate increasing scholarly recognition of the need for medical curricula to cultivate students' wellbeing (Ball & Bax, 2002; Dyrbye & Shanafelt, 2016; Dyrbye et al., 2006; Eisenberg & Burgess, 2015).

Scholars widely maintain that learning environments consist of formal and hidden curricula, as already mentioned in Chapter 1. The formal curriculum is more easily measured, modified, and controlled by medical schools. A formal curriculum can be understood in terms of its structure, duration of classes, varying degrees of attention paid to didactic, clinical, and testing experiences, and the types of scales used to evaluate student performance. The limited research focus to date is extensively on the relationships between curriculum structure and students' wellbeing.

Scholars have also suggested multiple approaches to encouraging medical students to adopt healthy lifestyles including the implementation of a wellbeing curriculum, self-care (Eisenberg & Burgess, 2015; Malatskey et al., 2017), and using non-intrusive monitoring and assessment methods: for example, pass/fail grading in preclinical courses (Lyndon et al., 2017), providing students with role models, and encouraging social connections and support (Dyrbye et al., 2019). Medical schools have also been encouraged to facilitate health fitness resources and provide access to self-assessment tools for students to keep track of their wellbeing levels (Dyrbye et al., 2006; 2019; Lyndon et al., 2017).

A cross-sectional comparative study showed that a shift to the PBL, progressive testing and the adoption of the pass/fail assessment method led to an increase in health-promoting behaviours among students (Lyndon et al., 2017). In that study, 437 medical students followed a traditional curriculum while 446 medical students followed a revised medical curriculum that replaced lecture-based learning with PBL and with progress testing for all the years instead of the annual examination. It also replaced the traditional numerical or letter-grade hierarchical systems with the pass/fail assessment method. This study found a statistically significant improvement in students' health-promoting behaviours after following the revised medical curriculum, particularly among the fourth-year study cohort. Still, there was no correlation between curriculum revision and motivation and burnout (Lyndon et al., 2017). Consistent with that, the PBL curriculum did not positively influence nursing students' academic performance either but did improve their wellbeing and decreased absenteeism (Jones & Johnston, 2006).

According to Jones and Johnston (2006), the positive changes of the PBL curriculum on students' wellbeing compared to the traditional curriculum would be due to students on the new curriculum having fewer worries regarding academic load and clinical concerns. It might also be the result of the way in which the school and students interacted (Jones & Johnston, 2006).

Several studies of medical students in Germany have drawn conclusions which support this justification. They found that students following PBL felt more supported than did their peers on the traditional curriculum, through study conditions and social support at university (Kiessling et al., 2004). Moreover, German medical students described the PBL curriculum as a supportive learning method. They also added that the PBL included high quality teaching, and that they were able to easily communicate with tutors and peers (Kiessling et al., 2004).

In relation to the PBL medical curricula' academic effectiveness, several reports have shown inconsistent satisfaction results between different medical schools. However, a meta-analysis study conducted among 270 published comparison studies, which were all carried out in one medical school, Maastricht University in the Netherlands, one of the well-established PBL medical schools concluded that students and graduates from the PBL curriculum performed much better in the area of interpersonal skills and practical medical skills (Schmidt et al., 2009). Furthermore, students consistently rated the quality of the curriculum as higher than the traditional one. The authors also found that fewer students dropped out of the PBL curriculum compared to the traditional one, and those who completed the course needed less time to graduate. Finally, they concluded that PBL curricula can have positive effects on learning because they deemphasise direct instruction (Schmidt et al., 2009). On the whole, and with respect to the limited evidence assessing the relationship between students' health promotion behaviours and the learning environment of medical schools, researchers have recommended that medical schools consider optimising the formal curriculum structure and assessment methods to reduce students' distress and promote their health (Wasson et al., 2016).

In the context of T2D preventive behaviours, researchers have paid attention to the importance of preparing students to be aware and competent to prevent this epidemic on personal and public levels. Eisenberg and Burgess (2015) encouraged health educators to 'think outside the box' in order to prepare the future doctor for preventing T2D and obesity. The researchers also recommended teaching students cooking skills and practicing self-care. And inclusion of didactic and experiential learning modules relating to nutrition and diet, exercise and movement, sleep and rest, mindfulness and its application to self-care, as well as the most up-to-date research relating to behavioural change strategies in future curricula (Eisenberg & Burgess, 2015). Becker et al. (2010) suggested that adding the concepts of positive health and mindfulness to the medical curriculum and textbooks is an important strategic step toward promoting health (Becker et al., 2010).

Medical students' wellbeing and personal health promotion behaviours were not clearly identified through the Saudi standards and frameworks. This area was explained further in Chapter 8. However, in CanMeds, a similar medical framework to SaudiMEDs (Shadid et al., 2019), students' wellbeing was clearly described as part of professionalism (Frank et al., 2017). Furthermore, self-care is one of the main components of teaching professionalism courses (McKimm et al., 2017). In the CanMeds framework it was stated that in order "to provide optimal patient care, physicians must take responsibility for their own health and wellbeing and that of their colleagues" as part of their professionalism (Frank et al., 2017, p. 26). Despite the contextualisation of doctors' wellbeing and health promotion behaviours in medical professionalisation literature, the Arabic perception of professionalism seems to be missing these components in their own definition of professionalism. Professionalism is a social contract between doctors and society (Al-Eraky & Chandratilake, 2012; McKimm et al., 2017). Thus, professionalism cannot be conceptualised independently of its wider social context and is inevitably shaped by wider culture (Al-Eraky & Chandratilake, 2012). Subsequently, it was suggested that the way medical students learn professionalism in Saudi Arabia should be improved (Adkoli et al., 2011; Guraya et al., 2016). Lack of positive role models and inclusion of professionalism in the formal curriculum were some of the challenges that medical students identified when they were invited to participate in focus group discussions (Adkoli et al., 2011). How medical students in Saudi Arabia learn self-care and how to promote their health requires an in-depth investigation to understand how the medical curriculum influences their health.

The theoretical rationale for curriculum development can be viewed from multiple perspectives. It may have a cognitive epistemological basis, such as knowledge gain or skill development, or it may be more liberal in providing a context in which broader sets of ideas, values, attitudes, and health behaviours may develop. There is always, inevitably, a lack of correlation between the knowledge and skills that students are intended to learn and what they ultimately learn in practice. Health educators who subscribe to the formal curriculum's effectiveness hold that medical students acquire knowledge, skills, and attitudes through formal and informal instruction in lecture halls, seminar rooms, labs, tutorials, and various types of clinical settings. Nevertheless, scholars widely accept that what students learn is sometimes directly at odds with the didactic aims of the formal curriculum.

Despite the richness of assessing medical and healthcare students' health promotion behaviours, the overall status of their health behaviours and how their medical education influences their knowledge, beliefs and behaviours is not clear. Factors beyond negative or positive health behaviours were insufficiently investigated among students in Saudi Arabia. Developing a systematic understanding of how medical students' self-perceptions are shaped through their learning might help create educational strategies that place medical students' sense of identity at the core of medical education.

3.4 Conclusion

Medical schools play a significant role in shaping future doctors' lives, not only educating them and preparing them for the responsibilities of professional life but also shaping their personal development. Research indicates that the influence of the medical curriculum on medical students' knowledge, beliefs and behaviours related to T2D is a gap in the evidence. A close relationship might exist between doctors' wellbeing and compassionate care for patients. While attention has been given to medical students' unhealthy lifestyle habits, less attention has been paid to preventing these habits and promoting the future doctor's wellbeing.

This literature review has shown that the medical curriculum is a source of stress and other T2D risk factors which might negatively impact patient care in the future. Also, despite the extensive recommendations of promoting students' wellbeing through improving medical education, little is known about the effect of enhancing the medical curriculum.

Also, as noted through this review, most of the studies conducted among medical students have been quantitative studies; additional insight might be gained from the qualitative or mixed method approaches. Qualitative analysis has the advantage of being able to identify the medical students' voices and their lived experiences, and to understand the real challenges that they face, which may be missed by rigid and closed-ended questions of a quantitative survey. Hence, this thesis' results derived from both quantitative and qualitative components extends the existing knowledge and literature in this area.

Since medical schools play an essential role in shaping students' wellbeing values and practices, it seems apparent that such institutions should also take active responsibility for cultivating health-promoting behaviours. Ultimately, medical educators should provide an environment that maintains and restores health and wellbeing for medical students. The findings from this thesis may help medical educators understand how best to take such responsibility for their students.

CHAPTER 4 HEALTH PROFESSIONAL STUDENTS' KNOWLEDGE, BELIEFS AND BEHAVIOURS RELATED TO PREVENTING TYPE 2 DIABETES AND ITS RISK FACTORS IN SAUDI ARABIA: A SYSTEMATIC REVIEW

This chapter describes a systematic literature review relating to Saudi medical students' knowledge, beliefs, and behaviours regarding preventing T2D and its risk factors. The chapter begins by outlining the research method used in this review and lists all considered publications. Next, the information found in the included studies is discussed. The chapter ends with considering the importance of the studies for the present thesis and identifies gaps within the analysed studies.

4.1 Objectives of the systematic review

This systematic review had two main objectives:

The primary objectives:

1. To identify and summarise the relevant literature on the knowledge, attitudes and behaviours relating to T2D and its risk factors among medical and healthcare students in Saudi Arabia, as well as the factors influencing these perceptions and behaviours.
2. To identify the influence of medical education on knowledge, attitudes and behaviours relating to T2D and its risk factors among medical and healthcare students in Saudi Arabia through tracking changes in knowledge, attitudes and behaviours during several years of academic study.

The secondary objective: To use the findings of this review in developing the research instrument of this thesis, particularly for assessing what encourages and prevents students from following a healthy lifestyle. The impact of this objective is considered in Chapter 5.

4.2 Materials and methods

The shift toward using evidence-based practices in healthcare decision making has resulted in the increasing use of systematic reviews to make sense of rapidly expanding bodies of available research (Hawker et al., 2002). The systematic review gained in popularity among researchers during the 1990s (Bryman, 2016). Greenhalgh described it as “an overview of primary studies which contains an explicit statement of objectives, materials, and methods and has been conducted according to explicit and reproducible methodology” (Greenhalgh, 1998, p. 672).

Systematic reviews differ from narrative reviews not only in terms of article length but also in the purpose of the review (Hawker et al., 2002). The systematic reviews aim to (a) answer a specific question or questions, (b) reduce bias in the selection and inclusion of studies, (c) appraise the quality of studies deemed relevant, and (d) summarise them objectively (Hawker et al., 2002; Petticrew, 2001). To meet these aims, the systematic review applies detailed selection criteria determined at the start of a study, which is made explicit and referred to at each stage of the review. The inclusion criterion in the systematic review methodology breaks down the research aim and questions and implements them by putting them into practical terms to narrow the focus of the review and determines whether particular studies should be considered at each stage of assessment or not (Hawker et al., 2002).

4.2.1 Search database and strategies

A comprehensive approach was used to appraise and synthesise the existing research evidence. This systematic review was undertaken in two stages; the first stage focused on knowledge, beliefs and behaviours related to healthcare professional students’ perceptions of public health issues in Saudi Arabia. The second stage is the updated stage, and it focused on knowledge, beliefs and behaviours related to healthcare professional students’ perceptions of T2D and its risk factors (see Figure 4.1).

The major databases of general medical bibliographic – MEDLINE, PubMed, CINAHL, Applied Social Sciences Index & Abstracts (ASSIA), PsycINFO, British Education Index (BEI) and Educational Resources Information Centre (ERIC) – were searched for all original, English-language articles from 1st January 2000 to 28th February 2017. The Arabic-language articles were not included, as the medical and healthcare studies journals in the Arab world publish articles in English-language with abstracts translated to Arabic. The decision to limit the search to this timeframe was made because medical education is a relatively new field that has seen substantial growth in the last two decades.

Medical subject headings or text words used in the searches were 'knowledge' OR Belief* OR 'behav* (behavior)', combined with (AND) 'student*' OR 'undergraduate' OR 'health professional*' or 'medical' or 'dental' or 'pharmacy' or 'nursing' combined with (AND) 'Saudi Arabia'. Furthermore, the reference lists retrieved from the included articles were reviewed to identify additional, relevant papers.

The extractions from MEDLINE, PubMed, CINAHL, ASSIA, PsycINFO, BEI and ERIC were restricted to original studies that focused on health professional students studying in Saudi universities (Appendix 1). The selection and inclusion of relevant studies were made according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines (Moher et al., 2009). PRISMA was developed to help researchers improve the reporting of systematic reviews and meta-analyses (Moher et al., 2009). It mainly focuses on randomised trial reviews, but PRISMA can also be used as a tool for reporting systematic reviews of other research types (Moher et al., 2009). The PRISMA guidelines were adopted during the data collection and reporting stages, as shown in Figure 4.1.

Following the publication of the PRISMA statement in 2010 (Moher et al., 2009), the UK Centre for Reviews and Dissemination at the University of York in England responded to its recommendation for prospective systematic review registration by developing an international prospective register of systematic reviews with health-related outcomes (Booth et al., 2012). The objectives were to reduce unplanned duplication of reviews, provide transparency in the review process, and minimise reporting bias (Booth et al., 2012; Sideri et al., 2018). To ensure the originality and quality of this systematic review, the protocol was sent to the International Prospective Register of Systematic Reviews, known as PROSPERO, database in April 2017. The protocol was registered with PROSPERO and received a serial number (CRD42017060629). (Appendix 2).

4.2.2 Inclusion criteria

- Aim: studies which investigate the knowledge, attitudes, behaviours and wellbeing of health professionals' students.
- Study population: health professional students (medicine, dentistry, nursing and applied medical sciences, pharmacology) in Saudi universities.
- Study design: any original empirical quantitative, qualitative or mixed-method study.
- Study language and date: articles published in English from 1st January 2000 to 28th February 2017.

4.2.3 Exclusion criteria

- Study population: any studies conducted on students of subjects not included within the general remit of healthcare studies. Saudi students in non-Saudi universities, even if they are healthcare students.
- Study design: review papers, editorials, and opinions.

4.2.4 Screening and selecting eligible studies

Once the search of the selected databases had been performed according to the abovementioned criteria, the resulting studies were imported into the referencing software, Endnote, which detected any duplication and managed the identification of eligible articles. Endnote also helped to identify articles that should be excluded based on the exclusion criteria given above.

The initial search procedure identified 342 publications, with a further 122 found on reference lists as well as other sources identified as eligible (e.g., Google Scholar). One hundred and seventy-five articles were removed because they were duplicates, and a further 195 articles were deemed irrelevant after assessing their titles and abstracts. Full copies were obtained for the remaining 94 articles. Of these, 44 were excluded because they did not match the inclusion criteria: eight because they examined the prevalence of health problems without investigating relevant knowledge, beliefs, behaviours, or other factors influencing related behaviours. A further 25 were excluded because they addressed the topic from a clinical rather than a public health perspective, 10 constituted reviews rather than primary research. The remaining 50 studies were included in the review (see Figure 4.1).

The included 50 studies differed in their nature, determinants, risk factors and preventive factors among medical and healthcare students. These disparities made it difficult to navigate the assessment process of the influence of medical education on medical and healthcare students' T2D preventative behaviours. Therefore, in March 2020, the analysis of the systematic review was updated by narrowing the research scope. In the new analysis plan, only the health problems that named T2D, or the health problems considered as a risk factor for T2D, were selected from the 50 included studies from the prior stage. Consequently, a further 18 studies were excluded from the total number of studies eligible for consideration. These 18 articles were excluded because they investigated health problems that are not related to the newly updated research remit. Three of these studies related to oral health, alcohol, and energy drinks; five of them investigated different types of drug abuse; one looked at road traffic regulations; another unnecessary cosmetic surgery; two focused on AIDS; two studied hepatitis B and C; two looked at types of cancer research, and a further two focused on respiratory diseases.

On completion of this stage, a full-text review of the remaining 32 articles was conducted, and the articles were categorised according to the investigated T2D risk factor, or under the T2D category. The categories were designated as follows: smoking; physical inactivity and nutrition; mental health; and T2D. Among the 32 studies, 13 studies were performed among healthcare students, and 19 studies among medical students.

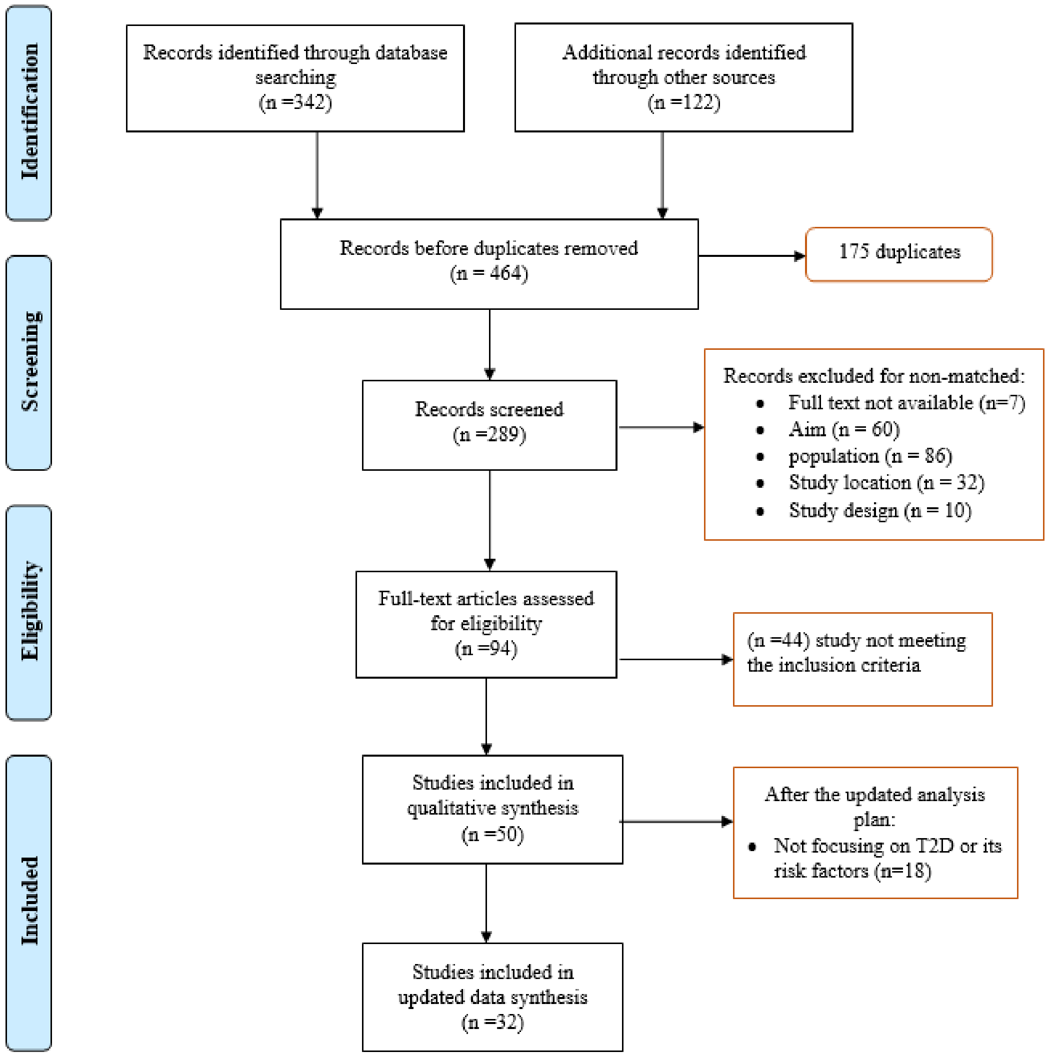

Figure 4.1: Literature selection flow diagram.

4.2.5 Quality assessment

The terms ‘quality’, ‘validity’ and ‘bias assessment’ have been used interchangeably in the systematic review literature to describe methodological aspects conditions that are relevant to the validity of study results (Hartling et al., 2009). According to PRISMA guidelines, conducting a bias assessment in systematic reviews is highly recommended, and should be reported at the outcome level, or study level, or both (Moher et al., 2009;

Shamseer et al., 2015). These recommendations mainly apply to interventional research, as the PRISMA guidelines were developed mainly to guide randomised control trials (Shamseer et al., 2015), to ensure standardisation of measurement tools. Thus, to ensure the quality of this systematic review, it was essential to search for an appropriate quality assessment method for the qualitative and quantitative research (Shea et al., 2007). In 2002, Hawker and colleagues pointed out that qualitative research had no universal quality assessment methods and went on to develop such methods in a systematic review study (Hawker et al., 2002). Debates about how to grade or judge research studies using qualitative, or a combination of qualitative and quantitative, methods is continuing. In the present study, both qualitative and quantitative research studies were expected to be included. Thus, Hawker's guidelines were adopted (Hawker et al., 2002). Hawker et al.'s (2002) quality assessment methods can be applied to qualitative, quantitative, or mixed-methods' studies.

In developing their critical appraisal tool in 2002, Hawker and colleagues developed a system that made it possible to calculate a total score indicating the methodological rigour of any given empirical study. The tool examines the research design protocol. This tool allows for a critical appraisal of nine domains: introduction and aims, method and data, sampling, data analysis, ethics and bias, findings/results, transferability or generalisability and implications, and usefulness. According to pre-specified characteristics, each domain is classified as 'good', 'fair', 'poor', or 'very poor' (Appendix 3) (Hawker et al., 2002). These descriptors are then converted into numerical scores, with one point indicating 'very poor' quality, ranging up to four points indicating 'good' quality. This produces a score of between nine and 36 points for each study. To give an overall quality grade, the following definitions from a previous study were adopted (Lorenc et al., 2013): high quality (A), 30–36 points; medium quality (B), 24–29 points; and low quality (C), 9–23 points.

In this study, two reviewers (R.A and F.A[1]) reviewed the selected papers independently according to Hawker's criteria (Hawker et al., 2002). The quality assessment results were

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[1]R.A: Reem Almutairi, the main researcher of this thesis.
F.M: Fatemah Almoayad, an assistant professor in the College of Health and Rehabilitation Sciences at Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia.

discussed before applying the final grade if there was no matching of the suggested grades. The quality assessment process showed that the majority of the included studies were classed as high-quality studies (n=24). Four studies were classed as being of medium quality (Al-Saleh et al., 2010; Alissa et al., 2015; Alonazi et al., 2016; Hashim, 2000; Inam, 2007; Subhan et al., 2009) whereas one study was classed as being low-quality assessment (Al-Turki, 2006). In general, most of the studies had a small sample size. In some studies, there were also issues with insufficient details provided about recruitment strategies inclusion and exclusion criteria; there was a lack of clarity in the rigor of the data analysis and reporting of ethics (see Table 4.1).

Table 4.1: Results of Hawker quality assessment tool for the included studies

Articles	Abstract and title	Introduction and aims	Method and data	Sampling	Data analysis	Ethics & bias	Results	Transferability or generalizabilit	Implications and usefulness	Total score	
Hashim (2000)	4	4	3	2	3	1	3	3	3	26	B
Al-Turki (2006)	4	4	2	1	2	1	2	3	3	22	C
Inam (2007)	4	4	2	2	3	3	3	3	3	27	B
Subhan et al. (2009)	1	3	2	3	3	4	3	4	4	27	B
Al-Haqwi et al. (2010)	4	4	2	3	4	4	4	4	4	33	A
Al-Saleh et al. (2010)	3	4	3	2	4	4	3	2	4	29	B
Taha et al. (2010)	4	4	3	3	4	3	3	3	3	30	A
Abdulghani et al. (2011)	4	4	3	3	3	4	4	3	3	31	A
Al-Kaabba et al. (2011)	4	3	2	4	4	4	4	3	3	31	A
El-Gilany & El-Masry (2011)	4	4	3	3	4	4	3	3	4	32	A
Wali (2011)	4	4	2	3	4	4	4	3	4	32	A
Abdulghani et al. (2012)	4	4	3	4	4	4	3	3	4	33	A

Allam et al. (2012)	3	4	3	3	4	3	4	3	4	31	A
Alrsheedi & Haleem (2012)	4	4	3	2	4	3	4	3	4	31	A
Azhar & Alsayed (2012)	4	4	3	4	4	4	4	4	4	35	A
Sani et al. (2012)	4	4	3	4	4	4	4	4	4	35	A
Abdulghani et al. (2013)	4	4	3	3	4	3	4	3	3	31	A
Al Wadaani (2013)	4	4	2	3	4	3	4	3	4	31	A
Almutairi (2014)	4	4	4	3	4	4	4	4	4	35	A
AlSwuailem et al. (2014)	4	4	4	4	3	4	3	3	3	32	A
Awadalla et al. (2014)	4	4	3	4	4	4	4	3	4	34	A
Ibrahim et al. (2014)	4	4	3	4	4	4	4	4	4	35	A
Jradi & Al-Shehri (2014)	4	4	3	3	4	3	4	3	4	32	A
Aboalshamat et al. (2015)	4	4	3	3	4	3	4	3	4	32	A
Alissa et al. (2015)	4	4	2	4	3	3	3	3	3	29	B
Majeed (2015)	4	2	4	3	3	4	4	3	4	31	A
Al-Drees et al. (2016)	4	4	2	4	4	4	4	3	4	33	A
Alonazi et al. (2016)	2	3	2	3	3	4	3	3	3	26	B
Al-Qahtani (2016)	4	4	2	4	3	2	3	4	4	30	A
Awan et al. (2016)	4	4	4	3	2	4	3	3	3	30	A
Sabra & Taha (2016)	4	4	3	3	4	4	4	3	4	33	A
AlQahtani (2017)	4	4	4	4	4	3	4	4	4	35	A

4.2.6 Data synthesis

After preparing the final list of the included studies and dividing them into influencing studies and descriptive studies, data were summarised into a compilation table that included: general information (first author's name, year of publication, location of study, particular health issues), information about the study population (the speciality of health professional students, age, gender, sample size), and description of the findings with regard to knowledge, beliefs, and behaviours, and whether these findings were influenced by medical education or not, together with a list of the mentioned influencing factors.

4.3 Results

4.3.1 Description of the retrieved studies

The literature review revealed a considerable amount of evidence relating to Saudi healthcare professionals' perceptions of, and behaviours relating to, T2D and its risk factors (see Appendix 4). Despite the large number of studies included in the first stage (50 articles), the extent of investigation and interest in tracking the influence of the undergraduate medical curriculum on students' knowledge, beliefs and behaviours was limited. The included studies in the second stage (32 articles) were divided into two groups: (a) descriptive studies (n= 12), which identify current knowledge, beliefs and behaviours of students related to the investigated health issue and (b) influencing studies (n=20), which look at the influence of medical education on students' knowledge, beliefs and behaviours through comparing first-year with final-year students, or through comparing students from medical and healthcare schools with those from other non-health professionals' programmes (see Figure 4.2).

The study populations in these papers were mostly from medical schools (n=19), and the remainder were from other health professional programmes (n=13). The studies were conducted in all regions in Saudi Arabia. Thus, the overall result of this review might represent a sample of the whole Saudi population, as well as similar populations in the Arabian Gulf region.

The retrieved studies were conducted through quantitative cross-sectional methods only. The data were collected by self-administered questionnaires – paper, or electronically based. There were no qualitative or mixed-methods studies which reveal a gap in the knowledge in this field. Knowledge, beliefs and behaviours were explored in five studies only. Four of these assessed the students' knowledge and perceptions of and behaviours relating to smoking (Al-Haqwi et al., 2010; Azhar & Alsayed, 2012; Hashim, 2000; Wali, 2011) and diabetes (Al Wadaani, 2013). None of these studies highlights the relationship between those three aspects. Moreover, none of these studies investigated whether better knowledge or positive attitude might correlate with health-promoting behaviours, or not.

The reason for the high number of studies conducted among medical students compared to other healthcare students was unclear. However, one of the possible reasons might be that the significant changes to medical education curricula in most Saudi medical schools over the past 20 years has prompted researchers to assess the impact of these changes. For example, most of the researchers recommended modifying the medical curriculum to have a more comprehensive impact on students' knowledge and wellbeing.

As previously explained, the 32 articles were classified into two groups. The first group consisted of 12 studies that focused solely on describing the knowledge, beliefs and behaviours of students. The second group consisted of 20 studies that, as well as describing the knowledge, beliefs and behaviours of students, also assessed the influence of medical education on at least one of these three components of the student experience. Within the second group, 10 studies found no significant influence of medical education on the students' knowledge, beliefs and behaviours. In contrast, five studies found significant positive influences of medical education on preventing unhealthy behaviours, such as smoking. Moreover, five studies reported a negative influence of medical education on the students' beliefs and behaviours, as shown in Figure 4.2 and Table 4.2.

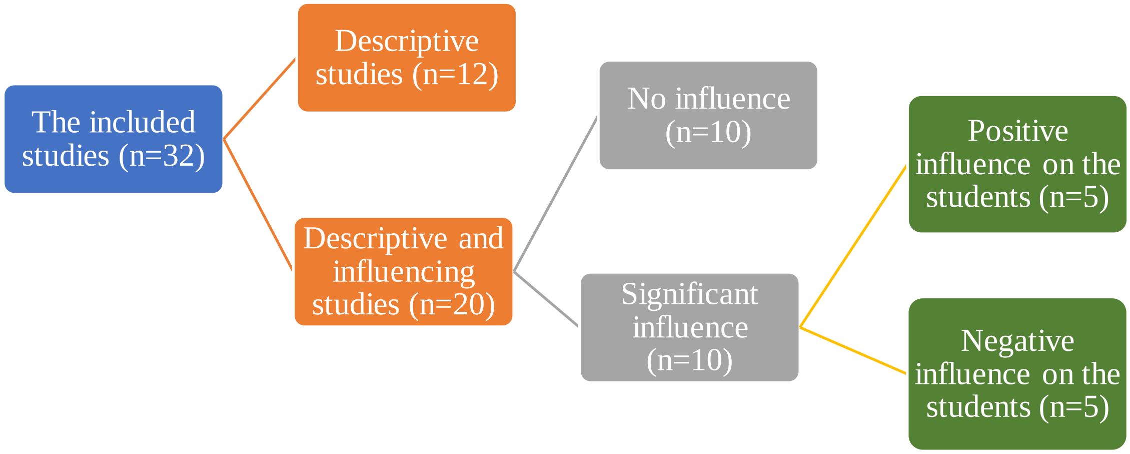

Figure 4.2: Classification of the selected studies in the systematic review.

In addition to the lack of methodological rigour mentioned above, two other difficulties emerged from this review. Firstly, most of the included studies did not specify the curriculum's overall design or educational approach. Due to the variation between the geographical locations, specialities, and types of curricula it was difficult to ascertain any link between students' knowledge or beliefs toward health problems and the type of curriculum used. However, based on their findings, most studies recommended improving curriculum content or the teaching methods. Therefore, this review was unable to investigate the potential relationship between the type of the medical curriculum and the students' knowledge, beliefs, and preventive behaviours.

The second issue is the lack of any standardised evaluation of the level of the students' knowledge or beliefs. Even when test scores were reported, it is impossible to compare these (and subsequent assessment of knowledge or behaviours) between different professional programmes as these mean different things in different contexts. Most of the included studies were carried out and analysed by a university faculty member where the study took place. They were, therefore, familiar with the study participants, their characteristics, and levels of knowledge. This review has consequently used the investigators' descriptions for the level of knowledge or beliefs of their participants, acknowledging that this review is not comparing like with like.

Table 4.2: The main findings of the included studies in the systematic review

	Health issue	ME influence	Knowledge	Beliefs	Behaviours
Hashim (2000)	Smoking	Not assessed	• 73% of the students are aware of smoking hazards.	• 88% of the students believed smoking to be detrimental to health • 70% of smoking students are willing to quit.	• 29% of the students are smokers.
Al-Turki (2006)	Smoking	Not assessed	---	---	• 13% of the students are smokers (male)
Subhan et al. (2009)	Smoking	Negative influence	---	---	• 11.1% of the students are smokers.
Taha et al. (2010)	Smoking	Not assessed	---	---	• 12.6% of the students are smokers.
Al-Haqwi et al. (2010)	Smoking	Negative influence	• 94% of the students were aware that smoking can cause serious illnesses, especially lung cancer and heart disease.	• 90% of the students would advise their patients to quit smoking. • 88% of the students thought that smoking should be banned in public areas. • 20% of the students believed that smoking has some beneficial effects. • 24% of the students believe that smoking is a coping strategy for stress alleviation. • 5% of the students thought that smoking plays a role in preventing some diseases like Parkinsonism and viral diseases.	• 19% of the students are smokers (all were male).

	Health issue	ME influence	Knowledge	Beliefs	Behaviours
Al-Kaabba et al. (2011)	Smoking	No variation	---	---	• 17.6% of the students are smokers.
Wali (2011)	Smoking	Negative influence	• 96.6% of the students were aware of health complications resulting from smoking. • 9.5% of the students thought that smoking a water pipe is not harmful • 50-68.7% of the students were aware of the link between smoking and having a stroke.	• 90% of the students believed that doctors should set a good example by not smoking.	• 24.8% of the male students and 9.1% of the female students were smokers.
Alrsheedi and Haleem (2012)	Smoking	Not assessed	---	• 71.2% agreed that health professional students smoke is a problem that needs to be addressed. • 9.5% students did not consider it a problem. • 74.7% agreed that health professional students should serve as a role model for their patients and the public.	• 16% of the students are smokers.
Azhar and Alsayed (2012)	Smoking	Positive influence	• All the medical students are aware of the consequences of smoking.	• 23.9% of medical student said that being a medical student had affected their smoking habit. • 26.1% said it had not. • None of the students said they encouraged others to smoke.	• 0.65% of the students are smokers.
Abdulghani et al. (2013)	Smoking	Positive influence	---	---	• 0.86% of the students are smokers.

	Health issue	ME influence	Knowledge	Beliefs	Behaviours
Almutairi (2014)	Environmental tobacco smoke	Not assessed	---	• 99% of the students held positive attitudes toward tobacco control. • 93.1% of the students felt that healthcare professionals should be required to receive training for cessation counselling. • 87% of the students believed that healthcare professionals should serve as public health role models. • 87% of the students believed that advertisement for tobacco products and smoking in public places should be banned.	• 4.7 % of the students are smokers. • 57.7 % of the students reported that the exposure to the environmental tobacco smoke was much higher in public places. • 13.9% of the students reported being exposed to environmental tobacco smoke at home.
AlSwuailem et al. (2014)	Smoking	No variation	---	• 92% of the students believed that they should act as a role in smoking cessation programmes. • 66% of the students thought that their advice to patients who smoke is likely to increase the chance of the patient's quitting. • 63% of students believed that public tobacco use is not well addressed in the current college curriculum. • 68% thought that they would need special training in tobacco cessation interventions.	• 17% of participants are smokers. • Most smokers used shisha only.

	Health issue	ME influence	Knowledge	Beliefs	Behaviours
Jradi and Al-Shehri (2014)	Smoking	Not assessed	• 53% of students possessed low levels of knowledge related to the health risks of smoking. • 66% of students possessed fair knowledge of the benefits of smoking cessation. • 75% of the students knew the health risks of second-hand smoke.	---	• 19.4% of participants are smokers.
Awan et al. (2016)	Water-pipe smoking	Positive influence	• 14.9% of students failed to identify a single harmful effect of water-pipe smoking. • The majority of students considered it less harmful than cigarette smoking.	---	• 62.1% of participants are smokers.
Sabra and Taha (2016)	Water-pipe smoking	Positive influence	• 78.4% of the students possessed good knowledge regarding health complications resulting from water-pipe smoking.	• 57.4% of shisha smokers were thinking of quitting smoking. • 42.6% of smoker students were not thinking, or had no plans to quit, smoking.	• 12.6% of participants are smokers
AlQahtani (2017)	Smoking	Negative influence	• The majority of the students were well-aware of the serious complications resulting from smoking.	---	• 30% of participants are smokers.
Inam (2007)	Anxiety and depression	No variation	---	---	• Prevalence of anxiety and depression in females was 66.6% and among males it was 44.4%.
Al-Saleh et al. (2010)	Perceived stress	Negative influence	---	---	• The score of stress ranged from 1.06 to 3 with a mean score of (2.23± 0.31).
Abdulghani et al. (2011)	Stress	Positive influence	---	---	• The prevalence of stress was 63%.

	Health issue	ME influence	Knowledge	Beliefs	Behaviours
Abdulghani et al. (2012)	Sleeping disorder	No variation	---	---	• 36.6% of participants • had abnormal sleep habits. • Normal sleep associated with high grades.
Sani et al. (2012)	Stress	Negative influence	---	---	• The prevalence of stress is 71.9%.
Aboalshamat et al. (2015)	Depression, anxiety, stress, self-efficacy and satisfaction	Not assessed	---	---	• High levels of depression (69.9%), anxiety (66.4%) and stress (70.9%). • Normal levels of self-efficacy and life satisfaction.
El-Gilany and El-Masry (2011)	Physical inactivity	Not assessed	---	• 70% of students perceived that physical activity promotes and maintains health.	• 41.1% of the students were physically inactive.
Ibrahim et al. (2014)	Risk factors of Coronary Heart Disease	Not assessed	---	---	• 57.9% of the students were physically inactive • 31.2% of the students were overweight or obesity • 73.4% consumed a high-fat diet daily. • 13.1% consumed fast food daily. • 2.8% of participants are smokers.
Awadalla et al. (2014)	Physical inactivity	No variation	---	---	• 58% of the students were physically inactive.
Alissa et al. (2015)	Nutritional and lifestyle habits	No variation	• 94-75% of students were aware of the importance and sources of healthy food. • 2- 18%) of students were aware of healthy ways of cooking.	---	• 50% of the students were physically inactive. • 43% of the students practice PA 1−3 times a day.

	Health issue	ME influence	Knowledge	• Beliefs	• Behaviours
Majeed (2015)	Dietary and exercise habits	Not assessed	---	• 81% of students preferred home-cooked food. • 24% of students preferred fast food.	• 63.7% of the students were of a normal weight. • 16.6% of the students were overweight and obese. • 75.3% of the students did not exercise regularly.
Al-Drees et al. (2016)	Physical activity	No variation	---	---	• 53% of the students were physically inactive.
Alonazi et al. (2016)	Health awareness in: nutrition, personal health, physical exercise, and body building.	No variation	• Students were aware of personal health issues. • The students were less aware of body building and physical exercise. • Students were less aware of the nutrition.	---	---
Allam et al. (2012)	Nutritional and health status	Not assessed	---	--	• 34.5% of the students are overweight. • 10.3% of the students are obese. • 64.4% of the students were physically inactive.
Al-Qahtani (2016)	Dietary habits and lifestyle	No variation	• 94.1% of students are aware of the benefits of eating vegetables and fruits and health risks associated with consuming of soft drinks.	---	• 91.3% were consuming fast foods 3 times or more per week. • 65% of the male students were physically inactive. • 80% of the female students were physically inactive. • 77.4% of students consume many soft drinks and inadequate amounts of vegetables and fruit.

	Health issue	ME influence	• Knowledge	• Beliefs	•Behaviours
Al Wadaani (2013)	Diabetes and diabetic retinopathy.	Not assessed	• 28% of students were aware of the prevalence of diabetes in Saudi Arabia. • All of students were aware the symptoms and causes. • 74% of students were aware of the risk factors for diabetic retinopathy. • 69.9% of students were aware of the treatment for a patient with diabetic retinopathy.	• 36% students agreed that diabetes is more common among uneducated people. • 54% agreed that "diabetic retinopathy can be prevented".	• 99% of the students followed the guidelines established the by American Diabetic Association for advising patients with diabetes.

4.3.1.1 Smoking

As shown in Table 4.2, 16 studies were conducted among medical and healthcare students to assess their knowledge, beliefs and behaviours relating to smoking. Two studies investigated water-pipe smoking (Awan et al., 2016; Sabra & Taha, 2016) and one focused on the effects of second-hand tobacco smoke (Almutairi, 2014). Only four studies assessed all the three variables together (Al-Haqwi et al., 2010; Azhar & Alsayed, 2012; Hashim, 2000; Wali, 2011).

The researchers described levels of knowledge about smoking and its effects among students as 'good'. Moreover, a good level of knowledge was found to be a preventable factor for tobacco smoking among the participants, with non-smokers found to be significantly more knowledgeable about these effects than those who smoked (Almutairi, 2014; Jradi & Al-Shehri, 2014; Sabra & Taha, 2016; Wali, 2011). However, Almutairi (2014) and Jradi and Al-Shehri (2014) did not find significant variations in levels of understanding of smoking health risks between students from different academic levels. In other words, students in the later stages of the medical programmes did not report healthier behaviours.

Students' understanding of the health risks of water-pipe smoking was variable. While Sabra and Taha (2016) found that almost 80% of students possessed good knowledge regarding the dangers of water-pipe smoking, Awan et al. (2016) found that 18 of their participants failed to identify a single hazard of water-pipe smoking, with the majority considering it less harmful than smoking cigarettes. Four of six of the tobacco knowledge assessment studies used a version of the 'Global Adult Tobacco Survey' (translated into Arabic), which is a widely used, valid and reliable research tool. The findings across different professionals and universities were consistent and reflected a 'good' level of knowledge (Al-Haqwi et al., 2010; AlQahtani, 2017; Azhar & Alsayed, 2012; Wali, 2011). The only study that described the final-year medical students' level of knowledge in three universities as 'low' had used an English version of the instrument (Jradi & Al-Shehri, 2014). It is possible therefore that an untranslated instrument affected the validity of the research tool, and subsequently the findings of the study.

Medical and healthcare students display a deep sense of responsibility toward their community even before their graduation. Most students in the included studies demonstrated a positive attitude and a high degree of motivation to prevent smoking, either by quitting smoking themselves (Hashim, 2000; Sabra & Taha, 2016) or by advising their patients to do so (Al-Haqwi et al., 2010; AlSwuailem et al., 2014). Students also believed that smoking should be banned in public places (Al-Haqwi et al., 2010; Almutairi, 2014) and they understood how their smoking behaviour might influence their patients and community (Almutairi, 2014; Alrsheedi & Haleem, 2012; Wali, 2011). Almost 77% of students believed that a doctor who smoked is unlikely to refer his smoking patients to smoking-cessation units (Almutairi, 2014). Moreover, 75% - 90% of medical and dental students believed that being a positive role model for their patients and community is an important professional responsibility (Alrsheedi & Haleem, 2012; Wali, 2011).

Smoking behaviours were generally measured by the prevalence of active tobacco smoking during the data collection period. The results varied between the different studies, which could be explained by the differences in the geographical locations, times, and professions. There are inconsistent patterns for cigarette and water-pipe smoking since 2000. As shown in Table 4.2, the prevalence of cigarette smoking steadily dropped from 29% in 2000 to 4.7% in 2014, but then increased to 30% in 2017. Most of the included studies were conducted among relatively small samples (e.g., in a single city or single health profession) which probably made the prevalence less representative of the community of health professional students as a whole, nationally speaking. Sixteen per cent might be the most representative figure, which resulted from a comparative study conducted among 2,336 mixed professions in 20 colleges located in 12 universities in Saudi Arabia (Alrsheedi & Haleem, 2012). Although it was conducted among male students only, the prevalence of smoking among female students is significantly lower than among male students generally (Al-Haqwi et al., 2010; AlSwuailem et al., 2014; Wali, 2011).

Water-pipe smoking appears to be more common than cigarette smoking (AlSwuailem et al., 2014), although only a limited number of studies assessed its prevalence. In Riyadh city, 62% of 535 male students from different health professionals were water-pipe smokers (Awan et al., 2016), while in another study only 3.3% of students were water-pipe smokers (Subhan et al., 2009). The majority of those students considered water-pipe smoking to be less harmful than smoking cigarettes (Awan et al., 2016; Wali, 2011), and most of the smoking students did not plan to quit (Sabra & Taha, 2016). Social environment factors were the most reported influencing factor for smoking; for example, having parents and friends who smoke encouraged the students themselves to take up smoking (see Table 4.2).

In this review, three studies found that medical education did not prevent students from smoking. On the contrary, smoking prevalence increased the higher the year group to which the student belonged (Al-Haqwi et al., 2010; AlQahtani, 2017; Wali, 2011). Participants related that smoking is a coping strategy for alleviating academic life pressures (Al-Haqwi et al., 2010; Wali, 2011) as a possible reason for the correlation of smoking prevalence and year group.

In comparison, three studies noted the positive influence of medical education on the prevalence of smoking among the students (Abdulghani et al., 2013; Awan et al., 2016; Azhar & Alsayed, 2012). Abdulghani et al. (2013) and Azhar and Alsayed (2012) conducted their studies among female medical students and compared their smoking prevalence and knowledge with non-medical female students in the same institutions. They found a significant difference between the two groups, as medical students were less likely to smoke than non-medical students. However, the prevalence of smoking among female medical students in the 16 reviewed studies was very low compared to male students. In fact, in one of the studies, the prevalence was zero (Al-Haqwi et al., 2010) (see Table 4.2). Social norms and religion might be the reason for the wide variation in smoking prevalence according to gender (Wali, 2011). Medical education also influenced medical and healthcare students' awareness of water-pipe smoking dangers during their years of study (Sabra & Taha, 2016). Therefore, medical students are more aware of the effects of smoking than non-medical students, particularly when this awareness significantly correlates with smoking behaviour (Azhar & Alsayed, 2012).

Similarly, three other studies did not find a significant correlation between medical education and students' knowledge, beliefs, or behaviours (Al-Kaabba et al., 2011; AlSwuailem et al., 2014; Subhan et al., 2009). In these studies, researchers recommended addressing the students' wellbeing and health promotion intervention on the medical curriculum. It seems that these recommendations were developed based on a hypothesis that medical curricula did not actively address health promotion and healthy lifestyles in the curriculum.

In conclusion, it seems that smoking habits were not influenced by engaging with medical curricula, since smoking prevalence was uniformly lower among female students than male students, regardless of educational input and level. The influence of social norms and religion were reported several times among the analysed studies.

4.3.1.2 Physical activity and dietary habits

In this review and as shown in Table 4.2, nine studies investigated physical activity and dietary habits, five of which assessed both issues together (Al-Qahtani, 2016; Alissa et al., 2015; Allam et al., 2012; Ibrahim et al., 2014; Majeed, 2015). The International Physical Activity Questionnaire (IPAQ) was used in three studies (Allam et al., 2012; Awadalla et al., 2014; El-Gilany & El-Masry, 2011). This tool was considered as a reliable, valid, and widely used instrument. The rest of the studies included in the review developed their own instruments. However, the findings, in terms of knowledge, beliefs and behaviours observed, were consistent. Even though students demonstrated a 'good' level of knowledge relating to healthy dietary habits (Al-Qahtani, 2016; Alissa et al., 2015), physical activities (Alonazi et al., 2016), and positive attitudes toward the role of these in promoting wellbeing (El-Gilany & El-Masry, 2011; Majeed, 2015), their behaviour did not correlate with their understanding of such issues. Between 40% and 80% of the students in the included studies were physically inactive (Al-Drees et al., 2016; Al-Qahtani, 2016; Alissa et al., 2015; Awadalla et al., 2014; El-Gilany & El-Masry, 2011; Ibrahim et al., 2014; Majeed, 2015) and their dietary habits were also unhealthy. Almost 90% of medical students consumed fast foods more than three times per week (Al-Qahtani, 2016), with 13% consuming fast foods on a daily basis (Ibrahim et al., 2014). In a study conducted among medical students in their final years, almost 73% ate high-fat foods daily (Ibrahim et al., 2014). The prevalence of being overweight or obese among medical students ranged from 16.6% (Majeed, 2015) to 45% (Allam et al., 2012; Ibrahim et al., 2014). Factors that possibly influenced behaviours in relation to physical activities and healthy diet, as well as the frequency of reporting these factors, are summarised in Tables 4.3 and 4.4. The six most frequently reported modifiable factors were time limitation, access to sports facilities, knowledge and awareness, busy study schedules, anxiety and stress, and the non-availability of healthy food choices.

Five of the selected studies considered the relationship between medical education and students' knowledge, beliefs and behaviours related to healthy diet and physical activity (Al-Drees et al., 2016; Al-Qahtani, 2016; Alissa et al., 2015; Alonazi et al., 2016; Awadalla et al., 2014). In all these studies, there were no significant differences between students of different academic levels, which indicates that the influence of external physical, environmental and social factors was greater than the influence of medical curricula. As with the studies of smoking habits discussed above, researchers recommended establishing students' wellbeing intervention on the campus to promote healthy lifestyle resources. In addition, researchers also recommended curriculum improvement to include health promotion knowledge and skills.

4.3.1.3 Mental health

Six studies explored mental health issues among students of the healthcare professionals (see Table 4.2). These studies assessed behaviours related to anxiety (Aboalshamat et al., 2015; Inam, 2007), stress (Abdulghani et al., 2011; Aboalshamat et al., 2015; Al-Saleh et al., 2010; Sani et al., 2012), depression (Aboalshamat et al., 2015; Inam, 2007), and sleep disorder (Abdulghani et al., 2012). None of these studies assessed knowledge or beliefs related to mental health issues.

Four of the included studies assessed the psychological wellbeing of medical and dental students. They used reliable and validated instruments to measure anxiety, stress, and depression. These were the Aga Khan University Anxiety and Depression Scale (AKUADS) (Inam, 2007), the Kessler10 Psychological Distress instrument (K10) (Abdulghani et al., 2011), the General Health Questionnaire (GHQ 20) (Sani et al., 2012) and the Depression Anxiety and Stress Scale (DASS-21) (Aboalshamat et al., 2015). All the researchers noted that their findings highlighted a serious problem needing to be addressed. The prevalence of anxiety among students ranged from 44% to 66% (Aboalshamat et al., 2015; Inam, 2007), for stress, the prevalence was from 63% to 72% (Abdulghani et al., 2011; Sani et al., 2012), and the prevalence of depression was 70% (Aboalshamat et al., 2015). Notably, 3% of medical students stated that they slept less than three hours a day (Abdulghani et al., 2012).

Among these six studies, five were concerned with students' psychological wellbeing across all academic years. Al-Saleh et al. (2010) and Sani et al. (2012) reported that students in earlier years of study had significantly fewer psychological problems compared to their more advanced colleagues. The researchers suggested that this might be because students at the beginning of their academic journey have yet to be exposed to any clinical experience or intensive preclinical courses, both of which are likely to induce high levels of stress (Al-Saleh et al., 2010; Sani et al., 2012). Sani and colleagues (2012) further recommended modifying the curriculum as most of the stress sources were related to the curriculum. Several modifications were suggested such as: ensuring a balance between the content of the courses and the time distribution; teaching and assessing methods; establishing a student counselling centre in the campus with qualified and experienced staff; improving the facilities for extracurricular activities in the campus to reduce psychological stress, and strengthening and activating a tutorial system in colleges.

A study conducted by Abdulghani et al. (2011), however, contradicts the findings of the studies mentioned above. It found that stress levels decreased according to advancing levels of training. Abdulghani and colleagues found that the level of stress among medical students gradually decreased from 78.8% in the first year to 70.8%, 65% and 43% in the second, third and fourth years, respectively (Abdulghani et al., 2011). The findings of this study contradict the findings of the majority of similar studies on stress and depression among medical students around the word (Dyrbye & Shanafelt, 2016; Dyrbye et al., 2006). According to Abdulghani these findings might be "explained by many factors first, that this is a cross-sectional and not a cohort study to be sure that the stress is decreasing in the study subjects. This finding could be just due to chance as the study shows the increase of stress in different groups and not the same student groups" (Abdulghani et al., 2011, p. 520). In conclusion, there is a general agreement among researchers that medical education has a negative influence on students' psychological wellbeing, even among those who found positive influence of medical education on students' psychological wellbeing.

Medical and other healthcare programmes are known to be highly demanding and provide stressful learning environments (Dyrbye & Shanafelt, 2016). Contemporary curricula require students to attain diverse proficiencies, including the acquisition of theoretical knowledge, clinical competencies, and interpersonal skills. All the included six studies recommended improving the medical curriculum, considering the importance of student/faculty relationships, and reducing the impact of busy studying and training schedules to prevent psychological distress which, in turn, could improve the wellbeing and the performance of the students. They also noted that stress and anxiety correlated with other harmful behaviours, e.g., smoking and lack of exercise (see Table 4.3).

4.3.1.4 Diabetes Mellitus

Only one study assessed students' awareness and perceptions of diabetes. It was conducted at King Faisal University by researchers who felt that information regarding the management of diabetic retinopathy was not addressed fully in the medical curriculum (Al Wadaani, 2013). Researchers studied the knowledge, beliefs and prevention behaviours relating to diabetes and diabetic retinopathy in final-year medical students to improve the curriculum concerning these health problems. The results showed that students possessed a 'good' understanding of symptoms, causes, risk factors, screenings, and treatment for diabetes and diabetic retinopathy (Al Wadaani, 2013). Almost all of them were acquainted with the guidelines laid down by the American Diabetic Association for advice to patients with diabetes (Al Wadaani, 2013). However, only 28% of students were aware of the epidemiological facts relating to diabetes in Saudi Arabia. This highlights the need to promote the epidemiological knowledge of diabetes in the curriculum. Al Wadaani did not report any variation in students' knowledge and beliefs, as all the participants were in the final academic year (Al Wadaani, 2013).

4.3.2 Influencing factors

Studies included in this systematic review provided substantial information relating to possible factors influencing student health professionals' behaviours. Tables 4.3 and 4.4 summarise these factors in relation to students' health-promoting behaviours. In order to synthesise the current body of knowledge, there was a need for a theory-based classification framework to understand the multifaceted and interactive effects of the personal and environmental factors determining behaviours, and which will identify behavioural and organizational leverage points and intermediaries for health promotion within organizations.

The Social Ecological Model (SEM) seems to be a useful way of describing how the various factors interplay at the individual and the community levels to influence knowledge, beliefs, and behaviours (McLeroy et al., 1988). The SEM perspective on health promotion is based not on a singular discipline or theory but rather on a broad, overarching paradigm that bridges several different research fields (McLeroy et al., 1988). It is rooted in certain core principles or themes concerning the interrelations among environmental conditions and human behaviours and wellbeing (Stokols, 1996). There are five nested, hierarchical levels of the SEM: individual, interpersonal, community, organizational, and policy/enabling environment. Due to the type and divergences of the factors consistently noted in the literature and the study limitations, four levels of the SEM were used. As shown in Figure 4.3, the overlapping rings in the model illustrate how factors at one level influence factors at another level. Besides helping to clarify these factors, the model also suggests that, in order to promote health, it is necessary to act across multiple levels of the model at the same time.

Table 4.3: Factors negatively influencing health behaviours among health professional students based on the Socio Ecological Model

Stage of Influencing Factors	Negatively Influencing Factors	T2D Risk Factors	Frequency
Individual factors	Age (older)	Smoking (Al-Haqwi et al., 2010; Al-Kaabba et al., 2011; Awan et al., 2016; Hashim, 2000)	4
	Gender (female)	Anxiety & depression (Inam, 2007) Stress (Abdulghani et al., 2011; Al-Saleh et al., 2010; Sani et al., 2012) Sleep disorder (Abdulghani et al., 2012) Physical activity (Al-Drees et al., 2016)	6
	Anxiety and stress	Smoking (Abdulghani et al., 2013; Al-Kaabba et al., 2011; Al-Turki, 2006; Alrsheedi & Haleem, 2012; Awan et al., 2016; Sabra & Taha, 2016) Physical activity (Alissa et al., 2015; Majeed, 2015)	8
	Leisure	Smoking (Abdulghani et al., 2013; Al-Kaabba et al., 2011; Alrsheedi & Haleem, 2012; Awan et al., 2016; Sabra & Taha, 2016)	5
	Health unawareness	Smoking (Almutairi, 2014; Jradi & Al-Shehri, 2014; Wali, 2011) Physical activity (Al-Drees et al., 2016; Alissa et al., 2015; Awadalla et al., 2014)	6
	Physical health	Stress (Abdulghani et al., 2011)	1
Interpersonal factors	Uneducated parents	Smoking (Taha et al., 2010)	1
	Parents' habits	Smoking (Hashim, 2000; Wali, 2011) Physical activity (Awadalla et al., 2014)	3
	Friend habits	Smoking (Al-Turki, 2006; Al-Haqwi et al., 2010; Alrsheedi & Haleem, 2012; Awan et al., 2016; Hashim, 2000; Wali, 2011) Physical activity (Awadalla et al., 2014)	6
	Time limitation	Physical activity (Al-Drees et al., 2016; Alissa et al., 2015; Awadalla et al., 2014;	8

		El-Gilany & El-Masry, 2011; Majeed, 2015). Stress (Sani et al., 2012) Diet (Alissa et al., 2015; Majeed, 2015)	
	Social problem	Smoking (Al-Turki, 2006)	1
Community factors	Busy study schedule	Physical activity (Al-Drees et al., 2016; El-Gilany & El-Masry, 2011) Stress (Sani et al., 2012)	3
	Clinical training and student–faculty relationships.	Stress (Al-Saleh et al., 2010)	1
	Accessibility to sporting places	Physical activity (Alissa et al., 2015; Awadalla et al., 2014; El-Gilany & El-Masry, 2011; Majeed, 2015)	4
	Availability of healthy foods	Diet (Majeed, 2015)	1
Organizational factor	Media	Smoking (Al-Haqwi et al., 2010; Wali, 2011)	2
	Lack of entertainment	Stress (Sani et al., 2012)	1

Table 4.4 Factors positively influencing health behaviours among health professional students based on the Socio Ecological Model

Stage of Influencing Factors	**Positively Influencing Factors**	**T2D Risk Factors**	**Frequency**
Individual factors	Health awareness	Smoking (Almutairi, 2014; Jradi & Al-Shehri, 2014; Wali, 2011) Physical activity (Al-Drees et al., 2016; Alissa et al., 2015b; El-Gilany & El-Masry, 2011)	6
	Religion	Smoking (Abdulghani et al., 2013; Al-Kaabba et al., 2011)	2
	Gender (female)	Smoking (Al-Haqwi et al., 2010; Al-Kaabba et al., 2011; AlSwuailem et al., 2014; Wali, 2011) obesity (Ibrahim et al., 2014)	5
Interpersonal factors	Family advice and support	Smoking (Abdulghani et al., 2013)	1
Community factors	Role modelling	Smoking (Wali, 2011)	1

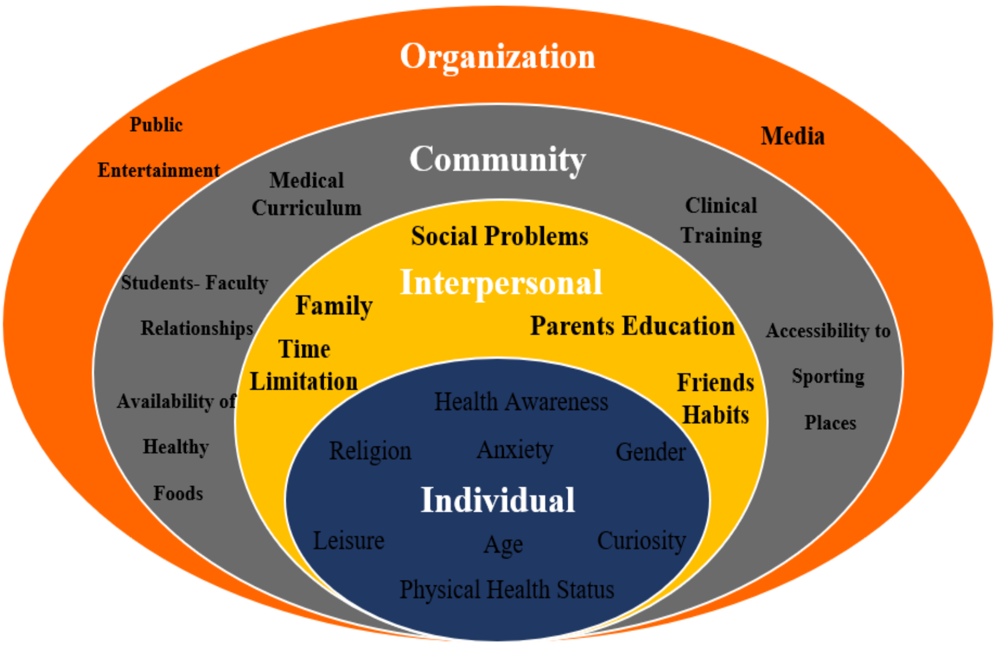

Figure 4.3: Factors influencing health professional students to follow T2D preventive behaviour based on The Socio Ecological Model

Stages of Influencing Factors

4.3.2.1 Individual (student) factors

These factors describe the characteristics of the individual healthcare professional student that influence behaviour change. Considerable evidence shows that personal characteristics were associated with the development of numerous diseases, including diabetes (Wilmot et al., 2012). This review identified a number of personal characteristics significantly associated with unhealthy lifestyles such as age, gender, physical health status, health awareness, curiosity, leisure, and levels of anxiety and stress. Nevertheless, other personal characteristics of students such as positive attitudes toward promoting health, role modelling, and religion are preventive factors for a number of health problems. How frequently these factors were reported among the included studies is summarised in Tables 4.3 and 4.4.

Health providers might benefit from these descriptions in targeting and tailoring the health interventions to meet each group's needs. For example, researchers have noted that female students are at a higher risk of developing stress, depression, and anxiety than are male students (Abdulghani et al., 2012; Al-Saleh et al., 2010; Inam, 2007; Sani et al., 2012). Moreover, female students tend to lead more sedentary lifestyles than do male students (Al-Drees et al., 2016), but are not necessarily more overweight than male students (Ibrahim et al., 2014), indicating that they need support to engage more in physical activities. On the other hand, female students smoke less (Al-Haqwi et al., 2010; Al-Kaabba et al., 2011). In Saudi Arabia, male and female students study in separate campuses and, therefore, they have access to different resources, facilities and regulations, as previously explained in Chapter 3.

4.3.2.2 Interpersonal factors

Both formal and informal social networks and social support systems influence individual behaviours. In this review, family, friends, parents' level of education, social problems and family responsibilities that lead to time pressures were risk factors for a number of health problems (see Tables 4.3 and 4.4 and Figure 4.3). It seems that students need to be more educated and empowered to manage their time and work stress more independently. Healthcare professionals' students tend to justify their unhealthy lifestyles because of lack of time (Al-Drees et al., 2016; Alissa et al., 2015; Awadalla et al., 2014; El-Gilany & El-Masry, 2011; Majeed, 2015). This lack of time might be partly related to busy study schedules. Health providers may need to consider preparing students for managing their time effectively at the beginning of the medical and healthcare programmes as part of students' wellbeing interventions.

Interpersonal factors are usually located outside the remit of healthcare professionals' programmes. However, family and friends play a vital role in influencing students' behaviour. Medical students were significantly influenced by their friends' and parents' smoking habits (Al-Haqwi et al., 2010; Al-Turki, 2006; Hashim, 2000; Wali, 2011). Conversely, families who abstain from smoking tend to produce offspring who are non-smokers (Abdulghani et al., 2013). This finding influenced the decision not to directly assess external interpersonal factors influencing medical students' values and practices as it is out of the scope of the medical curriculum (see Chapter 5).

4.3.2.3 Community factors (the educational institution)

This type of factor relates to relationships between organizations, institutions, and information networks within defined boundaries. In other words, this type of factor highlights how medical education institutions influence students' lifestyles and wellbeing. Medical and healthcare students spend a substantial proportion of time in their chosen educational institution, whether on campus or at training hospitals. Therefore, these institutional structures and processes significantly influence students' wellbeing and health behaviours, as this review indicated in Tables 4.3 and 4.4. Previous studies have shown that interventions conducted inside institutions, such as at workplaces or schools, provide a context for health-promoting activities, and promote the social acceptability of such activities and social support for behaviour change (Whittemore et al., 2004). Health behaviour interventions that target healthy lifestyles in the workplace have provided researchers with strong evidence that these interventions support positive health behaviour modifications (Husted et al., 2020). Conversely, lack of, or inaccessibility to, healthy lifestyle-promoting resources correlate with evidence of unhealthy lifestyle habits, and this was noted in the results of this review. The review found that lack of accessibility to sporting places and healthy foods on campus, the assessment methods of clinical training, the type and content of curricula, and the poor relationships between students and faculty members all correlate with multiple health problems such as stress, obesity and physical inactivity (Al-Drees et al., 2016; Alissa et al., 2015; El-Gilany & El-Masry, 2011).

In response to these findings, researchers have recommended a number of medical curriculum modifications. Physical activity was one of the areas most detrimentally affected by busy course schedules. Thus, researchers encouraged curriculum developers to consider new teaching and learning methods designed to give students more free time for exercise (Al-Drees et al., 2016; El-Gilany & El-Masry, 2011). Busy schedules also negatively impacted on students' mental health. Sani and team reported that intensive schedules significantly correlate with harmful stress levels, a trend which increases year on year as students progress through their studies (Sani et al., 2012).

The informal medical curriculum might influence behaviour modification among medical students, either positively or negatively. On the negative side, this review found that students' relationships with faculty members in medical school, particularly during the clinical training period, was a leading cause of stress (Al-Saleh et al., 2010). Al-Saleh et al. (2010) believed that a certain amount of tension exists between students and faculty members due to the latter's evaluative and authoritative role, leading to unavoidable stress. On the positive side, medical students began to abstain from smoking when they perceived that it might harm their professional standing and perceptions of them as role models for their patients (Wali, 2011). Despite the limited number of factors highlighted in this review related to the curriculum and the medical schools, this deserves further investigation in the next phase of this research.

The physical environment of the campus influences students' physical activity and dietary habits. Several studies report the lack of sports clubs on campus and argue that having accessibility to private sports clubs is having a detrimental effect on medical students' lifestyles (Alissa et al., 2015; Awadalla et al., 2014; El-Gilany & El-Masry, 2011; Majeed, 2015). Similarly, the lack of healthy food choices on campus or in the cafeteria in the training hospitals leads to unhealthy dietary choices among students (Majeed, 2015). Those two factors were acknowledged in developing the questionnaire for the second phase of this thesis, as they constitute two strong barriers to adopting a healthy lifestyle.

4.3.2.4 Organizational factors

Various kinds of regulatory channels at the local and national levels shaped students' values and practices. To promote the wellbeing of a population, a coordinated and sustained plan of action is required because the process can be slow and difficult (Whittemore et al., 2004). This review classified factors at this level of influence as describing the impact of an organisation's rules and regulations on students and assessing how well services are provided to students and finding out how successful these services were. The organisation might be the country (Saudi Arabia) or medical education's regulatory bodies (MOE, NCAAA, or SCFHS). Public policy, media and public entertainment events influenced some health-related behaviours and experiences, such as stress (Sani et al., 2012) and smoking (Al-Haqwi et al., 2010; Wali, 2011), (see Tables 4.3 and 4.4).

This information could serve as a basis for designing and implementing intervention programmes that aim to promote healthcare professional students' wellbeing over the long term. In this thesis, it seems essential to assess the influence of these factors on medical students' behaviours for two reasons; first to structure the overall findings of the next phases of this study and second, to guide the current study recommendations. This level of factors needs to be investigated through stakeholders or by reviewing the policy and regulations related to students' wellbeing in Saudi Arabia, as implemented in this study (Chapters 5 and 8). Using the SEM approach may identify more interventions to sustain disease prevention and health promotion efforts over time more than any other single intervention.

4.4 Gaps in the literature

This systematic review identified several gaps in research on medical education's influence on students' wellbeing. The literature review revealed that no research had been conducted to explore the influence of medical education on students' knowledge, attitudes and behaviours relating the prevention of T2D in Saudi Arabia. There were only a few comparison studies between students' knowledge and attitude and behaviours, focusing mostly on smoking habits. No single study covered all three domains simultaneously among two academic levels in medical school. Consequently, to fill this gap, this thesis covered the three domains.

All the comparison studies to data conducted in Saudi Arabia regarding medical students' wellbeing have not clarified the type or characteristics of the medical curricula in the schools in which study took place. Researchers nevertheless recommended a number of curriculum modifications to promote students' wellbeing. This thesis seeks to address this gap by conducting a comprehensive assessment of medical students' knowledge, beliefs, and behaviours relating to T2D in Saudi Arabia.

Reviewing the existing studies further revealed methodological shortcomings. First, all the included studies only gathered quantitative research data, and none of them explored the students' perspectives and evaluated the influence of curricula on their behaviours through qualitative methods. Therefore, this thesis attempts to provide an in-depth description of students' justifications and explanations for their lifestyle behaviours, through carrying out semi-structured interviews with final-year medical students (see Chapter 7).

Second, none of the existing studies linked its findings to curriculum descriptions. Despite the wide range of recommendations for modifying the medical curriculum, no specific part has been identified to improve or exclude. It remains unclear due to the incomplete description of the problem if there was one. Therefore, this thesis followed the data to better understand exactly what the influences of curricula are on students' values and practices. This was carried out through analysing the medical curriculum and all the available documents (see Chapter 8).

Overall, this thesis attempts to fill the identified gaps in the literature by utilising three studies in addition to this systematic review: questionnaire survey, interviews, and documentary content analysis. The next chapter describes the research design, methodology, and methods used in each of the studies, how these studies were conducted, and how the data were analysed.

4.5 Conclusion

To the best of the researcher's understanding, this is the first review to bring together the body of Saudi-based evidence relating to the knowledge, beliefs and behaviours of health professional students beside personal and environmental factors that may influence students. Although this review is exploratory in nature and does not provide strong conclusions, it helped to add to the understanding and the findings of other studies that suggested that being a health professional (educated through a formal, university-based programme) is not always associated with living a healthy lifestyle. The findings of this review suggested some pathways through which a number of factors at the individual, interpersonal, community and organizational levels may have an impact on health professional students' behaviours, and in turn, may influence their wellbeing.

The relationship between health professional education and health awareness and leading a healthy lifestyle, are complex. In this review, some similarities were reported between the level of knowledge, beliefs and behaviours of health professional students, and non-health professional students or the general public. For example, smoking prevalence was similar for these students and the general adult Saudi population of the same age group (35% to 40%) (Hashim, 2000).

The influence of formal education on the beliefs and behaviours of health professional students seems to be weak. However, the educational philosophy and structure of the curricula was not mentioned in the above studies, even when authors recommended improving them.

The findings also suggested that health professionals' curricula may have a detrimental impact on students' overall health. Certain health professions appear to be more seriously affected by stress, anxiety and depression than others, with medical and dental students being the most susceptible to mental health problems (Wasson et al., 2016). Such studies suggest that the hidden curriculum, academic scheduling, and poor student-faculty relationships might be to blame for the low quality of health of some students and that this may be as important as understanding the achievements of medical education and its impacts on knowledge, beliefs, and behaviours and, in turn, on wellbeing.

The influences of personal and environmental factors on health professional students' behaviours were multidimensional. Aspects of the physical environment that act as enabling factors were clearly relevant to behaviour to some extent. Still, this review found that behaviours often relate more directly to an individual's personality, cultural background, and interpersonal relationships than buildings and structures do. For example, the social context of parents and friends' lifestyle may largely nullify the possibility of practicing physical activities even if there is access to sporting facilities

(Awadalla et al., 2014). Conversely, personal awareness increases the possibility of adopting a healthy lifestyle (Al-Drees et al., 2016; Alissa et al., 2015). This review showed how social context could mediate the health behaviours of healthcare students.

This review's primary purpose was to describe the current knowledge, beliefs and behaviours related to T2D and its risk factors among medical and healthcare students in Saudi Arabia and assess the influencing role of medical education in the reviewed studies. Students demonstrated fair to good levels of knowledge. While most students showed positive attitudes toward adopting a healthy lifestyle, they also reported unhealthy living lifestyles. Half of the comparison studies did not note any influence of medical education on the students' knowledge, beliefs, or behaviours. The other half of the comparison studies did not help in predicting the real influences. Five studies reported that medical education negatively impacts students' behaviours, while the other five reported positive influences. However, some of the researchers justified this positive influencing as due to chance.

The systematic review revealed a number of studies that facilitated a better understanding of the obstacles that may hinder medical and healthcare students from following healthy lifestyles, and provided a better understanding of the facilitators that may enhance healthy lifestyles. The literature revealed 22 influencing factors, which have been categorised into four levels based on the SEM: individual, interpersonal, community, and organizational. Only factors categorized within the community level were considered in developing the current study questionnaire, as they were related to the medical curriculum and the medical school environment.

CHAPTER 5 RESEARCH METHODOLOGY

This chapter is divided into four parts: the first part explores the research paradigm underpinning this study, the study's particular methodological approach, the design, the participants, and sampling. The second part specifies and discusses the study setting, participants, sampling, data collection process, and data analysis approach for phase one of this study. Similarly, the third and the fourth parts of this chapter discuss methodological approaches of phases two and three of this study.

As discussed in the literature review chapter, doctors play an important role in empowering patients to lead healthy lifestyles, particularly, terms of this thesis, in relation to lifestyle habits that prevent T2D. Providing the community with knowledgeable medical practitioners, who can act as role models by leading healthy lifestyles themselves, is a chief goal of many medical schools, such as QUMS (Qassim.University, 2008). However, how the formal and the informal curricula achieve this goal needs to be investigated. The present study has five objectives, detailed in Chapter 1, which guided the methodology of this study.

5.1 Research paradigms and philosophy

The term 'paradigm' is used in academic studies to refer to the philosophical assumptions or the basic set of beliefs that guide the actions and define the researchers' worldview (Bryman, 2016; Cohen et al., 2017; Kaushik & Walsh, 2019). 'Worldview' is used by some researchers as a synonym for the word paradigm (Kaushik & Walsh, 2019). Bryman further defines the paradigm as "a cluster of beliefs and dictates which for scientists in a particular discipline influence what should be studied, how research should be done, and how results be interpreted" (Bryman, 2016, p. 637).

Modern sociological research is structured and organised according to several paradigms or worldviews, such as positivism, constructivism, participatory action frameworks, and pragmatism. All these paradigms are basically philosophical in nature and encompass common elements. Each paradigm incorporates axiology, ontology, epistemology, methodology, and rhetoric (Bryman, 2016; Cohen et al., 2017; Kaushik & Walsh, 2019).

Each paradigm has a different perspective on axiology, ontology, epistemology, methodology, and research rhetoric. For instance, positivism, one of the older social research approaches, is usually associated with quantitative methods and involves highly formal rhetoric that focuses on reliability, precision, replicability, and generalisability. The researchers of this philosophical school view inquiry as a logical series of steps and present the knowledge based on objectivity, deductive reasoning, control, and standardisation within the research procedure. However, quantitative descriptive research alone is inadequate if the study aims to generate insight (McMillan, 2010).

The constructivist approach commonly utilises qualitative methods and yields more informal rhetoric in which the researcher aims to elicit the participants' worldviews and develops subjective meanings of the phenomena. Thus, constructivist research is shaped from the bottom up, i.e. from individual perspectives to broad models, and eventually to broad understandings (Kaushik & Walsh, 2019; Tashakkori & Teddlie, 2010).

The specification of the social-behavioural and educational concepts (ontology) in this study, as in any research project, should represent a particular philosophical knowledge of reality (epistemology) and of methods through which knowledge can legitimately be obtained from the participant world (methodology) (Bryman, 2016).

Medical education research's ultimate goal is to improve patient outcomes (Cleland & Durning, 2015). Thus, it aims to generate the kind of information that other health educators need to understand and, thereafter, to improve the teaching and the learning, with the ultimate purpose of improving healthcare practices, patient care, and outcomes (Cleland & Durning, 2015).

A research paradigm is also a combination of the nature of the world (field), and the research function (Plano Clark et al., 2008). For the purposes of this study, the presence of a relationship between the medical curriculum and students' knowledge, beliefs, and behaviours (quantitative) and how these relationships were developed and became influential (qualitative) constitutes the description of the research field, which is used by researchers to gather proof for their hypotheses (Plano Clark et al., 2008). The pragmatist paradigm claims to bridge the gap between the scientific method and structuralist orientation of older approaches and the more naturalistic methods of newer approaches (Kaushik & Walsh, 2019). The pragmatism research paradigm is based on the proposition that researchers should use the philosophical and/or methodological approach that works best for the particular research problem being investigated (Tashakkori & Teddlie, 2010). It is often associated with a mixed-methods or multiple-methods study design (Tashakkori & Teddlie, 2010; Teddlie & Yu, 2007). Because the focus on these types of studies is on the consequences of research and the research questions rather than on the methods, it may use formal and informal rhetoric (Kaushik & Walsh, 2019; Tashakkori & Teddlie, 2010).

A pragmatic approach posits that scientific knowledge is developed from combining both deductive and inductive methods of research. According to Reynolds, "a composite of these two strategies may provide a more efficient overall procedure and simultaneously provide a more accurate representation of the process that occurs in building scientific knowledge" (Reynolds, 2015, p. 157). This composite approach produces three types of research: explanatory research, descriptive research, and exploratory research (Reynolds, 2015).

Research methodologists have adopted the term mixed-methods research to describe a methodological approach that combines quantitative and qualitative studies (Plano Clark et al., 2008; Tashakkori & Teddlie, 2010). It is a flexible approach, where the research design is determined by what the researcher wants to find out rather than by any predetermined epistemological position (Cleland & Durning, 2015).

As previously discussed in Chapters 3 and 4, medical students' wellbeing, as with that of the general population, is a complex public health issue incorporating multiple influencing factors, many of which are unclear in terms of their work processes. Accounting for the processes by which students foster their wellbeing is thus a challenging and complex task. This study aimed to understand how medical curricula influence medical students' understanding of T2D as a health problem, how curricula influence their beliefs regarding the importance of preventing this health problem on the individual level, and how such beliefs translate into T2D preventive behaviours. In terms of basic paradigms underpinning this project, the pragmatist philosophy is well suited to this study's aims. As discussed below, this research philosophy informs choices made relating to research strategy, data collection techniques and data analysis procedures used in the investigation.

5.2 Research study design

Bryman (2016) described the research design as a logical framework for data collection and analysis, developed to create evidence that applies to a group of factors concerning and addressing a research question. The methodological strategy devised in this study applied various methods to enable achievement of the research objectives.

According to Johnson (2007), the mixed-methods research approach "is the type of research in which a researcher or team of researchers combine elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding and corroboration" (Johnson et al., 2007, p. 123). However, two central criticisms of the approach are that it carries epistemological commitments and that quantitative and qualitative research paradigms are essentially separate and, therefore, do not combine well (Bryman, 2016). Abbas and Charles (2003) and Plano Clark et al. (2008) believed, however, that the quantitative and qualitative methods are complementary and that their combined use produces much richer research results than can be achieved by using just one method alone. Cleland and Durning (2015) stressed that it is central for the effectiveness of the mixed-method study to define the relationship between the methods in order to ensure that the data converge and triangulate to produce greater insight than can be produced using a single method; hence, this approach was adopted in this study.

Data integration is an important component of mixed-methods analysis and conceptualisation. It has three key purposes: illustration, convergent validation and the development of analytic density or 'richness' (Fielding, 2012). In this study, four methods were used to triangulate findings and increase the research conclusion's reliability (Table 5.1 and Figure 5.2).

In addition, mixing methods effectively requires a profound appreciation of the threats to validity inherent in the combined methods (Fielding, 2012), particularly among social-behavioural researchers. Using mixed methods requires epistemological clarity and sophistication. Social-behavioural research is an important domain within the health research field. The term 'social-behavioural' refers to human motivations, activities, psychological processes and interactions (small groups, families, communities, and whole societies). Such research is commonly conducted in many academic disciplines such as education, sociology, psychology, anthropology, economics, political science, and history (USC, 2020).

In the current study, achieving a complementarity of results is a central item of the overall discussion, and therefore an explanatory sequential mixed-methods design was used. This design has often been used in research with the intention of complementarity, whereby information gained from a qualitative study, which is second in the sequence, is used to enhance understanding of the quantitative element, which is often seen as the primary component of this mixed-methods design (Tashakkori & Teddlie, 2010). Hodgkin (2008) selected an explanatory sequential mixed method in social research to show how mixed-methods research can be complementary research. Hodgkin began with a quantitative phase and ended with a qualitative component, which was used to help explain complexities in the quantitative data (Hodgkin, 2008; Tashakkori & Teddlie, 2010) (see Figure 5.1).

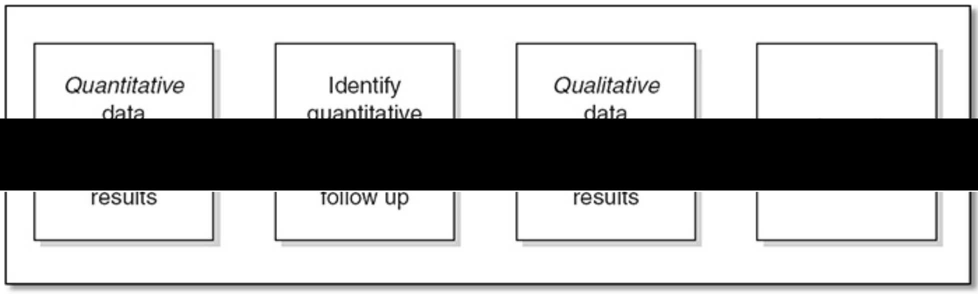

Figure 5.1: Hodgkin's explanatory sequential mixed-methods research design (Hodgkin, 2008).

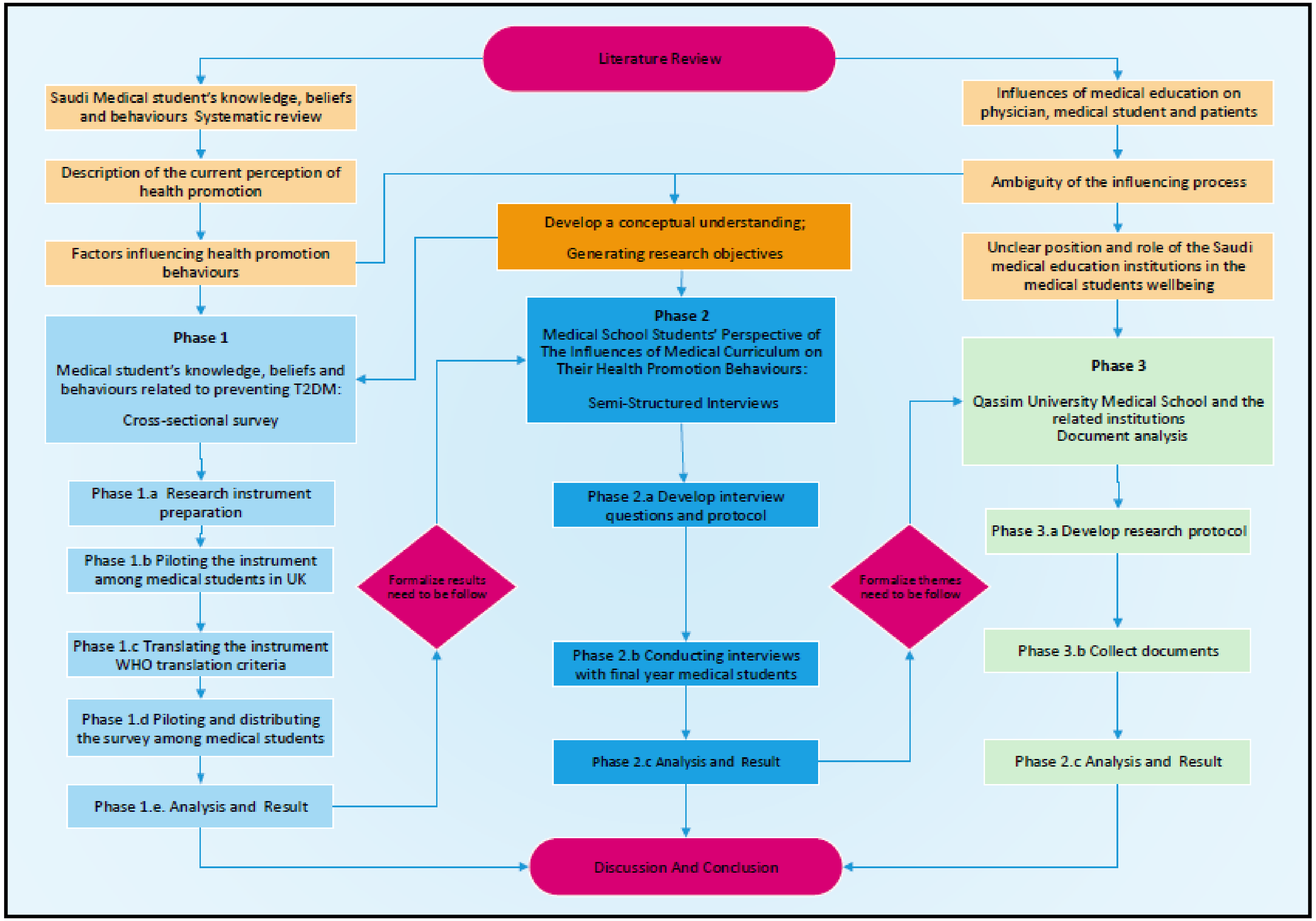

Figure 5.2: The study design of the thesis

Based on the definition given above of social-behavioural research, the research questions of this thesis were developed from the standpoint of medical education. More precisely, this research sought to describe the relationship between medical curricula in Saudi Arabia and medical students' knowledge, beliefs and behaviours related to preventing T2D; then, to explain how this relationship works and in which context. As the medical students react and interact with each aspect of the medical curriculum – formal, informal and the hidden curriculum – the choice of research methodology depends on the nature and context of the research questions asked (Abbas & Charles, 2003; Bryman, 2016; Cohen et al., 2017) (see Figures 5.1 and 5.2, and Table 5.1).

In order to answer the research questions, this study employed an explanatory sequential mixed-methods approach divided into three phases. The first phase aimed to assess the influence of medical education and medical students' knowledge and beliefs related to T2D health preventive behaviours. Data were collected and analysed using questionnaires. This phase made two significant contributions to the overall research output: (a) it served as a conceptualisation of this thesis and (b) it helped identify some of the key informants included in the second phase. The second phase aimed to explore and explain how these concepts contrasted during the course of students' years of learning medicine. In conjunction with phase one, this phase also had two purposes; (a) to explain the influencing pathway and factors beyond it; (b) to identify some keywords that would guide the search for the third phase. The third phase investigated the influential role played by QUMS and other higher medical education authority institutions in Saudi Arabia in shaping medical students' beliefs and T2D preventive behaviours.

The following sections outline the participants, sampling, ethical considerations and research tools used in the three phases of this research. The recruitment of participants, developing, piloting research instruments, and data analysis of each phase are addressed separately.

Table 5.1: Research questions and data collection strategies

Main Research Question	**Q1: Does formal academic medical education influence the knowledge, beliefs and preventive behaviours related to T2D among medical students in QUMS?**		**Q2: How does the medical education curriculum influence beliefs and health behaviours related to T2D prevention among medical students in QUMS?**	
Method	Analyse the current levels of knowledge, attitude and behaviours related to public health problems among medical and healthcare students in Saudi Arabia. Also, identify the factors influencing these perceptions and behaviours.	Assess medical education's influence, medical students' knowledge and beliefs on health-promoting behaviours to prevent T2D.	Explain how the medical curriculum influences beliefs and preventive behaviours relating to T2D during students' study courses.	Provide an accurate and contemporary picture of health promotion and T2D prevention content within the Saudi medical curriculum.
Study Sample	Medical and healthcare Saudi students in studies published in a peer-reviewed journal (2000-2017).	First- and final-year medical students at Qassim University Medical School, Saudi Arabia.	Final-year medical students at Qassim University Medical School, Saudi Arabia.	NCAAA, SCFHS and the Qassim University medical curriculum.
Data Collection	Systematic review.	Cross-sectional survey.	Semi- structured interview.	Documentary analysis.
Data Analysis	Documentary analysis (EndNote & Excel).	Statistical analysis (SPSS).	Thematic analysis (ATLAS.ti).	Content analysis (ATLAS.ti).
Timeline for data collection and analysis	December 2016 – April 2017.	September 2017 – January 2018.	June 2018 – April 2019.	June 2019 – December 2019

5.3 Study participants

The study was conducted at QUMS in Qassim City, Saudi Arabia. Arabic-speaking male and female students in the first and the final years of medical school, who were enrolled in the college during the academic year of the data collection period (2017−2018), were invited to participate in this study. Chapter 2 has already outlined information relating to the study’s location, participants, and the medical education institutions in Saudi Arabia.

5.4 Sampling strategy

Research sampling is the process of selecting a sample unit from a larger group or population of interest, and its purpose is to address the study's research question (Tashakkori & Teddlie, 2010). This study involved a comparison between two groups of medical students undertaking the same curriculum in the same organisation. Purposive sampling is defined as “techniques involve selecting certain units or cases based on a specific purpose rather than randomly” (Teddlie & Tashakkori, 2003, p. 713). This study used the purposive sampling approach in two stages during the two phases of this study. Phase one targeted medical students in the first and final years only, and in the second phase, only the final-year medical students were invited to explain the results of the first phase.

5.5 Phase one; survey questionnaires

The first phase of the study took the form of a cross-sectional study. Data were gathered using a self-administrated questionnaire. This phase aimed to provide information about levels of medical students’ knowledge regarding T2D, their beliefs regarding ways to prevent T2D and their lifestyle habits related to preventing T2D. This phase further seeks to understand the relationship between these variables.

This stage used the HBM as a theoretical framework (Becker & Janz, 1985). Theories developed in social-behavioural and academic research help classify ideas, clearly identify the problem at hand, and help formulate the research hypothesis. Moreover, doing so might identify new issues and research areas (Cohen et al., 2017). Using the HBM might help to generalise the findings of this study. According to Gorard (2013), however, using the HBM to predict influencing factors might make the explanation tentative. To prevent this from happening, the second and the third phases of this research (the interviews and documentary analysis) added depth and provided a more reliable explanation.

Using the cross-sectional design in this phase was essential for three reasons: (a) to assess the variation between the two groups (first- and final-year medical students); (b) to assess the relationship between the research variables; and (c) to provide this research project with benchmark data for the next phase of the study.

5.5.1 Participant recruitment for phase one

In the first phase, participants were recruited from QUMS in Qassim city. The purposive sampling approach involved simultaneously recruiting medical students from the first and final medical school years. The approached participants were invited to take part in the study through receiving study information sheets and invitation flyers distributed by QUMS academic and administrative staff.

Due to the university's segregating of students according to gender, a volunteer researcher, who is familiar with taking body measurements, helped distribute the questionnaire and took the male participants' body measurements. In contrast, the researcher of the current study conducted data among female students. The medical school offered a classroom for the participants to complete the questionnaires and give their body measurements confidentially and in privacy.

In a cross-sectional study, an adequate sample size is needed to allow the resarcher to control for the risk of reporting a false finding (a type II error) (Pourhoseingholi et al., 2013). In this study, the sample size was calculated in order to identify the required number of study participants to answer the research question.

The formula used, was developed by Daniel and Cross (2013) and can be denoted as ;

n= N*X / (X + N – 1), where, X = $Z_{\alpha/2}^2$ -*p*(1-p) / MOE^2

Whereby, n is the sample size, p is the sample proportion (in this study p was 50%), and N is the population size (the total number of medical students in the first year was 127, and 100 in the final year, so the total population size was 227 medical students). Z refers to the corresponding statistical confidence level (for a confidence level of 95%, the Z value was determined as 1.96), and MOE is the margin of error (for a confidence level of 95%, the MOE is 5%). Given this formula, a sample size of 143 medical students was calculated as the minimum sample size required to control the risk of type I and II errors.

5.5.2 Data collection tool for phase one; survey questionnaires

The survey questionnaire comprised four parts; the structure and the content of each section was developed in different ways. The questionnaire was developed initially in English and later translated into Arabic. Two versions of the questionnaire can be seen in Appendices 5 and 6.

5.5.2.1 First section: knowledge of Type 2 Diabetes Mellitus health problem

The researcher and two supervisory team members identified knowledge at a basic competency level and designed and developed the knowledge assessment section. The formation of the questions in this section required a clear definition of T2D issues and the related concepts (Murray, 1999). It covered two main themes: (a) diabetes as an epidemiological health problem and (b) T2D prevention methods. The questions and items in the closed-ended multiple-choice questionnaire were formulated in line with up-to-date evidence, recommendations of the IDF, and what is routinely tested in other academic and health institutions. This section of the questionnaire was developed to describe and compare the basic T2D knowledge of first- and final-year medical students. It comprised nine questions, and each question could be answered by choosing one out of a choice of four or the participant could alternatively select ‘I don’t know’ as an option. Each correct answer was awarded two points, with incorrect answers awarded zero, and the ‘I don’t know’ option scoring one point. If the participant selected all answers correctly, the total score awarded would therefore be 18.

5.5.2.2 Second section, beliefs assessment

This section was developed based on the HBM's parameters: perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and perceived self–efficacy. Questions relating the parameters were rated on a four-point Likert-type scale, ranging from one (strongly disagree) to four (strongly agree). Questions relating to perceived susceptibility, perceived severity, perceived benefits and barriers in this section were partially adapted from a previous study conducted among people at high risk of developing T2D (Whitford et al., 2009). Other kinds of questions relating to perceived benefits and barriers to engage in T2D preventive behaviours were identified by the systematic review carried out for this research (detailed in Chapter 4).

The General Self-Efficacy (GSE) scale was used to measure perceived self-efficacy. This scale was originally developed through the German language medium in 1979 by Ralf Schwarzer and Matthias Jerusalem and has been translated to 33 languages, including Arabic (Schwarzer, 1999).

The final version of the beliefs assessment section in the questionnaire consisted of five parts, and each part assessed one of the HBM parameters. The total number of questions in this section was 39. Three questions related to perceived susceptibility, seven assessed perceived severity, 10 assessed willingness to overcome barriers, nine assessed perceived benefits, and 10 assessed self-efficacy.

5.5.2.3 Third section: behaviour assessment

This section was adapted from the Health Promoting Lifestyles Profile 2 (HPLP2). In 1987, Walker, Sechrist and Pender developed the HPLP2 scale to assess behaviours associated with a health-promoting lifestyle. A health-promoting lifestyle has been defined as "a multidimensional pattern of self-initiated actions and perceptions that serve to maintain or enhance the level of wellness, self-actualisation, and fulfilment of an individual" (Walker et al., 1987, p. 76). This approach to health promotion aims to increase the individual's responsibility for their health. The HPLP2 examines those self-induced behaviours and perceptions which sustain or improve levels of wellness. This term incorporates dimensions such as health responsibility, exercise, nutrition, spiritual growth, interpersonal relations, and stress management. The HPLP2 shows high internal reliability and consistency, with an alpha coefficient of 0.922. Test-retest reliability, in a sample of 63 adults tested every two weeks, produced values of r = 0.926 for the total scale (Walker et al., 1987). Moreover, this instrument has been used in different samples and demonstrates satisfactory internal consistency (Jefferson et al., 2000; Whittemore et al., 2009).

The HPLP2 scale is a 52-item questionnaire, with items rated on a four-point, Likert-type scale, where participants indicate the frequency of particular behaviours as ‘never’, ‘sometimes’, ‘often’ or ‘routinely’. The assessment tool consists of six subscales. However, in this study, only three subscales were adopted: physical activity, nutrition, and stress management. This limitation was for two reasons: (a) to focus on the behaviours potentially associated with preventing T2D and (b) to save participants’ time and effort as the whole questionnaire was already long. The reduction of the HPLP2 instrument was not expected to affect the questionnaire's reliability and internal consistency, as this process was previously followed by other researchers (Whittemore et al., 2009). The total number of questions included in this section was 25. Table 5.2 summarises the questionnaire variables.

5.5.2.4 Fourth section: anthropometric measurements

The height and weight were measured for the participants and reported in this section of the questionnaire, in order to calculate Body Mass Index (BMI) – weight (kg) divided by height (m^2). The BMI is a simple, non-invasive method for measuring adiposity and is a standard indicator used to assess health risks associated with being overweight, such as T2D and CVD.

5.5.2.5 Fifth section: demographic variables

This section aimed to elicit further information about the participating students, in terms of gender, level of study (first- or final-year in medical school), date of birth, and personal and/or family history of diabetes.

Table 5.2: Assisted variables and associated instruments in the research questionnaire

Sections	Indicators	Measurement tools
Knowledge	T2D as an epidemiological health problem	Multi-choice Questions
	Prevention and control strategies	Multi-choice Questions
Beliefs	Perceived susceptibility	HBM
	Perceived severity	HBM
	Perceived barriers	HBM
	Perceived benefits	HBM
	Self-efficacy	GSE
Behaviour	Exercise	HPLP2
	Diet	HPLP2
	Stress-management	HPLP2
Demographic	Age	Demographic questionnaire
	Gender	Demographic questionnaire
	Educational level	Demographic questionnaire
	Prior diagnosis of diabetes	Demographic questionnaire
	Family history of diabetes	Demographic questionnaire
Anthropometric Measurements	Bodyweight	Anthropometric measurements*
	Height	Anthropometric measurements*

**Anthropometric measurements ascertained by the research assessment after students fill in the questionnaire*.

5.5.3 Questionnaires' translation

In order for the research questionnaire to be understood in a way that is comparable across medical students studying in both the UK and Saudi Arabia (where the first pilot test took place in the UK and where the study was conducted in Saudi Arabia), it is necessary to have a translation procedure that yields equivalent versions of the questionnaire across the different language mediums. The Arabic translation of the original English-language questionnaire should be consistent and clear for all the sections. The first section of the questionnaire was initially developed in English (T2D Knowledge Assessment) but the HBM Scale (Becker & Janz, 1985), including the GSE scale (Schwarzer, 1999) and the HPLP2 (Walker et al., 1987) have been translated into several languages including Arabic (see Table 5.3).

The World Health Organisation (WHO) recommendations regarding the translation of research instruments were used to guide the translation of the questionnaire to achieve the highest possible content validity (WHO, 2008). This includes forward translation, back-translation, pre-testing, cognitive interviewing, and final version. As the research questionnaire was developed in three main sections, some sections were already translated into Arabic but not backwards into English. The steps of translation and adaptation of instruments are shown in Table 5.3. The first sections of the questionnaire followed all of the WHO's guidelines for instruments' translation and adoption. The second section had already been translated into 33 languages, including Arabic (Schwarzer, 1999). The third section had been translated into Arabic in previous research conducted in Kuwait (Al-Kandari & Vidal, 2007) and permission to use the Arabic version was granted from Al-Kandari and colleagues.

5.5.3.1 Stage 1: forward translation

The methodology process required the questionnaires to be translated into Arabic from English. For this purpose, each section of the questionnaire was translated independently by health professionals familiar with the terminology used in the questionnaire. All the translators involved at this stage are bilingual, and they are all native Arabic speakers (see Table 5.3).

5.5.3.2 Stage 2: back translation

This step was completed by two independent translators. The first is a professional translator from Lingua Translation Company, a native English speaker who translated the first three sections of the questionnaire, as shown in Table 5.3 (Appendix 7). The second translator is a PhD candidate at Swansea University Medical School (SUMS). He is a native Arabic speaker and translated the fourth section of the questionnaire. Both translators had no previous information about the original questionnaire.

The back translation of the questionnaire from Arabic to English in this study was limited to selected items deemed complicated in terms of how they may be interpreted. Such items account for almost 80% of the questionnaire. The other 20% of items including simple nouns (e.g., heart diseases, AIDS and 'I don't know'), were translated by the current study researcher.

This stage also involved reviewing the penultimate questionnaire with a small number of other experts. To ensure the back-translated version's conceptual and cultural equivalence and to avoid linguistic errors, any discrepancies were discussed with the experts who then approved the translated forms and a separate comparative analysis of the pre- and post-translated documents.

5.5.3.3 Stage 3: pre-testing and cognitive interviewing

This stage was completed by interviewing four male medical students in their third year at Almaarefa Medical College in Riyadh city. After they had completed the questionnaire, a short interview was conducted with each one of them independently, via Skype. The following questions were asked systematically for each section of the questionnaire:

- What does question X mean? Can you interpret the question in your own words?
- Why did you choose this answer?
- Did you face any difficulties in understanding the meaning of any word or expression or terminology?

Feedback from each participant was reported to the experts. Their report outlined issues with the format and identified potential modifications needed to be made to the questionnaire before the pilot stage. Subsequently, the experts reviewed this report and helped in developing the final version of the questionnaire. The pilot test was conducted among medical students in both the UK (for the English version) and Saudi Arabia (for the Arabic version of the questionnaire).

Table 5.3: Questionnaire translation task force

Questionnaire Sections	Developed By	WHO Translation Process / Done By		
		Forward translation into Arabic	Back translated into English	Back translation review
Diabetes Public Health Problem Knowledge Assessment	The current study team	The researcher	Lingua Translation Company	Supervisors
Health Belief Model Scale	Whitford et al. (2009)	Al-Mutairi et al. (2015)	Lingua Translation Company	Supervisors
The General Self-Efficacy scale[2]	Schwarzer (1999)	Al-Manssour et al. Germany, 1993[2]	Lingua Translation Company	Supervisors
The Health Promoting Lifestyle Profile 2	Walker et al. (1987)	Al-Kandari and Vidal (2007)	Asim Ali[3]	Supervisors

5.5.4 *Pilot study of phase one*

A pilot study is recommended to identify any potential problems with the survey questionnaire and its reliability, validity, feasibility, and practicability (Cohen et al., 2017).

For the current study, two pilot studies were conducted to evaluate the questionnaire's quality in the quantitative survey (English/Arabic version). The method for quality-assessment identified by Alyousef (2016) was used. It included testing the duration of the questionnaire, the effectiveness of its layout and presentation, the administration process, the level of question response, the difficulties of understanding questions, and the identification and resolution of any other unexpected procedural issues. The pilot study of this phase was therefore carried out to:

[2] http://userpage.fu-berlin.de/health/engscal.htm
[3] PhD Candidate, Swansea University Medical School.

- Assess the feasibility, reliability, and validity of the English version of the questionnaire.
- Assess the extent to which the knowledge assessment questions section is realistic and workable.
- Identify logistical problems potentially arising during the data collection period.

5.5.4.1 Sampling the pilot study

Selecting a sample size for pilot studies is a process guided by cost, time constraints, and the size and variability of the population (Cohen et al., 2017; Hertzog, 2008). Hertzog (2008) recommended sizes ranging from 10 to 40 per group, in order to evaluate their adequacy in providing estimates precise enough to meet a variety of possibilities. Meanwhile, other researchers advise that a pilot study sample should be 10% of the sample projected for the main study (Lackey & Wingate, 1998).

When it comes to the number of participants available for the body of the study, there were 227 medical students enrolled in the first- and the final-year in QUMS. To reach an adequate sample for the pilot study, 29 participants were included in the first pilot study (the English version); comprising 17 final-year medical students and 12 medical students in their first year of medical school; while in the second pilot study (the Arabic version), 10 participants were included. The second pilot study was planned to assess the feasibility, validity and time needed to complete the questionnaire by the students taking the questionnaire in Arabic. Due to the relatively small number of participants, it was not enough to calculate the internal reliability or to analyse the findings.

5.5.4.2 Recruiting participants for the pilot study

The first pilot study was carried out for a week in SUMS. The study was advertised via information sheets and wall-posters displayed in the medical school. Participants were provided with an information sheet and a written informed consent form. Study participants answered questionnaires, and then anthropometric measurements were recorded for each participant individually, and, as much as was possible, confidentially. Finally, each participant was given a copy of the debriefing form, and the finishing time was written on the top of the last page. Completing the survey took the participants 10−18 minutes, while the body measurements process took around three to six minutes. The pilot study participants were excluded from the main survey as they were not studying at QUMS. Moreover, a number of researchers recommend excluding the pilot sample from the main study sample (Hertzog, 2008; Lackey & Wingate, 1998).

5.5.4.3 Findings of the pilot study

The sample population comprised both male and female medical students. The first pilot study cohort were all British Male and female medical students (n=29), while the second pilot study cohort comprised Saudi male medical students (n=10).

A. Feasibility of the questionnaire

Feasibility was evaluated using the response rate, participants' time taken filling out the questionnaire, and data completeness on each questionnaire item. This pilot study targeted 140 students in SUMS (70 students in each cohort). The response was 21%, which is generally considered a low percentage and not acceptable (Bryman, 2016). The location and the length of the data collection process might account for the low response. These potential reasons were considered in the main study. The completion times for the questionnaire and anthropometric measurements ranged from approximately 10 to 18 minutes. The average length of time taken to complete the survey was under 14 minutes, which is generally considered an acceptable amount of time. There were also no missing data. One participant withdrew from the study after knowing about the body measurements requirement. Some participants recommended using an electronic questionnaire to encourage colleagues who were busy and, therefore, unwilling to come to the data collection room to participate.

5.5.4.4 Reliability of the questionnaire

Research instrument reliability refers to the degree to which an assessment tool produces stable and consistent results (Cohen et al., 2017). Cronbach's alpha was employed in this study to evaluate the internal consistency of the instrument and it is subscales. In terms of percentages Cronbach's Alpha test scores range from 0 to 100% or 0−1. The minimum acceptable alpha score for internal consistency is 70% or 0.70 (Bland & Altman, 1997).

The Cronbach's alpha was run only for the first pilot study, the English version, as the number of the participants in the second pilot study was small. The questionnaire's overall internal consistency in the pilot study was 0.825 which indicates that it has a high degree of reliability. Initial internal consistency estimates for the belief section were computed for each of the five subscales of the HBM. Results ranged for the individual subscale from 0.658 to 0.798 and the internal consistency for all the HBM subscales together was 0.837. This means that the HBM was a reliable, consistent scale and therefore suitable for further use during the data collection phase.

By testing the reliability of T2D preventive behaviours using the HPLP2, a moderate level of consistency was identified over the three included subscales (nutrition, physical activity, and stress management) with an overall result of 0.682. The main weak point was the 9-item nutrition subscale, with a Cronbach's alpha of 0.343, making it unreliable. Although many studies using the HPLP2 achieved relatively high scores, including all the subscales (Hashem et al., 2013; Nacar et al., 2014), by deleting the nutrition subscale from the HPLP2 assessment, the Cronbach's alpha score rose to 0.754, which makes it a reliable result. However, this option was considerable in the main study.

5.5.4.5 Validity of the questionnaire

Content validity refers to how the questions measure what they were intended to measure (Bryman, 2016). Frequency distributions were initially ascertained to assess the distribution of responses across sections. This analysis pointed to whether particular types of questions relating to knowledge assessment, beliefs and behaviour sections yielded the kind of data they were designed to obtain.

Content validity was assessed in this study to determine whether the language, content and structure of the Arabic version of the questionnaire were suitable. Participants in the second pilot study were asked if the questionnaire structure, the questions, and the language were clear and understandable. Participants were further asked to clarify how they understood and interpreted specific questions and how they chose their answers.

5.5.5 Analysis plan for phase one data

A total of 195 students participated in phase one of the current study, with a response rate of 85.6%. After completion of the data collection stage, the data entry and analysis were performed using SPSS (version 25) for Windows. The raw data, on the SPSS sheet, were first examined for omissions, inconsistencies, and potential errors to achieve quality control at the coding and data entry stages. Any errors discovered were corrected by checking the data against the hard copies of the questionnaires. The data were then checked for missing values (Field, 2013).

A clear analysis plan is essential for choosing the type of statistical techniques in a study (Bryman, 2016; Simpson, 2015). All the main study variables (knowledge, beliefs and T2D preventive behaviours) and the demographic variables data were presented using descriptive statistics in the form of frequencies, percentages, means and standard deviations for numerical variables (Field, 2013).

The demographic variables' values were summarised into numbers and percentages showing the variation between the two groups (first- and final-year medical students). Regarding the knowledge assessment section, the score for each question's answer was calculated, then the mean score for each cohort for each question was reported. The comparison between dependent variables – i.e., knowledge, beliefs and T2D preventive behaviours – in the two groups were summarised using parametric statistics of means and standard deviations, as shown in Chapter 6.

For the inferential statistics section, the study design, measurement levels, and the kind of selected inferential statistics were all developed based on the research questions. As the study aimed to describe the relationship between medical education, beliefs and T2D preventive behaviours, the independent samples *t*-test was used to identify any significant disparities regarding the dependent variables between the two groups (first- and final-year medical students). Statistical significance was defined as a p-value < 0.05 (Field, 2013; Simpson, 2015). The *t*-test was further used to address the research question "does medical education influence knowledge, beliefs and preventive behaviours relating to T2D among medical students in QUMS?".

The determination of the relationship between two series of data was carried out among (a) knowledge and beliefs, (b) beliefs and behaviours, and (c) knowledge and behaviours, then the evaluation of its strength was undertaken based on the Pearson correlation test. The Pearson correlation test is used to determine whether an association exists between two variables measured at the interval or ratio levels (Field, 2013; Simpson, 2015). Finally, to predict the variables that influence medical students'

T2D preventive behaviours, a multiple regression test was used to build the final model. Multiple regression is a type of analysis that considers the influence of multiple predictors on an outcome at the same time (Simpson, 2015).

5.6 Phase two; semi-structured interviews

The second phase of this study allowed medical students the time and the scope to explain their opinions, beliefs and reflections on the medical curriculum, and the influence of the curriculum, including the learning environment, on their lifestyle behaviours. The qualitative data were collected using a semi-structured interview. Using this method offers the opportunity to elicit rich and detailed data on how the students perceive that the medical curriculum influences their beliefs and practices. The main aim of interviewing the final-year medical students was to elicit the underpinning processes of influencing beliefs and preventive behaviours related to T2D during their academic education years in QUMS, Saudi Arabia.

5.6.1 Sampling and participants' recruitment for phase two

Since this is an explanatory, mixed-methods study, and since this phase constituted qualitative data gathering through semi-structured interviews, a smaller sample size than was required in the earlier phase of the study is acceptable. Researchers recommend the interview sample size to be from six to 12 participants (Abbas & Charles, 2003). Final-year medical students in QUMS were invited to participate in this phase. According to the data acquired in phase one, there would be a limited number of potential study participants (n=100). The only selection criterion was achieving a gender balance among participants. The principle of saturation was applied to the number of interviews carried out. To achieve saturation, interviews were collected and analysed to determine whether sampling additional participants would provide any new information (i.e. informational redundancy) (Abbas & Charles, 2003).

Participants were recruited from the cohort of the fifth year (final year) medical students only. They were enrolled in QUMS during the data collection period, as they are, at this stage, thought to be the most well-informed on how medical education influences medical students.

Study invitations were sent to the final-year students' representatives (i.e. student reps) for both female and male cohorts. They forwarded the study information sheet and invitation flyers to their colleagues via email and SMS messaging. Participants interested in taking part sent a text to the study researcher to set a time and their appropriate online Platform to be contacted through. The final sample comprised of 25 students willing to be interviewed. No further invitations were sent, as the data saturation was achieved.

Because the researcher was in the UK during the data collection stage of phase two, and the participants were in Saudi Arabia, telephone interviews were conducted. Even though using the telephone interviewing method was necessary because of logistics, this method of interviewing is valid (Bryman, 2016; Cohen et al., 2017). It presents both advantages and limitations (Cohen et al., 2017) which were mitigated in this study.

5.6.2 Data collection tool for phase two: semi-structured interviews

Data were collected through semi-structured interviews. The interviews were conducted to gather richer data with regard to the impact of medical curricula on students' health-promoting behaviours. The findings of the first phase of this research were summarized in a diagram (see Chapter 6) and presented to the participants to assess their interpretation of the findings and their justifications. The interview's questions were formulated based on the research objectives and the findings of the first phase in order to achieve the data necessary for obtaining satisfactory answers to the main research questions. This step is important for planning the interview study (Cohen et al., 2017). During the semi-structured interview, a flexible interview protocol was followed (see Appendix 8).

The interview schedule aimed to guide the information flow and to unify data-gathering approaches between participants. The interview schedules were prepared, and the contents of the schedules were reviewed with the supervisory team (Appendix 9). During the interviews, it was anticipated that the discussion would digress from the interview schedule to explore related ideas in more detail.

5.6.3 Pilot study of phase two

The pilot study sample consisted of two Saudi male medical students in their third-year medical school in Riyadh city, Saudi Arabia. Thus, the pilot participants bore strong similarities to the group of participants in the actual study. The pilot study was carried out in Arabic over the telephone and was voice-recorded. Before each interview, a consent form and information sheet were provided, the time allowed for reading and questions related to these were outlined, and the formal consent was obtained verbally. The interviews ranged from 20 to 25 minutes in duration, and they were transcribed and translated into English for preliminary analysis and further discussion with the researcher's supervisors. One of the main outcomes of this pilot staudy was that conducting the interviews, transcribing them in Arabic, then translating to and analysing the transcripts in English was time-consuming and labour-intensive. Each interview took four hours to transcribe and six hours to translate.

Another concern raised during the discussion following the preliminary analysis was that doing the interview in one language and analysing it in another language might compromise the findings' accuracy. Drawing on the pilot study's findings, the interviews were conducted, transcribed and analysed through the medium of Arabic only. However, from the main study interviews, five transcripts were translated into English for validation and review of the analysis process by a second reviewer. Selected quotations serving as examples for the emerging sub-themes were also translated to English (Appendix 10).

5.6.4 Quality and trustworthiness of data

Qualitative research's quality criteria have been subject to much debate (Bryman, 2016; Shenton, 2004). It is impossible to apply measures applicable to research aligned with a positivist stance to studies that come from an interpretivist or a constructivist paradigm. For example, the validity or generalisability issue would seem to have little bearing on studies gathering qualitative data (Bryman, 2016; Tashakkori & Teddlie, 2010). In light of this, the trustworthiness criteria suggested by Guba et al. (1994) were adopted because of their relevance and comprehensiveness. Trustworthiness was established by ascertaining the study's credibility, transferability, dependability, and confirmability (Guba et al., 1994; Shenton, 2004).

Research credibility essentially means the same as internal validity in quantitative studies (Shenton, 2004). To achieve this, the final research findings were developed using three different research methods, in addition to the systematic review findings that promote confidence in having accurately recorded how the medical curriculum influences a student's lifestyle. In other words, adopting a mixed-methods design triangulates the research interpretation and ensures its credibility.

The first three chapters described Saudi culture, lifestyle, medical education policies and regulations in extensive detail to verify the study's transferability and quality. Transferability means the extent to which a study's findings might be applied in another context (Shenton, 2004). In this study, the detailed methodology description was reported to help future researchers compare their findings with those of this study, aiming to enhance the study's dependability (Shenton, 2004).

The last criterion for ensuring trustworthiness was confirmability. Confirmability is associated with objectivity, which is difficult to achieve in qualitative research (Bryman, 2016; Shenton, 2004). Bryman encouraged researchers to show that they act "in good faith; in other words, it should be apparent that researchers have not overtly allowed personal values or theoretical inclination to sway the conduct of the research and the findings deriving from it" (Bryman, 2016, p. 386). In order to avoid any personal bias during the analysis of the interview scripts, an external reviewer was invited to review five scripts and highlight the emergent themes. Subsequently, the conducted sub-themes and the external reviewer comments were discussed in the context of academic supervision. This step was recommended to enhance the study's confirmability (Bryman, 2016; Shenton, 2004).

5.6.5 Analysis plan of phase two data

Qualitative data analysis concerns how to move from data to explain and interpret findings to answer the research question (Cohen et al., 2017). One purpose of qualitative data analysis in this study was to make sense of the collected quantitative data in phase one through analysing and interpreting the underlying meaning of what the data are conveying (Bryman, 2016). However, it might give rise to new findings and suggest new ways that were never thought about to answer the research question. For this study's purposes, the thematic analysis approach was used to give broader scope during the data analysis process, as this method can potentially provide a rich and detailed explanation that helps to understand the phenomena (Braun & Clarke, 2006).

The research questions often guide the data analysis method and research aim itself. The data analysis procedure was conducted alongside the data collection process. The ATLAS.ti programme was used to analyse, store and administer the imported, transcribed interviews. Although this software does not analyse the transcript without human intervention, it does help organise and structure the data for subsequent analysis (Cohen et al., 2017). ATLAS.ti was chosen for its ability to analyse texts in Arabic.

The 25 interviews conducted ranged from 18 to 40 minutes in duration. Transcription of each interview was conducted immediately after it ended, and was then re-checked against the recording in case anything had been misheard or omitted the first time around. Once the 25 participants had been interviewed, the audio files were downloaded to a password-protected computer at Swansea University.

During the first two interviews (P1 and P15), the model developed in the first stage of the research was used to describe the survey findings to the interviewees (Chapter 6). The recordings were paused for 20 and 23 minutes to give participants time to understand the results and ask questions. It became clear that the model was not helpful for the interviewees. Therefore, in the following interviews, the study and the findings were explained to the participants without showing them the model.

A codebook was developed during the coding process to act as a guiding manual. This reference source included specifications and definitions of the codes and a full detailed description of each code and when to apply it and when not to (Appendix 11). This step was useful for data analysis and ensured consistency in the coding process (Kodish & Gittelsohn, 2011).

The six thematic analysis approach steps outlined by Braun and Clarke (2006) were modified and applied in the analysis:

1. The first is familiarising oneself with the transcribing data, which involves transcription, reading, and re-reading the data. While doing this, notes were taken and preliminary observations made, then transcripts were checked against the original records to ensure accuracy and enable familiarisation with the data.

2. The second step is generating initial codes. After becoming familiar with the data, initial lists of the interesting elements of the data are produced in a systematic way across all transcripts. Each script was given equal attention to identify the emerging themes. This study carried out this step in parallel with developing the codingbook and using the ATLAS.ti Software. The collected codes were listed, and all the information relevant to these codes was reported in the coding book (see Appendix 11). There was great attention to code for as many potential themes/categories as possible. The process of coding is part of the analysis. Therefore the data were organised into meaningful groups, then a conceptual pattern and relationship between them were suggested.
3. The third step involves searching for themes. This step begins when all the data have been coded and grouped. It requires re-focusing the analysis on a broader level of themes, instead of focusing on codes, as in the second step. It is helpful to use tables, as a visual representation tool, to sort the different codes into different themes. In this study, themes were developed in two stages: categories then themes.
4. The fourth step is reviewing themes. This step begins when a set of candidate themes are developed. The defining themes in this research were reviewed to ensure internal homogeneity and external heterogeneity. In other words, this was done to ensure that the codes, and the developed themes, formed a coherent pattern. The validity of the individual themes was then reviewed regarding the data set.
5. Once the researcher was confident that the developed thematic map presents the whole data accurately, and that the developed thematic map in this study fit and explained the influencing process of medical education in healthy lifestyle among future doctors, the fifth step begins. This consists of defining and naming themes. At this stage, the essence of each theme was identified: what is the theme about? why is it interesting?
6. The sixth step consists of producing the report. This step consisted of writing up the findings of the qualitative data for this study.

5.7 Phase three; documentary content analysis

The third phase of this study aimed to answer the second research question; “how does the medical education curriculum influence the beliefs and health-related behaviours in relation to T2D prevention among medical students in Saudi Arabia?". This was accomplished by reviewing the description and guidelines of the medical curriculum documents that were published by the medical education regulatory bodies in Saudi Arabia and from QUMS to explain the existing health promotion strategies to support students' wellbeing in general and T2D prevention in particular. This analysis intended to achieve the following objectives:

- Identify health promotion strategies embedded within the medical curriculum.
- Describe how religious, social and cultural values are presented in a health-promotion context within the medical curriculum.

5.7.1 Research framework of phase three

Phase three used documentary content analysis method to understand and further investigate the themes that emerged from the interviews and that might explain the influencing role of medical education on the students' T2D preventive behaviours, (see Chapter 7). Documentary analysis is a method of developing knowledge regarding a particular phenomenon being studied (Ahmed, 2010; Gorsky & Mold, 2020). However, it is a type of research methodology that is often neglected (Ahmed, 2010). Some researchers have expressed doubt regarding the extent to which documentary analysis can accurately describe a phenomenon (Bryman, 2016). Atkinson and Coffey (2011) argued that documentary analysis should be viewed as a distinct level of reality in its own right. In other words, they argued that researchers should examine the document in terms of the context in which it was originally developed and intended for and try to understand the mindset of the readership for which it was designed (Atkinson & Coffey, 2011; Bryman, 2016).

Documents should not be regarded as precise, accurate or complete recordings of events that have occurred (Ahmed, 2010; Bowen, 2009; Gorsky & Mold, 2020). Bowen (2009) advised against simply transferring words and passages from the documents to a research report and instead establishing the meaning of the document and its contribution to the issues being explored. Using the documentary analysis findings in this study would make the answer to the research question more precise and reliable. Triangulating data was intended to ensure the credibility of the evidence. Using multiple methods of developing data sets and considering them alongside one another would prevent bias creation (Bowen, 2009). Bryman (2016) stated that triangulation of data sets makes for a more substantial and authoritative piece of research than one that uses a single methodology, or one that perhaps demonstrates strong bias.

Some researchers noted that documentary analysis produces high-quality research in ethnographic studies, and sometimes it is more cost-effective than surveys, interviews, or participant observation (Ahmed, 2010; Bowen, 2009; Gorsky & Mold, 2020). However, studies that draw on documentary data are constrained by what are available and their quality (Bowen, 2009).

Relying on documentary analysis as the sole research methodology is insufficient for accurately understanding a phenomenon (Ahmed, 2010; Atkinson & Coffey, 2011; Bryman, 2016; Gorsky & Mold, 2020). Therefore, researchers need to develop other sources of data regarding the real-life contexts within which the documents are produced (Atkinson & Coffey, 2011; Bryman, 2016). By triangulating data sets, the researchers can protect their research from potential accusations of reactivity, researcher bias, and respondent bias (Bowen, 2009). Thus, multiple data sets provide a more complete and nuanced picture of the research topic under examination than would a set derived from a single methodology.

The analysis framework of phase three followed the documentary content analysis methodology in two stages: (a) quantitative content analysis of words and phrases relating to the highlighted themes from phase two and (b) qualitative content analysis (see Figure 5.3). The ATLAS.ti software was used to import documents (listed in Table 5.4) and search systematically for the highlighted themes from phase two. Furthermore, data were imported and analysed in either Arabic or English according to the language used in the document of focus.

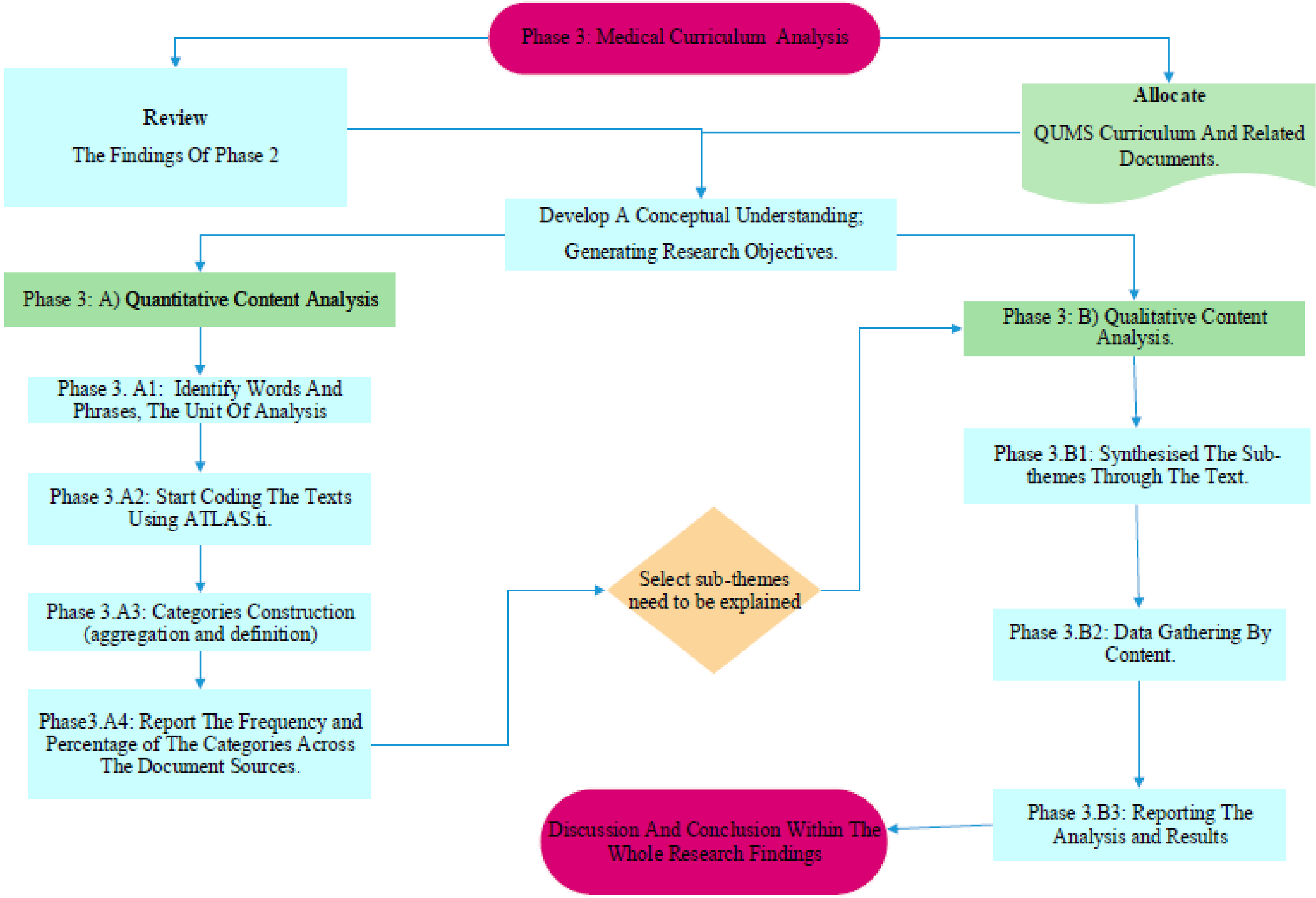

Figure 5.3: Study design process of phase three

5.7.2 Sources of documents

A request in writing to gain access to the Blackboard system of QUMS to analyse the medical curriculum was sent to the Dean of the QUMS and authorised personnel in QU. The request letter explicitly stated that the information on the Blackboard would not be used for commercial purpose and not to be shared with any external party unaffiliated with this research project. After several months of waiting, the request was declined for security reasons.

An alternative plan was devised, and the research team decided to request the medical curriculum from the QUMS. The new request to QUMS was to provide copies of the medical programme (including the course description, objectives, curriculum, evaluation, and assessment) and examples of PBL case scenarios. The QUMS' staff believed, however, that all the PBL case scenarios and assessment tools were confidential documents that might be used again in the future and that sharing these documents would affect their reliability. QUMS offered the medical programme description, selected courses' descriptions and the syllabus that related to the scope of the study only. This restriction thus limited the study's scope and affected the quality of the data and its interpretation. A list of the requested courses was developed. Selecting the course to be included was based on its relevance to the research question.

This study collected the data from three sources: QUMS, NCAAA and SCFHS. The decision to add NCAAA and SCFHS for the data sources was made after considering and discussing with the supervisory team, the possible effects of the limited documents from QUMS on the credibility of the findings. Findings based on a limited number of medical courses of QUMS, as the only source of data, might not fully or accurately represent the current medical education system in Saudi Arabia nor the medical curriculum of QUMS. To overcome this limitation and reach a contemporary picture of the health promotion and T2D prevention content within Saudi medical curricula, the Saudi medical programmes' accreditation guidelines and standards issued by NCAAA were added to the analysed documents. SaudiMEDs is a national framework that promises equivalent standards, and at the same time guaranteeing schools and faculty's autonomy (Zaini et al., 2011), (see Chapter 2). SaudiMEDs is part of the NCAAA, which is similar to the CanMEDs framework in Canada. The CanMEDs acknowledge health promotion and medical students' wellbeing in their strategies, and therefore including the NCAAA, would show how the medical education regulatory bodies in Saudi Arabia deal with medical students' wellbeing.

In order to go deeper into the medical curriculum, it was essential to use academic resources and references that are part of the curriculum. Some of the SCFHS publications were part of the medical curriculum of Saudi medical schools including the QUMS curriculum. Some courses run by QUMS identify these references in their course descriptions. Since these documents are openly published and available, they were added to the review. Some of the documents included in this study are written in Arabic and some in English. Table 5.4 presents the types of data included and Figure 5.4 describes the relationship between the medical student and the three sources of documents.

Qassim University Medical School (QUMS)

The College of Medicine adopted the PBL curriculum with a hybrid approach. A total of 41 courses are taught in three phases in medical school (see Chapter 2). The curriculum documents that describe the courses related to T2D prevention are included in Table 5.4.

The Saudi Commission for Health Specialties (SCFHS)

The SCFHS is an independent body, working to accredit postgraduate programmes, board examinations, professional classification, licensing, and registration (Telmesani et al., 2011). Each medical school acknowledges SCFHS resources to prepare students for the national examination and the qualification required for obtaining the Saudi licence to practice medicine. This licence is administered by the SCFHS (Telmesani et al., 2011). Therefore, it was essential to include this educational resource with the literature to be analysed since it was used in QUMS. The selected resources published by the SCFHS and used in QUMS are shown in Table 5.4.

The Saudi National Commission for Academic Assessment Accreditation (NCAAA)

Since the NCAAA was tasked with quality assurance for higher education in the country, it is mandatory for every institution of higher education to be accredited by the NCAAA (Telmesani et al., 2011) (see Chapter 2). The accreditation criteria for medical schools are similar to criteria applied in other educational institutions. In this study, the SaudiMEDs framework was included as it shows specific accreditation requirements for medical schools. The selected documents from the NCAAA are listed in Table 5.4. The relationship between the three sources is presented in Figure 5.4.

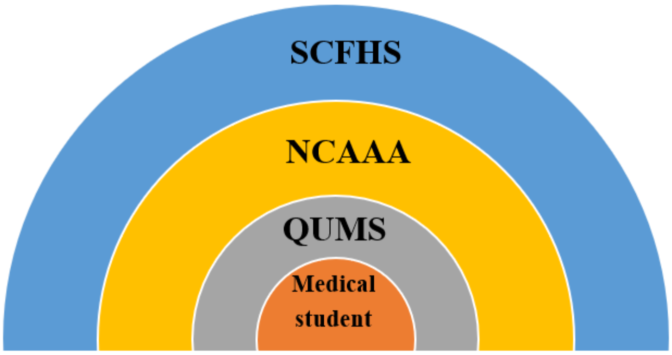

Figure 5.4: The relationship between the medical student and the three sources of documents

Table 5.4: Description of the included documents in the curriculum analysis

Documents	Name of the document/ symbol	Source	Type of the data	Issue date	Language of the document
D1	CMD212: Growth and development	QUMS	Course description	2015 – 16	EN
D2	CMD 211: Medical education Concepts and Principles	QUMS	Course description	2016 –18	AR & EN
D3	CMD 212: Principles of Pharmacology and Therapeutics	QUMS	Course description	2017-18	EN
D4	CMD 213 Man and His Environment	QUMS	Course description	2015-16	EN
D5	CMD 221 Principles of Disease	QUMS	Course description	2016 –17	AR & EN
D6	CMD 312 Cardiovascular System	QUMS	Course description	2018-19	EN
D7	CMD 322: Reproduction and Endocrine	QUMS	Block Brochure	2017-18	AR & EN
D8	CMD 332: Gastrointestinal system	QUMS	Course description	2018-19	EN
D9	FCM 431: Family and Community Medicine	QUMS	Course summary	2018-19	EN
D10	HIC-1 211: Health and illness in the community 1	QUMS	Course objectives	Missed	EN
D11	HIC-1 211: Principles of Population Health	QUMS	Course description	2017-18	EN
D12	HIC-2 311: Health and illness in the community -2	QUMS	Course description	2017-18	EN
D13	MED 311 Clinical Skills	QUMS	Course specifications	2018-19	EN
D14	MED 411 & 412 Medicine 1 & 2	QUMS	Student's Orientation Booklet	2018	EN
D15	CMD 321: Pathological Bases of Diseases	QUMS	Course description	2017-18	EN
D16	College of Medicine Programme Manual	QUMS	Booklet	2003	AR & EN
D17	Staff Guide for Qassim University Medical School	QUMS	Booklet	2008	EN
D18	Student Guide for Qassim University Medical School	QUMS	Booklet	Missed	EN

Cont.

Document	Name of the document/ symbol	Source	Type of the data	Issue date	Language of the document
D19	ETHIC 411	QUMS	Course description	Missed	AR
D20	ISLAM 101	QUMS	Course description	Missed	AR
D21	ISLAM 103	QUMS	Course description	Missed	AR
D22	ISLAM 301	QUMS	Course description	Missed	AR
D23	Academic Guidance Handbook	QUMS	Booklet	Missed	AR
D24	Communication Skills Key to Understanding	SCFHS	Booklet	2016	EN
D25	Health Practitioners' Ethics	SCFHS	Booklet	2014	AR
D26	Communication Skills Key to Understanding	SCFHS	Booklet	2016	EN
D27	Annual Programme Report	NCAAA	Form	2018	EN
D28	Course Report	NCAAA	Form	2018	EN
D29	Course Specifications	NCAAA	Form	2018	EN
D30	Eligibility Requirements for an Application for Programme Accreditation	NCAAA	Handbook	2018	EN
D31	Programme KPIs Performance Indicators	NCAAA	Indicators	2019	EN
D32	Programme Specifications.	NCAAA	Form	2018	EN
D33	SaudiMEDs Framework	NCAAA	Handbook	2017	EN
D34	Self-Study Report for The Programme	NCAAA	Form	2018	EN
D35	Self-Evaluation Scales for Higher Education Programmes	NCAAA	Manual and Form	2018	EN
D36	Standards for Programme Accreditation.	NCAAA	Standers	2018	EN
D37	Standards for Quality Assurance and Accreditation of Higher Education Programmes	NCAAA	Standers	2015	EN

5.7.3 Quality of documents

Managing documentary sources is not different from methods applied to other areas of social research (Ahmed, 2010; Bowen, 2009). In the documentary analysis, it is important to provide detailed information about how the study was designed and conducted to ensure the validity of the findings (Bowen, 2009). Scott developed quality control criteria for handling documentary sources, which included the following guiding principles: authenticity, credibility, representativeness and meaning (Scott, 2014).

Authenticity refers to the truthfulness of origins, and that evidence, attributions and intentions are genuine. Authenticity of evidence for analysis is the fundamental criterion in any research (Ahmed, 2010; Scott, 2014). Therefore, it was essential to ensure that the selected documents are genuine and have integrity. All the included documents in this study are the official documents published by the institutions named and are thus authentic.

Credibility refers to the objective and subjective components of a source's believability (Ahmed, 2010; Scott, 2014). Bryman characterised the credibility of a document according to whether it is free from error and distortion. Official documents generally require a higher level of credibility (Bryman, 2016). The documents have to be prepared independently and beforehand and, most importantly, the documents must not be produced for the benefit of the researcher (Scott, 2014). None of the documents included in this study was prepared for the benefit of the researcher, and the documents allocated from the NCAAA and the SCFHS were published on their web pages. For this phase, the latest version of each document was included, as shown in Table 5.4; therefore, the included documents were considered as credible.

Representativeness refers to whether the evidence is typical of its kind or not, and this issue is more applicable to some documents than to others (Ahmed, 2010; Scott, 2014). It might, therefore, be considered a complicated issue (Bryman, 2016). In this research project, limited access to the full curriculum of QUMS, the nature of the analysed documents, curriculum descriptions and guidelines might affect the extent to which the documents represent the medical students' wellbeing values within the medical school environment. Therefore, the findings of this phase are not generalisable and cannot be interpreted separately from the students' interview phase. This is one of the limitations of documentary analysis in general, as documents were produced for some purpose other than the research project's goal. They are created independent of a research agenda and, consequently, they do not always provide sufficient information to fully answer a research question (Bowen, 2009).

Assessing the *meaning* of the document as a quality criterion refers to whether the evidence is clear and comprehensible (Bryman, 2016; Scott, 2014). Ahmed (2010) shed light on another important point to consider in analysing documentary sources, which is how the researcher should decide which inference to make from a document about matters other than the truth of its factual assertions. Social scientists tend to use traditional methods, such as surveys or interviews, to interpret the meaning of the textual data (Ahmed, 2010). In this research, the interviews helped to anticipate what was happening through understanding the perceptions of these key informants, something that may not be able to be deduced from documents (Ahmed, 2010). Here, interviews were used as key information to understand the textual evidence in greater depth. They helped capture certain perceptions related to how medical institutional bodies contextualise religion and culture within the curriculum. The process also helped to detect any meaning conflicts.

5.7.4 Analysis plan of phase three data

Phase three of this study used content analysis methodology. Content analysis is a means of analysing texts, and it has been used in research exploring newspaper articles and interview transcripts (Bos & Tarnai, 1999). Content analysis is an “approach to the analysis of documents and texts that seeks to quantify content in terms of predetermined themes and a systematic and replicable manner” (Bryman, 2016, p. 285). This type of analysis emphasises the reliability and validity of the framework to ensure that the study findings' inferences are justifiable (Bos & Tarnai, 1999).

The findings of the thematic analysis of the second phase hypothesised a potential influencing role of the medical curriculum of QUMS and other national medical regulatory bodies in Saudi Arabia in developing students’ perceptions of their health-related behaviours and lifestyles. The findings of phase two suggested that students’ wellbeing strategies as well as social and religious values played vital roles in developing students’ beliefs toward their wellbeing and their lifestyles.

A list of all possible cue words and phrases expected to reflect wellbeing strategies, social and religious values in the curriculum was developed. The identified words and phrases (codes) were aggregated under sub-themes, and then themes. Their frequencies were counted, then presented as a measure of the theme's intensities within the curriculum documentation.

5.7.4.1 Quantitative content analysis

This approach investigated the role of medical education curriculum in influencing students' health-promoting behaviours. This approach followed the analysis steps suggested by Rourke et al. (2001). After selecting the documents and highlighting the areas needing to be investigated from phase two, the analysis steps were implemented as follows, and as shown in Figure 5.3.

- To begin with, the research objectives were reviewed to guide the process of collecting and preparing the documents. All the included courses, higher education strategies, guidelines and accreditation documents are listed in Table 5.4.
- Areas that needed further investigation in this phase were defined to ensure the reliability of searching for codes (see Table 5.5).
- After reading through the literature and discussing it with the supervisory team, the analysis units were selected which, in this study, were words and phrases that might be used to explain and refer to the investigated areas.
- Documents were imported using ATLAS.ti software for coding and analysis.
- A comprehensive and systematic review of the medical curriculum and all related documents carried out by noting any word or phrase associated with health promotion and T2D prevention, general or specific, was used for coding (i.e. wellbeing, health promotion, healthy lifestyle, healthy diet, disease prevention, role modelling, empowerment, social support, and stress management) (see Table 5.5).
- If the word/phrases reflected the investigated areas' definitions, it was highlighted and counted as a code using the Auto-code feature in the ATLAS.ti software. This step was conducted in both Arabic and English.
- Words and phrases were counted in the body of the text electronically, which was more efficient than undertaking this manually. This method increased the

reliability of the findings, and it was easy to handle a large number of documents in a short time (Bryman, 2016).

- After a complete review of the first three documents, more synonyms of the cue words/phrases were added to the content analysis framework. The aim was to pilot the early version of the extracted words and phrases. Piloting helped identify the difficulties of categorising some terminology, and it enhanced the quality of the searching codes. Multiple researchers recommend this step for content analysis approach (Bryman, 2016; Wesley, 2009).
- After completing the coding process, codes were grouped into sub-themes.
- Frequency of the codes within the document was presented on an Excel sheet.
- The frequency and percentage of themes, sub-themes and codes across the three documents sources were tabulated.

5.7.4.2 Qualitative content analysis

This approach was used to give meaning to the finding codes. Quotations were used to shed light on the medical curriculum influences on medical students' behaviours to prevent T2D. This approach followed the qualitative approach of content analysis process suggested by Elo and Kyngäs (2008). The process involved conducting the following steps:

- Codes were grouped into sub-themes. This step was done in conjunction with the quantitative content analysis process.
- Quotations were identified to represent sub-themes.
- The final report interpreted the findings using both approaches.

Table 5.5: The investigated areas' definitions and cue words/phrases

Investigated areas	Definition	Example of cue words
Students' wellbeing strategy to prevent T2D	Terminology used in the text refers to healthy lifestyle, healthy behaviours and attitude aimed to prevent diabetes, and health promotion strategies that aim to promote the students' wellbeing.	Community health, public health, wellbeing, diabetes, T2D, exercise, physical activity, fitness centre, sport, health promotion, healthy lifestyle, self-awareness, control stresses, healthy meals, healthy foods, healthy diet, nutrition. Health belief, health attitude, behaviour modification. Empowerment, patient attitude, patient education, patient empowerment, patient's perception, support. تعزيز الصحة ، تعزيز الصحة الذاتية ،صحة المجتمع ،مرض السكري ،داء السكري البولي ،وقاية النفس ،تغيير السلوك ،نشر الوعي ،تعزيز السلوك الصحي. (the Arabic codes of the theme)
Social and religious values	Refers to following healthy lifestyle behaviours in the context of social and cultural influences or in context of religious influence.	Prevailing culture, social norms, social influence. تأثير اجتماعي، عادات اجتماعيه، اعراف اجتماعيه تقاليد اجتماعيه. (the Arabic codes of the theme) Faith, Islamic values, religious belief الاسلام ونمط الحياة، القيم الإسلامية قدوة حسنة، الأمانة، الاحسان. (the Arabic codes of the theme)

5.8 Ethical considerations

As the research was among students, it was essential to consider the potential effect of this research on participating students. Consequently, the ethical research considerations were different in the three phases of the study due to the type of research, participant recruitment, and type of questions asked. Following submission to the Swansea Medical School Research Ethics Sub-Committee, approval for phases one and two was gained. In addition, a permission from Qassim University Medical School in Saudi Arabia was gained from the dean's office in QUMS to allow this study to be conducted (see Appendix 12). Regarding phase three, there was no need for ethical approval, as the analysed documents were published and available for public scrutiny.

5.9 Conclusion

The research methodology used to answer the research questions addressed by this study was explanatory sequential mixed-methods design which produced quantitative and qualitative data. This study follows the pragmatism paradigm philosophical framework (Abbas & Charles, 2003). This approach helped to optimally frame, examine and provide tentative answers to the research questions. Moreover, in this study, using a mixed-methods approach contributed to producing more in-depth information about the predicted factors and provided a richer data set to analyse. Reliability and credibility of the interpretations were strengthened through triangulation using the different types of evidence.

The first phase of the explanatory sequential mixed-methods design was the quantitative data phase, during which data were collected using knowledge, beliefs and T2D preventive behaviours questionnaire. The findings of phase one were used to address research questions one and two. Following the quantitative data collection and analysis phase, semi-structured interviews with medical students were conducted. The second phase of the study aimed to collect qualitative data among final-year medical students of their on-campus experiences that facilitate or inhibit the adoption of T2D preventive behaviours and the related role of the medical curriculum. Phase three aimed to understand how the emerged themes from the phase two function in the context of the medical curriculum in Saudi Arabia. Documentary content analysis were used in phase three with quantitative and qualitative analysis approaches. Interpretation of the findings from phases two and three addressed the second research question.

CHAPTER 6 RESULTS OF PHASE ONE: SURVEY QUESTIONNAIRE

In this phase of the thesis, quantitative data were obtained through a self-administered questionnaire, which was used to assess and describe medical students' knowledge, beliefs and lifestyles related to preventing T2D in Saudi Arabia. The contents of this chapter are divided into three parts: the first part confirms the reliability of the research instrument and describes the characteristics of the study participants.

The second part outlines the results of levels of medical students' knowledge, beliefs, T2D preventive behaviours, and the evaluation of the variations among the two groups (first- and final- year medical students) in relation to the three domains (i.e. knowledge, beliefs, and preventive behaviours). These results are presented using descriptive statistics in the form of frequency, percentage, mean, standard deviation and variation test results.

The third part of the chapter describes the relationships between variables, and analyses how all study factors compare and relate to one another, focusing particularly on how such factors predict medical students' T2D preventive behaviours. Inferential statistics – correlation and regression – were the data analysing processes used to assess results in this section.

6.1 Description of the quantitative data

6.1.1 Reliability of the research instrument

Research instrument reliability, which is the extent to which an assessment tool produces stable and consistent results (Cohen et al., 2017), was assessed during the pilot and the main study to ensure the collected data's reliability. Table 6.1 shows the reliability score for each of the subscales in the study tool, in which the overall internal consistency of the questionnaire in this study is 0.88, which indicates that it is a highly reliable instrument.

Table 6.1: Cronbach's Alpha result of the questionnaire

	Cronbach's Alpha	No of Items
HBM subscale	0.84	33
HPLP2	0.86	25
Questionnaire overall	0.88	58

The questionnaire's feasibility during the data collection stage was assessed in this phase using the response ratio. Out of the 227 medical students enrolled, 195 participated in the study by completing the questionnaire and consenting to be measured for body weight and height. The overall response was 85.9% (89.2% and 82% for first- and final-year medical students, respectively). Reasons for non-completion of the questionnaire were (a) coincided with teaching sessions, (b) student placement in different hospital sites, and (c) leave/absences. No questions relating to the meaning of individual words or questions were raised during the data collection process, which indicated a lack of ambiguity with regard to the content of the questionnaire.

6.1.2 Participant characteristics

The purposeful sampling approach involved simultaneously recruiting medical students from two cohorts, first-year students and final-year students. Participants of both genders were recruited over a four-week period. The goal was to obtain a representative sample of medical students in QUMS. The majority of participants were first-year students (57.9%), and just over half of both sample cohorts were male (51.3%). Sixty-eight per cent (n= 135) of the participants had a family history of T2D. The mean age of first- and final-year medical students were 20.1 ± 0.54 and 24.5 ± 1.2, respectively (see Table 6.2).

Table 6.2: Demographic variables of study participants by academic level

Variables	First-year	Final-year	Total
Number of subjects (%)	113 (57.9)	82 (42.1)	195 (%)
Age (years)	(20.1 ± 0.54) 19-22 years	(24.5 ± 1.2) 23-28 years	(21.9 ± 2.4) 19-28years
Gender			
Male	53 (46.9)	47 (55.3)	100 (51.3)
Female	60 (54.9)	35 (42.7)	95 (48.4)
Family history of T2D			
None	40 (35.4)	22 (26.8)	62 (31.8)
One member	40 (35.4)	28 (34.1)	68 (34.9)
Two or more members	33 (29.2)	32 (39)	65 (33.3)
BMI Classification*			
Underweight < 18.5	16 (14.2)	7 (8.5)	23 (11.8)
Ideal body weight 18.5 – 24.9	62 (54.9)	42 (51.2)	104 (53.3)
Overweight 25.0 – 29.9	26 (23)	17 (20.7)	43 (22.1)
Obese class 1 30.0- 34.9	6 (5.3)	15 (18.3)	21 (10.8)
Obesity class 2 35.0 – 39.9	3 (2.7)	1 (1.2)	4 (2)

**The classification adopted from the WHO report (WHO, 2000).*

6.2 Descriptive analysis of the medical students' knowledge, beliefs, and health promotion behaviours related to T2D

6.2.1 Knowledge assessment

Participants' knowledge regarding T2D was measured in two sections: (a) T2D as an epidemiological health problem (four different issues relevant to the topic) and (b) T2D prevention methods (five components). The process through which these questions were devised was described in Chapter 5.

Boxplots were used to demonstrate how knowledge assessment data were distributed between first- and final-year medical students. The boxplot provides a simple yet effective and useful means of analysing a data set because it highlights only the essential characteristics of the data set (Potter et al., 2006). The boxplot in Figure 6.1 shows that final-year students were significantly more knowledgeable than first-year students. The final-year students' median knowledge score was 11; that is, 50% of the cohort scored between 9 and 13 points. In comparison, the first-year students' median score was below nine, and half of these participants' scores were between eight and 10 (see Figure 6.1 and Table 6.3). In conclusion, both groups showed a moderate level of awareness of T2D.

A *t*-test was applied to detect any significant difference between the variation of knowledge related to T2D between the first- and the final-year medical students. Significant difference in variation was reported between the two groups: $t(13.15) = 4.45$, $p < 0.00$. The mean of the total score of the final-year students (10.6 ± 2.8) was significantly higher than that of first-year students (9.1 ± 2). The final-year students showed a higher mean score in eight elements of the knowledge assessment section, and four of these differences were statistically significant (see Table 6.4).

Table 6.3: Distribution of the knowledge score among first- and final-year medical students in QUMS

Total score of knowledge	Academic level	Percentiles			Median	Mean	S. D	95% C. I	Minimum	Maximum
		25	50	75						
	First-year	8	9	10	9	9.1	2	8.7 _ 9.5	5	13
	Final-year	9	11	13	11	10.6	2.8	10.1 – 11.26	3	16

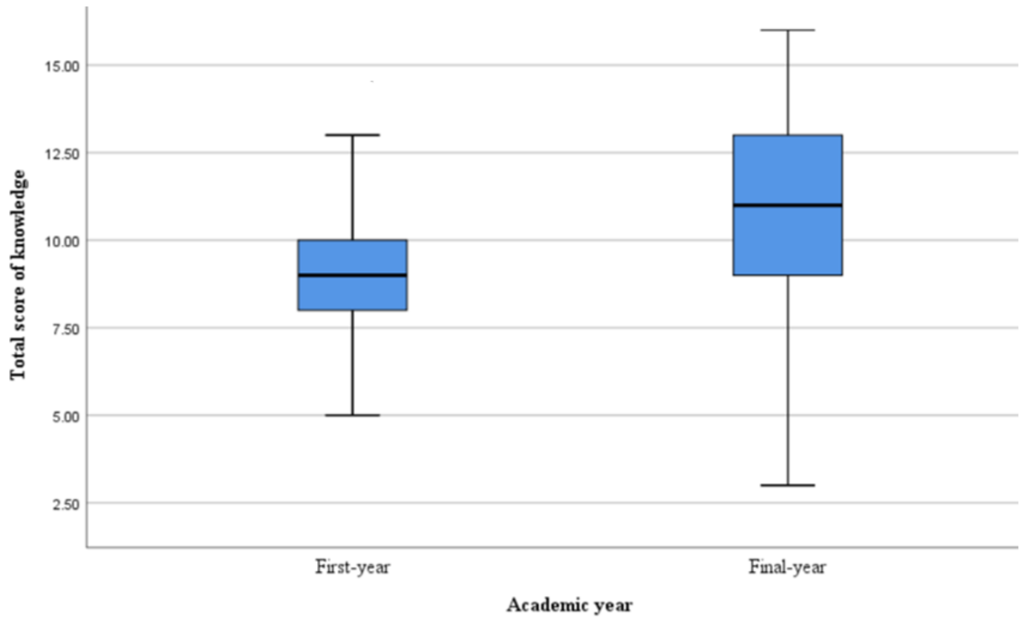

Figure 6.1: Comparing T2D knowledge score between first- and final-year medical students in QUMS

Table 6.4: *Differences of knowledge scores between first- and final-year medical students in QUMS*

Knowledge questions	Mean of knowledge of		*t* test	df	*p* value
	First-year	Final-year			
1. What is the estimated number of adults in the world who have diabetes (type one and type two combined)?	1 ± 0.35	1 ± 0.54	0.00	193	1.00
2. The major cause of morbidity and mortality for individuals with diabetes is…:	1.68 ± 0.718	1.9 ± 0.83	-4.28	193	0.00*
3. From the list below, which pair of countries has the highest absolute number of people with diabetes (type 1 and type 2 combined).	0.25 ± 0.51	0.18 ± 0.45	0.92	193	0.36
4. What is the prevalence of diabetes (type 1 and type 2) in Saudi Arabia?	0.97 ± 0.60	1.35 ± 0.82	-3.723	193	0.00*
5. Changing which of the following factors will reduce the risk of developing type 2 diabetes.	1.3 ± 0.86	1.83 ± 0.54	-4.84	193	0.00*
6. Type 2 diabetes and prediabetes should be considered, and identified, in children and adolescents who are:	0.57 ± 0.68	0.2 ± 0.76	-0.54	193	0.59
7. Which of the following is part of the comprehensive diabetes evaluation?	1.3 ± 0.86	1.3 ± 0.95	-.031	193	0.98
8. As part of standard diabetes prevention, physicians should:	0.98 ± 0.94	0.93 ± 0.94	0.41	193	0.68
9. Structured patient education, an integral part of the management of all people with Type 2 diabetes, should:	1.5 ± 0.8	1.7 ± 0.63	-2.29	193	0.02*
Overall knowledge	9.1 ± 2	10.6 ± 2.8	-4.55	193	0.00*

6.2.2 Belief assessment

This section was developed using the five factors described in the HBM (Becker & Janz, 1985) (see Chapter 1): perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and perceived self-efficacy. The theory was used to predict factors that might influence T2D preventive behaviours among medical students. The justifications behind using the model were reported in Chapters 1 and 5.

6.2.2.1 Perceived susceptibility

Study participants were asked to rate how likely they think it is that they might develop T2D at some point in their life (susceptibility). The maximum score was four for each item, and a minimum score of three was required to indicate that the participant believed that they might develop T2D in the future. Three questions were used to assess perceived susceptibility.

Generally, one hundred and forty-five participants (74%) believed it likely that they would develop T2D at some point in the future. One hundred and sixty-two participants (83%) believed it likely that someone would develop T2D even with no family history of T2D. One hundred and twenty-three participants (63%) worried about the potential risk of developing T2D (see Table 6.5).

Table 6.5: Distribution of perceived susceptibility of T2D among first- and final-year medical students in QUMS

Susceptibility questions		**Not at all likely**	**Not very likely**	**Quite likely**	**Very likely**	**I don't know**
		n(%)	**n(%)**	**n(%)**	**n(%)**	**n(%)**
1. How likely do you think it is that you will get T2D sometime in your life?	First-year	4(3.5%)	12(10%)	66(58.4%)	8(7.1%)	23(20.4%)
	Final-year	2(2.4%)	6(7.3%)	54(65.9%)	17(20.7%)	3(3.7%)
	Total	6(3.1%)	18(9.2%)	120(61.5%)	25(12.8%)	26(13.3%)
2. How likely do you think it is that someone will get diabetes if he or she does not have a family history of T2D	First-year	5(4.4%)	18(15.9%)	75(66.4%)	7(6.2%)	8(7.1%)
	Final-year	0(0%)	0(0.0%)	69(84.1%)	11(13.4%)	2(2.4%)
	Total	5(2.6%)	18(9.2%)	144(73.8%)	18(9.2%)	10(5.1%)
		No	**Rarely**	**Sometime**	**Often**	**I don't know**
3. Do you worry that you might get T2D sometime in your life?	First-year	25(22.1%)	22(19.5%)	46(40.7%)	19(16.8%)	1(0.9%)
	Final-year	13(15.9%)	10(12.2%)	36(43.9%)	22(26.3%)	1(1.2%)
	Total	38(19.5%)	32(16.4%)	82(42.1%)	41(21%)	2(1%)

Medical students' perception of their susceptibility to T2D increased with educational progress. As shown in Table 6.6, final-year students' overall mean of perceived susceptibility to T2D (2.9 ± 0.85) was significantly higher than the overall mean of first-year students (2.28 ± 1.05), $t(193) = -4.26$, $p < 0.00$. Moreover, the final-year students' perception of susceptibility was significantly higher than that of first-year students according to all three questions assessing their perceived risk of developing T2D in future.

Table 6.6: Differences of perceived susceptibility of T2D between first- and final-year medical students in QUMS

Susceptibility statements	Academic year	Mean	Std. Deviation	*t* test	df	*p* value
1. How likely do you think it is that you will get T2D sometime in your life?	First-year	2.28	1.29	-4.26	193	0.00*
	Final-year	2.98	0.85			
2. How likely do you think it is that someone will get diabetes if he or she does not have a family history of T2D	First-year	2.60	0.94	-3.89	193	0.00*
	Final-year	3.06	0.60			
3. Do you worry that you might get T2D sometime in your life?	First-year	2.50	1.05	-1.89	193	0.05*
	Final-year	2.79	1.05			
Overall perceived susceptibility to T2D.	First-year	2.28	1.29	-4.26	193	0.00*
	Final-year	2.98	0.85			

6.2.2.2 Perceived severity

The study participants were asked to rate the degree of severity of seven health conditions, including T2D, on a four-point Likert-type scale. The answers also included an 'I don't know' option. The conditions were listed in random order, as follows: AIDS, cancer, flu, T2D, lung cancer, hypertension, breast cancer, and asthma (see Tables 6.7 and 6.8).

One hundred and twenty-three (63%) of the participants perceived T2D to be a very severe or life-threatening disease, and sixty-six (33.8%) of the participants perceived

T2D to be a quite severe disease. Only one first-year student believed that T2D is not a severe disease (see Table 6.7 and Figure 6.2).

Medical students' perception of the degree of T2D severity increased with educational progress. Table 6.8 shows that the overall mean of final-year students' perception of the degree of severity of T2D (3 ± 0.74) was significantly higher compared to the overall mean of first-year students' perception of the severity of T2D (2.5 ± 0.79), $t(193)= -4.44$, $p < 0.00$.

Table 6.7: Distribution of perceived severity of T2D among first- and final-year medical students in QUMS

		Not at all serious n(%)	**Quite serious n(%)**	**Very serious n(%)**	**Life threatening n(%)**	**I don't know n(%)**
1. AIDS	First-year	0(0%)	2(1.8%)	19(16.8%)	92(81.4%)	0(0.0%)
	Final-year	0(%)	1(1.2%)	22(26.8%)	58(70.7%)	1(1.2%)
	Total	0(0%)	2(1.5%)	41(21.6%)	150(76.9%)	1(0.5%)
2. Flu	First-year	39(34.5%)	64(5.6%)	8(7.1%)	2(1.8%)	0(%)
	Final-year	41(50%)	30(36.6%)	9(11%)	1(1.2%)	1.2(%)
	Total	80(41%)	94(48.2%)	17(8.7%)	3(1.5%)	1(0.5%)
3. T2D	First-year	1(0.9%)	50(44.2%)	50(44.2%)	8(7.1%)	4(3.5%)
	Final-year	0(0.0%)	16(19.5%)	46(56.1%)	19(23.2%)	1(1.2%)
	Total	1(0.5%)	66(33.8%)	96(49.2%)	27(13.8%)	5(2.6%)
4. Lung Cancer	First-year	0(%)	0(%)	23(20.4%)	89(78.8%)	1(0.9%)
	Final-year	0(0.0%)	1(1.2%)	4(4.9%)	75(91.5%)	2(2.4%)
	Total	0(0.0%)	1(0.5%)	27(13.8%)	164(84.1%)	3(1.5%)
5. Hypertension	First-year	2(1.8%)	41(36.5%)	59(52.2%)	11(9.7%)	0(0.0%)
	Final-year	1(1.2%)	9(11%)	44(53.7%)	26(31.7%)	2(2.4%)
	Total	3(1.5%)	50(25.6%)	103(%52.8)	26(31.7%)	2(1%)
6. Breast cancer	First-year	0(0.0%)	13(11.5%)	51(45.1%)	48(42.5%)	1(0.9%)
	Final-year	1(1.2%)	10(12.2%)	26(31.7%)	43(52.4%)	2(2.4%)
	Total	1(0.5%)	23(11.8%)	77(39.5%)	91(46.7%)	3(1.5%)
7. Asthma	First-year	0(0.0%)	14(12.4%)	85(75.2%)	11(9.7%)	3(2.7%)
	Final-year	10(12.2%)	49(59.8%)	20(24.4%)	2(2.4%)	1(1.2%)
	Total	24(12.3%)	134(68.7%)	31(15.9%)	5(2.6%)	1(0.5%)

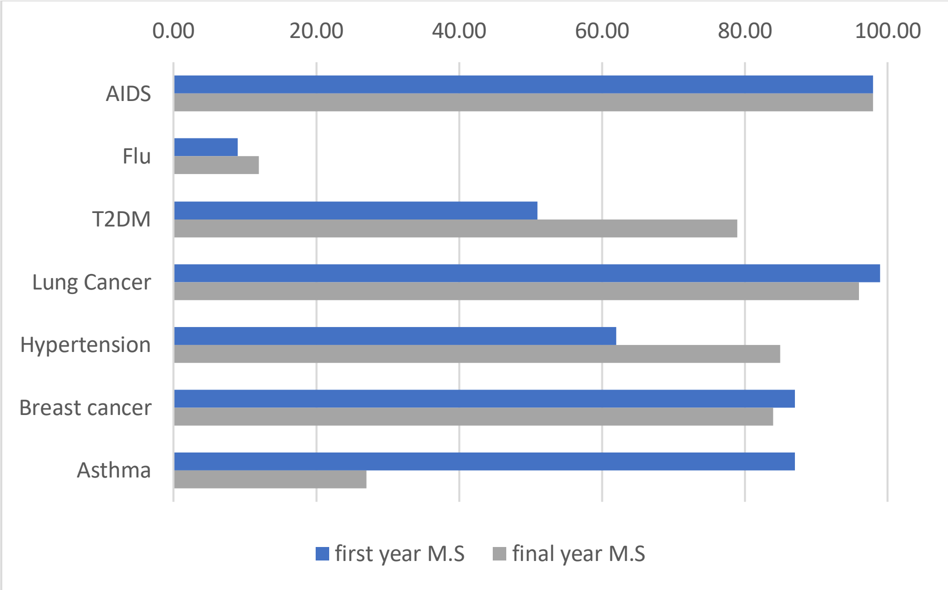

Figure 6.2: Perceived severity of T2D compared to other health conditions among first- and final-year medical students in QUMS

Table 6.8: Differences of perceived severity of T2D between first- and final-year medical students in QUMS

Disease	**Academic year**	**Mean**	**Std. Deviation**	***t* test**	**df**	***p* value**
1. AIDS	First-year	3.80	0.45	1.79	193	0.08
	Final-year	3.66	0.63			
2. Flu	First-year	1.76	0.66	1.49	193	0.13
	Final-year	1.61	0.75			
3. T2D	First-year	2.50	0.79	-4.44	193	0.00
	Final-year	3.00	0.74			
4. Lung Cancer	First-year	3.76	0.54	-0.78	193	0.44
	Final-year	3.83	0.68			
5. Hypertension	First-year	2.70	0.67	-3.82	193	0.00
	Final-year	3.11	0.83			
6. Breast cancer	First-year	3.28	0.74	-0.18	193	0.86
	Final-year	3.30	0.91			
7. Asthma	First-year	2.03	0.57	-1.306	193	0.19
	Final-year	2.15	0.70			

6.2.2.3 Perceived benefits

The benefits of adopting healthy lifestyles were assessed by asking questions relating to nine different health benefits and by using a four-point Likert-type scale. The maximum score was four for each item, and a minimum score of three was required to indicate that the subject was convinced of the benefit of adopting a healthy lifestyle to prevent T2D.

The findings show that participants were highly convinced of the benefits of adopting a healthy lifestyle to prevent T2D. As shown in Table 6.9 and Figure 6.3, the vast majority of participants in the first and final years believed in the benefits of following healthy lifestyles. Interestingly, five of the final-year medical students (6%) did not believe in the importance of being a healthy role model for their future patients, and six of them (7%) did not believe that their healthy outlook would influence their patients to follow their recommendations.

As shown in Table 6.10, there were no significant differences between the overall mean of perceived benefits of first- (3.3 ± 0.58) and final-year students (3.42 ± 0.7) with regard to the extent to which they believed adopting a healthy lifestyle was important to prevent T2D $t(193)= -0.99$, $p < 0.32$.

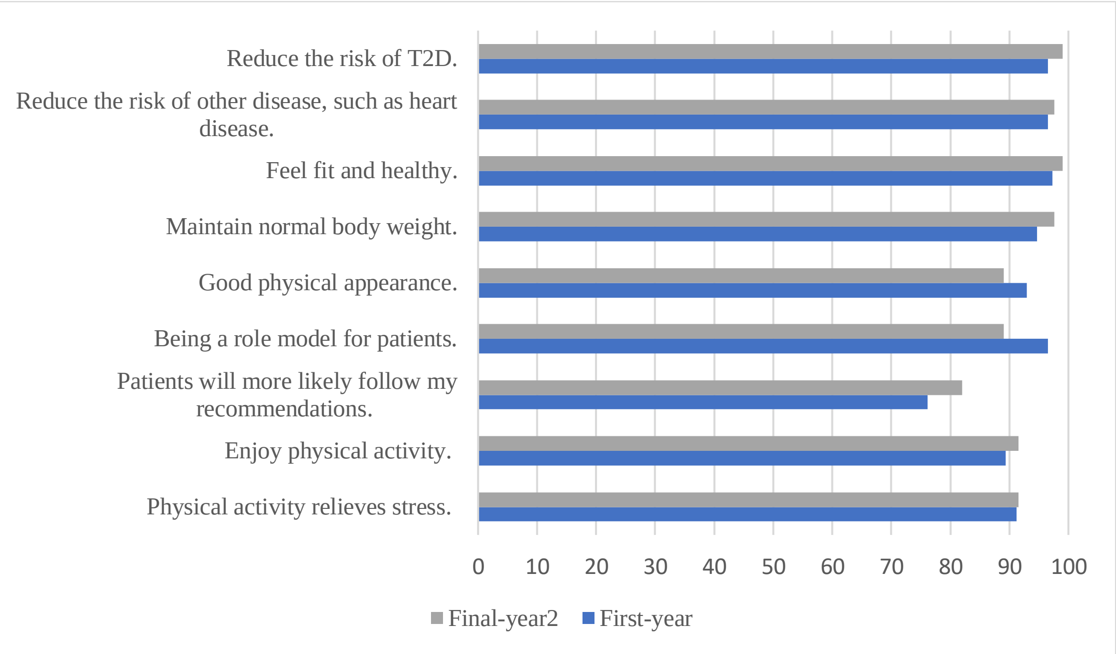

Figure 6.3: Percentage of first- and final-year medical students who believe in the benefits of following T2D preventive behaviours

Table 6.9: Distribution of perceived benefits of following preventive behaviours of T2D among first- and final-year medical students in QUMS

Benefits		Strongly Agree	Agree	Disagree	Strongly Disagree	I Don't Know
1. Reduce the risk of T2D.	First-year	49(43.4%)	60(53.1%)	2(1.8%)	0(%)	2(1.8%)
	Final-year	45(54.9%)	36(43.9%)	0(0%)	0(0%)	1.2(%)
	Total	94(48.2%)	96(49.2%)	2(1%)	0(%)	3(1.5%)
2. Reduce the risk of other disease.	First-year	57(50.4%)	52(46%)	2(1.8%)	0(%)	2(1.8%)
	Final-year	48(58.5%)	32(39%)	1(1.2%)	0(%)	1(1.2%)
	Total	105(53.8%)	84(43.1%)	3(1.5%)	0(0%)	3(1.5%)
3. Feel fit and healthy.	First-year	55(48.7%)	55(48.7%)	0(%)	0(%)	3(2.7%)
	Final-year	56(68.3%)	25(30.5%)	0(0%)	0.0(%)	1(1.2%)
	Total	111(56.9%)	80(41.2%)	0(0%)	0(0%)	4(2.1%)
4. Maintain ideal body weight.	First-year	56(49.6%)	51(45.1%)	1(0.9%)	0(%)	5(4.4%)
	Final-year	54(65.9%)	86(31.7%)	0(0%)	0(0%)	2(2.4%)
	Total	110(56.4%)	77(39.5%)	1(0.5%)	0(%)	7(3.6%)
5. Good physical appearance.	First-year	58(51%)	47(41.6%)	2(1.8%)	0(%)	6(5.3%)
	Final-year	48(58.5%)	25(30.5%)	3(3.7%)	0(%)	6(7.3%)
	Total	106(54.4%)	72(36.9%)	5(2.6%)	0(%)	12(6.2%)
6. Being a role model for patients.	First-year	66(58%4)	43(38.1%)	1(0.9%)	0(%)	3(2.7%)
	Final-year	49(59.8%)	24(29.3%)	5(6.1%)	0(%)	4(4.9%)
	Total	115(59.0%)	67(34.4%)	6(3.1%)	0(%)	7(3.6%)
7. Patients would follow advice.	First-year	51(45.1%)	38(33.6%)	7(6.2%)	1(0.9%)	16(14.2%)
	Final-year	34(41.5%)	34(41.5%)	6(7.3%)	0(0%)	8(9.8%)
	Total	85(43.6%)	72(36.9%)	13(6.7%)	1(0.5%)	24(12.3%)
8. Enjoy physical activity.	First-year	55(48.7%)	46(40.7%)	6(5.3%)	2(1.8%)	4(3.5%)
	Final-year	42(51.2%)	33(40.2%)	1(1.2%)	0(0%)	6(7.3%)
	Total	97(49.7%)	79(40.5%)	7(3.6%)	2(1%)	10(5.1%)
9. Physical activity relieves stress.	First-year	63(55.8%)	40(35.4%)	3(2.7%)	1(0.9%)	6(5.3%)
	Final-year	53(64.6%)	22(26.8%)	3(3.7%)	0(%)	4(4.9%)
	Total	116(59.5%)	62(31.8%)	6(3.1%)	1(0.5%)	10(5.1%)

Table 6.10: Differences of perceived benefits of following preventive behaviours of T2D between first- and final-year medical students in QUMS.

Benefits of healthy lifestyle	Academic year	Mean	Std. Deviation	*t* test	df	*p* value
1. Reduce the risk of T2D.	First-year	3.36	0.69	0.13	193	0.13
	Final-year	3.51	0.63			
2. Reduce the risk of other disease.	First-year	3.43	0.71	0.30	193	0.30
	Final-year	3.54	0.65			
3. Feel fit and healthy.	First-year	3.41	0.75	0.02	193	0.02
	Final-year	3.65	0.62			
4. Maintain ideal body weight.	First-year	3.35	0.89	0.06	193	0.05
	Final-year	3.59	0.74			
5. Good physical appearance.	First-year	3.34	0.95	0.96	193	0.96
	Final-year	3.33	1.09			
6. Being a role model for patients.	First-year	3.50	0.77	0.40	193	0.40
	Final-year	3.39	0.98			
7. Patients will follow advice.	First-year	2.95	1.36	0.59	193	0.59
	Final-year	3.05	1.18			
8. Enjoy physical activity.	First-year	3.29	0.92	0.94	193	0.94
	Final-year	3.28	1.06			
9. Physical activity relieves stress.	First-year	3.35	0.99	0.44	193	0.44
	Final-year	3.46	0.96			
Overall Perceived Benefits	First-year	3.30	0.60	-0.99	193	0.32
	Final-year	3.42	0.70			

6.2.2.4 Perceived barriers

The perceived barriers to adopting healthy lifestyles were assessed by asking 10questions relating to 10 different health categories using a four-point Likert-type scale. The suggested barriers in the questionnaire were developed out of the systematic review findings (see Chapter 4). A maximum score was four for each item and minimum score of three was required to indicate that the participants believed they could overcome barriers to fostering T2D preventive behaviours.

Food availability on campus (75%), limited time (71%) and the difficult weather (60%) were the most frequently reported barriers that were difficult to overcome to follow healthy behaviours among first-year medical students. For final-year medical students the availability of healthy food choices (67%) was the most frequently reported barrier that is difficult to overcome, followed by the lack of motivation (50%) and the limited time (47%) (see Table 6.11 and Figure 6.4).

Both cohorts believed that the barriers were insurmountable, as the overall mean of perceived barriers among first-year students (2.45 ± 0.57) and final-year (2.48 ± 0.58) were below the score of three and with no significant variation $t(193) = -0.32$, $p < 0.75$. Consequently, it seems that students were not willing to overcome these barriers. Both groups had similar levels of beliefs related to perceived barriers. The significant differences between the two years were in responses to questions regarding the detrimental effect of adverse weather conditions and the limited time to practice physical activities. The final-year students were more willing to engage in physical activities in difficult weather conditions, with higher mean score (2.45 ± 1.21) than that for first-year students (2.08 ± 1.103), $t(193) = -2.23$, $p < 0.027$. In addition, final-year students were more willing to manage times for practicing physical activities, with higher mean score (1.93 ± 0.86) than that for first-year students (1.84 ± 0.90), $t(193) = -0.67$, $p < 0.05$ (see Table 6.12).

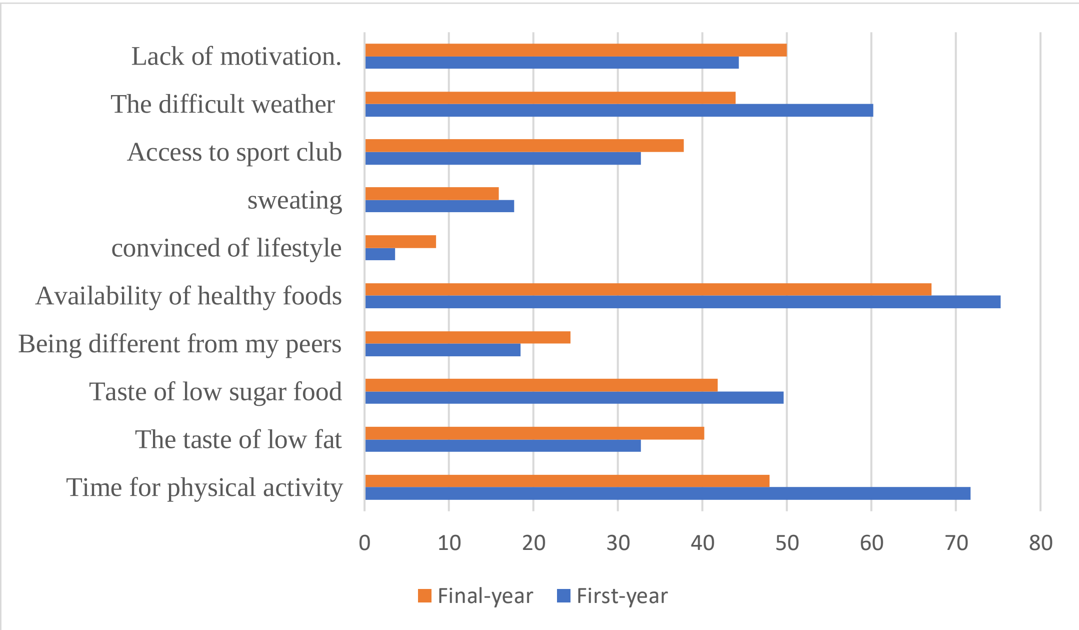

Figure 6.4: Percentage of medical students who were unwilling to overcome barriers to follow T2D preventive behaviours in QUMS.

Table 6.11: Distribution of perceived barriers of following preventive behaviours of T2D among first- and final-year medical students in QUMS

Barriers		Strongly Agree	Agree	Disagree	Strongly Disagree	I Don't Know
1. Time for physical activity.	First-year	38(33.6%)	43(38.1%)	24(21.2%)	3(2.7%)	5(4.4%)
	Final-year	22(26.8%)	37(45.1%)	18(22%)	2(2.4%)	3(3.7%)
	Total	60(30.8%)	80(41%)	42(21.5%)	5(2.6%)	8(4.1%)
2. The taste of low fat.	First-year	10(8.8%)	27(23.9%)	50(44.2%)	13(11.5%)	13(11.5%)
	Final-year	16(19.5%)	17(20.7%)	28(34.1%)	15(18.3%)	6(7.3%)
	Total	26(13.3%)	44(22.6%)	78(40%)	28(14.4%)	19(9.7%)
3. The taste of healthy food.	First-year	14(12.4%)	42(37.2%)	37(32.7%)	12(10.6%)	8(7%)
	Final-year	13(15.9%)	21(25.9%)	30(36.6%)	13(15.9%)	5(6.1%)
	Total	27(13.8%)	63(32.8%)	67(34.4%)	25(12.8%)	13(6.7%)
4. Being different from my peers.	First-year	4(3.5%)	17(15%)	53(46.9%)	35(31.5%)	4(3.5%)
	Final-year	4(4.9%)	16(19.5%)	32(39%)	23(28%)	7(8.5%)
	Total	8(4.1%)	33(16.9%)	85(43.6%)	58(29.7%)	11(5.6%)
5. Availability of healthy foods.	First-year	42(37.2%)	43(38.1%)	19(16.8%)	6(5.3%)	3(2.7%)
	Final-year	35(42.7%)	20(24.4%)	13(15.9%)	8(9.5%)	6(7.3%)
	Total	77(39.5%)	63(32.3%)	32(16.4%)	14(7.2%)	9(4.6%)
6. Convinced of lifestyle.	First-year	3(2.7%)	1(0.9%)	37(32.7%)	64(56.6%)	8(7.1%)
	Final-year	1(1.2%)	6(7.3%)	24(29.3%)	46(56.1%)	5(6.1%)
	Total	4(2.1%)	7(3.6%)	61(31.3%)	110(56.4%)	13(6.7%)
7. Sweating.	First-year	4(3.5%)	16(14.2%)	48(42.5%)	41(36.3%)	4(3.5%)
	Final-year	3(3.7%)	10(12.2%)	29(35.7%)	39(47.6%)	1(1.2%)
	Total	7(3.6%)	26(13.3%)	77(39.5%)	80(41%)	5(2.6%)
8. Access to sport club.	First-year	12(10.6%)	25(22.1%)	38(33.6%)	27(23.9%)	11(9.7%)
	Final-year	10(12.2%)	21(25.6%)	22(26.8%)	21(25.6%)	8(9.8%)
	Total	22(11.3%)	46(23.6%)	60(30.8%)	48(24.6%)	19(9.7%)
9. The difficult weather.	First-year	26(23%)	42(37.2%)	23(20.4%)	14(12.4%)	8(7.1%)
	Final-year	14(17.1%)	22(26.8%)	21(25.6%)	20(24.4%)	5(6.1%)
	Total	40(20.5%)	64(32.6%)	44(26.4%)	44(17.4%)	34(17.4%)
10. Lack of motivation.	First-year	9(8%)	41(36.3%)	35(31.0%)	15(13.3%)	13(11.9%)
	Final-year	14(17.1%)	27(32.9%)	19(23.2%)	16(19.5%)	6(7.3%)
	Total	23(11.8%)	68(34.9%)	54(27.7%)	31(15.9%)	19(9.7%)

Table 6.12: Differences of perceived barriers of following preventive behaviours of T2D between first- and final-year medical students in QUMS

Barriers to follow healthy lifestyle	Academic year	Mean	Std. Deviation	*t* test	df	*p* value
1. Time for physical activity.	First-year	1.84	0.90	-0.67	193	0.50
	Final-year	1.93	0.86			
2. The taste of low fat.	First-year	2.35	1.16	-0.07	193	0.95
	Final-year	2.37	1.20			
3. The taste of healthy food.	First-year	2.27	1.05	-0.82	193	0.41
	Final-year	2.40	1.12			
4. Being different from my peers.	First-year	2.98	0.96	1.63	193	0.10
	Final-year	2.73	1.18			
5. Availability of healthy foods.	First-year	1.85	0.92	0.47	193	0.64
	Final-year	1.78	1.11			
6. Convinced of lifestyle.	First-year	3.29	1.12	0.07	193	0.94
	Final-year	3.28	1.08			
7. Sweating.	First-year	3.04	0.99	-1.5	193	0.15
	Final-year	3.24	0.89			
8. Access to sport club.	First-year	2.51	1.24	0.28	193	0.78
	Final-year	2.46	1.27			
9. The difficult weather.	First-year	2.08	1.10	-2.20	193	0.03
	Final-year	2.45	1.21			
10. Lack of motivation.	First-year	2.27	1.15	-0.23	193	0.82
	Final-year	2.30	1.18			
Overall perceived barriers	First-year	2.45	0.57	-0.32	193	0.75
	Final-year	2.48	0.58			

6.2.2.5 Perceived self-efficacy

Perceived self-efficacy regarding students' capability of adopting health-promoting behaviours to prevent T2D was assessed using a four-point Likert-type scale, plus an 'I don't know' option on each of the 10 items. A maximum score was four for each item, and the minimum score of three was required to indicate participants' belief in their ability to adapt T2D preventing behaviours.

Generally, the students displayed moderate self-efficacy levels, as overall mean score of the first- (2.75 ± 0.76) and final-year students (2.76 ± 0.69) were nearly to the score of three. Both scores fell below the required score of three, as shown in Tables 6.13 and 6.14. Moreover, there was no difference between first- and final-year students in terms of perceived self-efficacy: $t(193) = -0.13$, $p < 0.89$.

Table 6.13: Distribution of perceived self-efficacy of following preventive behaviours of T2D among first- and final-year medical students in QUMS

Self-efficacy statements		Not at all true	Hardly true	Moderately true	Exactly true	I Don't Know
1. I can always manage to solve difficult problems if I try hard enough.	First-year	0(0%)	3(2.7%)	69(61.1%)	40(35.4%)	1(0.9%)
	Final-year	1(1.2%)	1(1.2%)	40(48.8%)	36(43.9%)	4(4.9%)
	Total	1(0.5%)	4(2.1%)	109(55.9%)	76(39%)	5(2.6%)
2. If someone opposes me, I can find the means and ways to get what I want.	First-year	1(0.9%)	10(8.8%)	72(63.7%)	23(20.4%)	7(6.2%)
	Final-year	4(4.9%)	8(9.8%)	47(57.3%)	19(23.2%)	4(4.9%)
	Total	5(2.6%)	18(9.2%)	119(61%)	42(21.5%)	11(5.6%)
3. It is easy for me to stick to my aims and accomplish my goals.	First-year	2(1.8%)	3(2.7%)	60(53.1%)	41(36.3%)	7(6.2%)
	Final-year	1(1.2%)	8(9.8%)	42(51.2%)	27(32.9%)	4(4.9%)
	Total	3(1.5%)	11(5.6%)	102(52.3%)	68(34.9%)	11(5.6%)
4. I am confident that I could deal effectively with unexpected events.	First-year	3(2.7%)	19(16.8%)	62(54.9%)	20(17.7%)	9(8%)
	Final-year	1(1.2%)	9(11%)	41(50%)	26(31.7%)	5(6.1%)
	Total	4(2.1%)	28(14.4%)	103(52.8%)	46(23.6%)	14(7.2%)
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.	First-year	0(0%)	17(15.0%)	59(52.2%)	22(19.5%)	15(13.3%)
	Final-year	2(2.4%)	12(14.6%)	41(50%)	23(28%)	4(4.9%)
	Total	2(1.0%)	29(14.9%)	100(51.3%)	45(23.1%)	19(9.7%)
6. I can solve most problems if I invest the necessary effort.	First-year	10(8.8%)	18(15.9%)	55(48.7%)	12(10.6%)	18(15.9%)
	Final-year	6(7.3%)	8(9.8%)	35(42.7%)	22(26.8%)	11(13.4%)
	Total	16(8.2%)	26(13.3%)	90(46.2%)	34(17.4%)	29(14.9%)
7. I can remain calm when facing difficulties because I can rely on my coping abilities.	First-year	2(1.8%)	12(10.6%)	67(59.3%)	26(17.7%)	12(10.6%)
	Final-year	3(3.7%)	7(8.5%)	40(48.8%)	23(28%)	9(11%)
	Total	5(2.6%)	19(9.7%)	107(54.9%)	43(22.1%)	21(10.8%)
8. When I am confronted with a problem, I can usually find several solutions.	First-year	2(1.8%)	16(14.2%)	62(54.9%)	15(13.3%)	18(15.9%)
	Final-year	1(1.2%)	13(15.9%)	43(52.4%)	13(15.9%)	12(14.6%)
	Total	3(1.5%)	29(14.9%)	105(53.8%)	28(14.4%)	36(15.4%)
9. If I am in trouble, I can usually think of a solution.	First-year	0(0%)	10(8.8%)	76(7.3%)	13(11.5%)	14(12.4%)
	Final-year	1(1.2%)	9(11%)	50(61%)	13(15.9%)	9(11%)
	Total	1(0.5%)	19(9.7%)	126(64.6%)	26(13.3%)	23(11.8%)
10. I can usually handle whatever comes my way.	First-year	5(4.4%)	13(11.5%)	67(59.3%)	9(3%)	19(16.8%)
	Final-year	2(2.4%)	5(6.1%)	50(61%)	8(9.8%)	17(20.7%)
	Total	7(3.6%)	18(9.2%)	117(60%)	17(8.7%)	36(18.5%)

Table 6.14: Differences of perceived self-efficacy of following preventive behaviours of T2D between first- and final-year medical students in QUMS

Self- efficacy statements	Academic year	Mean	Std. Deviation	*t* test	df	*p* value
1. I can always manage to solve difficult problems if I try hard enough.	First-year	3.30	0.61	0.40	193	0.69
	Final-year	3.26	0.94			
2. If someone opposes me, I can find the means and ways to get what I want.	First-year	2.91	0.94	0.15	193	0.88
	Final-year	2.89	0.98			
3. It is easy for me to stick to my aims and accomplish my goals.	First-year	3.12	1.01	0.38	193	0.71
	Final-year	3.06	0.96			
4. I am confident that I could deal effectively with unexpected events.	First-year	2.72	1.05	-1.90	193	0.06
	Final-year	3.00	1.02			
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.	First-year	2.65	1.19	-1.80	193	0.07
	Final-year	2.94	0.99			
6. I can solve most problems if I invest the necessary effort.	First-year	2.29	1.25	-1.80	193	0.08
	Final-year	2.62	1.32			
7. I can remain calm when facing difficulties because I can rely on my coping abilities.	First-year	2.72	1.11	-0.45	193	0.65
	Final-year	2.79	1.21			
8. When I am confronted with a problem, I can usually find several solutions.	First-year	2.48	1.23	-0.33	193	0.74
	Final-year	2.54	1.22			
9. If I am in trouble, I can usually think of a solution.	First-year	2.65	1.10	-0.25	193	0.80
	Final-year	2.70	1.11			
10. I can usually handle whatever comes my way.	First-year	2.37	1.23	.032	193	0.98
	Final-year	2.37	1.32			
Overall Perceived Self-efficacy	First-year	2.75	0.76	-0.13	193	0.89
	Final-year	2.76	0.69			

6.2.3 Behaviour assessment

The Health Promoting Lifestyle Profile (HPLP2) scale offers a comprehensive measure of an individual's body. It is a standardised instrument that uses a Likert-type behaviour rating scale (1 = never to 4 = always). It is composed of six subscales; the subscales used in the study were limited to those measuring T2D preventive behaviours: physical activities, nutrition, and stress management. The subscale scores were obtained by calculating the mean of the response to the subscale items. A maximum score was four for each item, and a minimum score of three was required to indicate that the participants had good engagement in health-promoting behaviours to prevent T2D.

6.2.3.1 Health nutrition behaviours

As shown in Tables 6.15 and 6.16, there were no notable differences between first- and final-year medical students regarding nutrition health promotion behaviours. For example, 37 of the first-year students (33%) and 31 of final-year students (38%) had never eaten two to four servings of fruit on a daily basis. At the same time, only six students from each group (5%) ate the same servings on a daily routine.

The overall mean of the nutrition subscale among the first- (2.47 ± 0.51) and final-year students (2.40 ± 0.49) were below the score of three, which indicated that they were not following healthy nutritional behaviours, and there was no significant difference between them $t(193) = -1.07$, $p < 0.29$ (see Table 6.16).

Table 6.15: Distribution of Health Promoting Lifestyle Profile2 (nutrition) among first- and final-years medical students in QUMS

Items		Never	Sometime	Often	Routinely
1. Choose a diet low in fat, saturated fat, and cholesterol.	First-year	23(20.4%)	53(4.9%)	26(23%)	11(9.7%)
	Final-year	18(22%)	32(39%)	18(22%)	14(17.1%)
	Total	41(21%)	85(43.6%)	44(22.6%)	25(12.8%)
2. Limit use of sugars and food containing sugar (sweets).	First-year	31(27.4%)	44(38.9%)	28(24.8%)	10(8.8%)
	Final-year	25(30.2%)	29(35.4%)	21(25.6%)	7(8.5%)
	Total	56(28.7%)	73(37.4%)	49(25.1%)	17(8.7%)
3. Eat 6-11 servings of bread, cereal, rice and pasta each day.	First-year	46(40.7%)	39(34.5%)	18(15.9%)	10(8.8%)
	Final-year	43(52.4%)	26(31.7%)	10(12.2%)	3(3.7%)
	Total	89(45.6%)	65(33.3%)	28(14.4%)	13(6.7%)
4. Eat 2-4 servings of fruit each day.	First-year	37(32.7%)	51(45.1%)	19(16.8%)	6(5.3%)
	Final-year	31(37.7%)	37(45.1%)	19(16.8%)	6(5.3%)
	Total	68(34.9%)	88(45.1%)	29(14.9%)	10(5.1%)
5. Eat 3-5 servings of vegetables each day.	First-year	33(29.2%)	56(49.6%)	17(15%)	7(6.2%)
	Final-year	26(31.7%)	36(43.9%)	16(19.5%)	4(4.9%)
	Total	59(30.3%)	92(47.2%)	33(16.9%)	11(5.6%)
6. Eat 2-3 servings of milk, yogurt or cheese each day.	First-year	16(14.2%)	46(40.7%)	33(29.2%)	18(15.9%)
	Final-year	14(17.1%)	26(31.7%)	29(35.4%)	13(15.9%)
	Total	30(15.4%)	72(36.9%)	62(31.8%)	31(15.9%)
7. Eat only 2-3 servings from the meat, poultry, fish, dried beans, eggs, and nuts group each day.	First-year	10(8.8%)	48(42.5%)	33(29.2%)	22(19.5%)
	Final-year	9(11%)	35(42.7%)	29(35.4%)	9(11%)
	Total	19(9.7%)	83(42.6%)	62(31.8%)	31(15.9%)
8. Read labels to identify nutrients, fats, sodium content in packaged food.	First-year	24(21.2%)	39(34.5%)	26(23%)	24(21.2%)
	Final-year	19(23.2%)	30(36.6%)	11(13.4%)	22(26.8%)
	Total	43(22.1%)	69(35.4%)	37(19%)	46(23.6%)
9. Eat breakfast	First-year	4(3.5%)	20(17.7%)	40(35.4%)	49(43.4%)
	Final-year	5(6.1%)	25(30.5%)	14(17.1%)	38(46.3%)
	Total	9(4.6%)	45(23.1%)	54(27.7%)	87(44.6%)

Table 6.16: Differences of Health Promoting Lifestyle Profile2 (nutrition) between first- and final-years medical students in QUMS

Items	Academic year	Mean	Std. Deviation	*t* test	df	*p* value
1. Choose a diet low in fat, saturated and cholesterol.	First-year	2.22	0.88	-0.88	193	0.38
	Final-year	2.34	1.01			
2. Limit use of sugars and food containing sugar (sweets).	First-year	2.15	0.93	210.	193	0.83
	Final-year	2.12	0.95			
3. Eat 6-11 servings of bread, rice and pasta each day.	First-year	1.93	0.96	1.96	193	0.05
	Final-year	1.67	0.83			
4. Eat 2-4 servings of fruit each day.	First-year	1.95	0.84	0.87	193	0.39
	Final-year	1.84	0.82			
5. Eat 3-5 servings of vegetables each day.	First-year	1.98	0.83	0.06	193	0.96
	Final-year	1.98	0.85			
6. Eat 2-3 servings of milk, yogurt or cheese each day.	First-year	2.47	0.93	-0.23	193	0.82
	Final-year	2.50	0.90			
7. Eat only 2-3 servings the meat, nuts group each day.	First-year	2.59	0.90	1.02	193	0.31
	Final-year	2.46	0.83			
8. Read labels to identify nutrient content in packaged food.	First-year	2.44	1.05	0.02	193	0.98
	Final-year	2.44	1.12			
9. Eat breakfast.	First-year	3.19	0.85	1.12	193	0.27
	Final-year	3.04	1.01			
Overall Nutrition subscale in HPLP2	First-year	2.26	0.51	-1.07	193	0.29
	Final-year	2.34	0.52			

6.2.3.2 Physical activities behaviours

As shown in Table 6.17, there were no notable differences between the first- and final-year medical students regarding physical activities behaviours. For example, 46 of first-year students (40%) and 36 of the final-year students (36%) never had a planned exercise programme. Moreover, 45 of first-year students and 33 of final-year students, almost 40% of both groups, never had practiced vigorous exercise for 20 minutes or more, and only 29 (14%) of both groups reported that this type of exercise was part of their daily routine.

The overall means scores of physical activities behaviours subscale was the lowest compared to other HPLP2 subscales. The overall final-year students were scoring the lowest out of all calculated scores for both cohorts (1.95 ± 0.64). However, the overall mean score of physical activities subscale among first-year students was also below the score of three (2.05 ± 0.69), which indicated that both cohorts were not following physical activities behaviours, and there was no significant variation between them $t(193) = 1.03$, $p < 0.30$ (see Table 6.18).

Table 6.17: Distribution Health Promoting Lifestyle Profile2 (physical activities) among first- and final-years medical students in QUMS

Items		Never	Sometime	Often	Routinely
1. Follow a planned exercise programme.	First-year	46(40.7%)	45(39.8%)	13(11.5%)	9(8%)
	Final-year	30(36.6%)	28(34.1%)	14(17.1%)	10(12.2%)
	Total	76(21%)	73(37.4%)	27(13.8%)	19(9.7%)
2. Exercise vigorously for 20 or more minutes at least three times a week.	First-year	45(39.8%)	41(36.3%)	12(10.6%)	15(13.3%)
	Final-year	33(40.2%)	19(23.2%)	16(19.5%)	14(17.1%)
	Total	78(40.8%)	60(30.8%)	28(14.4%)	29(14.9%)
3. Take part in light to moderate physical activity (such as walking 30-40 min five week).	First-year	30(26.5%)	45(39.8%)	16(14.2%)	22(19.5%)
	Final-year	20(24.4%)	32(39%)	19(23.2%)	11(13.4%)
	Total	50(25.6%)	77(39.5%)	35(17.9%)	33(16.9%)
4. Take part in leisure-time (recreational) physical activities (such as swimming, bicycling).	First-year	31(27.4%)	49(43.7%)	28(24.8%)	5(4.4%)
	Final-year	34(4.5%)	30(36.6%)	10(12.2%)	8(9.8%)
	Total	65(33.3%)	79(40.5%)	38(19.5%)	13(6.7%)
5. Do stretching exercises at least 3 times per week.	First-year	64(56.6%)	35(31%)	8(7.1%)	6(5.3%)
	Final-year	47(57.3%)	19(23.2%)	10(12.2%)	6(7.3%)
	Total	111(56.9%)	54(27.7%)	18(9.2%)	12(6.2%)
6. Get exercise during usual daily activities (such as walking).	First-year	11(9.7%)	33(29.2%)	40(35.4%)	29(25.7%)
	Final-year	11(13.4%)	30(36.6%)	17(20.7%)	24(29.3%)
	Total	22(11.3%)	63(32.3%)	57(29.2%)	53(27.2%)
7. Check my pulse rate when exercising.	First-year	64(5.6%)	22(19.5%)	16(14.2%)	11(9.7%)
	Final-year	43(52.4%)	21(25.6%)	11(13.4%)	7(8.5%)
	Total	107(54.9%)	43(22.1%)	27(13.8%)	18(9.2%)
8. Reach my target heart rate when exercising.	First-year	69(61.1%)	30(26.5%)	7(6.2%)	7(6.2%)
	Final-year	43(52.7%)	21(25.6%)	11(13.4%)	7(8.5%)
	Total	112(57.4%)	51(26.2%)	18(9.2%)	14(7.2%)

Table 6.18: Differences of Health Promoting Lifestyle Profile2 (physical activity) between first- and final-years medical students in QUMS

Items	**Academic year**	**Mean**	**Std. Deviation**	***t* test**	**df**	***p* value**
1. Follow a planned exercise programme.	First-year	1.87	0.91	-1.31	193	0.19
	Final-year	2.05	1.02			
2. Exercise vigorously for 20 or more minutes three times week.	First-year	1.97	1.02	-1.04	193	0.30
	Final-year	2.13	1.13			
3. Take part in light to moderate physical activity.	First-year	2.27	1.06	.063	193	0.95
	Final-year	2.26	0.98			
4. Take part in leisure-time (recreational) physical activities.	First-year	2.06	0.84	1.23	193	0.22
	Final-year	1.90	0.96			
5. Do stretching exercises at least 3 times per week.	First-year	1.61	0.84	-0.66	193	0.51
	Final-year	1.70	0.95			
6. Get exercise during usual daily activities (such as walking).	First-year	2.77	0.95	0.78	193	0.44
	Final-year	2.66	1.05			
7. Check my pulse rate when exercising.	First-year	1.77	1.03	-0.07	193	0.94
	Final-year	1.78	0.98			
8. Reach my target heart rate when exercising.	First-year	1.58	0.86	-1.55	193	0.12
	Final-year	1.78	0.98			
Overall physical activity subscale in HPLP2	First-year	2.05	0.69	1.03	193	0.30
	Final-year	1.95	0.64			

6.2.3.3 Stress management behaviours

As shown in Table 6.19, first- and final-year students seem to be practicing stress management behaviours more than physical activities or healthy nutritional behaviours. For example, 52 of the first-year students (46%) and 40 of the final-year students (48%) were getting enough sleep. In addition to that, 63 of the first-year students (34%) and 39 of the final-year students (47%) used to take time out on a daily basis for relaxation. But, at the same time, 48 of the first-year students (42%) and 54 of the final-year students (66%) were not used to concentrating on pleasant thoughts at bedtime.

The overall means scores of stress management behaviours subscale for first- (2.47 ± 0.51) and final-year medical students (2.4 ± 0.49) were below the score of three, which indicate that both cohorts were not following stress management behaviours. There was no significant variation between the two cohorts, $t(193)= 0.93$, $p < 0.35$ (see Table 6.20).

Table 6.19: Distribution of Health Promoting Lifestyle Profile2 (stress management) among first- and final-years medical students in QUMS

Items		Never	Sometimes	Often	Routinely
1. Get enough sleep.	First-year	13(11.5%)	48(42.5%)	24(21.2%)	28(24.8%)
	Final-year	12(14.6%)	36(36.6%)	31(37.8%)	9(11%)
	Total	25(12.8%)	78(40%)	55(28.2%)	37(19%)
2. Take some time for relaxation each day.	First-year	11(9.7%)	39(34.5%)	30(26.5%)	33(29.2%)
	Final-year	11(13.4%)	32(39.0%)	22(26.8%)	17(20.7%)
	Total	22(11.3%)	71(36.3%)	52(53.3%)	50(25.6%)
3. Accept those things in my life which I cannot change.	First-year	17(15%)	45(39.8%)	39(34.5%)	12(10.6%)
	Final-year	6(7.3%)	29(35.4%)	37(45.1%)	10(12.2%)
	Total	23(11.8%)	74(37.9%)	76(39%)	22(11.3%)
4. Concentrate on pleasant thoughts at bedtime.	First-year	7(6.2%)	41(36.3%)	38(33.6%)	27(23.9%)
	Final-year	14(17.1%)	40(48.8%)	10(12.2%)	18(22%)
	Total	21(10.8%)	81(41.5%)	48(24.6%)	45(22.1%)
5. Use specific methods to control my stress.	First-year	12(10.6%)	50(44.2%)	35(31%)	16(14.2%)
	Final-year	13(15.9%)	35(42.7%)	18(22%)	16(19.5%)
	Total	25(12.8%)	85(43.6%)	53(27.2%)	32(16.4%)
6. Balance time between work and play.	First-year	9(8%)	50(44.2%)	41(36.3%)	13(11.5%)
	Final-year	8(9.8%)	25(30.5%)	32(39%)	17(39.7%)
	Total	17(8.7%)	75(38.5%)	73(37.4%)	30(15.4%)
7. Practice relaxation or mediation for 15-20 minutes daily.	First-year	56(49.9%)	33(29.2%)	10(8.8%)	14(12.2%)
	Final-year	41(50%)	24(29.3%)	11(13.4%)	6(7.3%)
	Total	97(49.7%)	57(29.2%)	21(10.8%)	20(10.3%)
8. Pace myself to prevent tiredness.	First-year	13(11.5%)	53(46.9%)	33(29%)	14(12.4%)
	Final-year	13(15.9%)	40(48.8%)	19(23%)	10(12.2%)
	Total	26(13.3%)	93(47.7%)	52(2.7%)	24(12.3%)

Table 6.20 : Differences of Health Promoting Lifestyle Profile2 (stress management) between first- and final-year medical students in QUMS

Items	Academic year	Mean	Std. Deviation	*t* test	df	*p* value
1. Get enough sleep.	First-year	2.59	0.99	1.04	193	0.30
	Final-year	2.45	0.88			
2. Take some time for relaxation each day.	First-year	2.75	0.99	1.43	193	0.15
	Final-year	2.55	0.97			
3. Accept things in my life which I cannot change.	First-year	2.41	0.87	-1.76	193	0.08
	Final-year	2.62	0.79			
4. Concentrate on pleasant thought.	First-year	2.75	0.89	2.64	193	0.01
	Final-year	2.39	1.02			
5. Use specific methods to control my stress.	First-year	2.49	0.87	0.27	193	0.79
	Final-year	2.45	0.98			
6. Balance time between work and play.	First-year	2.51	0.80	-1.6	193	0.12
	Final-year	2.71	0.91			
7. Practice relaxation for 15-20 a min/day.	First-year	1.84	1.03	0.42	193	0.68
	Final-year	1.78	0.94			
8. Pace myself to prevent tiredness.	First-year	2.42	0.85	0.86	193	0.39
	Final-year	2.32	0.89			
Overall stress management subscale in HPLP2	First-year	2.47	0.51	0.93	193	0.35
	Final-year	2.4	0.49			

Taken these findings together, medical students in their first and final years in this study were leading unhealthy lifestyles. The overall means scores for all the three subscales fell below a score of three. Moreover, no significant differences were reported among first- and final-year students in the three HPLP2 subscales. These results suggested that there was no perceptible influence of medical education on medical students' health-promoting behaviours.

6.3 Inferential statistics

The third objective of this thesis is to measure the relationships between medical students' knowledge, beliefs and health-promoting behaviours related to T2D prevention. In order to achieve this objective, inferential statistics were applied to formalise the results (predict influencers) as a platform for the next phase of this research (the qualitative study). This section outlines findings relating to the relationship between medical students' knowledge, beliefs and health-promoting behaviours (correlation). Moreover, the predicted influencing factors for health-promoting behaviours were identified (multiple regression).

6.3.1 Correlation

The Pearson correlation coefficient test was used to analyse the nature of the relationships between the three research domains and their subscales, and how that was linked to medical students' characteristics, Table 6.21 summarises these relationships. Generally, there were 19 positive and significant correlations between the participants' demographic variables, knowledge, beliefs, and health-promoting behaviours. Conversely, there was one negative correlation between participants' family history of T2D and their stress-management behaviours. Participants who live with one or more family member living with T2D correlated with diminished ability to manage stresses (r = -0.18, n = 195, p < 0.01), although this significant negative correlation was weak, as the correlation value (r) was located between 0 and -0.5. This relationship might be explained by the significant positive correlation between having a family history with T2D and a belief in susceptibility to being diagnosed with T2D in the future (r = 0.32, n = 195, p < 0.00).

With regard to the relationships between the characteristics of the medical students and the three domains, being an older student (the final year in medical school) was significantly positively correlated with being more knowledgeable about T2D (r = 0.195, n = 195, p < 0.00), more believed in the severity of T2D (r = 0.22, n = 195, p < 0.00), and more were inclined to believe themselves susceptible to develop this condition in the future (r = 0.16, n = 195, p < 0.01). Moreover, older students positively correlated with higher awareness of the benefits of leading a healthy lifestyle (r = 0.11, n = 195, p < 0.04). However, all these correlations were weak relationships (see Table 6.21).

Being more knowledgeable about T2D was positively correlated with a belief that T2D is a severe condition (r = 0.15, n = 195, p < 0.04). This correlation is understandable as greater knowledge about a disease might plausibly be expected to correlate with a stronger awareness of how severe it could be.

Analysing students' beliefs according to the five perceptions'of the HBM resulted in two statistically significant correlations within the HBM's perceptions. The first positive correlation was between perceived severity of T2D and perceived susceptibility to developing T2D in the future (r = 0.32, n = 195, p < 0.00). The second positive correlation involved three of the HBM's perceptions; medical students who believed in the benefits of following healthy lifestyles were significantly more willing to overcome barriers preventing such behaviours (r = 0.27, n = 195, p < 0.00). Furthermore, students who both believed in the benefits of leading a healthy lifestyle and who were willing to overcome barriers preventing T2D were correlated positively with self-efficacy (r = 0.25, n = 195, p < 0.00 and r = 0.25, n = 195, p < 0.00) respectively. Despite these significant relationships it was described as a weak correlation.

As with the belief assessment, positive correlations were found between reported health-promoting behaviours. Medical students who reported following healthy dietary behaviours were significantly more physically active (r = 0.60, n = 195, p < 0.00). This was the strongest relationship reported in this study. Similarly, a positive correlation was found between medical students who managed their stress in a healthy way, with healthy dietary habits (r = 0.39, n = 195, p < 0.00) and with practicing physical activities (r = 0.37, n = 195, p < 0.00).

Finally, and most importantly, the correlation coefficient test showed significant factors that were most likely to be influencing medical students' lifestyles. Self-efficacy was positively correlated with following healthy lifestyles to prevent T2D in relation to following healthy dietary habits (r = 0.19, n = 195, p < 0.01), practicing physical activities (r = 0.24, n =195, p < 0.00), and managing stress in a healthy manner (r = 0.23, n = 195, p < 0.00). Similarly, ability to overcome barriers to leading a healthy lifestyle was strongly correlated with following healthy diets (r = 0.22, n = 195, p < 0.00) and practicing physical activities (r = 0.35, n = 195, p < 0.00) as seen in Table 6.21.

Table 6.21: Correlation between the medical students' characteristics, knowledge, beliefs and T2D preventive behaviours

		Age	No. family member with T2D	Knowledge	Perceived susceptibility	Perceived severity	Perceived benefits	Perceived barrier	Perceived self efficacy	Nutrition behaviour	Physical activity behaviour	Stress management behaviour
Age	*r*=	1										
	P value	.										
No. family member with T2D	*r*=	0.07	1									
	P value	0.24	.									
Knowledge	*r*=	0.19	0.03	1								
	P value	0.00	0.66									
Perceived susceptibility	*r*=	0.16	0.32	0.13	1							
	P value	0.01	0.00	0.08								
Perceived severity	*r*=	0.22	0.13	0.15	0.32	1						
	P value	0.00	0.08	0.04	0.00							
Perceived benefits	*r*=	0.11	-0.02	0.04	0.08	0.14	1					
	P value	0.05	0.79	0.63	0.29	0.05						
Perceived barrier	*r*=	0.04	-0.00	0.08	-0.04	0.01	0.27	1				
	P value	0.51	0.96	0.25	0.59	0.95	0.00					
Perceived self efficacy	*r*=	0.08	-0.01	0.08	0.13	0.05	0.25	0.25	1			
	P value	0.12	0.91	0.25	0.07	0.53	0.00	0.00				
Nutrition behaviour	*r*=	-0.02	0.01	-0.06	-0.02	-0.02	0.10	0.22	0.19	1		
	P value	0.67	0.85	0.44	0.77	0.82	0.15	0.00	0.01			
Physical activity behaviour	*r*=	0.02	-0.05	-0.02	0.01	0.08	0.21	0.35	0.24	0.60	1	
	P value	0.73	0.46	0.78	0.90	0.27	0.00	0.00	0.00	0.00		
Stress management behaviour	*r*=	-0.06	-0.18	0.01	-0.06	-0.02	0.11	0.09	0.23	0.39	0.37	1
	P value	0.28	0.01	0.85	0.41	0.75	0.11	0.22	0.00	0.00	0.00	

6.3.2 Multiple regression

A multiple regression test was used to identify the independent, influencing factors on medical students' health-promoting behaviours to prevent T2D (the dependent factor). Multiple regression is a type of analysis where several independent variables are combined to predict the dependent variable (Cohen et al., 2013; Field, 2013). Multiple regression analysis can predict which variable or set of variables are the best predictors for medical students' health-promoting behaviours within the range of the data (Cohen et al., 2013). Unlike bivariate regression, multiple regression considers the effect of each independent variable while controlling for the impact of the other independent variables in the model (Cohen et al., 2013).

Before implementing the multiple regression analysis, four assumptions should be tested to ensure that the findings are trustworthy. The four assumptions underlying multiple regression are: (a) normality of error distribution; (b) independence of the independent variable (i.e. no multicollinearity); (c) linear relationship between independent and dependent variables, and (d) homoscedasticity (i.e. the variance of errors is the same across all levels of the independent variable) (Field, 2013; Osborne & Waters, 2002).

Shapiro-Wilk tests were conducted to assess the normality distribution for each independent and dependent variable, the findings showed that the majority of the data were normally distributed (i.e. family history of T2D, knowledge, perceived benefits, barriers, self-efficacy, nutrition behaviours, physical activities behaviours and stress management behaviours). Although skewness was presented in some of the data, multiple regression assumption of normal distribution can frequently be violated (Field, 2013).

The scatterplots charts for each of the dependent variables – nutrition, physical activities and stress managements subscales – showed that the residuals were linear and spread equally around the central line (see Figures 6.5, 6.6 and 6.7) This linearity or homoscedasticity means that the variance of errors was the same across all levels of the independent variables (Osborne & Waters, 2002). Additionally, the Durbin-Watson test statistic, which tests for correlations between errors, and also tests for whether adjacent residuals are correlated, was included to test whether the assumption of independent errors is acceptable. The Durbin-Watson value can vary between 0 and

4 (Osborne & Waters, 2002). Field (2013) suggested that the Durbin-Watson statistics should be between 1 and 3, and, in this study, the values of the Durbin-Watson test were for all models below 3 as shown in Tables 6.23, 6.24 and 6.25.

The assumption of no multicollinearity was initially assessed by examining the correlations between the predictor variables. This was assessed using Pearson's correlations coefficient test between all the dependent and independent variables (see Table 6.21). Cohen et al. (2013) suggested that correlations of 0.70 or higher are problematic for regression analyses. Although significant correlations existed between many predictor variables, the analysis did not reveal any independent variables with correlations higher than 0.70 (see Table 6.21).

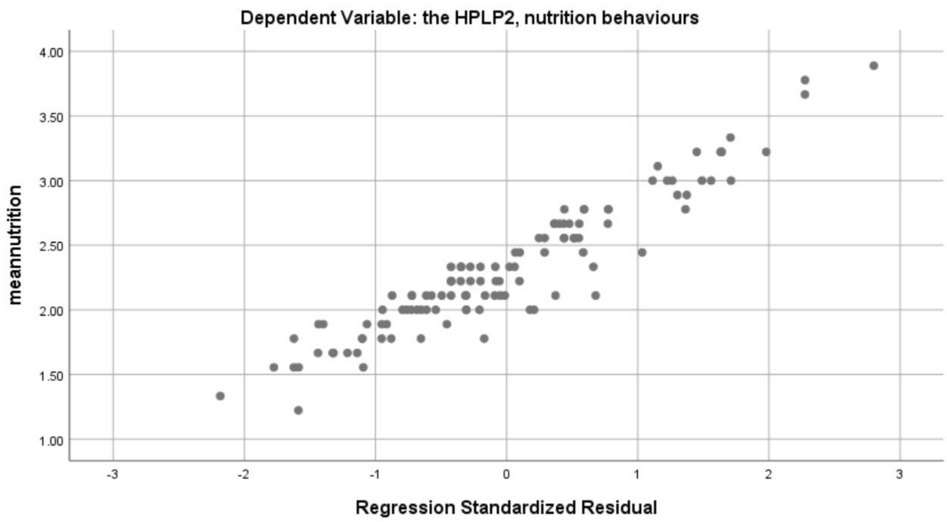

Figure 6.5: Scatterplot showing the homoscedasticity of the HPLP2, nutrition subscale

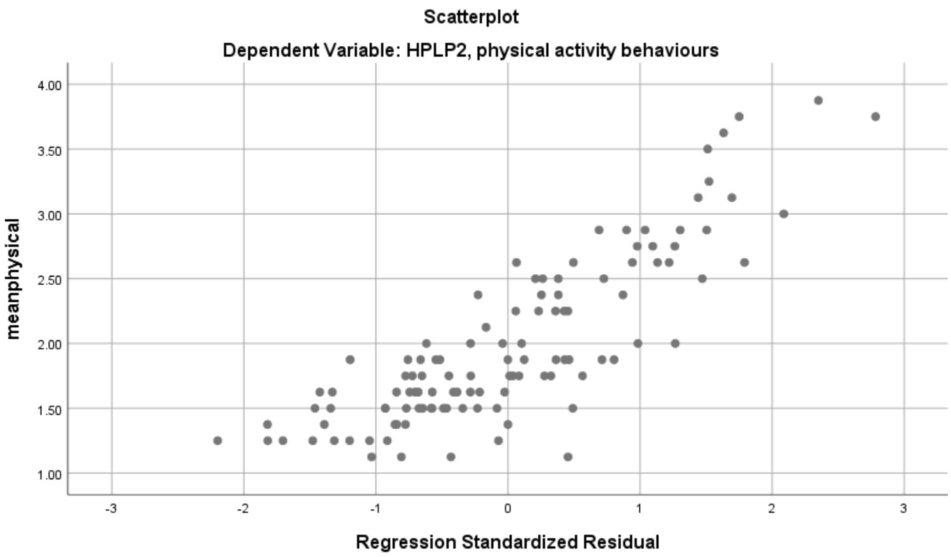

Figure 6.6: Scatterplot showing the homoscedasticity of the HPLP2, physical activity subscale

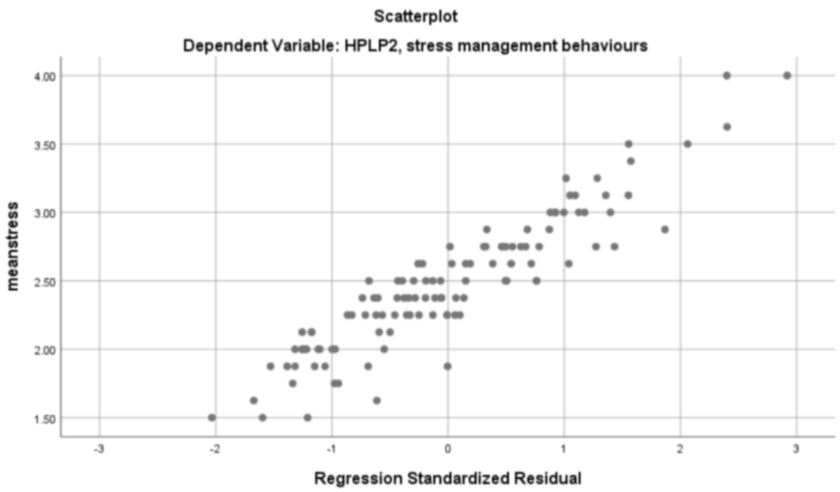

Figure 6.7: Scatterplot showing the homoscedasticity of the HPLP2, stress management subscale

After conducting this preliminary analysis and screening of data, the assumptions of multiple regression for the most part seem to have been met. Therefore, the model appears to be accurate for this sample. In the next step, all independent variables were placed in a multiple regression equation to predict students' health promotion behaviours.

In this study a stepwise regression (backward elimination regression) was chosen over a hierarchical regression simply because not enough information was known about T2D preventive behaviours among medical students in term of HPLP2 subscales and related predictors in order to make assumptions about a predefined hierarchy as required for hierarchical regression models. The backward elimination procedure was used to predict factors influencing following T2D preventive behaviours. This type of regression analysis is suitable for research with explanatory objectives (Cohen et al., 2013). Backward elimination starts with the full model then removes variables sequentially beginning with the lowest *F* value (Cohen et al., 2013; Field, 2013).

Assessment and interpretation consisted of the goodness of fit of the model in the form of the $_{\text{adjusted}}R^2$, the result of the regression test in the form of a *F* value and the measure for the strength of each predictor in the form of standardised β were conducted. All the three subscales included in the assessment of the HPLP2 were analysed separately as single dependent variables (see Tables 6.16, 6.18 and 6.20).

In this study, the backward elimination regression selected two predicted factors for following healthy dietary habits to prevent T2D ($_{\text{adjusted}}R^2 = 0.06$, $F(2, 192) = 6.88$, $p < 0.05$). It was found that perceived self-efficacy significantly predicted the following healthy dietary behaviours (β = 0.144, p < 0.05), as did perceived barriers (β = 0.181, p < 0.05) (see Table 6.22).

The backward elimination regression analysis also found two predictive factors for practising physical activity ($_{\text{adjusted}}R^2$= 0.14, F(2, 192)= 16.2, p < 0.01). Perceived self-efficacy (β = 0.162, p <0.05) and perceived barriers (β = 0.305, p <0.01) were found significantly predicted following physical activities behaviours to prevent T2D (see Table 6.23).

In regards to stress managements behaviours, the backward elimination regression selected two predictive factors ($_{\text{adjusted}}R^2$=0.08, F(2, 192)= 8.78, p < 0.01). The analysis found that perceived self-efficacy was a significant predictive factor for following healthy stress management behaviours to prevent T2D (β = 0.23, p<0.01). Moreover, having a family history of T2D was a risk factor for medical students for managing stress to prevent T2D (β = -0.174, p <0.05) (see Table 6.24).

Table 6.22: Summary of backward regression analysis for variables predicting adopting diabetes prevention behaviours, nutrition (N = 195)

Variable	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6			Model 7			Model 8			Model 9		
	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	B	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β
Age	-.034	.036	-.154	-.034	.036	-.154	-.034	.036	-.157	-.034	.036	-.154	-.034	.036	-.155	-.033	.036	-.149	-.017	.016	-.076	-.020	.015	-.094			
Academic Level	.088	.179	.083	.088	.178	.084	.095	.176	.090	.085	.173	.081	.090	.172	.086	.086	.172	.082									
BMI	.003	.008	.025	.003	.008	.025																					
History of T2D	.018	.043	.031	.018	.043	.031	.018	.043	.031	.014	.041	.024															
Knowledge	-.014	.016	-.066	-.014	.015	-.066	-.014	.015	-.067	-.014	.015	-.068	-.014	.015	-.068	-.014	.015	-.068	-.013	.015	-.063						
Susceptibility	-.013	.036	-.029	-.013	.035	-.029	-.012	.035	-.026																		
Severity of T2D	3.941E-5	.050	.000																								
Benefits	.030	.063	.036	.030	.062	.036	.028	.062	.034	.027	.062	.033															
Barrier	.168	.068	.187*	.168	.068	.187*	.170	.068	.188*	.172	.068	.190*	.178	.066	.197*	.178	.066	.197**	.173	.065	.192**	.171	.065	.190**	.164	.065	.181*
Self- efficacy	.108	.054	.152*	.108	.054	.152*	.106	.053	.149*	.104	.053	.146*	.108	.052	.152*	.108	.052	.152*	.109	.051	.153*	.106	.051	.149*	.103	.051	.144*
adjusted R^2		0.083			0.083			0.082			0.082			.081			.080			.079			.076			0.06	
F		1.665			1.860			2.087			2.38			2.77			3.30			4.08			5.20			6.88	
df for regression		10			9			8			7			6			5			4			3			2	
df for the residual error		184			185			186			187			188			189			190			191			192	
Durbin-Watson																										2.081	

Table 6.23: Summary of backward regression analysis for variables predicting adopting diabetes prevention behaviours, physical activity (N = 195)

Variable	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6			Model 7			Model 8			Model 9		
	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β
Age	-.057	.044	-.202	-.057	.044	-.203	-.056	.044	-.201	-.056	.044	-.198	-.057	.044	-.202	-.056	.044	-.201	-.009	.019	-.031						
Academic Level	.265	.218	.197	.268	.216	.200	.264	.214	.196	.251	.213	.187	.281	.211	.209	.251	.209	.187									
BMI	.001	.010	.009																								
History of T2D	-.042	.052	-.057	-.042	.052	-.057	-.044	.050	-.060																		
Knowledge	-.020	.019	-.074	-.020	.019	-.074	-.020	.019	-.074	-.019	.019	-.073	-.018	.019	-.069												
Susceptibility to T2D	-.008	.044	-.013	-.007	.043	-.012																					
Severity of T2D	.062	.061	.075	.062	.061	.075	.059	.059	.072	.054	.058	.066															
Benefits	.095	.077	.090	.095	.076	.089	.094	.076	.089	.097	.076	.091	.106	.075	.100	.107	.075	.101	.102	.075	.096	.099	.075	.093			
Barrier	.350	.083	.303**	.350	.083	.303**	.351	.082	.304**	.351	.082	.304**	.348	.082	.301**	.342	.082	.296**	.332	.082	.287**	.329	.081	.285**	.353	.080	.305**
Self- efficacy	.135	.066	.148*	.134	.065	.147*	.133	.064	.146*	.134	.064	.146*	.134	.064	.146*	.130	.064	.143*	.132	.064	.145*	.131	.064	.144*	.148	.063	.162*
adjusted R^2		.171			.171			.171			.168			.164			.160			.153			.152			0.14	
F		3.808			4.25			4.81			5.384			6.142			7.179			8.592			11.43			16.2	
df for regression		10			9			8			7			6			5			4			3			2	
df for the residual error		184			185			186			187			188			189			190			191			192	
Durbin-Watson																										2.103	

*$p < .05$. **$p < .01$.

Table 6.24: Summary of backward regression analysis for variables predicting adopting diabetes prevention behaviours, stress management (N = 195)

Variable	**Model 1**			**Model 2**			**Model 3**			**Model 4**			**Model 5**			**Model 6**			**Model 7**			**Model 8**			**Model 9**		
	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β
Age	-.045	.035	-.214	-.045	.035	-.214	-.045	.034	-.214	-.044	.034	-.207	-.043	.034	-.202	-.022	.015	-.104	-.020	.015	-.097	-.018	.015	-.086			
Academic Level	.124	.171	.123	.125	.170	.123	.131	.168	.129	.125	.166	.124	.110	.164	.109												
BMI	.007	.008	.068	.007	.007	.068	.007	.007	.068	.007	.007	.069	.007	.007	.066	.007	.007	.072	.007	.007	.068						
History of T2D	-.088	.041	-.159*	-.088	.041	-.159*	-.089	.041	-.160*	-.088	.041	-.159*	-.095	.039	-.171*	-.093	.039	-.167*	-.094	.038	-.169*	-.091	.038	-.165*	-.096	.038	-.174*
Knowledge	.004	.015	.019	.004	.015	.019																					
Susceptibility to T2D	-.017	.034	-.041	-.017	.033	-.040	-.017	.033	-.039	-.018	.033	-.042															
Severity of T2D	.001	.048	.002																								
Benefits	.056	.060	.071	.057	.059	.071	.056	.059	.070	.060	.058	.076	.059	.058	.074	.056	.057	.070									
Barrier	.021	.065	.024	.021	.065	.024	.022	.065	.025																		
Self-efficacy	.154	.051	.224**	.154	.051	.224**	.155	.051	.225**	.158	.050	.230**	.155	.049	.225**	.156	.049	.226**	.167	.048	.243**	.163	.048	.237**	.158	.048	.230**
adjusted R^2		.105			.105			.104			.104			.102			.100			.096			.091			0.08	
F		2.15			2.40			2.71			3.09			3.57			4.21			5.02			6.38			8.78	
df for regression		10			9			8			7			6			5			4			3			2	
df for the residual error		184			185			186			187			188			189			190			191			192	
Durbin-Watson																										2.021	

$*p < .05$. $**p < .01$

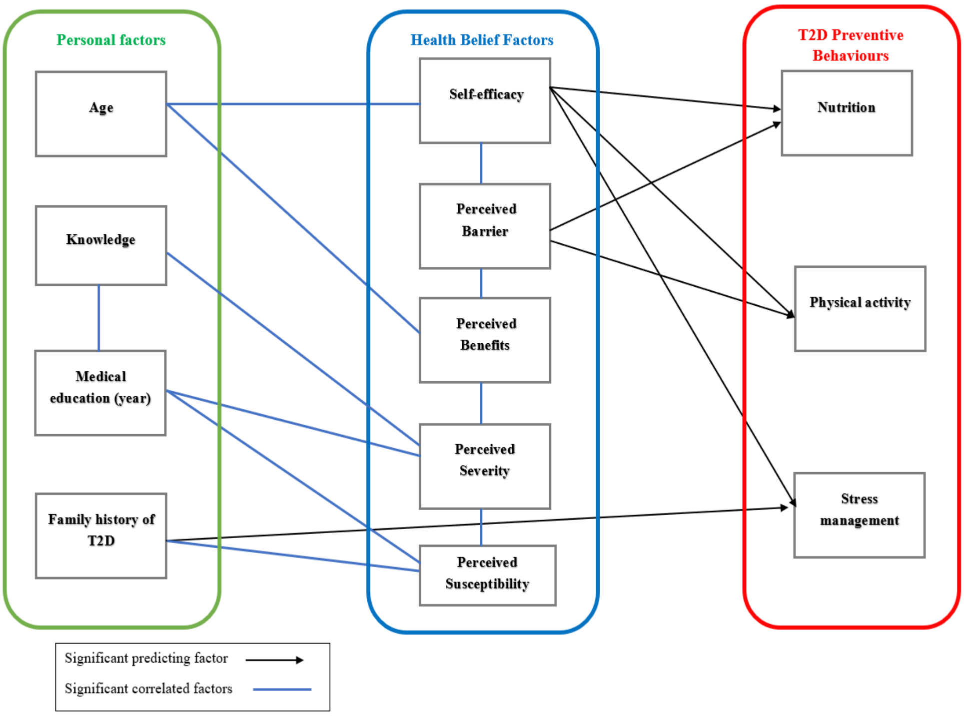

Figure 6.8: Factors influencing following T2D preventive behaviours among medical students in QUMS

6.4 Conclusion

Figure 6.8 summarises the significant relationships between the study variables. Self-efficacy and perceived barriers were strong predictive factors for adopting health-promoting behaviours to prevent T2D. Regarding the influence of medical education on the students' knowledge, beliefs and T2D preventive behaviours, there were significant variations between first- and final-year medical students in terms of knowledge, perceived susceptibility to developing T2D in the future, and perceived severity of T2D. There was no difference between students by year of study in terms of perceived benefits of leading a healthy lifestyle, perceived barriers to doing so, and perceived self-efficacy and health-promoting behaviours.

CHAPTER 7 RESULTS OF PHASE TWO: SEMI-STRUCTURED INTERVIEWS

The aim of the second phase of this thesis is to explain and justify the findings of the previous phase. This chapter presents the results of analysing semi-structured interviews. The contents of this chapter are divided into four parts: the first part describe the characteristics of the interviewed final-year medical students from QUMS. Three themes emerged from analysing these interviews. The three themes and their sub-themes are described in the next three parts of this chapter.

7.1 Participants' characteristics

Final-year medical students from QUMS were invited for this study, and 25 students were included. The principle of saturation was applied during these interviews. To preserve total anonymity, participants were coded using a series of numbers instead of names to prevent accidentally identifying them with current students' real names, i.e. participant number 5 was referred to as P5.

The majority of the participants were male (n = 14). Only five of the participants had no family history of diabetes. Seven participants described their daily lifestyle as 'healthy', by which they meant following a healthy diet plan and undertaking physical activity regularly. The majority of participants (n = 22) believed that doctors are in a position to act as a role model for patients and wider communities. In contrast, only three believed that being a role model is not part of a doctor's overall responsibilities and should not be relied on as a means of improving patients' and communities' health. The characteristics of participants are presented in Table 7.1.

Table 7.1: Demographic characteristics of participants in the semi-structured interviews

Participant number	Gender	Age	Interview period (min)	Family history of diabetes	Believe in doctors role modelling	Healthy Lifestyle	
						Diet	Physical activity
P1	M	25	23	No	Yes	No	Yes
P2	M	25	31	Yes	Yes	No	Yes
P3	M	23	20	No	Yes	No	No
P4	M	23	40	Yes	Yes	Yes	Yes
P5	M	25	24	Yes	Yes	Yes	Yes
P6	M	24	37	No	Yes	Yes	Yes
P7	M	24	30	Yes	Yes	Yes	Yes
P8	M	25	34	Yes	Yes	No	Yes
P9	M	25	35	Yes	Yes	No	No
P10	M	24	27	Yes	Yes	Yes	Yes
P11	M	26	37	Yes	Yes	No	No
P12	M	26	27	Yes	Yes	Yes	No
P13	M	24	26	Yes	No	No	No
P14	M	25	37	Yes	No	No	No
P15	F	25	28	Yes	Yes	No	No
P16	F	23	21	Yes	Yes	No	Yes
P17	F	23	20	No	Yes	Yes	No
P18	F	23	32	Yes	Yes	Yes	No
P19	F	25	30	Yes	Yes	No	No
P20	F	24	23	Yes	Yes	Yes	Yes
P21	F	23	18	Yes	Yes	No	No
P22	F	24	18	No	Yes	No	No
P23	F	24	26	Yes	Yes	Yes	Yes
P24	F	25	23	Yes	No	No	No
P25	F	24	23	Yes	Yes	No	No

7.2 Results of data analysis of phase two

The time difference between the UK and Saudi Arabia proved more of a challenging issue than anticipated and prolonged the data collection period to six months. The interview protocol and schedule were used with guiding questions (Appendices 8 and 9) and responses were recorded using an audio-recording device and a notebook. Participants were asked to describe their daily lifestyle, and their justifications and explanations for the findings of phase one of this research. The participants were also encouraged to describe how medical education had influenced the way they view themselves as potential role models for patients and wider communities. During the interviews, each participant was afforded the time to gather their thoughts and reflect on their accumulated experiences of engaging with the medical curriculum and medical school environment over the last five years.

Three major themes emerged from analysing the interviews through the thematic analysis approach, which helped to identify the phenomenological factors that shape medical students' lifestyles:

1- Key factors contributing to unhealthy lifestyles among medical students.
2- The informal medical curriculum including role modelling for patients and community.
3- Recommended interventions to improve T2D preventive behaviours among medical students.

Within each theme, sub-themes were identified and outlined (see Table 7.2).

Table 7.2: Thematic analysis findings of the semi-structured interviews

Themes	Sub-themes	Codes
Key factors contributing to unhealthy lifestyle among medical students.	Recourse	Lack of resources supporting a healthy lifestyle.
		Affordability and accessibility of health-promotion services.
		Feasibility of health-promotion services.
	Social factors	Social norms, cultural beliefs, and the lifestyles of participants' wider families.
	Individual factors	Cognitive dissonance.
		Low levels of self-motivation and lack of incentives.
The informal medical curriculum including role modelling for patients and community.	Tutors' impact	Tutors' advice (informal curriculum).
		The personality profile of positive role model tutor.
		Witnessing an experience of a negative role model to patient.
	Professional impact (prestige)	
	Impact of religion: Interpretation of professional obligation	
	Priorities	
Recommended interventions to improve T2D preventive behaviours among medical students'	Develop a students' wellbeing unit	
	Realistic of cases through PBL curriculum	
	(Early clinical training) Start clinical training years in the first years	

7.2.1 Theme one: key factors contributing to unhealthy lifestyle among medical students

The first part of the interview aimed to identify key factors contributing to unhealthy lifestyles among the participants. This stage of the research was conducted by showing and explaining to students the general findings of the first phase of this study. Participants reported being unsurprised by the findings and provided many reasons for why they were unable to follow healthy lifestyles, despite being more aware and convinced of the severity of and their susceptibility to T2D than the first-year medical students.

> "*I am not surprised by your research results. This is expected due to the lack of some resources.*" (P5)

They affirmed the relevant findings of phase one of the research and described the 'unhealthy lifestyle' as the usual lifestyle for them.

> "*The study results are very logical and expected. In addition to this, it is the common lifestyle among most medical students.*" (P25)

None of the participants questioned the reliability of the findings; for example, one student had reached a similar conclusion in a study they had conducted themselves:

> "*Previously I conducted a similar study, and it shows the similar results, but it was conducted among students from all medical years.*" (P13)

Under this theme, three sub-themes emerged: resources, social factors, and individual factors.

7.2.1.1 Resources

Participants identified a range of factors contributing to their leading an unhealthy lifestyle during their years of study. Most of the participants suggested that problems related to resources were a key factor: *lack* of resources supporting a healthy lifestyle; the lack of *affordability* of and *accessibility* to health-promoting services and resources; and *feasibility* of these services were the problems most identified (Figure 7.1).

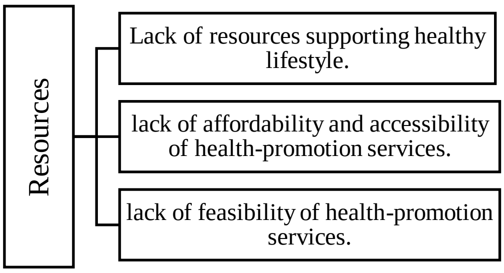

Figure 7.1: Resource sub-theme

According to P5, the lack of indoor sports clubs on campus was one of the reasons for not practicing physical activity, as identified in the HPLP scale's results:

> "*This is expected due to the lack of some resources that help us practise sports in this hot weather. Although the students have knowledge awareness now, it is not reflected in their lifestyles.*" (P5)

In addition, P19 identified the lack of resources for cooking or selling healthy food on campus, where they live, or outpatient clinics where they spend most of their time.

> "*We go to work at the college clinics where there are no places prepared for having healthy food or selling food in general. What is there is a vending machine, which, of course, sells unhealthy food*." (P5)

For students living in the university accommodation, *availability* of resources was a challenge. P2 had reported that a year ago they did not care about the type of food served in the cafeteria more than the food availability. The cafeteria was not open daily. However, the situation had improved.

> "*I used to live at the students' dorm and spend most of my time at the campus to study and have meals at the college restaurant. Unfortunately, healthy meals were not available in campus regularly all weekdays. Besides, the cafeteria used to open in the past at intervals, but now it is officially and continuously open daily. It used to be open for two or three days a week for the dorm's students. The rest of the week, we used to go to restaurants or cook for ourselves. ... We didn't care about the kind of food provided as much as we cared about its being available, plentiful, continuous and hot."* (P2)

Women in Saudi Arabia need to practice physical exercise indoors because of adverse weather conditions and to maintain their privacy. The *availability, affordability* and *accessibility* of sports centres for female students presented problems for the participants. According to P18, the limited number of women's fitness clubs in the city meant that some women had to spend greater amounts of time on public transport in order to reach these clubs, which in turn adversely affected their attempts to exercise regularly.

> *"The club which I go to is about half an hour from home. Thus, I lose one full hour travelling daily to and from the club, which is one of the major difficulties that I personally face and is also faced by other girls."* (P18)

The scarcity of these fitness clubs also means that they could charge high prices which is a further inhibiting factor to female students in terms of their willingness and tendency to engage in physical exercise.

> *"Women's clubs are rare and not available, in addition to their being difficult to join because of their high fees, something which is considered a big obstacle for many of us… sports places are more available for men than women and at a lower cost, in addition to their also being fully equipped*." (P18)

The infrastructure of the campus's roads, according to some participants, did not encourage students to practice physical exercises such as walking, jogging or running around the campus, particularly for female students. Considering some encouraging factors in the campus physical environments such as convenience of pavements for walking exercises and the green spaces for cooling during the hot and dry weathers, seemed to be missing in the university infrastructures:

> *"Walking around in the campus is difficult for me."* (P25)

This issue was also reported by male students:

> *"As I told you before, the most important of which is hot weather, I personally believe that if there were outdoor prepared places or indoor, cold areas, all students would practice sports regularly, or simply walk."* (P5)

Two students mentioned that the university had taken the initiative of promoting students' wellbeing by opening a free sports club on the female campus. However other female students were unaware of this. The two students that were aware of the sports club negatively commented on its *accessibility*, however, and consequently did not feel motivated to join it. P16 was not satisfied with the opening hours of the sports club:

> *"A sports club was opened for girls on campus at the beginning of 2018. It is only for female students. I couldn't attend, however, for lack of time. Opening hours in the club are very short, from 8 am to 4 pm, which coincide with work hours at college (8 am to 5 pm). I like to practice sports at other times outside these hours, for example before going to college or after 6 pm. Besides, it is not fully equipped or developed like the rest of the private clubs."* (P16)

It can be seen from the above responses that some of the participants had struggled to overcome physical obstacles related to the lack of specific resources on campus or in the city. QU has, nevertheless, provided students with some health promotion services. These services are provided for all university students free of charge and implemented in accordance with Islamic religious and local cultural values. Moreover, like other Saudi public universities, QU provides all students who move to Qassim City from elsewhere to study free, fully equipped, and secure accommodation. The accommodation usually provides services according to students' needs. As P2 described, the cafeteria used to only open on a limited number of days per week for students living in university accommodation, but now the cafeteria is open every day. At the time of writing this thesis, many regulations have changed in Saudi Arabia, including allowing women to drive. These new regulations are expected to minimise the impact of the resources placing barriers on students' ability to lead healthy lifestyles.

7.2.1.2 Social factors

The second sub-theme contributing to an unhealthy lifestyle among medical students was social factors. Participants' social norms, cultural beliefs and their family's lifestyle often led to unhealthy diets and eating habits, as shown in Figure 7.2.

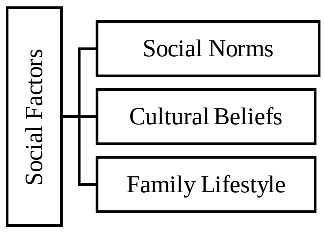

Figure 7.2: Social factors sub-theme

Social norms and cultural traditions were seen as barriers to a healthy lifestyle and were responsible for young people's inability to adopt a healthy lifestyle.

> *"I believe that society plays a role that makes us unable to apply what we study of healthy behaviours to our daily life. For example, when someone is invited to a feast (banquet), he cannot refuse, unless the person has a firm will and can control his desire and impose his opinion*." (P8)

Similarly, another medical student thought that *society* does not help them to follow healthy lifestyles.

> *"I expect the community does not help you change (this is what we found our fathers doing)."* (P12)

Participants described the limited healthy food choices available at *family* gathering occasions.

> *" I think if healthy options are available, everyone will go for them with no embarrassment.*" (P8)

Moreover, the *traditional* way of cooking is fundamentally unhealthy, and it considered another challenge.

> *"The traditional way of cooking food is full of fats and carbs. The basic meal in a Saudi house is rice and meat, whether for lunch or dinner. ...We, often, cannot break the eating rules at home and I don't have time to cook meals for myself."* (P12)

Engaging in physical activity is also affected by *family habits* and the traditional way of living. According to P12, if the whole family valued the importance of physical exercise, they would then be able to encourage each other to engage in it:

> *"We have customs and traditions that we got used to and are difficult to change. Had the society and family valued sports and respected their time, I would have encouraged them, and they, in turn, would have encouraged me, to go on in practicing sports. But, if I had tried to motivate them for this while they were so negative about it, then I would lose the impetus and become like them in the end.*" (P12)

Saudi *culture* shapes women's values and practices in additional ways. The local *cultural factors* prevent women from going out and leading an active lifestyle. This common perception is changing somewhat but, by and large, most Saudi women are restricted by their culture from leading an active lifestyle. According to two participants, social conservatism restricted their physical activity:

> *"Social constraints, such as specifying times for going out from home, or the availability of appropriate open spaces (areas) for women to practice sports, play a role in women's avoiding of practicing sports." (*P24)

> *"Allowing walking outside the building is one of the most forbidden things, … It was not socially acceptable to go out and walk outside the building or classrooms without a logical reason, such as moving between halls or going out for buying things or even for going home."* (P25)

The results show that most of the participants held a negative view of their community's lifestyle behaviours, and most of them blamed social factors for their particular lifestyle habits. None of the participants talked about the positive impact of society on their lifestyle behaviours.

It is understandable how difficult it is to lead a lifestyle that goes against some of the societal norms, particularly in the case of women in Saudi Arabia. Nevertheless, medical students are seen as more educated, respectful and independent in Saudi society than their peers. Therefore, before discovering these findings, social factors were expected to significantly influence medical students' lifestyles.

7.2.1.3 Individual factors

The majority of participants reported that they are uncomfortable with the incongruence between their knowledge and some of their daily behaviours. A sense of internal conflict was reported by most of them. Many of the remarks highlighted below attest to a sense of struggle experienced by students in trying to, or feeling obliged to, adopt healthy lifestyle habits. This tension is defined in this research as *cognitive dissonance* which is a psychological state where the possession of two incongruent sets beliefs leads to a sense of tension or discomfort. That is to say, if a person holds two sets of beliefs, ideas or perceptions that conflict with each other in some way (such as knowing smoking causes cancer vs enjoying smoking with friends and not seeing any change in their health), they will experience a sense of displeasure or unhappiness. Subsequently, they will try to resolve this unwanted experience by altering one or both cognitions somehow (Harmon-Jones & Mills, 2019). *Low self-motivation* and *lack of incentives* were two more factors adversely affecting students' ability to adopt healthy lifestyle habits; Figure 7.3.

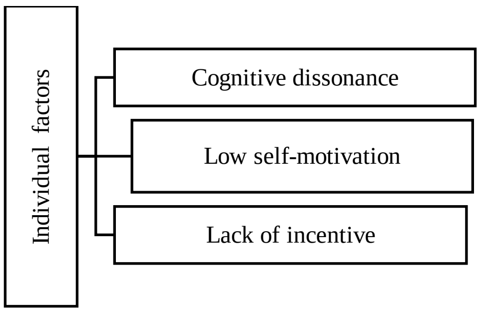

Figure 7.3: Individual factor sub-theme

Cognitive dissonance was identified in the remarks of certain students. For example:

> "*Frankly, I don't know why our knowledge is not reflected in our behaviour! We have learned about disease risk factors and infectious diseases, yet we didn't change our behaviour in order to become healthier. We think that knowing information, such as the number of calories, could change our behaviours for the better, as well as the notion that some people eat a lot but don't gain weight. All such information makes many of us believe that obesity does not depend on eating alone. Heredity is an influencing factor."* (P14)

P3 displayed *cognitive dissonance* in his expressed reliance on his young age in preventing T2D.

> *"In my view, the reason for students' behaviours not being influenced by what they studied at medical college is that they don't believe they are prone to all the diseases they study. Risk factors for chronic diseases are not far from all. Personally, I believe that I am vulnerable to having diabetes, but I expect that I am like many people likely to develop diabetes in later life (40s). I hope I can change for the better, but I can't yet."* (P3)

Self-motivation is an important trait when trying to foster healthy lifestyle habits. However, there was a marked lack of enthusiasm for preparing healthy meals and/or engaging in exercise among participants who described their lifestyle as 'unhealthy'. This highlighted further gaps in participation, empowerment and collaboration efforts between the educational institution and the students. According to P14:

> *"I believe that, especially in youth, there is a degree of carelessness about the hazards presented by such things. Youths don't think they face many dangers, or that there is no healthy alternative [to how they live]. Besides, healthy behaviour needs energy, such as sports, or even food preparation, which is something that we mostly don't have or do. If I can't find a ready meal at home, I go to a restaurant to buy food from, and I don't think of preparing it by myself. By doing so, I feel comfortable and I save my effort for other things, such as studying."* (P14)

P11 emphasised the need for *incentives* and peer support to encourage him to be healthier:

> *"As for behaviours, I tried to practice sports and follow a healthy diet, but I didn't continue and had no incentive to go on, and I feel bored. I think if I practiced sports with a group of friends, there would be a reason to keep going."* (P11)

Even though *cognitive dissonance* was not overtly displayed in many of the responses, it may nevertheless account for the generally unhealthy lifestyles led by most medical students, particularly given that none was surprised with this study's earlier findings. Lack of *self-motivation,* such as the availability of sports competitions, which considered as an *incentive,* was also mentioned by some participants. How other medical students overcome these factors deserves further investigation. It might be one of the significant health influencers that might enable medical students to follow healthy lifestyles. The main finding in this section is that psychological state play a key role in shaping medical students' behaviours.

In conclusion, the first theme that emerged from the analysis of medical students' responses (key factors contributing to unhealthy lifestyle among medical students) highlighted the importance of interrelated physical, social and psychological factors in promoting or inhibiting a healthy lifestyle among the QU medical students.

7.2.2 Theme two: the informal medical curriculum including role modelling for patients and the community

This section explores further the actors shaping health-related behaviours among medical students in QU. Medical students were influenced by their tutors, how they learned professionalism, and how religion is contextualised in the informal and hidden curricula. Participants described how they prioritise their health through certain messages they received informally through the curriculum. In other words, it appears that their lifestyles are more greatly influenced by the informal medical curriculum than the formal curriculum (see Table 7.2).

7.2.2.1 Tutors' impact

The professionalism that the student observes and learns during clinical placement was, according to participants, an indirect way of promoting a healthy lifestyle (see Figure 7.4).

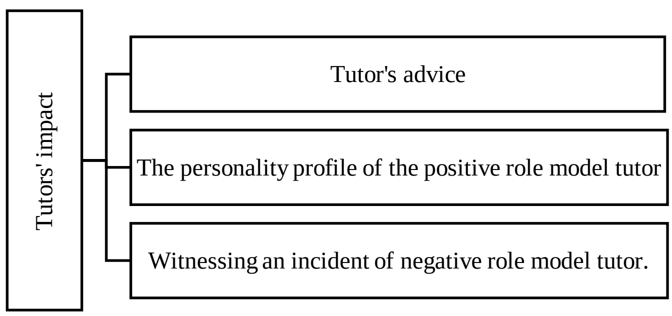

Figure 7.4: Tutors' impact sub-theme

Participants shared some stories which demonstrated important turning points in the development of their beliefs and behaviours. During medical school years, tutors play a vital role in reminding students of their non-verbal influence on patients' adherence to their treatment plans. Possessing a professional appearance, being punctual, maintaining ideal body weight, and avoiding smoking were the most common ideals presented to students in terms of what they should aim for in cultivating non-verbal influence. Female students were encouraged to take care of their skin in order to be a good role model for patients in the dermatology clinics.

According to P11, the type of advice students got from their tutors was dependent on their needs and their level in medical school. For example, tutors were keen to advise students in their first year of medical school to manage their time well and engage in exercise to manage stress.

> "*Tutors were encouraging us, especially during the early years of training, to stop smoking, and also to reduce pressures. They used to draw our attention to the role of sports in this regard and in raising the focus level, as well as the correct study methods."* (P11)

During the final years of medical school, when students begin clinical work, tutors directed students' attention to the need for a professional physical appearance for the benefit of patients:

> *"They didn't directly advise us as regards the doctor's appearance or the impact of this on the patient until we were at the beginning of clinical training and the beginning of getting into actual contact with patients."* (P11)

Similarly, P7 and P19 commented that their tutors were keen to encourage them to look healthy, avoid smoking, and be fit to be a good role model for their patients:

> "*A doctor advised us to quit smoking. But there was no advice about healthy lifestyles like exercise or diet. I believe this is because it is not noticed by patients. Yes, tutors did warn us a lot about the necessity of maintaining healthy bodies. I noticed that during the basic years, for doctors care much about that.*" (P7)
>
> P19 shared a story: "*I remember one doctor entered at the lecture start time and we were sitting eating chips and cola. She was upset and said, 'How come you're doing that, you are future doctors eating unhealthy food'. This is as far as nutrition is concerned. Also, they used to advise us about our look, such as clothes and so on."* (P19)

Although that participant clearly described how their lifestyle was shaped by *tutor advice*, they were strongly influenced by the *tutor's lifestyle*. The hidden curriculum speaks to the ability of an environment to convey messages and information, which can encompass future attitudes and behaviours.

> "*One professor caught our attention and I desired to become like him... He was enjoying his life, his lifestyle was perfect, he was hardworking and had control over his workloads, and he was showing that he is doing what he loves. His lifestyle caught my attention more than knowledge because knowledge comes by time. His lifestyle is smoother and easier. He told us that he was obese, and he underwent sleeve gastrectomy surgery and lost a lot of his weight. His lifestyle changed, too, for the better. I liked his sharing with us this experience and the amount of enthusiasm and optimism that he showed. He was inspiring hope in those around him to face their challenges and overcome them and be creative in doing what they love.*" (P25)

> P18 shared how she decided to join the sports club "*One of the most important things for me during the past five years was that there are many doctors who strike good examples. They have a heavy workload and experience a lot of work pressure, but they have the ability to control these pressures to a great extent. One of the things that encouraged me to subscribe to the fitness club, after finishing my study, is my desire to be like them, capable of working and studying and practicing sports all at the same the time, to be able to practice self-control and overcome pressures.*" (P18)

7.2.2.2 Professional impact (prestige)

Many participants seemed to be motivated by the desire to be perceived as being exceptional, highly educated, good looking and elite. Being a doctor in the Saudi community is a sign of wealth and intelligence, but it also signifies other forms of access and privilege in society: ability to gain the ear of ordinary and elected people, entitlement to a special chair at family gathering occasions, and entitlement to be referred to as a unique and credible person. That is a form of *elitism* in the Saudi community.

P4 believed that smoking would affect his credibility and his unique image among his patients:

> "*If I were a smoker, and it showed on my appearance or my smell, and I had a patient in his sixties or older, for instance, and he had high blood pressure and diabetes, when I tell him that smoking is*

> *harmful to his health and that he should stop smoking, he will question my credibility with respect to my advice. If smoking is harmful, I am supposed to be the first one to quit it because I am a doctor and more aware than him of the dangers of smoking. So, I believe he won't take my advice and, hence, I am sure that my behaviours affect the patients and my image before them. I can't imagine myself in this position!"* (P4)

P2 was concerned about the impact of being overweight as a doctor on society and his patients:

> "*My behaviours will affect my patients. If the doctor is overweight and advises patient to lose weight, patient might not take it seriously."* (P2)

P18 was also worried that people might comment on her behaviours in the same way that they comment on her uncle's behaviours:

> "*The doctor's external appearance should, at least, conform with his directives given to the patient and not be contrary to them. My uncle is a doctor, and his lifestyle is unhealthy. This has its impact on those surrounding him: they take it as an excuse for not practising healthy behaviours by saying (if they were harmful, doctor so and so would not do them). This might be because they knew his behaviours, but I believe that this matter will be evident in the clinic according to the speciality. For example, if the case requires that the patient's body be ideal or that he should lose weight, or that his facial skin be beautiful and look healthy, then the doctor should be a good example for the patient in order to be more responsive to him. I felt sad when I heard them talking about my uncle in that way.*" (P18)

In comparison, P14, who did not believe in the impact of doctors as a role model for patients, felt overwhelmed by the assumption that doctors should act as role models for patients. He wanted society to stop commenting on his unhealthy lifestyle:

> "*We always hear this saying from people when they see us engaging in unhealthy behaviour: 'How come you are doing this while you are a doctor?!'. This is suffocating and illogical. It is not my duty to be a good example or influential. I am only a doctor. I give my advice to the patient and he, in turn, is free to follow the instructions or not. Nobody can force him to stick to the treatment. In the end, it is his life, his health, and he is either the first and only winner or loser in the whole case*." (P14)

Participants described the positive impacts of witnessing patients criticising their doctor's look or behaviour. Thus, P4:

> "*I used to work in a medical unit. There was a general practitioner GP, who was extremely obese, and he was giving advice to a patient to lose weight. The patient was smiling because his advice didn't convince him. Of course, this greatly affects the extent of the patient's compliance with the treatment. I was looking at the situation from a personal perspective without being neutral to any party* [sic]. *I don't like to see that look directed at me from any of my patients."* (P4)

P16 had observed a similar situation in the primary clinic:

> "*I noticed that doctors who are careless about healthy behaviours in their private life give advice to patients with a lack of enthusiasm or spirit as if they were reading them from a paper. So, I don't think that patient will be motivated to follow any advice or instruction from such a doctor."* (P16)

7.2.2.3 Impact of religion

Some participants had their own interpretations of what constitutes professional obligation. The definition of professionalism varies by place, time, and culture (Wilkinson et al., 2012). The formulation of professionalism from an Islamic perspective consists of seven dimensions: consciousness (Taqwat), best character (Ahsan al akhlaq), excellent performance (Itqaan Al 'amal), striving toward perfection (Ihsan), responsibility (Amanat), and self-accountability (Muhasabat Al nafs) (Kasule, 2013). Striving toward perfection (Ihsan) motivated some participants who were following healthy lifestyle and improved their skills and knowledge to have the best outcome in their medical practice. They mentioned that Ihsan and Amanat were their guiding principles for living healthily and looking healthy in order to improve their clinical performance outcomes.

P7 believed that the patient should be treated as a whole person and that the clinical focus should not be solely on their pathology:

> *"I think that the external appearance [of a doctor] more greatly influences the patient. However, my duty as a doctor is to advise by words in all cases, though deeds are more effective than verbal advice. The doctor is responsible for the patient's self-perception.*

> *He treats the patient from all perspectives [of health and life], not only the pathological one.*" (P7)

P18 said:

> "I*t is not a doctor's duty to be a (role model), but that would be of the work's goodness and perfection (Ihsan). I believe it is important that doctors do their work as perfect as possible and that they don't fail in the patient's treatment.*" (P18)

Role modelling is part of a doctor's responsibilities toward their patients according to P6; doctors have obligations toward their patients from the perspective of a professional clinical manner and from an Islamic perspective.

> "*A doctor is a good example for a patient, particularly in seeing things that concern the patient. Straightforward things (acts) are effective in the treatment and in adhering to it. I believe that among the responsibilities of the doctor and faithfulness (Amanat) in work is to be a good example for the patient."* (P6)

P12 believed that doctors are not only role models for patients but for the whole community. According to P12, ordinary people might question the reliability of health awareness messages if they saw doctor smoking a cigarette or standing in a queue in a fast-food restaurant.

> *"I believe that a doctor should be a good example for the community but in a different way. If I go to a fast-food restaurant wearing scrubs (uniform for health practitioners), I feel like people are looking at me as if to say: 'Why are you here?!'. The same looks are directed to any health practitioner wearing scrubs and standing at the back door of the hospital smoking a cigarette, as if to say to them, 'What are you doing here?', even if they, themselves (the people), are not complying with healthy behaviours. Seeing a practitioner in this situation distorts any advice or educational campaign. This behaviour should not be exhibited by doctors as it will destroy their credibility in front of the community and will affect their faithfulness (Amanat)"* (P12).

Participants believed that the enthusiasm and the experience of how to live a healthy lifestyle must be authentic, and that it is this authenticity which might inspire patients to adopt healthy lifestyle habits. P12 commented:

> *"As the saying goes, 'An empty hand has nothing to give' so a doctor not complying with health-enhancing behaviours will give an*

impression to the patient that they are not important, and without realising they are doing so. The doctor's enthusiasm while giving instructions to the patient shows the patient how important and serious, they are, and that the opposite is true. If a patient asked the doctor about the best sports that would suit his condition, and the doctor is, often, not a sportsman, he would advise the patient to just walk to the mosque. Conversely, a sportsman doctor would give the details and methods and show enthusiasm which would encourage the patient to practice sports." (P12)

7.2.2.4 Priorities

This sub-theme emerged as the analysis considered the changing attitudes expressed by the participants in relation to the informal curriculum's impact combined with the influences of social and institutional factors. Some of the participants who were aware of the severity of T2D and believed in the importance of being a role model for patients and community clearly stated that the academic burden of the curriculum consumed all of their time and energy, leading them to prioritise their academic studies and progress rather than undertaking exercise or preparing a healthy meal.

The interviews revealed that studying medicine is a challenge and that this, combined with the lack of health-promotion resources, led many students to dispense with cultivating healthy habits until after graduation. Participants believed that, making healthy lifestyle choices – e.g., following healthy diets, engaging in physical exercise regularly, and managing life stress – are all important. Still, the academic performance had a higher priority over these areas during their years of study. P6 clearly stated:

"*I think that changing lifestyles is difficult during studying because it will affect one's academic performance. For example, if a student practices sports five times per week, one hour per day, this will affect his academic performance negatively. But this doesn't apply to diet, of course, I am only speaking of sports. I mean that deducting one hour a day from study time will affect the student's academic achievement*." (P6)

It seemed that medical school was not seen as promoting a student's wellbeing during scheduling lectures and exams. P19 reported that he wants to follow a healthy lifestyle, but the study pressures impacted his current lifestyle:

"*As for sports, we all want to have a schedule for practicing sports. Yet, some things don't help us practice sports regularly,*

> *such as pressures of exams, lectures and reporting for work. Besides, priority is given to our study, in plain words.*" (P19)

Participants who had lived with people living with diabetes and witnessed diabetic complications prioritised their wellbeing over anything else. Two of the 25 interviewees reported prior experience of lifestyle modification. The primary influencer for adopting and maintaining a healthy lifestyle, despite all the above challenges, was living with a person with diabetes and witnessing their daily problems. An internal motivator helped P23 and P4 to overcome barriers to prevent diabetes in future life. P23 shared her family history with diabetes:

> *"I lived with the fear of diabetes before I joined medical college because some of my family members lived with it, such as my father before he died, and my grandmother, which resulted in amputation of her lower limbs. My father died because of diabetic complications, and this frightens me a lot. After I joined college and read more about this disease, I decided to change my lifestyle to protect it. I brought my weight down to 83 kgs during the last five months because it was over 100 kgs., and that was because I realised the risks of this disease and my knowledge of them. I should care about myself because this might cause complications and other chronic diseases.*" (P23)

The impact of witnessing the painful complication of diabetes was not the influencer of P4 to change his lifestyle and maintain ideal body weight to prevent diabetes, but the prevalence of diabetes and its risk factor, i.e. obesity, among family members, were the real influencers:

> "*Diabetes is prevalent in my family to a very great extent. Both my parents had it, and also obesity is prevalent. Thus, I was always keen on maintaining an ideal weight. My weight hasn't changed for five years now, give or take, except for 1−2 kilos only during exams, and this motivates me to follow healthy behaviours most of the time.*" (P4)

The interviews highlighted the effectiveness of employing the informal medical curriculum to encourage medical students' lifestyles to be healthy through tutors in medical schools. Tutors seem to have a positive influence on encouraging medical students to follow healthy habits. Religious rewards, in term of seeking Ihsan, seem to encourage healthy behaviours more than medical knowledge does. Adherence to the Islamic faith in Saudi Arabia is an aspect of an expected lifestyle, and how medical students considered their religious beliefs to influence their professionalism. How students developed this understanding was not clear during the interviews, whether through their tutors, culture, or curriculum.

Some participants observed that cultivating their lifestyle was not a priority compared to devoting time and energy to their academic performance. They recommended that medical curriculum developers consider their wellbeing in designing the syllabus and assessment tools. However, participants who had witnessed diabetes complications in their family members considered their wellbeing a priority.

7.2.3 Theme three: recommended interventions to improve medical students' T2D preventive behaviours

The participants were asked about their recommendations for improving medical students' health promotion behaviours and wellbeing. Participants suggested several possible solutions related to the curriculum and the medical school system, such as establishing a student wellbeing unit, highlighting the cultural context of Saudi society in PBL cases, and starting clinical training in the early years of medical school (see Table 7.2).

7.2.3.1 Student wellbeing unit

The first and foremost solution proposed was to develop a student health and wellbeing unit. It was suggested that this should target healthy students (not students with illnesses) who need to be aware of health problems early on and geared towards prevention, rather than treating or supporting students with special needs, as these services are already in operation. According to P4:

> "*I hope to set up a permanent unit at college that is concerned with improving the health of the students so it can draw up programmes that suit our nature, customs and traditions. This unit shall be a nice initiative from the college, especially because it provides activities, projects and programmes for both the students and the outside community."* (P4)

Many other participants expressed similar views. P16 shed light on policies and academic guidelines. They suggested analysing the academic schedule from a health promotion perspective.

> "*When the academic guidance is developed, this will help understand the student's needs and minimise study-hours, listen to their problems, give them ways to control study pressures, and guide them to methods for venting these pressures, in the form of sports or any other method. Then, the student will be able to follow a healthier lifestyle. I would like it if students' supervisors form support groups for female students who face similar problems so that they could help them and encourage them to change their unhealthy behaviours."* (P16)

7.2.3.2 The relevance of Problem-Based Learning (PBL) cases

Although the first phase of this study clearly identified that medical knowledge did not change the students' health promotion behaviours, participants had remarked on when the curriculum touched their personal beliefs and life. PBL is a learner-centred method of teaching whereby the students are active participants in constructing their learning. At the core of PBL, students interact with an authentic 'case' of problem that gives the learning context. In this study, PBL cases' content had some influence on students' attitudes, which might encourage them to follow health promotion behaviours.

Some of the cases discussed in the PBL curriculum were similar to some students' family life, which would be a hidden psychological message to improve students' health promotion behaviours. P17 said:

> "*The cases we were discussing in GYN/OB (Gynaecology/ Obstetrics) course worried me sometimes about my sisters and my mother because they reminded me of them sometimes. Some cases look like their health conditions. The course does not affect me or my care about my family unless I felt that the scenario resembles our life. I began to feel more worried about the complications of some diseases or sometimes of the complications of surgery if one of them went through one*." (P17)

Similarly, P2 was motivated to read and search more if they knew that a health problem was common in their community:

> *"Some information tempts me to read and investigate more, such as reading broadly about the rates of some diseases in the Kingdom of Saudi Arabia and comparing that with other countries, for example, cancer, diabetes and other hereditary diseases. I think mentioning these statistical data is important*

> *for us to realise the size and gravity of the problem in our country. Besides, it is considered a health educational material that is easy to convey to the patients."* (P2)

7.2.3.3 Early clinical training

A number of medical schools in Saudi Arabia have modified the PBL curriculum over recent years. Medical schools worldwide use PBL differently. There are some schools with an almost 100% PBL curriculum. The medical school in Qassim University, like most medical schools, uses a hybrid model, which (in the university setting) employs lectures and PBL in similar proportions. PBL is only implemented in QUMS in the first three years and stops when students start their clinical training in the fourth and fifth years. Many participants believed that, if they started clinical training earlier, they would realise the severity of many health problems at an earlier stage of the study, which would encourage them to adopt healthy behaviours at an earlier stage. They suggested that the basic science and the PBL cases which were studied in isolation of clinical applications during the first three years could be revisited and taught during the fourth and fifth years to encourage healthy habits. According to P4:

> *"In an internal medicine course, we came in close contact with many patients and saw new diseases. We saw diseases, previously studied in books only, now represented in reality. It was one of the courses which raised worries among students about their health and their families, especially when we saw patients of heart diseases and cancer and other diseases. It was a new stage for us in studying medicine.*" (P4)

P19 commented that:

> *"I believe that students' engagement in practical practise in the first years to a greater extent might have a role in changing their behaviours. What's happening at our university is that visits to hospitals are every week in the third year. As for first- and second-year students, visits are only to primary care centres that exist in neighbourhoods. Mostly, these visits aim to boost the community's health more than diagnosing diseases or identifying them. In most cases, these visits do not concern the medical curriculum itself. Thus, I believe that, if there were weekly visits to get to know the patients and see the disease in reality from the outset of the first year, there would be a great change in the behaviour."* (P19)

This indicates that there might be a limited understanding of the real-life experience of the disease in the first three years, and possibly a wasted opportunity to provide implicit lessons for students. P12 said:

> "*There are things that may change a person; however, they are mostly realistic things, such as seeing a diabetic patient having a renal failure or is afflicted by gangrene or loss of eyesight. These things often prompt us to revaluate ourselves and our health condition, as well as that of our family."* (P12)

Similarly, P18 commented:

> *"Discussing cases at study table did not change my view of them; but, after coming in close contact with patients, I checked my background memory and began to understand actually what was mentioned in the books that we used to discuss coldly without any conception of its gravity. It is true that group discussion of cases with some colleagues gives me more information (knowledge) about the disease and more adequate and clearer explanation than the books, yet, as I said before, without a conception of the reality of the disease."* (P18)

The findings show that the absence of a student wellbeing agenda in the formal curriculum had led to common unhealthy behaviours among medical students. For example, separating the implementing of the PBL curriculum from the clinical training led to underestimating the burden of T2D. This may also identify the reason behind the beliefs and changes in behaviour for some participants, such as P2 and P17. However, it was difficult to assess the validity of this limitation due to the lack of accessibility to the PBL cases used in QUMS. Even though participants did not explain the type of strategies that they thought the unit should follow, it would be valuable to review students' concepts of wellbeing in the QUMS medical curriculum. This topic is investigated further in the next chapter.

7.3 Conclusion

The findings of the thematic analysis of the interviews helped to further the understanding of the context of the statistical results in Chapter 6. The process of evaluation embedded within the present work's study design provided significant insight into the underlying and changing attitudes, knowledge, and lifestyle practice of medical students. At the same time, it also highlighted features that require a greater emphasis on developing and implementing the medical curriculum.

Medical students who seem to be following a healthy lifestyle reported being influenced more by religious and social norms than other factors. This finding encouraged further exploration of the data to understand the reasons behind that. According to the responses, participants did not explain how they had gained that perception – i.e. either from their tutors or courses. Therefore, discovering the source of this influence is required to answer the main research question.

Another interesting point was that participants raised the need to have a student wellbeing unit in the university to promote healthier lifestyles. Participants did not elucidate further potential working strategies for the student wellbeing unit. This influenced further the next level of this study. Finding out how the medical schools in Saudi Arabia acknowledge and promote students' wellbeing appears to be essential for understanding the source of religious and social influence on medical students' lifestyles. These new areas for further study were developed in phase three. The next chapter explains how QUMS, and the organising body of medical education in Saudi Arabia, identify and demonstrate medical students' health promotion behaviours.

CHAPTER 8 RESULTS OF PHASE THREE: HOW HEALTH PROMOTION AND T2D PREVENTION ARE EMBEDDED IN THE FORMAL MEDICAL CURRICULUM: CONTENT ANALYSIS OF ORGANISATIONAL AND NATIONAL DOCUMENTS

The results of the first and the second phases of this study showed that medical students gained knowledge about T2D as both a local and a global health problem during their medical education years, which was accompanied by changes in their beliefs regarding their susceptibility to and the severity of T2D. Such knowledge and beliefs did not lead to active attempts to prevent T2D in their lifestyles; namely, how healthy their diets were, how much physical activity they engaged in, and how they coped with stress (Chapter 6). Students' reasoning and justifications for not following these behaviours were collected through semi-structured interviews and analysed into themes, presented in Chapter 7. These themes highlighted the potential roles of the social and religious impact and students' wellbeing strategies on influencing T2D preventive behaviours among the QUMS students.

By combining the findings of the first two phases, it seemed that further investigations were essential to understand the role of the medical education on medical students' T2D preventive behaviours. The three themes, identified in phase two, hypothesised a potential influencing role of the medical curriculum of QUMS and other national medical regulatory bodies in Saudi Arabia in nurturing students' perceptions of their health-related behaviours and lifestyles.

In order to construct an explanatory and contemporary picture of potential influencers, the further investigations had avoided subjective data sources 'self-reporting'. The data sources for the third phase of this study were from institutional (QUMS) and organisational (SCFHS and NCAAA) documents that related to promoting T2D preventive behaviours. The selected documents were analysed through documentary content analysis. The methodology, data collection, selection and quality assessment of the data are detailed in Chapter 5.

The results of the third phase of this study form the focus of this chapter. The contents of this chapter are divided into two parts according to the type of the content analysis approach. The first part of the chapter illustrates the quantitative results of the documents content analysis. The second part of the chapter describes the qualitative findings of the documents content analysis. Two themes emerged from the qualitative content analysis of the documents; these, their sub-themes and their categories are described in the second part of this chapter.

8.1 Quantitative content analysis results

The two areas that needed further investigations were (a) students' wellbeing strategy and (b) the role of social and cultural values in promoting the students' wellbeing. Those two investigation areas formalised the search codes for the third phase of this study. All words and phrases that might be used to explain or refer to each of investigated themes were listed. Synonym words were aggregated under one code. These codes were searched for in the documents, counted, then grouped into sub-themes (see Chapter 5). The quantitative content analysis was done in conjunction with the qualitative content analysis process. Table 8.1 shows a list of the identified codes, sub-themes, and the investigated themes in the third phase of this study.

Table 8.1: Documentary content analysis findings.

Themes	Sub-themes	Codes
Students' wellbeing strategy to Prevent T2D	Health awareness of T2D prevention	Health education (exercise, healthy diet, stress management)
		Patient education and patient's empowerment
	The attitude toward promoting and preventing T2D	Behaviour modification
		Belief
Social and cultural values	Islamic religion	
	Culture and social norms	
	Role modelling	

The most frequently occurring themes/sub-themes across the 37 analysed documents were, in ranked order:

- Health awareness of T2D prevention.
- Attitudes towards T2D prevention
- The religious values,
- The culture and social norms
- The less reported sub-theme was the role modelling.

Of the 37 analysed documents, 463 codes were identified into one of the above sub-themes (see Tables 8.2 and 8.3). A summary of the codes in each document are provided in Figure 8.1.

Table 8.2: Frequency of reported codes related to T2D preventive behaviours in the analysed documents.

Publisher/ Documents	**Theme / Sub-Themes**					
	Students' Wellbeing		**Social and Religious Values**			Total frequency of codes
	Health awareness of T2D prevention	Attitude toward promoting and preventing T2D.	Islamic religion	Culture and social norms	Role modelling	
QUMS						
D1	12	0	8	0	0	22
D2	2	1	0	0	0	3
D3	0	2	0	3	0	5
D4	17	0	0	0	0	18
D5	5	0	0	0	0	5
D6	10	3	0	3	0	16
D7	11	1	4	0	0	18
D8	4	0	0	0	0	4
D9	6	0	0	3	0	9
D10	12	0	0	0	0	12
D11	14	0	0	1	0	15
D12	15	2	0	0	0	17
D13	2	3	2	0	0	7
D14	0	0	0	0	0	0
D15	0	0	3	0	0	3
D16	45	30	20	23	0	119
D17	0	0	2	3	0	5
D18	3	1	2	2	0	8
D19	0	0	3	0	0	3
D20	0	0	0	0	0	0
D21	0	0	0	0	0	0
D22	0	0	2	0	0	2
D23	5	1	0	0	0	6
SCFHS						
D24	4	21	0	0	4	29
D25	1	2	11	6	0	20
D26	24	39	29	27	5	124
NCAAA						
D27	3	0	0	0	0	0
D28	0	0	0	0	0	0
D29	0	0	0	0	0	0
D30	0	0	0	0	0	0
D31	0	0	0	0	0	0

Cont.						
D32	2	0	0	0	0	1
D33	11	0	6	0	0	17
D34	0	0	0	0	0	0
D35	0	0	0	0	0	0
D36	2	0	0	0	0	1
D37	3	0	1	0	0	3
Totals	212	107	93	70	10	492

As might be expected from course documentation, the QUMS documents were the most detailed of the three sources of documents in terms of their quality and quantity of evidence of health promotion in the curriculum. Although the SCFHS source comprised three documents only, it was enough to show how the Saudi medical curriculum deals with the two themes. In contrast, the NCAAA did not show any health education content. In the NCAAA's documents, only the 'health awareness of T2D prevention' sub-theme and 'Islamic religion' sub-theme were presented in the context. There were only 28 codes (5.7%) identified in the NCAAA. The distribution of the themes/sub-themes among each source is presented in Figure 8.1. Tables 8.2 and 8.3 illustrate the number of curricula that showed evidence of T2D promoting behaviours content distinguished by the two themes.

Table 8.3: Distribution of theme/sub-theme among documents sources

	Students' wellbeing		**Social and cultural values**			Total n (%)
	Health awareness of T2D prevention	Attitude toward preventing T2D	Islamic religion	Culture and social norms	Role modelling	
QUMS (n=23)	163	44	46	38	0	291 (59%)
SCFHS (n=3)	29	62	40	33	9	173 (35%)
NCAAA (n=11)	21	0	7	0	0	28 (5.7%)
Total	213 (43.1%)	106 (21.7%)	93 (18.9%)	71 (14.2%)	9 (2.1%)	492

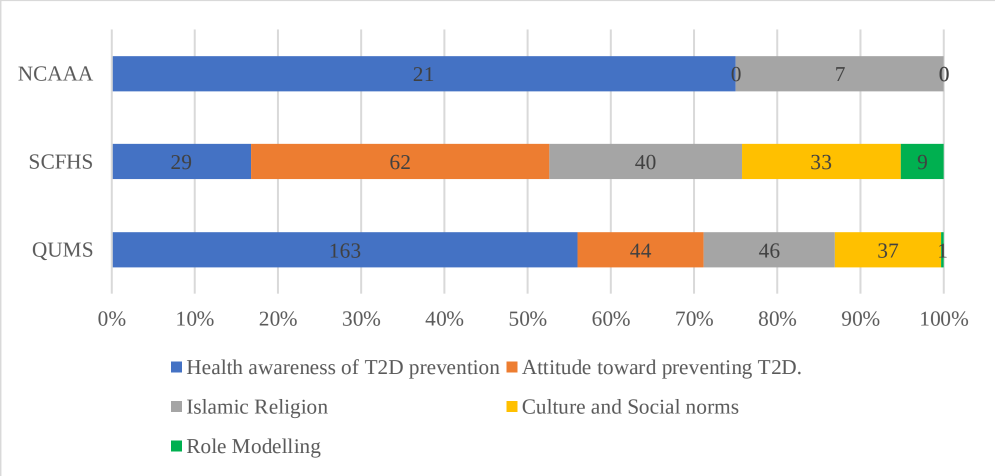

Figure 8.1: Distribution of sub-themes among documents' sources

8.2 Qualitative content analysis results

While frequency counts give some indication of content inclusion, they provide little insight into the quality of the content included. Discursive commentary was needed to illuminate the nature and omissions in health promotion content. The sub-themes were identified after the coding stage and summarised in Table 8.1.

8.2.1 Theme one: students' wellbeing strategy to prevent T2D

The codes under this theme were grouped into two sub-themes, according to the type of health education or promotion described. The first sub-theme, 'health awareness of T2D prevention' focused on terms used to describe the awareness intervention or strategies in the documents. It included nutrition, physical activities, education and regulation, at the individual and the community levels. The second sub-theme 'attitude toward promoting and preventing T2D' focused on the interventions or messages within the curriculum that encourage students to follow healthy behaviours at the individual level. The following are the most significant findings.

8.2.1.1 Health awareness of T2D prevention

This sub-theme included multiple search terms such as community health, public health, individual health, exercise, and healthy diet. The search discovered 213 portions of text within the analysed documents. Almost all these texts focused on the community health, and most were written in the context of justifying the significance of the courses (rationale of the course). Twelve courses at QUMS mentioned the medical students' role in improving and promoting community health.

Speaking about their medical curriculum, QUMS emphasise promoting community health through their vision statement:

> "*A leading national and internationally recognised college in innovative medical education supporting the development of a healthy community.*" (D2)

In addition, through including the "*Field/community activities*" (D1) in their educational strategies and assessment objectives, they aimed to:

> "*understand the basic principles of prevention of such disorders in the community.*" (D5)

The importance of promoting community health was present in almost all the course documentation analysed. However, promoting the students' wellbeing was completely omitted from the 23 documents of QUMS. It was located once but related to professional behaviour, not health behaviour:

> "*Develop self-awareness about one's own attitudes, beliefs and behaviours that influence his/her practice as a physician*." (D16)

Even though the SCFHS provided only three documents, it was the only source that revealed the importance of promoting the student's wellbeing:

> *"The health practitioner must pay attention to his [sic] physical and psychological health. It is one of the most precious human rights that must be maintained according to what was approved by the Prophet Muhammad, peace be upon him - Your Lord has a right on you, your soul has a right on you, and your family has a right on you; so you should give the rights of all those who have a right on you.*" (D24)

Diabetes was mentioned across all the analysed documents more than any other health problem. It was mentioned 29 times (in five courses at QUMS, and one document from the SCFHS). A comparison search was carried out among all the documents, which found that diabetes was the most frequently mentioned disorder, more so than hypertension, heart disease, stroke, and high cholesterol. Understanding the magnitude of the T2D condition, controlling diabetes and identifying the prevention strategies were included in several reproductive and endocrine course objectives. For example:

> "*Describe the impact of the morbidity and the mortality, and cost of diabetes mellitus on society… Describe the relative importance of genetic and environmental factors in the aetiology of different types of*

diabetes mellitus… identify strategies recommended for prevention and control of diabetes mellitus… Explain the epidemiology of diabetes mellitus at international and national levels." (D7)

Some courses used diabetes as an example of severe complications, such as the neurology course:

"*There are also systemic diseases which affect the nervous system, like diabetes and hypertension etc*." (D16)

Sometimes diabetes emerged in the form of an everyday example in case studies; for example:

"*Mrs Salma is a 70-year-old lady with diabetes. She sends her daughter, who requests a repeat prescription.*" (D25)

8.2.1.1.1 *Health education*

This code looked at the medical curriculum context as a diabetes health education intervention through tracking messages, strategies and interventions, all of which stressed the importance of following healthy lifestyles. This point was present in the majority of the QUMS curricula; however, the primary focus was on patients. This code covered all information related to physical exercise, healthy diet, and stress management strategies.

The importance of engaging in physical activities was stated eight times in three courses out of the QUMS curriculum and in one document of SCFHS, two of which were linked to diabetes.

"*Explain the role of exercise in types I and II diabetes.*" (D7)

Practicing exercise was recommended by the SCFHS to students as a method of controlling work stress.

"*How to deal with job stress…on Long-term stress relief recommendations: Positive thinking ... Physical exercise.*" (D25)

A healthy diet was frequently referred to in the documents, and segments of text relating to it were found in 57 locations. All these locations were found within the QUMS curriculum, but none targeted medical students' wellbeing. For example, in one of the courses' objectives it was stated that students need to:

> "*Appreciate the role of the doctor in the promotion of health through adequate nutrition.*" (D4)

A healthy diet was also linked to diabetes in another course objective:

> "*Explain the role of diet in both types of diabetes.*" (D7)

Stress Management was omitted in the QUMS analysed curriculum for no clear reason. Nevertheless, it was presented in one of the SCFHS documents. In the communication skills book, there was a section on controlling work stress:

> "*How to deal with job stress…… Physical exercise …Stress control techniques: yoga or relaxation.*" (D24)

8.2.1.1.2 Patient education and patient empowerment

These terms were used interchangeably in the reviewed documents to refer to the process of verbally educating and empowering patients with knowledge provision. It was found 21 times across the documents. Students were assigned to prepare educational messages for people with diabetes:

> "*In Health Education: Student prepares a health education message to be delivered to patients with diabetes mellitus and discuss the message with the trainer… Education message includes the necessary self-care related to nutrition, regular check-up, care of feet, exercise, control of hypertension and other co-morbid conditions, symptoms indicating emergency…etc.*" (D12)

Furthermore, the students were assessed on how they delivered these messages to the patients and their families:

> "*The students are expected to be able to show responsible and compassionate behaviour with the patient and family considering the cultural, social and economic background, and in dealing with all levels of education and abilities.*" (D16)

Because the analysed document from the SCFHS focused on communication skills, the patient education code in this document extended beyond verbal education to also consider nonverbal communication:

> "*Nonverbal communication is a universal language, with some nonverbal cues (signals) having different meanings in different cultures. Nonverbal communications include facial expressions, tone of the voice and gestures displayed through body language. These non-*

verbal signals can give clues and additional information and meaning in addition to the spoken (verbal) communication. Verbal communication alone would not have significant effects on a patient's education and health outcomes." (D25)

8.2.1.2 Attitude toward promoting wellbeing and preventing T2D

This sub-theme examined the medical curriculum content as a strategy to promote students' wellbeing through tracking messages and interventions. The codes under this sub-theme highlighted the importance of modifying one's lifestyle to become healthier through focusing on one's beliefs and attitude.

This sub-theme was absent in all the NCAAA documents and present in the SCFHS more than the QUMS documents (see Table 8.3). The search targeted all keywords used to send messages or describe ways or strategies of accepting change. The significant findings are listed below.

8.2.1.2.1 Behaviour modification

This code stressed the importance of helping patients modify their unhealthy behaviours and explaining the implemented strategies to achieve that goal. These areas were presented in 11 texts in two of the analysed documents in QUMS and SCFHS. The 'Cardiovascular system' course emphasised the importance and the effect of modifying behaviour at the national and international levels in the course's objective:

> "*Explain the effect of lifestyle modification on the prevention of atherosclerosis, CVD and hypertension.*" (D6)

The SCFHS gave many helpful examples, in a number of locations, of how to identify patients' denial of their need to modify their behaviours, and how to deal with them:

> "*Examples of help-seeking behaviour that need modification: Denial: Some patients unconsciously forget about their health problems and act as if they did not exist. This psychological defence mechanism leads to poor compliance with the management plan.*" (D25)

8.2.1.2.2 ***Belief***

The meaning of 'belief' in the analysed documents was inconsistent. In some locations, it was used to refer to faith or religion, and in others, it referred to the feeling that something which exists is true. The second definition was the criterion applied in this study to include any content under this code. Reviewing all the word search results was therefore essential for counting this code (belief and attitude). The work revealed that the belief code was present in 18 texts across the documents.

QUMS literature endorsed students' paying attention to, and cultivating of, their beliefs and values:

> "*Developing self-awareness about one's own attitudes, beliefs and behaviours that influence his/her practice as a physician.*" (D16)

That is one of the QUMS's core objectives in preparing students for the clinical phase. It was also one of the medical education assessment criteria:

> "*Observation is all important as monitoring attitudes, ethics and some intellectual skills of students. Task assignments and the student response to them give a clue to their motivation in the concerned activity.*" (D2)

Also:

> "*Determine the general appearance (behaviour, facial expression, body position and gait.*" (D13)

In contrast, this general objective of QUMS was not reported or expanded in any of the courses' descriptions. The word belief was not mentioned at all in all of the health promotion related courses such as the 'Cardiovascular System' course, 'Man and His Environment' course, and the 'Family Medicine' course.

Again, the SCFHS emphasised the importance of being aware of shared beliefs and values to prevent T2D onset in patients. It did so by explaining and giving many examples of the importance of acknowledging personal beliefs and perceptions in accepting the doctor's advice and therapeutic plans:

> "*Supportive comments are not enough for effective reassurance. Credibility is not just a package of skills. Credibility is the reflection of our beliefs and values.*" (D25)

The SCFHS went further to remind students about the type of beliefs that might influence a patient's receptivity to educational messages.

> *"Factors Affecting Illness Behaviour: Locus of control Some people have independent personality, and they believe everything is under their control; these types of people have —the internal locus of control."* (D25)

8.2.2 Theme two: social and cultural values

This area was investigated because of the high emphasis noted in medical students' replies on the social and religious factors influencing their lifestyle behaviours (Chapter 7). Most of the expressions identified regarding Islamic religion were stated in the Arabic language. The QUMS and the NCAAA reported many words associated with this theme more than they did with the first theme (see Table 8.3). That might be related to how both institutions interpret their missions, the mission of the QUMS was:

> "*Improving the health of the society by preparing competent health professionals who are able to respond to the changing healthcare needs and expectations of the community.*" (D16)

The NCAAA also sought:

> "*to gain the confidence of the local and global community.*" (D33)

The social environment of Qassim city is generally conservative in outlook, as the developers of the medical programme stated:

> "*Al Qassim Region… is well known for its prevailing Islamic culture and traditions.*" (D16)

It was not surprising as the NCAAA stipulated that all Saudi higher education programmes should prioritise incorporation of Islamic values when developing their mission statements:

> "*The mission should be consistent with Islamic beliefs and values.*" (D37)

8.2.2.1 Islamic religious practices

Islamic religious practices guide the daily lifestyles of the majority of Muslims. This was evident in almost all the analysed documents in this study, and with most of the responses of the interviewed students (Chapter 7). Medical students who participated in this study said that seeking religious rewards (Ihsan) influenced their lifestyle and their way of acting and communicating with patients. Moreover, it indirectly influenced them to act as a healthy role model for patients, and in some cases, for the public.

The SaudiMEDs framework expects a doctor who has been certified by a national institution to show their commitment to delivering the highest standards of ethical and professional behaviour in all aspects of health practices, through applying:

> “*Islamic, legal and ethical principles in professional practice*.” (D33)

Medical students in Saudi Arabia are required to pass four courses related to the Islamic religion in order to be certified as a doctor:

> “*Apply Islamic law (Fqih) in health-related matters.*” (D33)

These courses were analysed in this study (ETHIC 411, ISLAM 101, ISLAM 103 and ISLAM 301). The descriptions of these four courses were short but enough to show the relationship between medicine and Islam. The curriculum focused mainly on two aspects: the ethics of the Muslim doctor and the Islamic legislation for some medical practices – e.g., abortion and organ transplantation. These courses stressed the importance for future doctors to maintain a strong relationship between religion, scientists, and themselves:

> “*Strengthening the relationship between the religious and the health scientists and knowing that they cannot be separated*.” (D22 and D19)

More details on how to put Islamic ethics into action were located in the SCFHS documents. The doctor-patient relationship from the Islamic perspective has a unique interpretation. For example, empathy is not just another indicator for high professionalism; it is a way of worship:

> “*Empathy is a religious and humane value; it is not just a package of skills. Empathy is a response that recognises or names the patient’s feeling and does not in any way criticise*.” (D25)

The medical curriculum in Saudi Arabia emphasised the importance of reminding patients about God’s rewards for their patience. Breaking bad news to patients is a delicate skill, and one of the means of supporting patients is to help them to think positively:

> “*It is required by the Muslim doctor to believe that disease and healing are in the hands of God and that it is not permissible to despair of God’s mercy. And what might be hopeless is according to the doctors' estimation and experience and to what is available from the medical possibilities at the present time.” (*D24)

The SCFHS concluded how the Muslim health practitioner is supposed to interpret their professionalism and duty:

> *"A Muslim is motivated by his faith to show his ethics, and in this way, Prophet Mohammed the Messenger of God, may God's prayers and peace be upon him, said (The believers who show the most perfect Faith are those who have the best behaviour, and the best of you are those who are the best to their wives). The health practitioner does not abide by his responsibilities and duties in order to protect his reputation, or in order to achieve his financial and social success only, or just for fear of punishment, but, he is doing so, in order to achieve the servitude of God Almighty by obeying Him, adhering to His law, and following His pleasures."* (D24)

8.2.2.2 ***Cultural and social values***

Cultural and social values were less highlighted in the documents than religious values. This is likely to result from the curriculum developers' belief that cultural and social values are derived from religious values. Actions that are prohibited by the Islamic faith are subsequently rejected by social and cultural norms. Text segments emphasising the importance of considering cultural and social norms were located in 71 locations across the curriculum documents. Most of these were within the QUMS course descriptions.

In most of the cultural and social statements, the programme developers were keen to remind students about the local norms and habits and how they should be recognised during the learning and clinical working stages. The lifestyle habits of the local community were mostly regarded as unhealthy. For example, the developer of the 'Cardiovascular System' course included a section, in the course rationale, about how students should start to think about how they can modify such norms:

> "*Although these factors may differ from one society to the other, most of them can be eliminated in our societies simply by modifying our habits and lifestyle. Examples include taking a balanced diet (amount and type), ceasing smoking and alcohol consumption, regular moderate physical activities and early management of any disease. All these are part of our religious traditions.*" (D6)

In another location, assessing the students' understanding of local cultural habits was one of the course objectives:

> "*Outline the social, cultural and behavioural determinants of reproductive health-giving examples from Saudi Arabia*." (D7)

8.2.2.3 Role modelling

This code was not found in all the analysed documents that were written in English. However, it was located nine times in the Arabic-language documents. The SCFHS was the only institution that shed light on this. The SCFHS believed that one of the health practitioner's duties is to be a good role model for the general public:

> "*Responsibilities of the health practitioner towards the profession: to follow the sound standards of personal conduct and public ethics while practising professional and other activities. For example, by staying away from criminal behaviour and violent behaviours. Like using illegal drugs, for example, and he should stay away from suspicions that degrade him as a Muslim role model before becoming a health professional role model."* (D24)

The SCFHS documentation reminded students about the hidden role they play in and for society, whom they should respect, and how they should deal with this duty. It also reminded them about the leading role they might play in the future to improve and solve local issues:

> "*To be a role model for members of his [sic] community in his religious and moral commitment. The status of the health practitioner in society is to act as a leading role to improve the community. A health practitioner who lacks moral values in his own life cannot fabricate his professional activity even if he has the highest educational qualifications. The health practitioner is a productive and active member of the community that should interact with local issues.*" (D24)

8.3 Conclusion

Having reviewed and analysed the selected medical curriculum documents regarding the health promotion and prevention of T2D among medical students in Saudi Arabia, the documentary content analysis found that students' personal health information was limited. Importantly, the analysis revealed that students' wellbeing not paid much attention in the medical curriculum content and the medical education guidelines in Saudi Arabia. This lesser attention to promoting students' wellbeing might be the reason beyond the presence of the 'cognitive dissonance' in the students' responses in phase two. On the other hand, the religious, social, and cultural values in the documents received greater emphasis than promoting students' health and lifestyle, a finding that was also made clear in the students' reflections and replies in the interviews (Chapter

7). The strong relationship between professionalism and the Islamic religion was obvious in the documents as well as in the students' interpretation of the meaning of professionalism. Again, this relationship explains why students saw the importance, from a religious perspective, of being a healthy role-modelling doctor for patients and the community.

Considering that the documents have their limitations in providing a complete picture of health promotion and T2D prevention in medical curricula, this phase's findings need to be presented alongside the first and second phases of the research. In the following chapter, the findings of the three phases are discussed in the context of existing and relevant literature in the field.

CHAPTER 9 DISCUSSION

This thesis explored the influence of medical education on medical students' knowledge, beliefs and preventive behaviours relating to T2D. The HBM was used in this thesis as a theoretical framework and, in this chapter, the findings are presented and discussed in the context of this model. The HBM explains how medical education, in terms of knowledge, demographic factors and curriculum guidelines, promotes medical students' wellbeing, both in general and to prevent T2D in particular. This chapter comprises a summary of the findings on medical students' health promotion behaviours related to preventing T2D, followed by a discussion of the findings according to the HBM variables, emphasising significant relationships between the variables and the potential cues to promote the medical students' healthy lifestyles in Saudi Arabia. The discussion is presented in the context of existing published works. The chapter then concludes with a presentation of the implications, strengths and limitations of the study. Suggested recommendations for developers of medical curricula, and the faculty of medical and other healthcare schools to promote medical students' wellbeing are presented. Finally, suggestions for future research relating to the fields of medical education and health promotion are outlined at the end of this chapter.

9.1 Medical students' T2D preventive behaviours

The Health Belief Model focuses on the beliefs of individuals which are evaluated as having either a negative or positive influence on their behaviours with regard to the making of health decisions. The results of the present study indicate that medical students self-report a tendency not to follow healthy lifestyles. As shown in Chapter 6, first- and final-year medical students scored less than three in the HPLP2, which is the minimum mean score indicating that participants are following T2D preventive behaviours quite often. The study participants achieved the highest mean scores in stress management: 2.47 ± 0.51 and 2.40 ± 0.49 for first-year students and final-year students, respectively. Nutrition related behaviours scored the second highest: 2.26 ± 0.51 and 2.34 ± 0.52 for first-year students and final-year students, respectively. Physical activity scored the lowest, with final-year students' scoring the lowest out of all calculated scores for both cohorts: 2.05 ± 0.69, and 1.95 ± 0.64 for first-year students and final-year students, respectively.

The results of the statistical analysis (between groups *t*-test) presented in Chapter 6 revealed there was no significant variation between the two cohorts in all the assessed behaviours potentially indicates that the medical programme has a low level of influence in transforming medical students' behaviour. These findings are generally consistent with the findings of the studies analysed in the systematic review phase of this thesis (Chapter 4). Likewise, the current study participants' lifestyle is consistent with university students' general lifestyle behaviours in the Arab world (El Ansari & Berg-Beckhoff, 2017) reflecting that people in the Arab world (including in Saudi Arabia) share similar cooking styles and lifestyle habits (Mabry et al., 2016).

9.1.1 Physical activity

The subscale mean scores relating to students' physical activity were generally lower than those observed in earlier studies. These include a study conducted among first- and second-year medical students (2.25 vs. 2.38) (Masina et al., 2017) and among first- and final-year students in Croatia (2.15 vs 2.46) (Musić et al., 2021); medical students studying in Australia (2.47 ± 0.68) (Slonim et al., 2015); and physical activity mean scores for medical students in Nepal (2.25 ± 0.54) (Paudel et al., 2017). Paudel et al. (2017) believed that busy study schedules, together with the general stresses associated with studying, were the reasons behind these relatively low scores, which was also one of the reasons behind the low practicing of physical activities among the current study participants. However, the four studies mentioned above demonstrated a wider variety of culturally based factors influencing student behaviour than those identified in the present study. For example, there were no social barriers restricting female students from engaging in physical activities like their male colleagues (Masina et al., 2017; Musić et al., 2021), as was reported in this study. In addition, people in Australia, Croatia and in Nepal are accustomed to taking incidental exercise such as walking around the campus. On the other hand, the current study participants reported that they need to go to sports centers to practice exercise due to the limited walking areas around the campus and the difficult weather conditions.

The studies above also reported a positive impact of medical education on the students' physical activities, with the final year students generally being more physically active than first-year students (Masina et al., 2017; Musić et al., 2021; Paudel et al., 2017), which was missing in this study. It seemed that cognitive dissonance is one of the reasons that made the current study participants less influenced by their medical education (Harmon-Jones & Mills, 2019). Cognitive dissonance was used as an explanatory concept for lack of medical education influence on nursing students' smoking behaviours (Clark et al., 2004). Moreover, the limited resources and social barriers seem to be a challenge for students seeking to follow healthy lifestyles in Saudi Arabia. However, similar social challenges had also negatively affected people in the Gulf region from practicing physical activities (Mabry et al., 2016).

The present study's findings are consistent with similar studies that used the HPLP2 to assess medical students' behaviours in Saudi Arabia. For example, a cross-sectional survey conducted among 426 medical students revealed low scores relating to physical activity among both first-year (1.80 ± 0.62) and final-year medical students (1.90 ± 0.65), with no significant difference between the two groups (Algeffari et al., 2018). Another study, among 243 medical students in Jeddah from the fourth-, fifth-, and sixth-year study cohorts, recorded a slightly higher score on the physical activity subscale on the HPLP2 (Alzahrani et al., 2019). The overall mean score of physical activity was 2.47 ± 0.68 with, also, no significant differences between the cohorts (Alzahrani et al., 2019). Moreover, these studies accord with observations made earlier in Chapter 4, which indicated a lack of impact of medical education on medical students' physical activity in Saudi Arabia (Al-Drees et al., 2016; Al-Qahtani, 2016; Alissa et al., 2015; Alonazi et al., 2016).

Although the researchers in Saudi Arabia did not investigate the reasons behind the limited impact of medical education on the students' behaviours, they recommended increasing students' awareness of the importance of engaging in physical activity. However, this study found that a lack of awareness was not the reason. Even though none of the included studies in the systematic review (Chapter 4) used qualitative methods to ask medical students about the factors behind the low physical activities' behaviours, there are similarities between their study participants and the current study participants, which might indicate that they may have encountered similar barriers, such as social and cultural norms, limited times and walking areas, difficult weather and limited or lack of medical students' wellbeing services. In addition, medical and healthcare students in Saudi Arabia might be affected by cognitive dissonance, seeing that health is determined by the physical, social, cultural and economic environments where people live and work (Marmot & Wilkinson, 2005).

9.1.2 Nutrition

The current study found relatively low levels of following healthy eating habits among first-year (2.26 ± 0.50) and final-year medical students (2.34 ± 0.52), and the *t*-test revealed no significant difference between the two cohorts in any of the nutrition subscale items. However, these results are slightly lower than the findings of other international studies. For example, the mean of the nutrition subscale for first- and final-year medical students in Croatia (2.63 ± 0.45 and 2.85 ± 0.46, respectively) (Musić et al., 2021), and among medical students in Nepal (2.42 ± 0.46) (Paudel et al., 2017) were all slightly higher than the current study findings. As with the physical activity subscale, international studies reported a positive, significant variation in eating habits among final-year medical students compared to the first-year students (Masina et al., 2017; Musić et al., 2021; Paudel et al., 2017). This indicated the effectiveness of awareness about following healthy dietary habits. On the other hand, the current study participants showed significant difference in knowledge, but this did not influence their poor habits. The lack of availability of healthy foods on campus combined with traditional cooking methods were among the most reported barriers to healthy dietary habits in this study. According to Musić et al. (2021), some universities in Croatia developed a preventive–promotional framework to educate and support a more healthy lifestyle among students. This type of health promotion strategy was not noted in the participants' justifications in this study, or the documentary analysis findings. Another potential reason for the low nutrition score in this study might be related to social and cultural habits in cooking and serving foods, as the current study participants reported. This concurs with research into students in other Arab countries, who share similar cultural habits related to foods, who had reported similar dietary behaviours (El Ansari & Berg-Beckhoff, 2017).

Several studies of nutritional practices among students have reported similar results to those of the present study. A notable example is a cross-sectional survey questionnaire based study conducted among 304 nursing students from three universities in South Korea, that reported a mean score of the nutrition subscale on the HPLP2 similar to the present study's findings for first- (2.16 ± 0.56) and final-year students (2.28 ± 0.67)

(Hwang & Oh, 2020). The Korean community is well known for their high acknowledgement of their culture and adherence to their norms including those related to eating habits (Devine et al., 2006; Sobal et al., 1998). People in Korea commonly eat in groups comprising family members or work colleagues, which sometime led to respect other people's food choices and share the food with them (Park et al., 2017). This situation is similar to that reported by the current study participants; in other words, both communities' dietary behaviours are affected by srong cultural norms. However, the limited health promotion interventions through the curriculum seemed to be another similar reason for the relatively low score of nutrition behaviour among both students' communities. Hwang and Oh (2020) recommended promoting nursing students' wellbeing through the formal curriculum and through accessible resources.

Another example of a study consistent with the present one was conducted among Jordanian healthcare students, and the overall mean scores of nutrition subscale were 2.30 ± 0.55 (Shaheen et al., 2015). Nevertheless, no significant differences were observed between medical and non-medical students, which indicates the low impact of medical programmes in influencing healthcare students' dietary choices (Shaheen et al., 2015). People in Jordan share with the Saudi community a strong adherence to religious, social and cultural norms in addition to traditional dietary habits, which might play an influencing role in the dietary lifestyles of students in both countries.

The findings of the present study, in relation to nutrition, matched those observed in studies from across Saudi Arabia that were identified by the systematic review in Chapter 4 (Al-Qahtani, 2016; Ibrahim et al., 2014; Majeed, 2015). In addition to that, Almutairi et al. (2018) reported similar nutrition scores among healthcare students in Saudi Arabia on the HPLP2 (2.33 ± 0.64), and no significant differences between medical and non-medical students' physical activities and eating habits were reported. In a narrow range of results' comparisons, the majority of the students in both cohorts were eating between two to four servings of fruits and vegetables on a daily basis. At the same time, the majority of students in both cohorts were eating breakfast daily. This result is consistent with those produced by another, local study (Almutairi et al., 2018). These similarities, in both levels of physical activity and dietary choices between first- and final-year medical students in this study and other local studies, demonstrates the lack of influence of medical education on Saudi medical students' behaviours. Furthermore, the findings indicate that other factors influence Saudi medical students' behaviours that have yet to be identified. This study attempted to look at social and cultural values, as discussed in the following sections.

9.1.3 Stress management

As with physical activity and nutrition, stress-management behaviours were assessed using the stress-management subscale in the HPLP2. The findings showed that medical students in both cohorts reported being better at engaging in stress-management behaviours than engaging with physical activities and healthy eating habits. The first-year medical students had a numerically slightly higher score (but not statistically significant) for stress management (2.47 ± 0.51) than the final-year students (2.40 ± 0.49). The current study findings are consistent with the number of studies investigating Saudi medical students' management of stress and psychological health that reported high prevalence of stress, depression and anxiety among medical students (Abdulghani et al., 2011; Aboalshamat et al., 2015; Inam, 2007; Sani et al., 2012). Furthermore, it is also consistent with the local studies that reported negative influences of medical education on students' psychological wellbeing (Al-Saleh et al., 2010; Sani et al., 2012). Findings related to stress management produced in this study are, overall, consistent with the high prevalence of depression, anxiety, and stress reported in 40 international studies analysed in one systematic review (Dyrbye et al., 2006). However, The HPLP2 tool used in this study only assesses stress management behaviours among students, while all the above studies focused on the prevalence of stress, depression and anxiety as a proxy measure to better understand stress-management behaviours.

Comparing this study's findings with other studies that used the HPLP2 tool, Alzahrani et al. (2019) and Al-Qahtani (2019) are two of such studies that used the HPLP2 among Saudi students to assess managing stress. Their findings were consistent with those of the current study, that reported that the score of stress managements subscale on HPLP2 were 2.40 ± 0.46 (Alzahrani et al., 2019) and 2.35 ± 0.52 (Al-Qahtani, 2019). On an international level, Saudi medical students practiced similar stress-management behaviours compared to medical students from other nationalities (Paudel et al., 2017; Safaie et al., 2020). All the above studies reported that the busy study schedule was the reason behind the low score of stress management behaviours. The current study participants mentioned the same reason and Almutairi et al. (2018), Paudel et al. (2017)

and Safaie et al. (2020) recommended that medical-curriculum developers and tutors should manage the sources of stress within the medical school.

However, the factors predicting medical students' stress management behaviours are the same as those predicting physical activities and nutrition behaviours. Perceived barriers and self-efficacy, in addition to a positive family history of diabetes, were all factors that significantly shape the extent to which Saudi medical students led healthy lifestyles.

This combination of findings supports the conceptual premise (described in Chapters 3 and 4) that the medical programme in itself is not the only influencer on medical students' lifestyle behaviours. However, medical students' knowledge and beliefs are directly influenced by their medical education, such as an increase in their belief in their susceptibility to and the severity of T2D. The findings reported in Chapters 6, 7 and 8 support this assumption, suggesting that medical education can influence medical students' lifestyles indirectly.

The next sections compare the potential influencing factors that play an indirect role in shaping Saudi medical students' health-related behaviours with their impacts on preventive behaviours related to T2D. These factors are presented within the theoretical framework used in this study to explain how medical education can influence medical students' healthy lifestyle choices. The HBM and the potential factors are summarised in Figure 9.1.

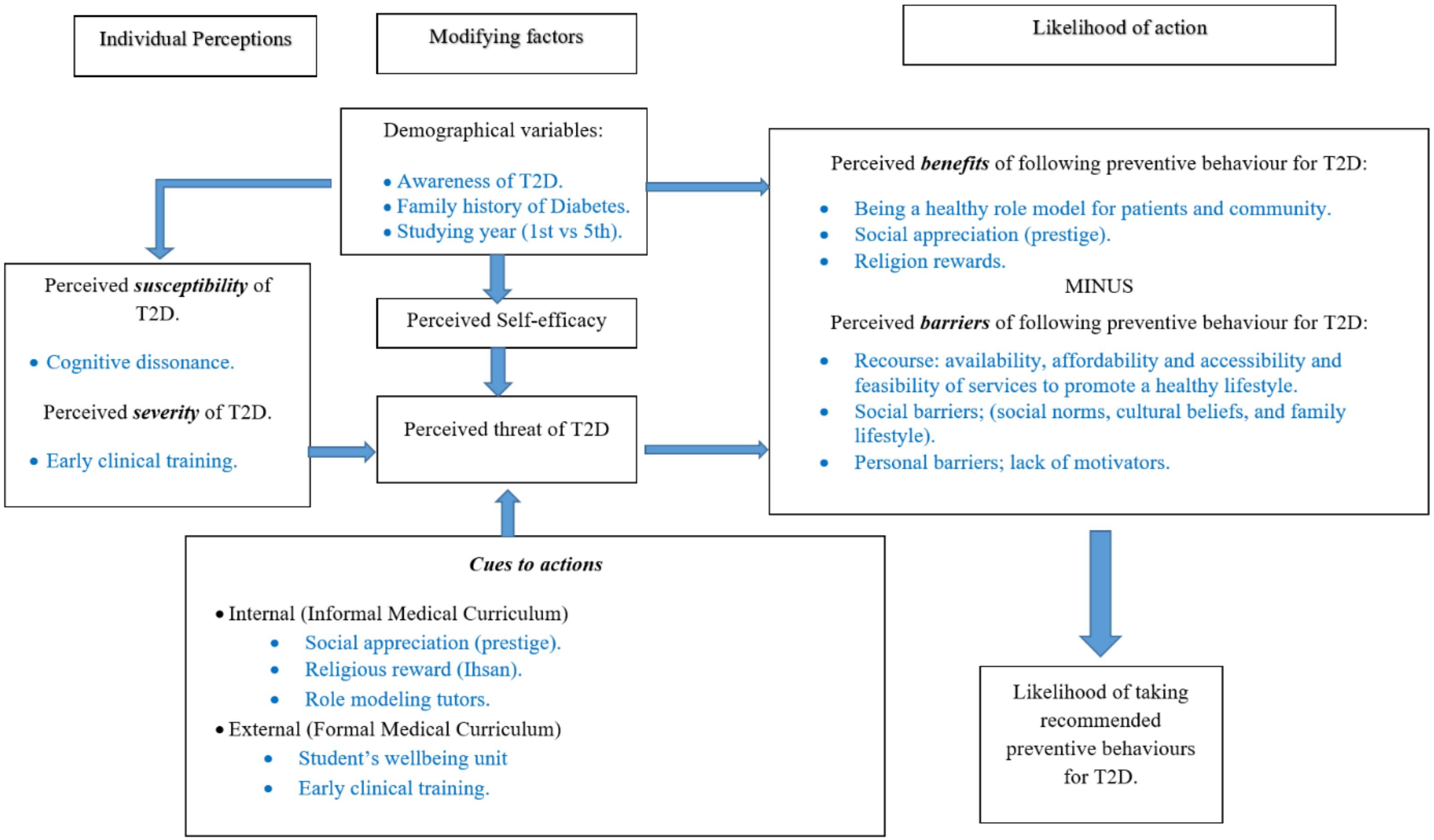

Figure 9.1: The thesis findings based on the theoretical framework.

9.2 The influencing role of medical education on medical students' behaviours within the context of the Health Belief Model

The HBM has not been used before to investigate the influencing factors on medical students' lifestyles in Saudi Arabia. This study has confirmed that perceived self-efficacy and perceived barriers influence health-promotion behaviours related to preventing T2D among medical students. Moreover, their perceived susceptibility to and perceived severity of T2D were influenced by their undergraduate medical education, but it did not impact their prevention behaviours. This study clearly indicates how religious beliefs and cultural values and expectations intersect with perceived benefits, and how they influence cues to take preventive actions.

In addition, this study has shown the extent to which medical curriculum developers and decision-makers working in the field of medical education in Saudi Arabia are addressing students' wellbeing, social norms, and the important role the Islamic faith plays in shaping values and practices. Students' wellbeing, fostering professionalism, and other potential motivating factors that lie beyond medical students' lifestyles are discussed in the context of the HBM as channels that indirectly influence medical students' behaviours (see Figure 9.1).

Figure 9.1 demonstrates how this study's findings are consistent with the HBM's conceptual meaning of the association between individuals' beliefs, modifying factors (medical education and knowledge) and health promotion behaviours. The data obtained are broadly consistent with the HBM concepts and variables, which makes the concepts of the HBM applicable to medical and healthcare students' beliefs and behaviours in different contexts.

The basic beliefs that influence medical students' perceptions of health-promoting behaviours are mostly consistent with those of other communities in different contexts, such as people living with diabetes, health workers, and secondary school students (Adams et al., 2014; Cao et al., 2014; Shabibi et al., 2017). In this study, the cues to adopt a healthy lifestyle were influenced by individuals' religious beliefs, social norms, and role modelling by their tutors. This study has discovered some potential external cues to action. For example, participants indicated their need to have a student wellbeing unit in their medical school to encourage and facilitate following healthy lifestyles, citing that the lack of such a service in the medical school was one of the reasons for their tending to lead unhealthy lifestyles. Participants further suggested that implementing of clinical training in the first years of study, instead of starting it in the fourth year, might further encourage them to lead healthier lifestyles, as they would have a chance to see the complications and the severity of T2D earlier. They would also understand the importance of being and acting as healthy role models. Furthermore, some PBL cases appear to have an influence on students' cues to action; for example, if a PBL case was similar to a student's family life, it would attract their attention as a hidden message to improve their own behaviours (see Figure 9.1).

The demographic data of participants did not correlate with any changes in their beliefs or behaviours, except where students had a positive family history of diabetes or not. In the HBM model, the family history's influence was identified as a modifying factor and as a cue to action. Medical students with a family history of diabetes were more likely to expect to receive a diagnosis of T2D one day in the future (perceived susceptibility). However, even that belief in their susceptibility to T2D did not influence them behaving in a health promoting way (e.g., manage their stress levels); in other words, this might be another form of cognitive dissonance (Harmon-Jones & Mills, 2019; Clark et al., 2004; Kasila et al., 2018).

Participants explained how their family history of diabetes led to their lifestyle choices. For example, if one of the family members with T2D was a doctor who did not show a healthy lifestyle, they would face more social criticism than a family member whose career was not in healthcare. Participants were concerned about facing judgement from their families and from the public. These feelings played a vital role in encouraging them to lead healthy lifestyles and to serve their communities as healthy role models. Participants narrated some personal stories that encouraged them to adopt healthy lifestyles. Being a healthy role model was not always an aim among participants across the board but maintaining a respected professional image in public was a common objective.

9.2.1 The influences of the modifying factors in the Health Belief Model

In the HBM, the modifying factors are identified as types of variables used within the model to provide explanations for an individual's choice of action (Adams et al., 2014). The modifying factors are classified into three groups: demographic factors, social and psychological factors, and structural factors (Adams et al., 2014). These factors may affect individual beliefs and influence health behaviours indirectly (Skinner et al., 2015). However, one of the major shortcomings of the HBM is its lack of specificity regarding how the modifying factors operate or interact with other variables of the HBM (Skinner et al., 2015). In this study, analysing and understanding the role of demographic factors (i.e. family history of diabetes) and the structural factors (i.e. knowledge assessment score and the year of studying in medical school) were essential to understand the influencing roles that other variables play in medical students' preventive behaviours. Such information might be useful to curriculum developers and tutors in considering how to promote students' wellbeing.

9.2.1.1 Knowledge and awareness of T2D health problem

Knowledge and awareness of T2D as a public health problem was assessed in this study through posing nine multiple-choice questions to participants. These focused on two domains: (a) diabetes as an epidemiological health problem and (b) T2D prevention methods. The process by which the tool was developed is explained in Chapter 5. The knowledge assessment process did not target academic information, but rather general information around T2D as a public health problem. The findings from the questionnaire survey identified a moderate level of awareness about T2D among both cohorts. As might be expected, the first-year medical students' mean score of the knowledge assessments (9.10 ± 2.00) was significantly lower than the final-year's score (10.6 ± 2.80). A number of studies report similar findings, as expected, final-year medical students seem to be more knowledgeable than their first-year peers regarding many health issues, such as waterpipe smoking (Sabra & Taha, 2016), antibiotic self-medication behaviours (Haque et al., 2019), and diabetes (Mumtaz et al., 2009; Singh et al., 2014).

The knowledge assessment section targeted the latest information in the epidemiological field and prevention strategies for T2D, rather than knowledge of pathology and clinical management, which would be higher among the final-year students than the first-year students because of their clinical training. Al Wadaani (2013) and Mehling and Jeong (2018) pointed out the need to improve knowledge of the health condition's epidemiological background among medical students. Understanding the epidemiological features of a public health issue is essential for healthcare workers, including doctors, to work together to provide a seamless web of health services (Frenk et al., 2010; Mehling & Jeong, 2018). Research to date has reported unsatisfactory levels of knowledge among medical students regarding the epidemiology of diabetes and recommends that curriculum developers in Saudi Arabia should acknowledge this issue (Al Wadaani, 2013).

In general, medical students at QUMS demonstrated an expected standard of knowledge for their stage of education in regard to knowledge about T2D as a public health problem. The total score of the knowledge assessment for final-year students was significantly higher than those of the first-year students, regarding the epidemiological implications of T2D globally and locally. However, in their answers to some questions (i.e. prevention of T2D) the first-year medical students showed similar awareness levels to final-year students. It is difficult to explain this result because all the participants were taught in the same medical school, but there might be two explanations. The first is the role of the type of medical curriculum used in QUMS centred around PBL. First-year students scoring similar or higher results in the knowledge-assessment part supports the expected, effective role of self-learning, research, and group discussion, particularly given that students have not yet started clinical training at this stage. This explanation is supported by the findings of a comparison study of medical students' awareness of public health issues in Turkey, which compared two different curricula in use. Medical students who followed the PBL curriculum displayed better scores relating to public health issues than those of their colleagues following a traditional curriculum (Gurpinar et al., 2005). The researchers stated that this result was to be expected as PBL students were supported by lectures, small group studies, and field studies, in addition to engaging with the PBL sessions themselves.

Even though the present study's participants recommended several modifications to the PBL cases, they expressed their satisfaction with the PBL curriculum. They acknowledged the role of PBL in encouraging self-learning and research skills, which they felt improved their understanding of a range of health conditions from multiple perspectives. Almost 460 Saudi medical students from Jeddah city, and following the hybrid curriculum, displayed similar satisfaction levels with the PBL curriculum (Ibrahim et al., 2014). The PBL curriculum significantly motivated the current study's participants to learn better, improve their learning skills, and experience learning satisfaction. They also preferred PBL because it helped them link together knowledge of basic and clinical sciences more than might a traditional lecturing model. These explanations are further supported by the findings of other studies that were carried out in Saudi Arabia (Al-Damegh & Baig, 2005; Al-Haqwi et al., 2015), in Hong Kong (Wun et al., 2007), and in India (Callis et al., 2010).

Another potential explanation for the awareness score in both cohorts might be a result of the medical institutions' targeted mission in Saudi Arabia to produce doctors who should understand the basic principles of prevention tools for pathological disorders in the community. Promoting students’ medical knowledge in relation to local public health needs was mentioned in all the analysed documents in this study (see Chapter 8). From a broader perspective, the data reported here appear to support international recommendations that emphasise the need for evidence-based knowledge for practice and health promotion within the medical curriculum (Allan et al., 2004; Rao et al., 2020; Trevena et al., 2005).

Regarding the influence of knowledge and awareness of T2D on beliefs related to preventing this condition, the findings of this study showed a lack of association between knowledge and behaviours. This finding is consistent with studies conducted among Saudi medical students that reported that the awareness was not influencing medical students’ dietary and physical activities behaviours (Al-Qahtani, 2016; Alissa et al., 2015). Moreover, the current study finding is also consistent with a study conducted among 190 US medical students from three cohorts, which showed no significant relationship between knowledge, beliefs, and healthy dietary behaviours (Memel et al., 2018). However, Memel et al. (2018) believed that the lack of knowledge influence on students’ nutritional behaviours was due to the type of curriculum. They recommended transiting the nutrition curriculum from lecture-based courses to more hands-on nutrition and student-centred classes. Although this justification seemed reasonable, the current study participants recommended early clinical training only. Both recommendations reflected the importance of practical learning in improving self-efficacy, which proved to be a significant predictive factor for following health-promoting behaviours.

Recently, in the case of the global COVID-19 pandemic, lack of awareness was cited as the reason for declining vaccination (Sharma et al., 2021), which contradicts the current study's findings. The significant influence of knowledge on behaviours related to preventing COVID-19 might be associated with the acute and fast complications of COVID-19 compared to long-term implications of unhealthy dietary habits and physical inactivity behaviours on health. The perceived severity of T2D was the only belief variable that correlated positively with knowledge. Study participants who were knowledgeable about T2D believed significantly more in the severity of T2D compared to less knowledgeable students.

These findings have important implications as they suggest that interventions to promote medical students' awareness of healthy lifestyles should redirect their focus. Rather than simply educating students about the benefits of following healthy behaviours, a stronger emphasis on enhancing perceived self-efficacy through practical learning as well as overcoming perceived barriers may be more likely to result in behavioural change.

9.2.1.2 Undergraduate medical curriculum

In this study, the influence of the undergraduate medical curriculum was measured by comparing the results of first-year medical students with their peers in the final year of medical school from the three parts of the study's questionnaire. The findings reflected not only the content of the formal written medical curriculum but also the influences of the informal and hidden curricula.

Logically, final-year medical students should be more knowledgeable than their peers in the first year but, as reported above, the core change of the medical students' beliefs and preventing behaviours seems to be influenced by other medical school elements during their years of study. The influence of medical education on students' knowledge was significant, as explained earlier, and was consistent with the findings of a number of other studies. Regarding the influence of medical education on students' beliefs, two factors in the HBM were affected: perceived susceptibility and severity of T2D.

It was difficult to investigate in depth the impact of the type of curriculum on medical students' knowledge because all the participants were from one medical school and had been taught using the same curriculum. This was compounded by the researcher's limited access to the detailed QUMS medical curriculum.

With regard to the influence of medical education on medical students' health promotion behaviours, the findings of this study did not show significant direct influence, as explained earlier. Several potentially influencing channels through medical education seem to have had an effect and are highlighted within the theoretical framework of this research (see Figure 9.1). In conclusion, these findings have important implications as they suggest that interventions to promote medical students' awareness of healthy lifestyles alone should redirect their focus and consider other factors. The next sections outline potential influencing factors that need to be emphasised in promoting medical students' lifestyles and wellbeing.

9.2.1.3 Family role

While the HBM acknowledges the illness of family members or friends as a supporting demographic factor, in a society like that of Saudi Arabia, the values and the role of family members are powerfully influential in the context of the wider family. A family history of diabetes was significant in providing medical students with increased awareness of the impact of the condition and might motivate individuals to make healthy decisions. The analysis of the first phase of this research showed a significant positive correlation between the number of family members living with diabetes and the extent to which students believed they were susceptible to developing T2D. This result was confirmed by the findings of Whitford et al. (2009), who reported that relatives of people with T2D possess a heightened perception of their susceptibility to the condition.

This expectation of susceptibility led to the participants taking measures to prevent T2D. Participants explained how they had witnessed the complications of diabetes, making their family member's life challenging and painful. These feelings encouraged some students to make changes to their lifestyles to prevent T2D. This source of motivation is supported by the findings of a comparison study on the influence of the family history of T2D on the prevention behaviours displayed by two groups of individuals, one with and one without a family history of diabetes. Forsyth and Goetsch (1997) found that individuals with a parental history of diabetes reported more frequent health protecting behaviours such as weight control, following a healthy diet, and engaging in more physical activities than the control group (Forsyth & Goetsch, 1997). Ard et al. (2020) also reported the influential role of family history of diabetes in African American individuals who were encouraged to follow T2D preventive behaviours.

Another example consistent with this study findings was conducted among qualified doctors. In a study of 4,501 female doctors in the USA reported that doctors with a family history of cancer were more likely to take recent preventive action, namely in the form of screenings for the type of cancer which members of their family had (Saraiya et al., 2001). This finding suggests a potential educational opportunity to promote students' wellbeing to prevent that health issue. Harrison et al. (2003) recommended using the positive family history of diabetes as an effective public health strategy to prevent T2D.

However, statistical findings of the current study (the backward elimination regression test) found that medical students with a positive family history of diabetes were less likely to manage their stress compared to their colleagues. One possible explanation for that might be related to their strong belief in their susceptibility to T2D and, at the same time, they are similar to their colleagues challenging to follow health promotion behaviours for the same barriers. Medical students with a positive family history of T2D might find themselves under more stress which, as expected, influenced their stress management behaviours negatively. This result indicated the importance of tailoring the health promotion interventions for medical students based on their needs.

In Saudi Arabia, the family typically provides advice, prepares food, pays for fitness clubs, and accompanies individuals when going for a walk, in addition to providing other forms of support. Although it might seem to make sense in theory that having strong family support helps to motivate individuals and facilitates their engagement with healthy lifestyle choices, this study found that family lifestyle was also perceived as a barrier for following healthy eating habits. The final-year medical students expressed how busy their schedule was and preparing a healthy meal, if there was none ready on the table, is one of the significant challenges they face in their lifestyles. In addition, medical students said that they feel compelled to join in with feasts and family gatherings, which are mostly unhealthy, and represent another barrier for following healthy dietary habits, because it is inappropriate to criticize the serving foods (social norms). In fact, the family dynamic was found to be involved in the dietary practice that need to be modified when caring for those with diabetes (Macaden

& Clarke, 2006). Therefore, considering the family's role in promoting medical students’ wellbeing and preventing the onset of T2D is worthwhile.

9.2.2 The influences of medical education on students’ beliefs

As explained in the methodology chapter, five out of six perceived of the HBM were assessed in this study. Potential explanations linking medical education to students’ behaviours are described below.

9.2.2.1 Perceived severity of T2D

With regard to the perceived severity of T2D, final-year medical students described T2D as a severe health condition (3.00 ± 0.74), while the first-year students described its severity as moderate (2.50 ± 0.79). Medical education and clinical information are likely to be the main and significant factors for this improvement. This is consistent with previous studies that assessed the impact of medical education on students’ perceptions of the degree of severity of some health conditions such as osteoporosis (Al Seraty & Ali, 2014) and diabetes (Merzah, 2014). Morover, the findings of the current study supported previous studies in finding a lack of influence of perceived severity on following preventive behaviours (Al Seraty & Ali, 2014; Merzah, 2014). The thematic analysis of this study expected that cognitive dissonance could be one of the reasons for fewer medical students following T2D preventive behaviours with strong belief in the severity to T2D.

Furthermore, final-year medical students believed that early clinical training would enhance their understanding of the discussed cases as part of the PBL. The final-year medical students reported another justification for the change in perceived severity of T2D, other than medical education. They acknowledged the important role of clinical training in shaping their understanding to the severity and the magnitude of T2D and other health problems. Moreover, they believed that, if the first-year medical students had had the chance of gaining early clinical training, they would understand how T2D is a serious issue and how they are highly susceptible to it. The testimonials of medical students in their fourth and fifth years in New Zealand correlate with those of the present study. They expressed a desire for more clinical training in earlier years of medical school, which would be consistent with teaching and assessments across the courses (Henning et al., 2011). Moreover, a number of researchers recommended early clinical training to promote the clinical education through the integration with curriculum, and to give students opportunities to apply their previous knowledge and to develop interpersonal skills, in addition to promoting self-confidence (Al-Haqwi & Taha, 2015; Littlewood et al., 2005).

Coulehan and Williams (2001) suggested that early clinical training enhances the tacit socialisation process. The tacit knowledge refers to the knowledge, skills and abilities an individual gains through experience that is often difficult to put into words or otherwise communicate (Coulehan & Williams, 2001). The tacit learning seems to be more powerful than explicit learning for the way it connects knowledge with practice. Moreover, early interaction with patients and their families led first-year medical students to profoundly reflect on the cognitive dissonance (Snyman & Geldenhuys, 2019).

Consequently, exposing students through the medical curriculum to a combination of cognitive and practical tasks in the first years might promote their beliefs and health behaviours in general and for T2D in particular. Employing this opportunity to reinforce health messaging would seem to be an effective health promotion strategy.

9.2.2.2 Perceived susceptibility to T2D

Medical students' perceptions of their susceptibility to being diagnosed with T2D in the future correlated with the extent of their medical learning experience. Final-year medical students reported higher future expectations of being diagnosed with T2D (2.98 ± 0.85) than their peers in the first year (2.28 ± 1.29). Medical education's positive influence on medical students' susceptibility to T2D correlated with findings of some studies conducted among medical and other healthcare students (Al Seraty & Ali, 2014; Merzah, 2014; Rahmati-Najarkolaei et al., 2015).

The HBM generally predicts that people will take action to prevent illness if they consider themselves to be susceptible to developing a particular health problem (Jones et al., 2015). However, as with perceived severity, medical students' belief in their susceptibility to T2D did not predict the following of preventive health behaviours. The current findings contradict those of a study which assessed osteoporosis-related knowledge, beliefs and prevention behaviours among medical and other healthcare students (Al Seraty & Ali, 2014). The authors reported a significant correlation between perceived susceptibility to osteoporosis and following preventive dietary habits on a daily basis. However, the significant findings of Al Seraty and Ali's (2014) study were reported after a one-month health awareness intervention, which might not be presenting the long-term nutritional behaviours of the students.

Diabetes is a common health condition in Saudi Arabia and the prevalence of diabetes among the Saudi population is relatively high. Reflecting this, the majority of study participants reported a family history of diabetes: 74 (64.6%) first-year students and 60 (73.1%) final-year students. What was difficult to explain in these data is why medical students in both cohorts did not take action to avoid this anticipated likelihood.

This aspect became clearer after interviewing final-year medical students. There were two potential reasons for this discrepancy between knowledge, beliefs and behaviours. The first was related to physical and social barriers, and these barriers are discussed over the next few sections. The second reason was deduced from their replies. A number of the interviewed participants mentioned that they were still young, fit and healthy, and felt reassured that they still have time to adopt the preventive behaviours at a later stage in their lives.

Cognitive dissonance might account for unhealthy lifestyle behaviours among study participants. A cross-sectional study conducted among 1,233 nurses and doctors in Finnish found that 864 (70%) of them had at least one health risk factor such as obesity, low levels of physical activity, smoking, and risky alcohol drinking. Despite this, the study reported a significant correlation between the number of risky behaviours and the health workers' levels of satisfaction with their lifestyle habits (Kasila et al., 2018). This study supports the potential role of cognitive dissonance in medical students' willingness to follow healthy preventive behaviours (Harmon-Jones & Mills, 2019; Clark et al., 2004).

The current study findings suggest that increasing awareness of T2D and belief in the severity of, and the susceptibility to T2D, are insufficient for promoting preventive behaviours and there is a need to consider other critical enabling factors. Interventions designed to encourage healthy habits among people with diabetes by utilising the power of social norms, cognitive dissonance theory and social desirability of certain health-related behaviours have been significantly more effective than traditional awareness interventions (Pansu et al., 2019). The results of several studies suggest, however, that the integration of nutrition and physical activity topics throughout the curriculum's classroom-based and clinical training is needed to positively influence students' attention to the knowledge and the importance of promoting health behaviours (Dacey et al., 2014; Kris-Etherton et al., 2014; Lobelo et al., 2009).

9.2.2.3 Perceived benefits of T2D preventive behaviours

Students' perceptions of the balance between costs and benefits associated with certain preventive health behaviours determine the value of adopting those behaviours and performing a cost-benefit analysis of the health action influences subsequent, health-related decisions (Skinner et al., 2015). When the perceived barriers outweigh the perceived benefits of engaging in certain behaviours, it is less likely that those behaviours will be adopted. Conversely, when an individual perceives the action to be potentially beneficial in terms of reducing the threat of major disease onset, they are likely to recommend such health actions to others (Skinner et al., 2015).

Individuals are more likely to adopt preventive health behaviour when they value their benefits to reduce their likelihood of developing certain pathologies (Carpenter, 2010). The perceived benefits play an essential role in, for example, the adoption of secondary preventive behaviours such as the uptake of screening (Skinner et al., 2015). Although some of the screening procedures may cause a measure of discomfort or be painful, such as in the case of screening for colon or breast cancer, individuals have been found to value the benefits over the costs associated with such screening (Skinner et al., 2015).

Medical students in QUMS strongly believe in the importance and benefits of following a healthy lifestyle to prevent T2D onset. The overall means of perceived benefits among the first- and the final-year medical students were 3.30 ± 0.60 and 3.42 ± 0.70, respectively. Although final-year students achieved a slightly higher score than first-year students, the difference was not statistically significant. Furthermore, despite this strong belief in these benefits, it was not enough to predict following T2D preventive behaviours. Therefore, it can be stated that medical education did not shape medical students' perceived benefits of leading a healthy lifestyle. This finding contradicts some studies showed that believing in the benefits of leading a healthy lifestyle for the purpose of preventing chronic diseases such as breast cancer led medical students to follow preventive behaviours (Didarloo et al., 2017; Mohamed et al., 2016). However, screening for breast cancer is not a daily behaviour; thus, it seems less challenging and effective behaviour for medical students.

In this study, perceived benefits correlated with practicing physical activities, but the data were insufficient to predict the practicing of preventive behaviours. The reason for this might be related mainly to the strong influence of barriers. Another potential reason for that might be related to assessed items of perceived benefit in the questionnaire. The systematic review conducted prior to data collection in the context of the present study supplemented the study questionnaire with a number of identified ‘common’ benefits of leading a healthy lifestyle among medical and healthcare students. All the studies included in the systematic review used quantitative not qualitative data. In other words, the final-year medical students added to these health benefits other new benefits. If those benefits were described and included in the questionnaire, perceived benefits might be able to predict T2D preventive behaviours among medical students in this study.

During the interviews, the final-year medical students commented on three main personal benefits of leading a healthy lifestyle. Participants stressed the importance of doctors seeing and feeling social appreciation from patients, as well as from the wider community and noted that this appreciation was important for their sense of prestige. Prestige is an evaluation of perceptions of various manifestations of respect, esteem, or dignity in relation to people, social groups, stances, positions or even institutions (Domański et al., 2010). Bogusz (2018) reported that the medical profession generally holds the highest position in common prestige hierarchies.

As in most countries, doctors in Saudi Arabia enjoy a high level of professional standing and public appreciation (AL-Jahdali et al., 2014). In Saudi Arabia, people consider doctors as role models and trusted sources of information relating to health awareness (Elagi et al., 2019). The public and professional standing of doctors might be compromised, however, if they act unhealthily, thus unintentionally encouraging unhealthy behaviours among the public. The public is largely critical of such actions. Medical students are aware of these social indicators, as was pointed out in Chapter 7 in this study. Gaining such prestige was a strong motivator for prospective students to attend medical school (AL-Jahdali et al., 2014) in choosing the future careers

(Abdulghani et al., 2013), and as a goal to overcome the academic stress (Abouammoh et al., 2020).

Some participants noticed a tendency for some patients not to take their doctor's advice and recommendations seriously, particularly if the doctors themselves appear not to be taking their advice seriously in the context of their own lives. Participants believed that doctors leading healthy lifestyles, as recommended to their patients, will increase their credibility as caregivers and add to their prestige and professionality.

Medical professionalism described the social contract between medicine and society by the tacit expectations that society has in exchange for providing the profession with autonomy, prestige, and privilege (ABIM Foundation et al., 2002). Professionalism serves as the foundation of the professional trust and relationship between physicians and patients, as well as for the contract between the medical profession and society (Holden et al., 2012). The current study participants described the professional trust from a different angle; they believed that doctors should act and look as they say. In other words, working to be a healthy role model for patients and wider communities was one of the main benefits.

Being a role model for the public is a big responsibility, and participants tended to take opposing views with regard to the extent to which a doctor should feel obligated to do so. Most participants regarded the ideal of the 'role-modelling doctor' as a benefit, believing that it is integral to their gaining of prestige and grants them fast access to Saudi society's elite circles. Accepting this responsibility and working to be trusted and credible requires participants to follow healthy lifestyles. This finding might provide an important opportunity to promote medical students' health behaviours.

Doctors who live a healthy lifestyle are more likely to advise their patients to follow preventive behaviours (Frank et al., 2010). Their patients are also more likely to follow their advice (Harsha et al., 1996). Preparing medical students to be role models for their patients and the community is acknowledged in many studies as being beneficial to patients' health (Frank et al., 2000; Harsha et al., 1996; Razavi et al., 2020), to the doctors in terms of the quality of their professional performance (Frank et al., 2010; 2013; Lobelo & de Quevedo, 2016), and to the wellbeing of the doctors themselves (Kemp et al., 2019). The current study participants revealed a new benefit of following the preventive health behaviours; namely, that acting as a healthy role model is not only to encourage patients to engage in similar behaviours but also to gain God’s rewards for working perfection (Ihsan).

In this study, it became apparent how the Islamic religion had shaped the participants' values and practices. Most study participants endorsed doctors’ maintaining a healthy demeanour and displaying noticeable healthy lifestyle habits as integral to their professional output. They identified these behaviours as stemming from the components of professionalism from an Islamic perspective. Participants used the word ‘Ihsan’ (striving for perfection) frequently as a goal of being a role model for patients. Ihsan had motivated some participants to improve their skills and knowledge to achieve optimal outcomes in the medical procedures they performed. They mentioned that Ihsan was the main guiding principle for living a healthy lifestyle and looking healthy in order to improve clinical outcomes.

In the Islamic world, medical professionalism is interpreted in the context of Islam, and Islamic principles and values are present in the modified frameworks of professionalism, such as the Ihsan (Al-Eraky & Chandratilake, 2012; Al-Eraky et al., 2014; Kasule, 2013). In the Four-Gates model, health professionals are encouraged to achieve eight principles through passing four gates; starting from dealing with self, dealing with tasks and dealing with others, before advancing to the final gate, which is dealing with God. This fourth gate is not only the largest but also underpins the significance and functions of the previous gates (Al-Eraky et al., 2014). By advancing through these gates, health practitioners move from self-management, where they balance personal and professional roles, to the final gate, where they should motivate themselves to do their best in clinical work, teaching, and other duties, and not expect rewards from people (patients, families, individuals, professional bodies or community at large), but to expect their reward from God (Ihsan) (Al-Eraky et al., 2014).

This study explored how religion interacts with healthcare organisations in Saudi Arabia in the documentary analysis phase. The emphasis on realising Islamic principles through healthcare practices was strong across all the documents. By contrast, students’ wellbeing was less acknowledged. This variation might explain why medical students underestimate their capacity to enhance their wellbeing compared to their religious values. The Islamic religion nevertheless encourages

Muslims to take good care of themselves. Self-care is a fundamental aspect of Islam because it shows gratitude to God.

Medical students expect God's rewards for being a healthy role model for patients and the community. Islamic faith was identified as a preventive factor for some unhealthy habits among Saudi medical students such as smoking (Abdulghani et al., 2013; Al-Kaabba et al., 2011) and unnecessary cosmetic surgery (Al Doheyan et al., 2016). These influences could be embedded in the formal, the informal or the hidden curricula for the purpose of promoting a healthy lifestyle. Conscious adjustment of medical students' mindsets and perspectives can be a powerful tool for promoting medical students' wellbeing over a lifetime.

The Muslim doctor holds the provision of honest and professional healthcare for their people to be an important duty (Al-Eraky et al., 2014). However, Muslims are not the only religious believers to aspire to have their faith reflected in their healthcare practices. Regardless of the reported religious faith, American medical students drew their strength and the power to overcome the challenges they faced in medical school and the clinical field from their faith (Ray & Wyatt, 2018). Their faith helped them cope with the academic strain and the high level of responsibility placed on them when making clinical decisions (Ray & Wyatt, 2018). Frank et al. (1999) assessed 4,501 US female doctors' religious beliefs and their influence and found that those who were reported as having a religious faith were more likely to do volunteer work and that those with the strongest religious beliefs were more likely to perform more than five hours of volunteer work per week.

Recommendations were recently made to incorporate courses on religion and spirituality into medical schools' curricula following an appreciation of these courses' potentially positive impact on reducing stress and promoting professional and personal wellbeing among medical students (Schonfeld et al., 2016). Medical educators and medical curriculum developers could utilise discussions about religion or spirituality to help students understand their influence on providing good patient care and good self-care.

9.2.2.4 Perceived barriers to adopting T2D preventive behaviours

Perceived barriers to adopting certain behaviours are integral to the HBM methodological approach. This factor was assessed in this study through questions posed to participants in the questionnaire to assess the extent to which medical students are willing to overcome barriers to leading a healthy lifestyle. These barriers were aggregated from the systematic review study of the literature that assessed the knowledge, beliefs, and behaviours of healthcare students in Saudi Arabia (see Chapter 4). The statistical analysis in the current study found no difference between first- and final-year medical students in perceived barriers. However, students who showed a high level of willingness to overcome barriers were significantly more likely to adopt health-promoting behaviours to prevent T2D onset. In other words, a highly perceived barrier was a significant predicting factor for adopting health promotion behaviours, as the regression analysis revealed. These results are consistent with other studies that found perceived barriers to be predictors for medical and healthcare students to adopt preventive behaviours (Al Seraty & Ali, 2014; Rahmati-Najarkolaei et al., 2015).

Final-year medical students provided a variety of descriptions of the types of barriers facing students. They drew attention to three types of barrier: resources, social, and individual. The resources barrier was the only common justification mentioned by all final-year medical students. Medical and healthcare students in several previous studies in Saudi Arabia claimed that the availability and feasibility of health-promoting resources constituted a major barrier to the adoption of healthy habits (Alissa et al., 2015; Alzahrani et al., 2019; Alzamil et al., 2019; Awadalla et al., 2014; El-Gilany & El-Masry, 2011; Majeed, 2015). Lack of resources was also a barrier for healthcare professionals in their endeavours to foster a healthy lifestyle (Huijg et al., 2015).

Motivators and barriers have a strong impact on decisions relating to health (Carpenter, 2010). The resources barrier can be overcome if there were motivators. Participants reported that lack of motivation, such as peer competition and support, and family encouragement and support, constituted barriers. Such resources are important for fostering an environment amenable to adopting a healthy lifestyle. As motivators enhance the adoption of health-related behaviours, so barriers discourage the following of healthy behaviours. Heavy academic workloads and a busy schedule were considered as strong barriers to practicing exercise or preparing a healthy meal (Al-

Drees et al., 2016; Alissa et al., 2015; Awadalla et al., 2014; El-Gilany & El-Masry, 2011; Majeed, 2015; Sani et al., 2012; Markowski & Roxburgh, 2019; Martinez-Lacoba et al., 2020), but there might be some personal motivators that encourage them to overcome these barriers. The literature has reported that healthy family habits were a strong motivator for Saudi medical students to follow the same healthy habits (Abdulghani et al., 2013; Awadalla et al., 2014; Hasim, 2000; Wali, 2011). However, in this study, the influence of family habits on students' behaviour created another type of barrier to leading a healthy lifestyle. Participants maintained that it is hard to break lifestyle habits common to one's society or culture. Students believed that it is unacceptable sometimes to go against prevailing norms; for example, it is unacceptable for a guest to refuse food that their host has prepared for them. Large number of students criticised their family's lifestyle habits for their inability to modify their own lifestyle in order to become healthy (Deliens et al., 2014; Markowski & Roxburgh, 2019; Martinez-Lacoba et al., 2020; Schnettler et al., 2016).

Study participants who were overwhelmed by playing the role of a healthy, role-modelling doctor, however, were more likely to be affected by individual barriers, such as low motivation, to justify their unhealthy habits, as stated in Chapter 7. Low self-motivation and ignoring their susceptibility to T2D (cognitive dissonance) were apparent from the students' responses and might significantly prohibit them from developing healthy habits for the purpose of preventing T2D. Peer support might play a significant role in promoting students' wellbeing (GMC, 2018). Managing this service through the medical school was recommended by several research reports focusing on students' wellbeing (AMSA, 2011; Kemp et al., 2019; Vogan et al., 2014; Wasson et al., 2016). Regular communication between the medical-school personnel and key staff from the university services departments can help medical school staff understand the full range of services available to help medical students get access to them and use them effectively (Vogan et al., 2014). This study had no access to QUMS's Blackboard page, which might feature announcements regarding planned social activities and physical competitions. These types of activities are expected to motivate students to participate and adopt these healthy habits. However, none of the analysed documents showed that these types of activities are officially recommended.

In regard to the social barriers, the influence of social habits and culture on students' daily behaviour constitutes another type of barrier to leading a healthy lifestyle.

Several participants blamed their society, their culture, and their family's lifestyle habits for their inability to modify their own lifestyle to become healthy. Gender variation is one of the cultural dimensions that should be considered in relation to health-promotion services provided for medical students. Female medical students raised some critical issues affecting the feasibility of health-promotion services supported by QU. This claim is consistent with the findings of Almahmood et al. (2017) who investigated the influence of social and cultural aspects on the practice of walking in Riyadh city in Saudi Arabia. The researchers found that these aspects regulate women's physical behaviours so that their sense of legitimised space for the purpose of walking is limited to indoor environments, such as shopping malls or women's sports centres.

The developers of the medical education documents analysed in this study might unintentionally support this concept by reminding medical students in different locations about the importance of acknowledging local cultures. The emphasis on social values was higher than the emphasis on promoting students' wellbeing (see Chapter 8). Medical students, especially female students, need to be empowered, encouraged, and prepared to overcome these cultural barriers (Massey, 2013). Female Arab students reported facing similar cultural barriers to engage in physical activities (Mabry et al., 2016). However, in the western society, female students are more likely than male students to be interested in healthy habits (Yahia et al., 2016). Empowerment is the best strategy for increasing self-confidence and health among people with less control (i.e. social or cultural) (Tengland, 2012). However, participants reported that they do not know with whom they should discuss such concerns within the context of the university setting. Based on the current study findings, what medical students know about health-promotion services and bodies in their university seemed to be limited. This lack of communications between students and medical school personnel is a significant challenge that should be overcome to promote medical students' wellbeing (Vogan et al., 2014).

Promoting student's wellbeing was a missing value in the analysed documents. Preparing and educating medical students to be qualified doctors and being aware of their public needs were mentioned in almost every document. Regarding preparing future doctors to help patients adopt a healthy lifestyle and prevent T2D onset, medical education documents stated how to advise patients to exercise, follow healthy diet plans, control stress, and foster self-empowerment for the purpose of adhering to all of these recommendations. However, preparing the future doctor to promote their own health was mentioned only once in the SCFHS documents. In a few passages, the NCAAA documents indicated the importance of ensuring medical students' safety during their years of academic study and training. Safety is a wide concept and whilst it most likely refers to preventing infectious and non-infectious diseases and injuries, it is difficult to be sure. On the other hand, the CanMEDs framework, which is similar to the SaudiMEDs, acknowledges the medical students' wellbeing in their strategies and description of professionalism (Frank et al., 2017). The General Medical Council (GMC) in the UK states the importance of medical schools fostering awareness among medical students of the importance of their personal physical and mental wellbeing, and the need to integrate self-care into their personal and professional lives (GMC, 2018). Moreover, the Australian Medical Council (AMC) emphasised that the medical institutions should prepare their graduates to be aware of factors affecting their health and wellbeing, including fatigue and stress management (AMC, 2012).

The current study participants clearly described their need to have a students' wellbeing unit in the medical school, which would develop health-promotion services according to their specific needs. Additionally, the students' wellbeing unit might help students overcome stress and barriers to leading a healthy lifestyle. In the systematic review phase of this study, many articles recommended promoting medical students' wellbeing (see Chapter 4). There have been repeated calls from both medical students and medical education researchers alike, in Saudi Arabia, for an embedding of students' wellbeing services and awareness in both formal and informal curricula. These recommendations are consistent and are supported by multiple medical education institutions (Frank et al., 2017; GMC, 2018; AMC, 2012). Today, the promotion of medical students' wellbeing is considered integral to promoting patient care (Kemp et al., 2019). However, it was recognised that preventing T2D and other chronic conditions is a topic that has been less well investigated than the study of the promotion of psychological health among medical students. Based on the findings of the second and third phases of this study, a students' wellbeing strategy seems to be a missing component in the medical curriculum and medical education guidelines in Saudi Arabia. Implementing this into the formal and informal curricula might motivate students and promote their self-efficacy, which will impact extensively on medical students' health behaviours.

The analysis of the three phases of this study showed that perceived barriers and perceived self-efficacy were the only predictive factors for medical students' preventive behaviours of T2D. Medical students should be empowered, encouraged, and prepared to overcome all types of barriers. Developing students' wellbeing strategies according to their needs and through medical education regulatory bodies seems to be an important fundamental step toward promoting their wellbeing and preventing T2D.

9.2.2.5 Perceived self-efficacy of adopting T2D prevention behaviours

Individuals who do not believe in their own abilities are unlikely to pursue an appropriate course of action. These people tend to display low self-efficacy (Skinner et al., 2015). Self-efficacy was added later to the original HBM variables (Rosenstock et al., 1988). Rosenstock et al. (1988) suggested that, for a behavioural change to succeed, an individual must have an incentive to take action by appreciating the potentially detrimental effects of their current behaviour, and by believing that a new course of action can be beneficial. Rosenstock and colleagues drew the concept of self-efficacy from Social Learning Theory developed by Bandura (Rosenstock et al., 1988). Within the context of the HBM, a person is likely to engage in a behaviour if they can value the outcome of that behaviour at an acceptable cost and feel that they are competent in performing the required change (Rosenstock et al., 1988).

In the present study, self-efficacy was assessed through 10 items in the questionnaire of the first phase. The regression analysis reported that self-efficacy was a significant predictor of following healthy diet habits, practising physical activities and stress management behaviours to prevent T2D. Self-efficacy was also a significant predictor for a range of health behaviours among medical and healthcare students. For exapmle, a study conducted among female medical students showed that students with highly perceived self-efficacy were 13 times more likely to perform a breast self-examination than those with a less-well-perceived self-efficacy (Didarloo et al., 2017). Self-efficacy also predicted other preventive behaviours among nursing students, such as controlling fat and alcohol consumption (Amiri et al., 2019; Zalewska-Puchała et al., 2007). However, low self-efficacy might affect medical students' future ability to practice counselling patients regarding preventive medicine (Dacey et al., 2014; Frank et al., 2010; Lobelo et al., 2009; Memel et al., 2018; Razavi et al., 2020).

The statistical analysis of the students' responses to the questionnaire found that students' self-efficacy was not influenced by medical education. Both cohorts scored moderate mean scores of self-efficacy (2.72 ± 0.66 and 2.82 ± 0.82) for first- and final-year medical students, respectively, and with no significant differences. Furthermore, self-efficacy was an essential predicting factor in following a healthy diet, practicing physical activities, and managing stress. These findings aligned with those reported in a number of health studies in Saudi Arabia (Elgzar et al., 2020; Mohamed et al., 2016) as well as in other countries (Goodarzi et al., 2019; Memel et al., 2018; Rahmati-Najarkolaei et al., 2015).

Although it was challenging to explore the factors that shaped students' levels of self-efficacy during the interviews, as none of the interviewed participants had commented on the significant role of self-efficacy in following the T2D preventive behaviours, two potential factors might play a role in building students' self- efficacy to follow healthy lifestyles.

The first factor might be the role-modelling tutors. Study participants mentioned some hidden messages delivered through their tutors in medical school that ignited a desire for changing their behaviours to become healthier. Some medical students were influenced by their tutors who they considered to be successful professors, great doctors, and who look physically fit and able to manage stress properly. Medical students were enthusiastic about emulating the values and practices of this type of tutor. Following a role-modelling tutor's healthy behaviours seemed to motivate and enhance medical students' self-efficacy that could lead to engagement in T2D preventive behaviours (Pansu et al., 2019). During medical school, the formation of students' identities is influenced more by the informal and hidden curricula than by formal teaching experiences (Goldie, 2012). Benight and Bandura (2004) showed that a supporting individual acts as a role model in terms of displaying coping skills and encouraging others to undertake some behaviours (e.g., physical exercise) that would inspire others by their own surmounting of obstacles. Posner et al. (2019) stated that medical school personnel should encourage students to develop healthy habits by first seeking to comprehend their self-care needs, second, by presenting their own physical and psychological healthy habits as traits to be emulated, and, finally, by considering how to best divide their time between professional and self-care activities, making no hard-and-fast distinction between the two as they do so. However, an expressed need for positive role models was reported previously by medical students in Saudi Arabia (Adkoli et al., 2011), which is consistant with the current study's findings.

The second expected factor of promoting medical students' self-efficacy is the peer support. Peer support can enhance one's sense of self-efficacy, thereby indirectly leading to increased physical exercise self-efficacy (Benight & Bandura, 2004). Some of the current study participants mentioned the importance of peer support in encouraging them to follow healthy lifestyles. Peer support was one of the main preventive factors for medical students to avoid cigarette smoking (Al-Haqwi et al., 2010; Al-Turki, 2006; Alrsheedi & Haleem, 2012; Awan et al., 2016; Hashim, 2000; Wali, 2011), and to practice physical activity (Awadalla et al., 2014). In addition, the GMC acknowledged the importance of educating the future doctors on the importance of peer support as a coping strategy for stress (GMC, 2018). Medical schools' personnel can make arrangements for students to support each other in a formalised setting, in the form of small group discussions. In these meetings, students can share experiences, thereby gaining a sense of support from their peers because of shared challenges and strategies to maintain wellbeing (Posner et al., 2019).

9.2.2.6 Cues to action to follow T2D preventive behaviours

The HBM suggests that cues to action influence individual behaviour. Cues to action as a form of personal learning can be influenced by internal or external cues. The cues to action include many examples of factors that might influence and trigger personal actions, including the events, people or things that influence people to change their behaviours (Skinner et al., 2015).

In the current study, assessing 'cues to action' was not part of the questionnaire. The influence of medical education on the medical students' T2D preventive behaviours, if there is an influence, has not clearly investigated and reported in the literature. Revealing these potential cues to action in future research could enhance the findings of this study. The analysis of collected data from the three phases of this research showed potential triggers and channels that might influence and promote medical students' wellbeing in general, and T2D preventive behaviours in particular. Even though no influence of medical education on the medical students' preventive behaviours was detected, some of the study participants related that their medical education positively influenced their behaviours. In this study, internal and external cues were identified within the medical curriculum context.

Internal cues trigger T2D preventive behaviours through the informal medical curriculum. The informal medical curriculum might influence medical students' behaviours through sending messages that encourage medical students to seek religious reward (Ihsan) and social respect (prestige) in order to encourage them to adopt preventive behaviours. Moreover, the faculty members had an influencing effect on the medical students through providing health advice and fostering appropriate attitudes and behaviours.

The external cues for following the T2D preventive behaviours appear to come through the formal medical curriculum. These potential cues need further investigation, however, as they are based on the medical students' claims and the lack of evidence of the acknowledgement for these cues in the analysed documents. The potential external cues seem to be the impact of students' wellbeing services in medical school and early clinical training.

9.3 Implications of this study

The various studies within this thesis have a range of implications.

- ***The effectiveness of using the HBM to explain the medical education influences on medical students' T2D preventive behaviours***

From a theoretical perspective, using the HBM to explain the potential factors influencing medical students' T2D preventive behaviours within the medical curriculum is a significant implication. Many previous studies have used the HBM to predict health behaviours among medical and healthcare students (Henning et al., 2011; Mohamed et al., 2016). However, as far as is known, no study had integrated the medical curriculum within the HBM. Researchers have used different tools such as knowledgeability or the HBM factors to clarify the influence between health beliefs and health behaviours of medical students. However, this study has revealed how the formal, informal, and hidden medical curricula interact with students' beliefs and predict their health-promoting behaviours. The innovative findings within the HBM might have an implication for effectively promoting medical students' wellbeing and health behaviours through tailoring medical curricula and health interventions.

- ***The religious reward (Ihsan) motivates medical students to overcome health barriers***

Within the HBM, 'perceived barriers' was one of the strong predictors of following health behaviours among medical and non-medical students in many studies (Al Seraty & Ali, 2014; Rahmati-Najarkolaei et al., 2015). Limited health promotion resources such as healthy foods on campus and accessibility to physical activities centres, in addition to the social and personal barriers, were highlighted in previous studies (see Chapter 4). However, the current study discovered new health benefits of following a healthy lifestyle that would outweigh the barriers and encourage medical students to follow healthy behaviours more often. Seeking religious rewards (Ihsan) for being a healthy role model for patients is one of the major contributions to the knowledge of this study. Even so, avoiding smoking behaviours for religious reasons is a common preventive factor among medical students in Saudi Arabia (Abdulghani et al., 2013; Al-Kaabba et al., 2011), as smoking is prohibited by Islam. Many health interventions used Islamic values to develop and implement health intervention among medical students and the general Muslim community to prevent smoking, but no intervention used religious rewards to promote other healthy lifestyles such as engaging in physical activities. Therefore, embedding religious rewards of being and acting as a healthy role modelling doctor through the informal and hidden curricula would effectively influence medical students' health-promoting behaviours.

- ***The social appreciation (prestige) motivates medical students to be healthy role models for patients and the community***

Gaining and maintaining social appreciation (prestige) for medical students was reported as a motivator for joining the medical school and selecting a speciality (AL-Jahdali et al., 2014; Abdulghani et al., 2013). In this study, prestige was reported for the first time as a motivator for looking like and acting as a healthy role model for patients and the community. This finding might provide a significant opportunity to promote medical students' health behaviours. Encouraging medical educators to employ the benefits of seeking religious reward (Ihsan) and the prestige in forming students' identity would have positive implications for their wellbeing. During medical school, the formation of students' identities is influenced more by the informal and hidden curricula than by formal curricula (Goldie, 2012).

- ***Role modelling tutor can promote medical students' self-efficacy and influence their T2D preventive behaviours***

The importance of the role modelling tutor for effective clinical training is fundamental for students' clinical development (Ennis et al., 2015). Many researchers investigated the implications of role modelling for the medical and healthcare professional students' development (Burgess et al., 2015). However, this study had revealed a new influence of the role modelling tutors on the students' health behaviours. Study participants mentioned some hidden messages delivered through their tutors in medical school that ignited a desire for changing their behaviours to become healthier. Moreover, role modelling tutors promoted the self-efficacy of medical students to follow health promotion behaviours. Although this study did not investigate the tutors' perceptions of that, the discovered impact that tutors have on medical students' health behaviours seems to be another implication of this study. Encouraging medical tutors to use their influence on students to promote health behaviours might significantly impact their wellbeing.

- ***Cognitive dissonance prevents healthy lifestyles among Saudi medical students***

Within the HBM, perceived susceptibility is one of the predicated factors for following preventive health behaviour. A number of studies conducted among medical and healthcare students reported the significant influence of perceived susceptibility to a health problem in following related preventive behaviours (Al Seraty & Ali, 2014). Although this study reported significant influence of medical education on increasing students' belief in their susceptibility to T2D, no influence of perceived susceptibility to T2D was reported following T2D preventive behaviours. Further investigation in this study detected some justification that indicated the presence of cognitive dissonance. To the best of the author's knowledge, this is the first time that cognitive dissonance has been linked to unhealthy lifestyles among Saudi medical students. This contribution to knowledge might help medical educators to promote students' health through raising awareness about the benefits of following healthy behaviours from the first years in medical school.

- ***Early clinical training might motivate medical students' beliefs and health behaviours***

Furthermore, this study found that early clinical training might significantly encourage medical students to act and look healthy by increasing their awareness of T2D and the importance of being and acting as a healthy role modelling doctor. However, many studies acknowledge the need for early clinical training to accomplish academic objectives (Al-Haqwi & Taha, 2015; Henning et al., 2011; Littlewood et al., 2005), and this study added potential health promotion benefits of early clinical training.

- ***Establishing medical students' wellbeing strategies in Saudi Arabia***

This thesis identified the predictors that might improve medical students' chances of following T2D preventive behaviours – perceived self-efficacy and perceived barriers. Further investigation in this study highlighted the need to establish students' wellbeing units in the medical schools in Saudi Arabia. Moreover, students' wellbeing had less attention in the medical curriculum and the analysed organisational documents. Establishing strategies for promoting medical and healthcare students' wellbeing would control the barriers students faced to follow health behaviours and would promote their self-efficacy to follow these behaviours. Highlighting these points was another significant implication of this study.

9.4 Strengths of this study

The strategy of addressing medical students' lifestyle behaviours related to preventing T2D in Saudi Arabia is one feature of the originality that this study delivers. More critically, the present research identifies the need to address and promote medical students' wellbeing, particularly through the medical curriculum and regulations in Saudi Arabia.

Furthermore, the main strength of this study is the use of a combination of methods which is likely to enhance the validity of the findings. A mixed-method design ensures that both the qualitative and quantitative methodological approaches assist one another, thereby creating a more comprehensive analysis regarding the research subject to answer the research questions and achieve the research objectives.

A further strength of the research is the novel findings that are introduced with respect to the opinions of the senior medical students (final-year students) against factors influencing and shaping medical students' lifestyle behaviours, their motivators, and their needed resources. In addition, the supportive evidence discovered through the documentary analysis of the medical curriculum and the related documents of medical education regulations in Saudi Arabia lends strength to this study.

Another strong point of this study is the literature review. The systematic review conducted to describe the current state of knowledge, beliefs and T2D preventive behaviours and the influencing factor among medical and healthcare students in Saudi Arabia and navigating the influence of medical education on these domains is the first of its kind undertaken in Saudi Arabia. Moreover, using the Socio Ecological Model to classify the reported influencing factors through the systematic review is a significant outcome that addressed each factor's level and environment. This classification is likely to help public health providers act across multiple levels simultaneously to tailor health promotion interventions before implementing them among medical and healthcare students.

The implementation of a verified theoretical framework, HBM, is another strength in this study, which permits it to be evaluated with other research which used the HBM to assess medical and healthcare students' beliefs and behaviours.

Furthermore, this study's strength is the quantitative approach, which permitted an evaluation of the extent to which specific factors account for promoting health behaviours. That evaluation approach aimed to identify the linear relationship between variables, which contributed to the highest level of following T2D preventive behaviours. After presenting these factors, a series of questions were introduced to investigate the perceptions and justifications of medical students on these factors' impact on their daily lives. These explanations led to identifying the potential influencing channels to promote medical students' health promotion behaviours.

9.5 Limitations of this study

This study applied different research methods, and the limitations of each method must be taken into consideration when reading the findings.

- ***The systematic review***

The first limitations are related to the systematic review study. Even though this thesis explored the influence of medical education on the knowledge, beliefs and behaviours of medical students only, the researcher also looked at studies performed among other healthcare professional students in Saudi Arabia, given the scarcity of studies conducted among medical students. This extension of the inclusion criteria did not affect the reliability of the systematic review findings for two reasons: (a) some of the included studies were conducted among mixed specialities, including medicine, and (b) there was no significant variation between the health-related behaviours of medical and other healthcare students. On the contrary, both types of students shared similar barriers and preventive factors to living a healthy lifestyle, and those two reasons confirm the overall findings of this study.

The second limitation is that, even though the systematic review included 32 studies, some of them were considered to be low-quality in at least one aspect of the quality-assessment appraisal. However, this was not considered a reason for exclusion as their results were highly relevant, and their low quality was made explicit.

The third limitation is that the findings reported in the systematic review might be somewhat limited by the number of small-sized but still meaningful correlations and should be cautiously interpreted within the context of each study. Nonetheless, the systematic review met its objectives by describing the status of medical and healthcare students' lifestyles in Saudi Arabia and provided evidence on T2D preventive behaviours' expected barriers. In addition, Chapter 4 showed details of the methods and results of the included studies. Thus, the readers can judge the transferability of the findings for themselves.

- ***The cross-sectional survey***.

One drawback of the demographic profiles of the study participants is that they were all studying at the same institution, and while almost all students from the two cohorts participated in this phase, the extent to which the findings can be generalised is limited to this one school and not to all Saudi medical schools or other healthcare schools.

Nevertheless, as Cleland and Durning (2015) argued, much of the research conducted in health professions' education has been on a single site, where all data are collected from one institution or one sub-group (e.g., surgical trainees or residents from one hospital, or even those from one surgical sub-speciality), which limits generalisability. Therefore, the applied tools and methods were described in detail so that other researchers can judge the transferability of the findings and perhaps replicate the study in different academic contexts, thereby aiming to confirm or refute the study results with different samples.

- ***The semi- structured interviews***

There were several limitations to the ways in which qualitative data were gathered. Although enough final-year medical students participated in this study, newly graduated students and internship students were not included. Including these cohorts could have added more practical suggestions for what cues to actions might be, and compared to those of final-year students, as their experiences and perceptions might be more mature. Based on the eligibility criteria used, therefore, the views of the newly graduated and the internship students were not represented.

Furthermore, the last question was asked regarding the suggested health-promotion strategies through the medical school and curriculum. As this research indicates, there was no strategy developed particularly to promote students' wellbeing in QUMS. Due to the lack of existence of such a strategy, most of the suggested interventions were based on perceptions rather than on more objective data or experience. Qualitative research is more fluid than quantitative research, however, and it is common and accepted practice for it be modified as findings emerge (Cleland & Durning, 2015).

A potential weakness of this study could be how the interview scripts were analysed by only one reviewer. To help reduce researcher bias, an external reviewer was involved in a later stage to review a sample of five scripts. It would have been preferable for the second reviewer to analyse all the scripts in conjunction with the first reviewer, however this was not possible because of the second reviewer's capacity to assist in the analysis. Involving two or more reviewers in thematic analysis and coding would also have enabled an exchange of ideas between reviewers that may tease out data that may not appear through a single reviewer analysis. To help compensate for this, the researcher described the data collection and analysis methods behind the emerged findings to ensure confirmability and allow the reader to judge the conclusion reached.

The data collection of the third phase was guided by the findings of the first two phases of this thesis, which were based on medical students' knowledge, beliefs, behaviours and perspective. Restricting the data to one type of data source might be another potential weakness in this study. For example, data could have been further triangulated through gathering data from the medical school faculty, for example, through a semi-structured questionnaire survey. Also, the third phase of this study (documentary analysis) could have utilised a wider range of documents and been informed by additional data from both medical students and faculty members. Due to the time frame of this stage of the research, it was difficult ot carry out additional research activities. However the researcher recommends extending the investigation in future studies to understand medical schools' faculty members' perspectives about medical students' wellbeing before suggesting or implementing health education interventions.

- ***The documentary analysis***

In order to follow up on the emerged themes from the qualitative study and to describe how QUMS and other medical-education regulatory bodies in Saudi Arabia prioritise medical students' wellbeing, it was crucial to carefully analyse relevant documents. At this stage, the researcher decided to conduct a documentary analysis because documents are a more accessible source of information than conducting interviews with hard-to-reach, time-poor, curriculum developers and stakeholders in the medical school. However, full access to QUMS's curriculum and related documents was restricted by the medical school which selected and provided only the documents they saw fit.

The researcher aimed to avoid selection bias by including all the available and public access official documents related to the regulations and standards for medical education in Saudi Arabia. Again, there was a limited number of the published official documents related to the regulations and standards for medical education in Saudi Arabia. As a result, it was not easy to demonstrate the prioritisation of students' wellbeing in Saudi medical schools. The objective of this phase of the thesis, however, was not to demonstrate direct links between medical students' wellbeing systems and their implications for students' health-related behaviours. Instead, the aim was to explore how medical schools and medical education regulatory bodies in Saudi Arabia acknowledged health-promotion strategies.

9.6 Recommendations

Preventing T2D remains a significant, global healthcare challenge. Studies have shown the effective role of health promotion counselling and having healthy, role-modelling doctors encourage people with diabetes or at risk of diabetes to follow recommended preventive behaviours. Medical schools play a significant role in preparing future doctors to be qualified to treat and prevent T2D and other conditions. It seems that training healthy, role-modelling doctors was not a priority for some medical schools, however. Preventing T2D among medical students also seems to be excluded from medical schools' priorities. Medical education appears to have some influence on medical students' perceptions and behaviours relating to the prevention of T2D. The influencing channels suggested by this study were presented based on the HBM perceived and according to the type of medical curriculum. The following recommendations may assist medical schools in Saudi Arabia in preventing T2D onset and promoting healthy lifestyle behaviours among medical students through the medical curriculum.

1- The most important recommendation identified by Saudi medical students and medical education researchers brought out in this thesis was the need to establish medical students' wellbeing services, both in the university setting as well as in the wider community. The evidence reviewed in this study has indicated that lack of communication between medical education organisational bodies, medical schools, and medical students in term of promoting health behaviours might be the main reason behind the unsatisfactory level of healthy lifestyle behaviours among students. Thus, an integrated, tailored health promotion and education system could be a significant solution to this challenge. The students' wellbeing services (or systems) need to be developed through multiple levels and collaborate with partners of organisational stakeholders. The stakeholders could be from the medical school, university, or other sectors such as MOH, health providers, MOE, NCAAA or SCFHS. The collaboration between medical schools and partners might help further explore how resources can be secured to ensure that medical students' wellbeing services are effectively developed and operationalised to both educate and promote healthy lifestyles among medical themselves so that they understand that a healthy lifestyle is not just something relevant to their patients.

2- Previous studies highlighted several pedagogical advantages that a PBL-based curriculum has over the traditional subject-based curriculum. For example, in the PBL curriculum, students can acquire knowledge in different ways. The PBL group situation allows the simultaneous expression of diverse learning styles; students may ask questions or offer explanations, they may clarify unclear points and draw connections between prior knowledge and the topic under consideration. In this study, another advantage for utilising PBL was discovered. The analysed data in this study indicated that culturally matched PBL cases might form part of effective health promotion strategies for students. Putting themselves or a family member in a similar situation would help minimise the influence of cognitive dissonance on their health behaviours to be more preventive. Therefore, reviewing the social context of the PBL cases that are developed around preventive health problems such as T2D would have a positive influence on the medical students' beliefs and on their preventive behaviour.

3- Medical education is as much about learning to act like a doctor as it is about learning the content of the medical curriculum. The analysed data in this study indicated early clinical training for medical students might be an effective health promotion strategy for students. Because patients have a significant positive influence on doctors' and students' self-perception, interacting with patients in the first years of medical school might help medical students put their knowledge into the contexts that impact people's lives. In addition, interacting with patients might encourage students to act as healthy role-modelling doctors, which could promote their wellbeing indirectly. The importance of providing students with plenty of patient interaction in clinical settings was highlighted in previous studies. It is important that tutors in medical schools ensure that they adopt a role-modelling consciousness in that they think about how they are modelling their role when interacting with patients. This point might be confirmed by including it in the assessment of medical students' clinical skills. Therefore, considering these issues in the formal curriculum and the assessment could promote medical students' identity as healthy role-modelling doctor.

4-Saudi medical students are highly influenced by Islamic values in their daily behaviours, and these values positively impact on their consultation skills in dealing with patients. Medical curricula in Saudi Arabia, as in other Islamic countries, are constructed on religious foundations, and medical education researchers construct related values, such as professionalism, on the same religious bases. If medical educators took actions to further embed these values in the formal and informal curricula to promote medical students' wellbeing and prevent chronic health conditions, such as T2D, the medical students would be more motivated to follow these behaviours. A notable recommendation from this study is that the Ihsan reward could be used as a goal through messages to encourage medical students seeking the optimal level of continuous learning and development to always be good doctors and ideal healthy role models for their patients and community. Similarly, medical educators could employ the effect of social rewards (prestige) on the informal and hidden curricula to prevent unhealthy habits and promote recommended ones. In conclusion, prevention efforts could be tailored to fit within the professional, social, and cultural contexts to utilise the powerful voices of religious and social values to disseminate messages about healthy lifestyle behaviours.

5- One of the key findings of this study was the effect of tutors' advice and role-modelling behaviours on shaping future doctors' lifestyles and attitudes, as part of the 'hidden' or 'informal' curriculum. Although this study did not intentionally explore tutors' perspectives about and intentions toward promoting medical students' wellbeing, students were greatly influenced by their tutors. However, the analysed evidence showed a lack of encouragement by tutors to play this role. In this case, considering and contextualising the influencing role that tutors could apply in promoting medical students' behaviours through training and career development workshops for tutors, and including this in academic guidance and educational approach would help encourage and support teachers. These channels would help to promote medical students' wellbeing as well as potentially preventing T2D.

6- This investigation has demonstrated that female medical students faced more challenges, compared to their male peers, in practicing physical activities and allocating resources needed to follow a healthy lifestyle because of cultural and social norms. This difference is concerning because women, possibly as a consequence of this, in Saudi Arabia, are at a higher risk of developing T2D. in addition, the significant influence of the family lifestyle in maintaining healthy habits among medical students was reported. This study recommends two ways to empower female medical students to overcome barriers to healthy lifestyles through the formal and informal curricula. As highlighted earlier in this study, the tutors could influence medical students' self-efficacy, which could motivate them to follow healthy lifestyles (informal curriculum). Cultural and resource barriers can also be addressed through supportive interventions for female students. These interventions should be part of the students' wellbeing services. Therefore, establishing students' wellbeing strategies in Saudi Arabia seems to be an effective health promotion and T2D prevention strategy (formal curriculum). As this study has indicated, such interventions would not only enhance female medical students' wellbeing but would also extend to include the entire family.

9.7 Call for further research

This study could be extended in three major ways. Further research needs to be carried out to investigate and understand the tutors', medical schools' administration and curriculum developers' perspectives toward medical students' wellbeing that might provide insights into how policy, regulations and recommendations are made for promoting medical students' health. Moreover, since several effective preventive strategies are known internationally for promoting medical students' wellbeing and preventing health conditions such as T2D, it is worth exploring the possibility of employing some of these strategies in the Saudi context. This investigation seems to be essential before suggesting or implementing health interventions to clarify the needs, the expected challenges, and the feasibility of adopting international strategies to ensure effectiveness.

Second, the current study reported the significant role of self-efficacy in influencing healthy lifestyle among medical students. However, none of the participants commented on this value during the interviews. The reasons for this are unclear. Therefore, further studies are needed to take psychological beliefs such as self-efficacy and capacity for change into account. Moreover, these variables might be the underpinning component of cognitive dissonance. Using the medical and healthcare students' focus group methodology to investigate these factors might be appropriate.

Finally, the research could also be extended to assess the current health and wellbeing services provided for medical students. This could be conducted by collecting primary data about the quality of preventive health services provided by the primary healthcare centres for medical and other healthcare students through the university. To avoid duplication, research should further evaluate the importance and comprehensiveness of this care from the health workers' perspective.

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APPENDICES

Appendix 1: Systematic review database findings

Searching Terms:

1. Knowledge OR Awareness OR Information.
2. Attitude OR Belief* OR Perceptions.
3. Behaviour OR Behavior OR Practice* OR Lifestyle OR Prevention.
4. “Students” OR Undergraduate Or Intern*
5. Health OR Therapist* OR Paramedic* OR Physician* OR Nurse* OR Dent* OR Medical* OR Pharmacist* OR Dietitian*
6. “Saudi Arabia” OR Saudi.
7. “Public Health Problems” OR “Public Health” OR Diabetes OR Hypertension OR Coronary heart disease OR Obesity OR Smoking OR “Sedentary lifestyle” OR Exercise OR Stress OR Depression OR Hepatitis C OR Hepatitis B OR “Sexual transmitted Disease” OR Accidents.

Database	No of findings articles
MedLine	57
PubMed	105
CINAHL	10
Applied Social Sciences Index & Abstracts (ASSIA)	102
PsycINFO	11
Embase	Could not access it
BEI (British Education Index), by ***EBSCO Information Services.***	54
ERIC (Educational Resources Information Centre),	3
and Social Services Abstracts	Could not access it
Other sources	122

Appendix 2: Systematic review registration letter in PROSPERO

From: CRD-REGISTER
Sent: 27 April 2017 12:42
To: [redacted]
Subject: PROSPERO Registration message [60629]

Dear Mrs Almutairi

Thank you for submitting details of your systematic review *Health professional studentsâ€™ knowledge, beliefs and behaviour towards public health issues in Saudi Arabia* to the PROSPERO register. We are pleased to confirm that the record has been published on the database.

Your registration number is: CRD42017060629

You are free to update the record at any time, all submitted changes will be displayed as the latest version with previous versions available to public view. Please also give brief details of the key changes in the Revision notes facility. You can log in to PROSPERO and access your records at
http://www.crd.york.ac.uk/PROSPERO

An email reminder will be sent to you on the anticipated completion date, prompting you to update the record.

Comments and feedback on your experience of registering with PROSPERO are welcome at: crd-register@york.ac.uk

Best wishes for the successful completion of your review.

Yours sincerely

Lesley Indge

PROSPERO Administrator
Centre for Reviews and Dissemination
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PROSPERO is funded by the National Institute for Health Research and produced by CRD, an academic department of the University of York.

Appendix 3: Hawker assessment tool

This checklist is from Hawker, S., S. Payne, et al. (2002). "Appraising the Evidence: Reviewing Disparate Data Systematically." Qualitative Health Research 12(9): 1284-1299.

Please assess each paper on the following criteria. For scoring please refer to notes below.

Good=4 Fair=3 Poor=2 Very poor=1 Lower scores =poor quality

Notes for appraising the quality of each paper:

1. **Abstract and title:**
   Did they provide a clear description of the study?
   - ✓ **Good**: Structured abstract with full information and clear title.
   - ✓ **Fair**: Abstract with most of the information.
   - ✓ **Poor**: Inadequate abstract.
   - ✓ **Very Poor**: No abstract.

2. **Introduction and aims:**
   Was there a good background and clear statement of the aims of the research?
   - ✓ **Good**: Full but concise background to discussion/study containing up-to date literature review and highlighting gaps in knowledge. Clear statement of aim AND objectives including research questions.
   - ✓ **Fair**: Some background and literature review. Research questions outlined.
   - ✓ **Poor**: Some background but no aim/objectives/questions OR Aims/objectives but inadequate background.
   - ✓ **Very Poor**: No mention of aims/objectives. No background or literature review.

3. **Method and data:**
   Is the method appropriate and clearly explained?
   - ✓ **Good**: Method is appropriate and described clearly (e.g., questionnaires included). Clear details of the data collection and recording.
   - ✓ **Fair**: Method appropriate, description could be better. Data described.
   - ✓ **Poor**: Questionable whether method is appropriate. Method described inadequately. Little description of data.
   - ✓ **Very Poor**: No mention of method, AND/OR Method inappropriate, AND/OR No details of data.

4. **Sampling:**
   Was the sampling strategy appropriate to address the aims?
   - ✓ **Good**: Details (age/gender/race/context) of who was studied and how they were recruited. Why this group was targeted. The sample size was justified for the study. Response rates shown and explained.
   - ✓ **Fair**: Sample size justified. Most information given, but some missing.
   - ✓ **Poor**: Sampling mentioned but few descriptive details.
   - ✓ **Very Poor:** No details of sample.

5. **Data analysis**:
   Was the description of the data analysis sufficiently rigorous?
   - ✓ **Good**: Clear description of how analysis was done. Qualitative studies: Description of how themes derived/ respondent validation or triangulation. Quantitative studies: Reasons for tests selected hypothesis driven/ numbers add up/statistical significance discussed.
   - ✓ **Fair**: Qualitative: Descriptive discussion of analysis. Quantitative.
   - ✓ **Poor**: Minimal details about analysis.

- ✓ **Very Poor**: No discussion of analysis.

6. **Ethics and bias:**

   Have ethical issues been addressed, and what has necessary ethical approval gained? Has the relationship between researchers and participants been adequately considered?

- ✓ **Good** Ethics: Where necessary issues of confidentiality, sensitivity, and consent were addressed. Bias: Researcher was reflexive and/or aware of own bias
- ✓ **Fair** Lip service was paid to above (i.e. these issues were acknowledged).
- ✓ **Poor**: Brief mention of issues.
- ✓ **Very Poor:** No mention of issues.

7. **Results**:

   Is there a clear statement of the findings?

- ✓ **Good**: Findings explicit, easy to understand, and in logical progression. Tables, if present, are explained in text. Results relate directly to aims. Sufficient data are presented to support findings.
- ✓ **Fair**: Findings mentioned but more explanation could be given. Data presented relate directly to results.
- ✓ **Poor**: Findings presented haphazardly, not explained, and do not progress logically from results.
- ✓ **Very Poor**: Findings not mentioned or do not relate to aims.

8. **Transferability or generalisability**:

   Are the findings of this study transferable (generalisable) to a wider population?

- ✓ **Good**: Context and setting of the study is described sufficiently to allow comparison with other contexts and settings, plus high score in Question 4 (sampling).
- ✓ **Fair**: Some context and setting described, but more needed to replicate or compare the study with others, PLUS fair score or higher in Question.
- ✓ **Poor**: Minimal description of context/setting.
- ✓ **Very Poor**: No description of context/setting.

9. **Implications and usefulness:**

   How important are these findings to policy and practice?

- ✓ **Good**: Contributes something new and/or different in terms of understanding/insight or perspective. Suggests ideas for further research. Suggests implications for policy and/or practice.
- ✓ **Fair**: Two of the above (state what is missing in comments).
- ✓ **Poor**: Only one of the above.
- ✓ **Very Poor**: None of the above.

Appendix 4: Description of the included studies in the systematic review

Authors	Study location (school)	Studying level	Sample size	Health issue
Hasim (2000)	Healthcare	All years	647 (M = 59% & F = 41%)	Smoking
Al-Turki (2006)	Medicine.	All levels	322 (M)	Smoking
Subhan (2009)	Healthcare	All years	910 (M=66.5% & F=33.5%)	Smoking
Taha et al. (2010)	Healthcare	Years 1 to 3	371 (M)	Smoking
Al-Haqwi et al. (2010)	Medicine	All years	215 (M=77% & F= 23%)	Smoking
Al-Kaabba wt al. (2011)	Medicine	Years 1 &2	153 (M= 54% & F=46%)	Smoking
Wali (2011)	Medicine	Years 2 to 6	643 (M=31% & F= 69%)	Smoking
Alrsheedi & Haleem (2012)	Healthcare	All years	2336 (M)	Smoking
Azhar & Alsayed (2012)	Medicine	Years 2 to 7	155 (F)	Smoking
Abdulghani et al. (2013)	Medicine	All years	233 (F)	Smoking
Almutairi (2014)	Medicine	All years	805 (M = 77% & F= 23%)	Environmental tobacco smoke (ETS)
AlSwuailem et al. (2014)	Healthcare	All years	400 (M = 57% & F= 43%)	Smoking
Jradi & Al-Shehri (2014)	Medicine.	5th year	212 (M = 84% & F=16%)	Smoking
Awan et al. (2016)	Healthcare	All years	535 (M)	Water-pipe smoking
Sabra & Taha (2016)	Healthcare	Years 1 to 3	371 (M)	Water-pipe smoking
AlQahtani (2017)	Healthcare	All years	433 (M = 52% & F = 48%)	Smoking
Inam (2007)	Medicine.	Years 1 to 3	302 (M = 44% & F = 66%)	Anxiety and depression
Al-Saleh et al. (2010)	Healthcare	Years 2 to 5	548 (M & F)	Perceived stress

Abdulghani et al. (2011)	Medicine	All levels	775 (M = 64% & F = 36%)	Stress
Abdulghani et al. (2012)	Medicine	Years 1 to 3	491 (M = 62% & F = 38%)	Sleeping disorder
Sani et al. (2012)	Medicine	All years	385 (M = 47% & F = 53%)	Stress
Aboalshamat et al. (2015)	Healthcare	Years 2 &3	422 (M = 47% & F = 53%)	Depression, Anxiety, Stress, Self-Efficacy and Satisfaction
El-Gilany & El-Masry (2011)	Healthcare	All years	297 (M = 77% & F = 23%)	Physical Inactivity
Awadalla et al. (2014)	Healthcare	All years	1257 (M = 32% & F = 66%)	Physical inactivity
Ibrahim et al. (2014)	Medicine	Years 4 to 6	214 (M = 25% & F = 75%)	Risk factors of Coronary Heart Disease (CHD)
Alissa et al. (2015a)	Medicine	All year s	200 (M=68.0% & F= 32%)	Nutritional and lifestyle habits
Majeed (2015)	Medicine	Year 1	215 (F)	Dietary and exercise habits
Al-Drees et al. (2016)	Healthcare	All years	409 (M= 50% & F= 50%)	Physical activity
Alonazi et al. (2016)	Medicine	Years 1 to 4	302 (F)	Health awareness, in terms of nutrition, personal health, physical exercise, and body building
Al-Qahtani (2016)	Medicine	1st, 3rd, and 6th year.	562 (M=59% & F=41%)	Dietary habits and lifestyle
Allam et al. (2012)	Medicine	Years 3 to 5	196 (M= 49% & F=51%)	Nutritional and health status
Al Wadaani (2013)	Medicine	Final year (6th)	73 (M= 41.10% & F= 58.9%)	Diabetes and diabetic retinopathy

Appendix 5: Research questionnaire used in phase one (English version)

Prifysgol Abertawe
Swansea University

Consent form

The Influence of Medical Education on Knowledge, Beliefs and Health Promoting Behaviours Regarding type 2 Diabetes Mellitus.

Dear Future Physician ....

I am a PhD student* in the Swansea University Medical School and I am happy to invite you to complete this survey. The purpose of this study is to assess the type 2 Diabetes Mellitus (T2DM) related Knowledge, Beliefs and Health Promoting Behaviours among medical students at Swansea University, UK and Qassim University, Saudi Arabia. The assessment will take you approximately 10 to 20 minutes to complete.

The results of this study will help medical educators to promote healthy lifestyle for medical students during their years of medical studies. This is important, not only for individual students but for your future as role models for patients and the general public.

Your replies will be anonymous and will only be reported in aggregate. Taking this survey will not cause you any risk or inconvenience. Participation is voluntary and if you would like to withdraw from the study, you may do so at any time without any negative consequences. By completing and turning in this questionnaire you are verifying that you have read the explanation of the study and you agree to participate.

Please complete the following questions by choosing the most appropriate answer to you. Answer all questions to the best of your ability. Do not use any outside sources to look up or answer questions.

Thank you very much for participating. We wish you all the best in health and future success.

***Reem Almutairi**

Please initial each box

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐
3. I agree to take part in the above study. ☐

Signature of Participant ______________________

*This study is under the supervision of Professor Judy McKimm, Professor Rhys Williams , Dr.Clive Weston and Dr.Darren Edwards. If you have, any comments kindly contact us on this email: [redacted]

Study. No# ....

Section 1:

Below are general questions about Type 2 Diabetes Mellitus (T2DM) prevention and control strategies and the role of health care professionals. Please read all the questions carefully and complete all sections of this survey. Circle the correct answer that represent the best response for you. Only provide one response per question and do not leave any questions blank. Do not worry if you cannot answer the question, just Circle the letter next to "I don't know".

1.1. What is the estimated number of adults in the world who have diabetes (type one and type two combined)?
   - A. 255 million.
   - B. 310 million.
   - C. 415 million.
   - D. 525 million.
   - E. I don't know.

1.2. The major cause of morbidity and mortality for individuals with diabetes is...:
   - A. Cardio Vascular Disease.
   - B. Kidney Failure.
   - C. Blindness.
   - D. Amputation.
   - E. I do not know.
   - F.

1.3. Which pair of countries, from the list below, has the highest absolute number of people with diabetes (type 1 and type 2 combined).
   - A. USA & Saudi Arabia.
   - B. Russian Federation & Pakistan.
   - C. Egypt & Bangladesh.
   - D. United Kingdom & Indonesia.
   - E. I do not Know.

1.4. What is the prevalence of diabetes (type 1 and type 2) in the UK?
   - A. 2.3%
   - B. 6.2%
   - C. 12.0%
   - D. 18%
   - E. I don't know.

1.5. What is the prevalence of diabetes (mainly type 2) in Saudi Arabia? (ONLY FOR SAUDI STUDENTS)
   - A. 12%
   - B. 17%
   - C. 24%
   - D. 38%
   - E. I don't know.

1.6. Changing which of the following factors will reduce the risk of developing type 2 diabetes.
   A. Age.
   B. Family history of type 2 diabetes.
   C. Physical inactivity.
   D. High blood pressure.
   E. I don't know.

1.7. Type 2 diabetes and prediabetes should be considered, and identified, in children and adolescents who are:
   A. Overweight (weight ≥ 20% of ideal for height) and who have Family history of type 2 diabetes.
   B. Overweight (weight ≥ 40 % of ideal for height) and who have signs of insulin resistance.
   C. Overweight (BMI ≥ 85th percentile for age and sex) and who had a maternal history of diabetes or GDM during their gestation.
   D. There is no need to test blood glucose among children and adolescents if they have no symptoms.
   E. I don't know.

1.8. Which of the following is part of the comprehensive diabetes evaluation?
   A. Foot examination.
   B. HbA1C test.
   C. Pre-conception counselling (Family Planning) for women of reproductive age.
   D. All the above.
   E. I don't know

1.9. As part of standard diabetes prevention, physicians should:
   A. Encourage individuals at risk for type 2 diabetes to limit their intake of sugar-sweetened beverages to prevent or delay type 2 diabetes
   B. Avoid smoking cessation counselling unless the patient already has evidence of cardiovascular disease
   C. Advise adults with diabetes to perform 50 min/week of moderate-intensity aerobic physical activity.
   D. None of the above.
   E. I do not know.

1.10. Structured patient education, an integral part of the management of all people with Type 2 diabetes, should:
   A. Start from around the time of diagnosis.
   B. Be accessible to all people with diabetes, taking account of culture, ethnicity, psychosocial, and disability issues
   C. Should be adapted to personal choices and learning styles.
   D. All the above.
   E. I do not know.

Section 2

This section is designed to determine the way in which different people view their possibility of developing T2DM.

Please make sure that you answer every item and that you select only **one answer** per item. This measure of your personal beliefs; there are, therefore, no right or wrong answers.

	Not at all likely	*Not very likely*	*Quite likely*	*very likely*	***I DON'T KNOW***
2.1 How likely do you think it is that you will get T2DM sometime in your life?					
2.2 How likely do you think it is that someone will get diabetes if he or she does not have a family history of T2DM?					
	No	*Rarely*	*Sometime*	*Often*	***I DON'T KNOW***
2.3 Do you worry that you might get T2DM sometime in your life?					

Please circle a number on each of the scales to indicate how serious you think the following problems are *in relation to their long term consequences.*

	Not at all serious	*Quite serious*	*Very serious*	*Life threatening*	***I DON'T KNOW***
3.1 AIDS					
3.2 Flu					
3.3 T2DM					
3.4 Lung Cancer					
3.5 Hypertension					
3.6 Breast cancer					
3.7 Asthma					

Following a healthy lifestyle e.g. by eating a healthy low-fat diet and regular physical activity, has been identified as a possible strategies to reduce a person's risk of getting T2DM.

Listed below are some possible **benefits** which might be gained by following a healthy lifestyle. Please select the answer that represents the extent to which you disagree or agree with each statement.

	BENEFITS	Strongly Agree	Agree	Disagree	Strongly Disagree	**I Don't Know**
4.1	I would reduce my chances of getting T2DM.					
4.2	I would reduce my risk of other disease, such as heart disease.					
4.3	I would be feel fit and healthy.					
4.4	I would keep my weight under control.					
4.5	It would enhance my physical appearance.					
4.6	I would be a role model for my patients.					
4.7	My patients will be more likely to follow my recommendations.					
4.8	I will enjoy physical activity.					
4.9	Physical activity will relieve stress.					

Listed below are some possible **barriers** that might prevent you following a healthy lifestyle. Please select the answer that represents the extent to which you disagree or agree with each statement.

	5. BARRIER	Strongly Agree	Agree	Disagree	Strongly Disagree	**I DON'T KNOW**
5.1	I do not have time for Physical activity.					
5.2	I do not like the taste of low fat.					
5.3	I do not like the taste of low sugar food.					
5.4	I do not want to be different from my peers.					
5.5	Healthy foods are not always available where I usually eat.					
5.6	I am not convinced of the benefit of a healthy lifestyle					
5.7	I do not enjoy physical activity because it make me sweat.					
5.8	I do not engage in physical activity because I cannot afford the club fees.					
5.9	I do not engage in physical activity because of the weather.					
5.10	I am not motivated to engage in physical activity.					

In regards to **preventing T2DM**, how **confident** do you believe you can overcoming the situations described below? Please select the statement, which most closely match your view.

		Not at all true	*Hardly true*	*Moderately true*	*Exactly true*	***I DON'T KNOW***
6.1	I can always manage to solve difficult problems if I try hard enough.					
6.2	If someone opposes me, I can find the means and ways to get what I want.					
6.3	It is easy for me to stick to my aims and accomplish my goals.					
6.4	I am confident that I could deal effectively with unexpected events.					
6.5	Thanks to my resourcefulness, I know how to handle unforeseen situations.					
6.6	I can solve most problems if I invest the necessary effort.					
6.7	I can remain calm when facing difficulties because I can rely on my coping abilities.					
6.8	When I am confronted with a problem, I can usually find several solutions.					
6.9	If I am in trouble, I can usually think of a solution.					
6.10	I can usually handle whatever comes my way.					

Section 3:

Please respond to each item as accurately as possible, and try not to skip any item. Indicate the frequency with which you engage in each behaviour.

		Never	Sometimes	Often	Routinely
7.1	Choose a diet low in fat, saturated fat, and cholesterol				
7.2	Follow a planned exercise programme.				
7.3	Get enough sleep.				
7.4	Limit use of sugars and food containing sugar (sweets)				
7.5	Exercise vigorously for 20 or more minutes at least three times a week (such as brisk walking, bicycling, aerobic dancing, using a stair climber).				
7.6	Take some time for relaxation each day.				
7.7	Eat 6-11 servings of bread, cereal, rice and pasta each day.				
7.8	Take part in light to moderate physical activity (such as sustained walking 30-40 minutes five or more times a week).				
7.9	Accept those things in my life which I cannot change.				
7.10	Eat 2-4 servings of fruit each day.				

	Never	Sometimes	Often	Routinely
7.11 Take part in leisure-time (recreational) physical activities (such as swimming, dancing, bicycling).				
7.12 Concentrate on pleasant thoughts at bedtime.				
7.13 Eat 3-5 servings of vegetables each day.				
7.14 Do stretching exercises at least 3 times per week				
7.15 Use specific methods to control my stress.				
7.16 Eat 2-3 servings of milk, yogurt or cheese each day.				
7.17 Get exercise during usual daily activities (such as walking during lunch, using stairs instead of elevators, parting car away from destination and walking).				
7.18 Balance time between work and play.				
7.19 Eat only 2-3 servings from the meat, poultry, fish, dried beans, eggs, and nuts group each day				
7.20 Check my pulse rate when exercising				
7.21 Practice relaxation or mediation for 15-20 minutes daily.				
7.22 Read labels to identify nutrients, fats, sodium content in packaged food.				
7.23 Reach my target heart rate when exercising.				
7.24 Pace myself to prevent tiredness.				
7.25 Eat breakfast				

Section 4

Demographic information

Please answer each question as accurately as possible by selecting the correct answer or filling in the space provided.

8.1 **Gender:** --- Male --- Female

8.2 **Academic level:** ---First Year --- Final Year

8.3 **Year of birth:** ------- years

8.4 Has your doctor ever told you that you have **diabetes**?

-----No. ---yes, (type 1) ---yes, (type 2) ---- yes, (I don't know the type)

8.5 Do you have a **Family history of T2DM**? (You may select more than one answer):

A) --- No, I don't have Family history of T2DM

B) Yes: --- Father --- Mother --Sister/Brother ---Grand Mother

---Grand Father

C) ---Unknown.

8.6 **Your body measurement** *(the researcher will take it for you)*

Weight ------------ Height ----------------

Appendix 6: Research questionnaire used in phase one (Arabic version)

تأثير المنهج الطبي على معلومات وسلوكيات طلاب كلية الطب حول الوقاية من داء السكري البولي

الإخوة والاخوات اطباء المستقبل،

السلام عليكم ورحمة الله وبركاته،

اسمي ريم المطيري طالبه دكتوراه في كلية الطب بجامعة سوانزي، المملكة المتحدة. بصفتك أحد طلاب او طالبات السنة الاولى او النهائية في كلية الطب بجامعة القصيم، يشرفني دعوتكم للمشاركة في هذه الدراسة عبر اجابتك على الاستبيان المرفق، والذي يهدف الى تقييم معلومات واراء وسلوكيات طلاب كلية الطب المتعلقة بالوقاية من النوع الثاني من داء السكري البولي.

نتائج هذه الدراسة ستساعد القائمين على برامج تعزيز الصحة وتطوير المناهج الدراسية على وضع الاستراتيجيات المناسبة لتعزيز صحة طلاب كلية الطب، مما سيعود بإذن الله بالفائدة ليس فقط على الصحة الفردية للطلاب والطالبات ولكن على صنع قدوات صحية للمجمع.

الإجابة على هذا الاستبيان ستستغرق منك 10 الى 15 دقيقه فقط، جميع اجاباتك و معلوماتك ستعامل بطريقه سريه للغاية (لذلك يرجى عدم كتابة الاسم او اي معلومات قد تبين هويتك الشخصية). المشاركة في هذه الدراسة هي مشاركه تطوعيه بحته ويمكنك الانسحاب في أي وقت تشاء .فضلا الإجابة على جميع الأسئلة وعدم استخدام اي مصادر خارجيه.

اشكرك جزيل الشكر علي كرم مشاركتكم وادعوا الله ان تكونوا دائما في تمام الصحة والعافية. دعواتي لكم بالتوفيق والصحة.

ريم المطيري

موافقه على المشاركة في الدراسة:

- **أعطيت الفرصة لقراءة واستيعاب المعلومات الخاصة بالدراسة المذكورة أعلاه. واعطيت الفرصة للاستفسار وتمت الإجابة على استفساراتي.**
- **اعرف ان مشاركتي تطوعيه ولي حق الانسحاب منها متى شئت وبدون إعطاء أي مبررات. كما لن يؤثر ذالك على حقوقي كطالب.**
- **اقبل المشاركة في هذه الدراسة.**

التوقيع ....

رقم الاستمارة

....

الجزء الاول

يوجد ادناه بعض الأسئلة عن النوع الثاني من مرض السكري واستراتيجيات الوقاية منه. فضلا اقراء جميع الخيارات المتاحة ثم اختر الإجابة الصحيحة. يرجى اختار اجابه واحده فقط لكل سؤال إذا لم تعرف الإجابة فضلا اختار (لا اعرف).

1.1 ما هو العدد التقديري الاجمالي للبالغين المشخصين بداء السكري البولي في العالم (النوع الأول والنوع الثاني مجتمعة)؟
- A. million 255.
- B. million 310.
- C. million 415.
- D. million 525.
- E. لا اعرف.

1.2 السبب الرئيس للوفاة بين المصابين بأداء السكري هو....
- A. امراض القلب والشرايين.
- B. الفشل الكلوي.
- C. فقدان النظر.
- D. بتر الاطراف (نتيجة للغرغرينا).
- E. لا اعرف.

1.3 في القائمة ادناه، دولتين صنفتا من ضمن اعلى عشر دول في العالم من حيث عدد مرضى داء السكري بهما (النوع الأول والنوع الثاني مجتمعة)؟
- A. الولايات المتحدة الأمريكية والمملكة العربية السعودية.
- B. روسيا وباكستان.
- C. مصر وبنغلاديش.
- D. المملكة المتحدة و اندونيسيا.
- E. لا اعرف.

1.4 ما هي نسبة الإصابة بالنوع الثاني من داء السكري في المملكة العربية السعودية؟
- A. 12%
- B. 17%
- C. 24%
- D. 38%
- E. لا اعرف.

1.5 الوقاية من اي من العوامل التالية سيساعد في خفض نسبة الإصابة بالنوع الثاني من داء السكري؟
- A. العمر.
- B. التاريخ العائلي لمرض السكري.
- C. الخمول البدني
- D. ارتفاع ضغط الدم.
- E. لا اعرف.

1.6 في اي من الحالات التالية يجب فحص الاطفال او المراهقين للتأكد من سلامة من الإصابة بالنوع الثاني من داء السكري؟

A. زيادة في الوزن (حيث يكون وزن الجسم اعلى بنسبة 20% من الوزن المثالي للطول) مع وجود تاريخ عائلي بالإصابة بالنوع الثاني من داء السكري.
B. زيادة في الوزن (حيث يكون وزن الجسم اعلى بنسبة 40% من الوزن المثالي للطول) مع وجود علامات على مقاومة الانسولين.
C. زيادة في الوزن (حيث يكون كتلة وزن الجسم اعلى من 85% من النسبة الطبيعية المناسبة للعمروالجنس) مع وجود تاريخ لإصابة الام بسكري الحمل خلال فترة حملها بهذا الطفل.
D. لا يوجد حاجه لفحصهم طالما لا يعانون من اعراض النوع الثاني من داء السكري.
E. لا اعرف

1.7 اي من الإجراءات التالية هي جزء من الفحص الشامل لمتابعة مرضى داء السكري؟

A. فحص القدم.
B. فحص نسبة الهيموجلوبين السكري (HbA1C test).
C. اعطاء استشاره طبيه حول الحمل وتنظيم النسل للسيدات المصابات بداء السكري خلال فترة الخصوبة.
D. كل ما ذكر اعلاه.
E. لا اعرف.

1.8 احدى استراتيجيات الوقاية من داء السكري تنص على اهمية ان يقوم الطبيب بـ:

A. تشجيع الافراد المعرضين للإصابة بداء السكري على تقليل تناول السكريات مما سيؤدي - بإذن الله - الى الوقاية اوتأخير الإصابة بالنوع الثاني من داء السكري.
B. احالة المرضى المصابين بأعراض اعتلال القلب والشرايين الى برنامج مكافحة التدخين.
C. توجيه الافراد المعرضين للإصابة بداء السكري الي ممارسة اي نشاط بدني متوسط الشده لمدة 50 دقيقه في الاسبوع.
D. غيرما سبق.
E. لا اعرف.

1.9 برنامج التثقيف الصحي لمرضى السكري هو جزء اساسي من برنامج المتابعة الدورية لجميع مرضى السكري، من اهم سمات هذا البرنامج:

A. ان يبدا مع بداية التشخيص بداء السكري.
B. ان يكون متاح ومناسب لجميع مرضى السكري على اختلاف ثقافاتهم واعراقيهم وطبقاتهم الاجتماعية وقدراتهم الفكرية والجسدية.
C. ان يتمتع بالمرونة التي تتيح للمصابين اختيارطرق التعلم المناسبة لهم.
D. كل ما ذكر اعلاه.
E. لا اعرف.

الجزء الثاني

هذا الجزء من الدراسة يهدف الى معرفة وجهات نظرطلاب الطب تجاه امكانية اصابهم بالنوع الثاني من مرض السكري. فضلا اجب على جميع الأسئلة، لا توجد اجابه صحيحه لذلك اخترالإجابة الاقرب تعبيراً عن رأيك.

	غيرممكن تماما	غيرممكن	ممكن	ممكن جدا	لا اعرف
2.1 ما مدي امكانية اصابتك شخصيا بالنوع الثاني من داء السكري في قت ما في المستقبل؟					
2.2 ما مدي امكانية ان يصاب اي شخص بالنوع الثاني من داء السكري إذا كان لا يحمل تاريخ عائلي بالنوع الثاني من داء السكري؟					
	لا	نادرا	احيانا	غالبا	لا اعرف
2.3 هل يقلقك احتمالية اصابتك بداء السكري في وقت ما في حياتك المستقبلية.					

الجزء الثالث

باعتقادك ما مدى خطورة كل من الامراض التالية على المدى البعيد.
حدد درجة الخطورة من 1 الي 4 حيث ان رقم 1 يعني ان المرض ليسا خطيراً ابداً ورقم 4 يعني ان المرض خطيرٌجداً ويهدد الحياة.

	ليس خطيرا ابداً (1)	متوسط الخطورة (2)	خطير(3)	يهدد الحياة (4)	لا اعرف
3.1 مرض الايدز.					
3.2 الانفلونزا.					
3.3 النوع الثاني مرض السكري.					
3.4 سرطان الرئة.					
3.5 ارتفاع ضغط الدم (الضغط).					
3.6 سرطان الثدي.					
3.7 الربو.					

الجزء الرابع

إن اتباع نمط حياة صحي يقوم على تناول الغذاء الصحي ذو السعرات الحرارية المنخفضة و ممارسة النشاط البدني بشكل منتظم (مثل المشي لمدة 30 دقيقه يوميا) هو احد اهم طرق الوقاية من مرض السكري.

العبارات التالية توضح بعض **الفوائد** التي قد تصاحب اتباع نمط حياتي صحي، ما مدى توافقك معها.

الفوائد	اوافق بشده	اوافق	لا اوافق	لا اوافق بشده	محايد
4.1 سوف اقي نفسي من الإصابة بمرض السكري.					
4.2 سوف اقي نفسي من الإصابة بالأمراض المزمنة مثل امراض القلب والشرايين.					
4.3 سوف أصبح أكثر لياقة وحيوية.					
4.4 سوف احافظ على وزن جسمي المثالي.					
4.5 سيصبح مظهري الخارجي أكثر جاذبيه.					
4.6 سأصبح قدوة صحية لمرضاي.					
4.7 سيتبع مرضاي نصائحي وارشاداتي الصحية لهم					
4.8 سأستمتع بالأنشطة الحيوية.					
4.9 النشاط البدني سيخلصني من التوتر.					

العبارات التالية توضح بعض **العوائق** التي قد تصاحب اتباع نمط حياتي صحي، ما مدى توافقك معها.

العوائق	اوافق بشده	اوافق	لا اوافق	لا اوافق بشده	محايد
5.1 لا أجد الوقت الكافي لممارسة النشاط البدني.					
5.2 لا أحب مذاق الأطعمة ذات السعرات الحرارية المنخفضة (قليله الدهون).					
5.3 لا أحب مذاق الأطعمة ذات السعرات الحرارية المنخفضة (قليلة السكريات).					
5.4 لا أحب ان اتبع نظام مختلف عن اصدقائي.					
5.5 أجد صعوبة في ايجاد الأطعمة الصحية في الاماكن التي اتناول طعامي غالبا فيها.					
5.6 لست مقتنع بفائدة اتباع نمط حياتي صحي.					
5.7 لا أستطيع الاستمتاع بممارسة التمارين الرياضية بسبب التعرق.					
5.8 رسوم الأندية الرياضية تعيقني عن ممارسة الرياضة.					
5.9 لا أستطيع ممارسة التمارين الرياضية بسبب صعوبة الاجواء (ارتفاع درجة حرارة الشديد او انخفاضها).					
5.10 لا أجد الحماس لممارسة التمارين النشاط البدني.					

الجزء الخامس

العبارات التالية تقيس مدى ثقتك بقدرتك الذاتية على الالتزام بالسلوكيات الصحية للوقاية من النوع الثاني من داء السكري، اختر العبارة التي تعبرعن مدى ثقتك بكفاءتك الذاتية على تجاوزكل من الحالات التالية:

	دائما	غالبا	نادراً	لا	محايد
6.1 أستطيع دائما حل المشاكل الصعبة إذا بذلت جهداً كافيا.					
6.2 إذا عارضني شخص ما، أستطيع ايجاد طرق ووسائل لتحقيق ما ابتغيه.					
6.3 يسهل علي التمسك بأهدافي والسعي لتحقيقها.					
6.4 اثق بقدرتي على التعامل مع الاحداث المفاجئة بكفاءة وفعالية.					
6.5 بفضل ارادتي فإنني قادر على معرفة طرق حل الازمات حتى ولو كانت غير عاديه.					
6.6 لا يعنيني ما يحدث لي من مشاكل على الاطلاق لأنني أستطيع التخلص منها بعزيمتي.					
6.7 انظر الى المصاعب بنفس هادئة " برزانه" وذالك لاعتمادي الدائم على قدراتي الذاتية.					
6.8 عندما يضعني أحد امام مشكله ما، اعرف كيف اتخلص منها بسهوله لأنني املك افكارا عديده تساعدني على حلها.					
6.9 عندما اواجه مشكله جديده اعرف كيف اتعامل معها.					
6.10 أجد حلا لكل مشكله تواجهني.					

الجزء السادس

العبارات التالية من هذا الاستبيان تهدف الى معرفة نمط وطريقة معيشتك الخاصة في الوقت الحاضر وعاداتك الشخصية. رجاء أجب عن كل عنصر بدقة وحاول أن لا تحذف أي عنصر، حدد إجابتك بوضع علامة على الاختيار المناسب لك

	بشكل روتيني	غالبا	احيانا	ابدا
7.1 أختار ريجيم قليل في الدسم والدهون المشبعة والكولسترول.				
7.2 أتبع برنامجا تدريبيا منظم				
7.3 آخذ قسطا واف من النوم				
7.4 أحدد استهلاك السكروالحلويات.				
7.5 أتمرن بقوة لمدة 20 دقيقة ثلاثة مرات في الأسبوع على الأقل (كالهرولة، ركوب الدراجة ..... الخ).				
7.6 أخصص وقت للاسترخاء كل يوم.				
7.7 أتناول من 6-11 وجبة صغيرة (خفيفة) من الخبزوحبوب القمح، الأرز، المكرونة كل يوم				
7.8 ممارسة بعض النشاط الجسدي الخفيف (كممارسة رياضة المشي لمدة 30-40 دقيقة 5 مرات أو أكثر).				
7.9 أتقبل الأشياء التي لا أستطيع تغييرها في حياتي.				
7.10 أتناول 2-4 وجبات صغيرة من الفواكه كل يوم.				
7.11 أشارك في النشاطات الجسدية كالسباحة، الرقص، وركوب الدراجة في أوقات الفراغ.				
7.12 أركزعلى الأفكار المبهجة قبل النوم.				
7.13 أتناول 3-5 وجبات خفيفة من الخضاركل يوم.				
7.14 القيام بتمارين التمدد 3 مرات في الأسبوع على الأقل.				
7.15 أتبع وسائل محددة للسيطرة على ضغوطي النفسية.				

	بشكل روتيني	غالبا	احيانا	ابدا
7.16 أتناول 2-3 وجبات خفيفة من الحليب أو الروب أو الجبن كل يوم.				
7.17 القيام ببعض التمارين الخفيفة أثناء اليوم كالمشي بعد الغداء واستعمال الدرج عوضا عن المصعد و إيقاف السيارة بعيدا والسير إلى المكان المطلوب.				
7.18 موازنة الوقت ما بين العمل واللهو.				
7.19 أتناول 2-3 وجبات خفيفة فقط من اللحم والدجاج والسمك والبقول والبيض ومجموعة المكسرات كل يوم.				
7.20 التحقق من معدل نبضات قلبي أثناء ممارسة الرياضة.				
7.21 القيام بتمارين الاسترخاء والتأمل لمدة 15-20 دقيقة يوميا.				
7.22 قراءة قائمة المحتويات الملصقة على علب الطعام لمعرفة نسب الدهون والصوديوم والعناصر الغذائية.				
7.23 الوصول إلى النسبة المطلوبة لمعدل نبضات القلب الخاص أثناء ممارسة التمرينات الرياضية.				
7.24 أوجه نفسي للوقاية من الإرهاق.				
7.25 أتناول وجبة الإفطار.				

الجزء السابع

هذا الجزء من الاستبانة هو لمعرفة بعض معلوماتك الشخصية، وسوف تُعامل بسريه تامه.

(يرجى عدم كتابة الاسم او اي معلومات تقود لهويتك الشخصية)

8.1 الجنس: ☐ ذكر ☐ انثى

8.2 المرحلة الدراسية في كلية الطب. ☐ السنة الاولى ☐ السنة النهائية

8.3 سنة الميلاد: 19............ م او ...... 14 هـ

8.4 هل انت مصاب بمرض السكري؟ ☐ لا ☐ نعم (النوع الاول) ☐ نعم (النوع الثاني) ☐ نعم (لا اعرف النوع)

8.5 هل انت مصاب باي مرض مزمن؟ ☐لا ☐ نعم اذكره................

8.6 هل أحد افراد العائلة مُصاب بمرض السكري؟ ☐ نعم ☐ لا

8.7 إذا كانت اجابتك بـ نعم، فمن هو؟ (يمكنك اختيار أكثر من اجابه) ☐ الام ☐الاب ☐الجدة ☐الجد ☐ الاخ ☐ الاخت

8.8 الوزن والطول (سيقوم أحد افراد فريق البحث بأخذها لك) الوزن ....كجم الطول .... سم

شكرا جزيلا لكرم مشاركتك..

Appendix 7: Questionnaire translation report

LINGUA TRANSLATIONS

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Date: 09/11/2017

Re: Certifying Letter for Translation of "KAP of Medical Student Questionnaire" from Arabic into English

To whom it may concern,

We, Lingua Translations, attest that to the best of our knowledge this Arabic into English translation is a complete and accurate rendition of the provided "KAP of Medical Student Questionnaire", and that the translator is fully proficient in both the Arabic and English languages. Please direct any further questions to **Lingua Translations**, the providing body.

Signed:
[redacted]

Adrian Graham

Senior Project Manager

The documents translated are:

"KAP of Medical Student Questionnaire"

CERTIFIED
Lingua Translations Ltd.

Registered office: As above

Registered in England and Wales No:08951669

Appendix 8: Interview protocol for the second phase of the research

Stage	**Guide**
Aim	To explore the process of influencing knowledge, beliefs and prevention behaviours related to T2D among medical students studying at Qassim University, Saudi Arabia.
Objectives	1. To explore the process of influencing knowledge, beliefs and prevention behaviours related to T2D among medical students <u>from three perspectives:</u> - Promoting personal health. - Role modelling. - Formal and informal medical curricula. 2. To understand medical students' perceptions. 3. To understand factors shaping such perceptions. 4. To identify opportunities for T2D prevention among medical students (or health professional students).
Introduction	• Introduce the study, confidentiality statement and interview length. • Introduce participants' rights. • Start audio recording.
During the interview	• Demographic data. • Describe the findings of the first phase of the study to the participant. • Guide the participant through the study questions. • Clarify each answer by asking sub-questions.
Ending the interview	• Finish covering issues raised during the interview. • Thank the participant and explain how his/her contribution is valuable to this study. • Reassure confidentiality of information. • Turn off the recorder.

Appendix 9: Interview schedule for the second phase of the research

Stage of interview	Guide
Introduction to warm up	I'd like to start off by thanking you for taking time to participate today. My name is Reem Almutairi and I would like to talk with you about your opinions regarding medical students' health promotion and prevention of T2D. The interview will take around 45 minutes. I will be recording the session. The information that you provide will be safeguarded, and protected, to ensure your privacy and confidentiality. Are there any questions about what I have just explained? Are you willing to participate in this interview? <u>If yes, verbal formal consent was recorded.</u>
Health promotion and lifestyle of medical students.	1. Age, gender, personal and family history of diabetes. 2. Could you describe your daily routine, lifestyle? 3. Do you practice physical exercise regularly? What type? How often? 4. How would you describe your dietary habit? 5. Do you think that you can influence the beliefs and behaviours of your patients in future? Why? 6. *<u>I would like to share with you our finding of a study done among your colleagues from the final-year and the first-year medical students,</u> (participants were given 5 to 10 minutes to think about it).* 7. From an educational perspective, how do you explain the variation between first- and final-year students' knowledge and beliefs, but not behaviours?
Core discussion (influence of medical	8. What courses were taken related to promoting health and preventing chronic diseases such as T2D in Qassim University?

curriculum on medical students) Questions	9. Do you think these courses taken were effective, practical or useful? Why or why not? 10. Does any of your previous research, group discussions about any health problem make it more serious than what you thought and/or make you more susceptible to it? How? Could you give an example? 11. Do any of your course's instructors advise you to implement any of the course information in your daily lifestyle? 12. Did any of your instructors' advise you and your colleagues to take care of your physical health, mental health, and your body weight? 13. Do you feel there is a conflict between what you know about T2D and what you are doing to prevent it? Why or why not? 14. Do you think there is anything curricular that we could do to improve the wellbeing of medical students?
Closing	15. Is there anything else you would like to add? This is the end of the interview. All the information you give will be treated confidentially, and it will be analysed and interpreted to write recommended ways to improve the wellbeing of medical students. Thank you so much for your time.

Appendix 10: Example of codes and themes that emerged from the translated scripts

Theme 1: Key factors contributing to living unhealthy lifestyle among medical students.

Code	Responses in Arabic	Responses in English	Participant
Lack of resources supporting healthy lifestyle.	لست متفاجئا بنتائج بحثك فهذا متوقع بسبب نقص بعض الموارد التي تعيننا على ممارسة الرياضة في هذا الجوا الحار . فعلى الرغم من أن الطلاب لديهم الوعي المعلوماتي ولكن لا ينعكس ذلك على سلوكياتهم، انا لا أعتقد أن الوعي أحد أسباب عدم التزامنا بالسلوك الصحي... لكن هناك أسباب أخرى مثلما ذكرت لك أهمها درجة الحرارة. وفي اعتقادي الشخصي لو وجدت أماكن مغلقه وبارده لمارس الجميع الرياضة بانتظام	I am not surprised at your research results. This is expected due to the lack of some resources that help us practice sports in this hot weather. Although the students have knowledge awareness now, it is not reflected on their lifestyles. I, myself, don't think that awareness is a reason for us for not sticking to a healthy lifestyle. However, there are other reasons, as I told you before, the most important of which is temperature. I personally believe that if there were closed, cold areas, all would practice sports regularly.	P5
Affordability and accessibility to healthy promotion services.	انا طالب طب كنت اسكن في سكن الطلاب الجامعيين ..واقضي معظم وقتي داخل الحرم الجامعي للدراسة وتناول الوجبات في مطعم الجامعة... للأسف الشديد لم تكن الوجبات الصحية متوفر داخل الحرم الجامعي بشكل مستمر طوال أيام الأسبوع ...كما ان البوفيه	I am a medical student. I used to live at the students' dorm and spend most of my time at campus to study and have meals at the college restaurant. Unfortunately, healthy meals were not available	P2

	كان يُفتح سابقاً على فترات، ولكن الآن أصبح مفتوح يومياً بشكل رسمي ومستمر.....نعم كان البوفيه يفتح يومين أو ثلاثة بالأسبوع لطلاب السكن الجامعي، وباقي الأيام كنا نذهب إلى المطاعم أو نطهو لأنفسنا.......... اما الان فهو مفتوح 7 أيام بالأسبوع. لم نكن نهتم بنوع الطعام المقدم لنا بقدر اهتمامنا بوجوده بشكل وفير ومستمر وساخن.	in campus regularly on week days. Besides, the cafeteria used to open in the past at intervals, but now it is officially and continuously open daily. It used to be open for two or three days a week for the dorm's students. The rest of the week, we used to go to restaurants or cook for ourselves. But now, it is open seven days a week. We didn't care about the kind of food provided as much as we cared about its being available, plentiful, continuous and hot.	
Feasibility of services to promote a healthy lifestyle.	تم افتتاح نادي رياضي صحي للفتيات داخل الحرم الجامعي في بداية هذا العام (2018) وهو خاص بالطالبات فقط ولكن لم أتمكن من الالتزام معهم لعدم تمكني من ايجاد الوقت الكافي.. فساعات العمل داخل النادي قصيره جدا 8 صباحا وحتى 4 مساء)وهي متزامنة مع ساعات العمل داخل الجامعة (8 صباحا وحتى 5 مساء) ... احب ان امارس الرياضة في أوقات أخرى خارج هه الأوقات مثل قبل الذهاب للجامعة او بعد الساعة السادسة مساء........كما انه غير مهيئ بشكل حديث ومتطور مثل باقي الأندية الخاصة.	A sports club was opened for girls in campus at the beginning of 2018. It is only for female students. Yet, I couldn't continue for lack of enough time. Opening-hours in the club are very short, from 8 a.m. – 4 p.m., which coincide with the work hours at college, (8 a.m. – 5 p.m.). I like to practise sports at other times outside these hours, for example before going to college or after 6 p. m. Besides, it	P16

		is not newly equipped or developed like the rest of private clubs.	
External locus of control (social norms, cultural beliefs and family lifestyle).	نعم يوجد تناقض احيانا. فمثلاً بعض الطلاب مبتعدين عن المشروبات الغازية والبعض الآخر لا يستطيع تناول الوجبات بدونها على الرغم من أنهم يعلمون بأضرارها، وأيضاً نفس الشئ بالنسبة للشيشة حيث يعتقد بعض الأشخاص أنها أقل ضرراً من تدخين السجائر...... اعتقد ان المجتمع يلعب دوراً يجعلنا غير قادرين على تطبيق ما ندرسه من سلوكيات صحيه في حياتنا اليومية مثلاً أحياناً يضطر الشخص لتناول المشروبات الغازية او الأطعمة غير الصحية بالعزائم ولا يستطيع الرفض....إلا إذا كان الشخص قوي العزيمة ويستطيع أن يسيطر على رغبته ويفرض رايه ...... أعتقد أنه إذا توفرت الخيارات الصحية سيتجه لها الجميع بدون احراج....	Yes, there are contradictions sometimes. For example, some students don't drink soft drinks, others cannot have their meals without them, though they know their harm. The same applies to (hookah) (narghile) as some believe it is less harmful than smoking cigarettes. I believe that society plays a role that makes us unable to apply what we study of healthy behaviours to our daily life. For example, sometimes one is obliged to have soft drinks or unhealthy food when invited to a feast (banquet) and cannot refuse, unless the person has a firm will and can control his desire and impose his opinion. I think if healthy choices are available, everyone will go for them with no embarrassment.	P8
Cognitive dissonance.	لا اعلم بصراحه لماذا لم ينعكس معلوماتنا على سلوكنا .... فنحن تعلمنا امراض جدا خطيره ومعديه ولم يتغير سلوكنا للجانب	Frankly, I don't know why our knowledge is not reflected in our behaviour! We have learned	P14

	الصحي...... فالاعتقاد ان إضافة معلومات مثل عدد السعرات الحرارية من الممكن ان يغير سلوكياتنا للافضل.....بالإضافة ان بعض الأشخاص يأكل كثيرا ولا يزيد وزنه فعذا الشيء يجعل الكثير يؤمن ان السمنة لا تعتمد فقط على الاكل .... الوراثة عامل مؤثر....	about very dangerous and infectious diseases, yet we didn't change our behaviour for a healthy one. We think that knowing information, such as the number of calories, could change our behaviours for the better, in addition to the notion that some people eat a lot but don't gain weight. All such information makes many of us believe that obesity does not depend on eating alone. Heredity is an influencing factor.	
Low Self-motivation and lack of incentive.	بالنسبة للسلوكيات حاولت ممارسة الرياضة واتباع نظام غذائي صحي ولكني لم أستمر ......أعتقد إذا ولم أجد الحافز وأشعر بالملل مارست الرياضة مع مجموعة من الأصدقاء سيكون هناك حافز للاستمرار	as for behaviours, I tried to practise sports and follow a healthy diet, but I didn't continue and had no incentive to go on and I feel bored. I think if I practised sports with a group of friends, there would be an incentive to go on.	**P11**

Appendix 11: Coding book and category definitions report of interviews

Lack of resources supporting healthy lifestyle.

Code definition:

Insufficient or absence of healthy meals or snacks that are ready for eating in QU campus or Qassim city. Also limited or absence of physical exercise clubs in QU campus or Qassim city.

Affordability and accessibility to healthy promotion services.

Affordability definition:

In this research affordability is defined as the ability of student to buy healthy meals or snacks and/or paying a membership fee in fitness clubs.

Accessibility definition:

In this research accessibility was defined as the quality of health promotion services (in food store/cafeteria and/or fitness clubs in QU) being able to be reached or entered for medical students. N.B. transportation and policy regulations were included as a barrier for accessibility to health promotion services.

Cognitive dissonance

In the field of psychology, cognitive dissonance is the mental discomfort (psychological stress) experienced by a person who simultaneously holds two or more contradictory beliefs, ideas, or values. This discomfort is triggered by a situation in which a person’s belief clashes with new evidence perceived by that person. When confronted with facts that contradict personal beliefs, ideals, and values, people will find a way to resolve the contradiction in order to reduce their discomfort.

Cognitive dissonance Code definition: in this study, any explanation a medical student gives as an excuse for not following healthy lifestyle to prevent diabetes with their belief in similar ordinary individual to it; in other words they believe that they are immune from T2D and at the same time they believe in the severity of T2D and that a sedentary lifestyle is risk factor for T2D (Van Ryn & Saha, 2011)

Self-motivation and incentive

Self-motivation is the ability to do what needs to be done, without influence from other people or situations. People with self-motivation can find a reason and strength to complete a task, even when challenging, without giving up or needing another to encourage them.

Low Self-motivation and lack of incentive code definition:

In this study any explanation given by medical students to justify their unhealthy habits like the lack of incentive or low enthusiasm and/or low self-motivation.

Elitism definition

The belief that certain persons or members of certain groups deserve favoured treatment by virtue of their superiority, as in intelligence, social standing, or wealth.

Code definition positive impact of elitism:

Any description of medical student's belief that he/she is different and special than any other ordinary person in community, and due to that feeling they are under the spotlight of attention which encourages them to be careful about their image i.e. their way of speaking about their own lifestyle, how they act daily, and how they look (healthy and fit). Studies that used this code: van Ryn et al. (2014).

Role-modelling definition

Role modelling is one of the most powerful means of transmitting values, attitudes and patterns of thoughts and behaviour to students (Bandura, 1986).

The hidden curriculum has been defined as a 'set of influences that function at the level of the organisation and culture (Passi et al., 2013)

The informal curriculum is defined as an 'unscripted, predominantly ad hoc, and highly interpersonal form of teaching that takes place among and between faculty and students. Studies used this complicated theme (Foster & Roberts, 2016; Passi et al., 2013)

"role-modelling doctor" code definition*:* in this study role model doctor is a description for doctor who is looking and living a healthy lifestyle and highlighting the importance that these behaviours influence patient to follow it.(Sandars, 2009)

Tutors impact code definition is adopted from Walton (1985) "Sociological research has demonstrated the extent to which an important component of learning derives from the example given in their own person by teachers, who significantly influence medical students in many respects, such as in their choice of future career, their professional attitudes, and the importance they assign to different subjects" ((Walton, 1985; p.50) through (Crosby, 2000). In other words, any explanation student emphasised how they were affected by the tutor's advice, look, value and behaviours.

The personality profiles of positive role model: the code included any attributes given by participants that distinguish tutors not only from the general public but also from other faculty members in medical school. Their willingness to cooperate, being trusted and keen to contribute to resolving students' problems and caring about them, their ability to control pressures, cope with stressful situations and being less anxious and more understandable (Passi et al., 2013).

Interpretation of professional obligation.

The Saudi Commission for Health Specialties SCFHS published a handbook for residents for professionalism and ethics in 2015. A lot of guides on physician duties toward their profession, patients and their families, and towards colleagues and community, were described in detail. “Treating patient as a person, not just a body” and “As far as possible, to be an ideal example in his attitude and religion” were extended in their interpretation and application implications. This code includes any expression given by the participant to explain their duty towards patients out of the boards of the SCFHS handbook.

Witnessing an experience of negative role model to patient.

This code involves all stories students had witnessed during their clinical training and/or internship when doctors were advising a patient to follow their recommendations while they (doctors) were obviously do not do so. These recommendations are quit smoking, lose bodyweight, and practice physical exercises.

Customise the patient needs for a role model doctor according to patient characteristics.

This code defines the perceptions of some participants who had linked the importance of being an example or a role model – of living a healthy lifestyle – to the patient's characteristics; being old, teenager and/or uneducated (Begum, 2014).

A responsible physician is one who is competent and who properly fulfils accepted or recognised commitments attached to that role. As a result, the practitioner is held to account for enhancing health, causing harm, or failing to prevent harm. Role responsibility has a moral connotation as well. In following the Aristotelian notion of a virtuous person, a responsible person is required to recognise and do what is appropriate according to accepted moral norms. The idea of role responsibility is central to the moral fabric of medicine. (Dharamsi, Ho, Spadafora, & Woollard, 2011).

Develop formal health promotion system in medical school. (Not-existing)

This code involves participants claiming for psychological support provided through medical school personnel (faculty members, academic supervisors, social workers and administration leaders like vice deans). This kind of logistical support aims to help medical school students to control stress, time managing, practice physical exercise, maintain a healthy diet and social relationships with colleague and community. This intervention is not existing according to the participants, but they ask for it in different ways.

Contextualise student’s knowledge and belief through PBL curriculum - realistic cases.

Code definition: In Problem-Based Learning PBL using cases is to allow students to work with real medical problems written with a clinical perspective. The patients in the cases have unique characteristics that not only provide depth to the case but allow students to contextualise their knowledge (understanding) and beliefs (susceptibility and severity) about how various factors affect the diabetic patients. During interviews participants highlighted some of the characteristic of cases that had significantly influenced their knowledge and beliefs. These cases were more representative of the student population and/or written by an attractive scenario.

Start clinical training years in the first year. Expectation vs reality-

Although most of participants were having a positive family history of T2D and they had three years of studying medicine, they didn't realise how T2D is a severe, complicated and an underestimated disease, until thy started the clinical years. For example, they were shocked when they saw that almost all the hemodialysis patents were diabetic. Participants had emphasised a lot of changing perceptions after starting the clinical years (Sharif, 2015).

Social accountability

A socially accountable medical school is committed to conduct education, research, and service programs addressing the determinants of health, i.e. political, cultural, social, economic, environmental.

In these transcripts, any context that describes the needs for considering community norm, culture, problems and meeting their specific needs is a call for social accountability (Boelen et al., 2016; Ventres, Boelen, & Haq, 2018).

Academic achievement

The academic achievement or performance is the extent to which the student has achieved his/her short- or long-term educational goals, the cumulative GPA or completion of educational benchmarks are examples that represent the academic achievement.

The Health Promotion Lifestyle

The health promotion lifestyle is defined by Walker as follows: "a multi-dimensional pattern of perceptions and activities which are started by self-motivation and help in the persistence and promotion of their health and self-improvement" (Walker, Sechrist, & Pender, 1987).

Academic achievement vs health promotion

In these transcripts any context, shows that student is traying to compare or prioritise between his/her academic achievement in medical school and practising health lifestyle activities, will be coded as academic achievement vs health promotion.

Medical Education Is A Social Experience.

In these transcripts any context shows how students reflect their knowledge on social life, i.e. caring, susceptibility to disease and/or family history of certain health problem, will be linked to this code.

Appendix 12: Ethical Approvals for the first phase of the research

SUMS

Ethical Approval

Ethics Committee Use Only

Principal Investigator	**Reem Almutairi**
Title of Proposed Research	The Influence of Medical Education on Knowledge, Beliefs and Health Promoting Behaviours Regarding Diabetes Mellitus Among Medical Students in South Wales and Saudi Arabia.

Application approved	**Yes**	x	**No**		**Pending**	
Conflict of interest	**Yes**		**No**	x		
If yes, please supply details						
Confirmatory email required from applicants Line Manager	**Yes**	x	**No**			
Date	09.10.17					
Name	Ana Da Silva					
Signature	p.p [redacted]					
Position (please state if a member or Chair of ethics committee and name of committee)	Member					

This application has been granted ethical approval in its current form.

Please use **reference number 2017-0030** on any correspondence with the Swansea Medical School Research Ethics Sub-Committee.

Time limit for applicant to respond	Two months from receipt of email from ethics panel

المملكة العربية السعودية
وزارة التعليم
جامعة القصيم
كلية الطب
مكتب العميد
(٠٤٠)

Kingdom of Saudi Arabia
Ministry of Education
Qassim University
College of Medicine
Dean Office

الرقم: ٩٤٠ التاريخ: ٢ / ٣ / ١٤٣٩هـ

المرفقات: الموضوع:

سعادة الدكتور / وكيل الجامعة للدراسات العليا والبحث العلمي حفظه الله

السلام عليكم ورحمة الله وبركاته وبعد ...

إشارة إلى إحالة سعادتكم على الطلب المقدم من الباحثة / ريم المطيري ، لتطبيق بحثها في الكليات الصحية بالقصيم .

نفيد سعادتكم بالموافقة و للتنسيق التواصل مع سعادة وكيل الكلية للشؤون التعليمية الدكتور / حميدان بن تركي الحميدان ، إيميل (dr.homaidan@qumed.edu.sa) تحويلة (٢٨٤٠) .

وتقبلوا خالص تحياتي وتقديري ......

عميد كلية الطب

[redacted]

د / أحمد بن صالح العمرو

Ethical Approval for The Second Phase of The Research

Ethical Approval

Ethics Committee Use Only

Principal Investigator	Reem Almutairi
Title of Proposed Research	The Influence of Medical Education on Knowledge, Beliefs and Health Promoting Behaviours Regarding Diabetes Mellitus Among Medical Students in South Wales and Saudi Arabia.
RESC Project reference number	**2017-0030A**

Application approved	**Yes**	X	**No**		**Pending**	
Conflict of interest	**Yes**		**No**	X		
If yes, please supply details						
Chair of SUMS RESC	Deya Gonzalez Associate Professor of Molecular Medicine CNH, [redacted] Swansea University Medical School Singleton Park, Swansea, SA2 8PP, UK. Email [redacted] Tel [redacted]					
Date 10.04.18	Signature [redacted]					

This application **has been granted ethical approval** in its current form.

Please ensure that you quote project reference number **2017-0030A** in any correspondence with the SUMS RESC

Time limit for applicant to respond	(two months from receipt of email from ethics panel)