Diabetes knowledge for patient self-management support and education: A concurrent mixed methods study of diabetes knowledge of nurses working in a major tertiary hospital in Saudi Arabia

By

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Declaration of original authorship

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Dedication

In the name of Allah the merciful, and prayer and peace upon the best of his creatures.

I dedicate this thesis to my family whose continuous support has been my mainstay throughout the entire process. I still remember all their words of encouragement that have always helped me through any difficulties.

I dedicate this work also to all my lovely family members, who have supported me throughout my PhD studies, with all my love and appreciation.

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greatly.

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Abstract

Introduction: Diabetes Mellitus poses a growing burden globally and Saudi Arabia is no exception. Optimal health outcomes require those affected to be well-informed about the disease and its treatment to enable them to make appropriate lifestyle choices, and to adopt effective self-management strategies. Registered Nurses are at the front line of patient education and have the opportunity to determine and deliver strategies for optimal diabetes care.

Aim: The aim of this study was to examine nurses' knowledge of diabetes care and its management, and to identify barriers and facilitators influencing diabetes knowledge acquisition among nurses working in a tertiary hospital in Saudi Arabia.

Methods: A concurrent mixed method design was used in this study. The study was comprised of two phases.

During Phase One, a cross-sectional survey was distributed to 700 nurses in a range of specialties in the Prince Sultan Medical Military City (PSMMC) in Riyadh, Saudi Arabia, with a response rate of 60.4%. Perceived and actual knowledge was assessed using the Diabetes Self-Report Tool and the Diabetes Basic Knowledge Tool.

In Phase Two, semi-structured interviews were conducted with 16 nurses from various specialties in the PSMMC. After data from the two phases were analysed individually to answer research questions specific to each phase, the results were integrated and considered in relation to Kanter's Theory of Structural Empowerment.

Results: Survey results suggested that Registered Nurses in the Prince Sultan Medical Military City perceived themselves as possessing adequate knowledge to provide diabetes care and education but knowledge test scores revealed insufficiencies. In-depth

semi-structured interviews with nurses shed light on the organisational and individual barriers perceived to hinder acquisition of diabetes knowledge by these nurses. These barriers included organisational characteristics of wards and multi-disciplinary team function that served to disempower nurses in their diabetes education role. Individual-level barriers included lack of access to diabetes education and clinical experience, lack of motivation or interest. Findings highlight how nurses' individual characteristics interacted with those of their environment in influencing the knowledge and skills they could apply in delivery of their roles.

Conclusion: Registered Nurses have the potential to influence the lives of many patients with diabetes. With the alarming growth in numbers of people with diabetes, nurses need to be empowered to engage patients in effective self-management. Thesis findings support development of policies and interventions to advance the diabetes knowledge and practice of frontline nurses, and strategies to empower them to apply this knowledge to promote better outcomes for people living with diabetes.

Keywords

1. Diabetes Mellitus
2. Knowledge
3. Nursing
4. Education
5. Training
6. Registered Nurse
7. Saudi Arabia
8. Prevalence
9. Incidence
10. Perceived knowledge
11. Actual knowledge
12. Barriers
13. Facilitators
14. Competency
15. Hyperglycaemia
16. Hypoglycaemia
17. Insulin
18. Perception
19. Awareness
20. Information
21. Type 1 Diabetes Mellitus
22. Type 2 Diabetes Mellitus
23. Understanding
24. Practice development

Overview of the Thesis

This thesis is presented in eight chapters. Some of these chapters are based on publications that are either in print or under consideration for publication in peer-reviewed journals.

Chapter One: This is the introduction chapter of this thesis. This chapter outlines the background, rationale and outcomes for this study along with the theoretical framework and the significance and research questions.

Chapter Two: This chapter presents an overview of peer-reviewed studies describing what is currently known of the incidence and prevalence rates of diabetes in Saudi Arabia. This chapter is based on a published paper: (Alotaibi, Gholizadeh, Perry, & Al-Ganmi, 2017b).

Chapter Three: This chapter presents a review of peer-reviewed studies examining nurses' knowledge in relation to diabetes care and its management in different healthcare settings worldwide. This chapter is based on a published paper: (Alotaibi, Al-Ganmi, Gholizadeh, & Perry, 2016).

Chapter Four: This chapter presents the research questions, design and methods of this mixed methods study: quantitative and qualitative phases along with data integration, management and ethical considerations.

Chapter Five: This chapter presents survey results on the perceived and actual diabetes knowledge reported by nurses working in Saudi Arabia. This chapter is based on a published paper: (Alotaibi, Gholizadeh, Perry, & Al-Ganmi, 2017a).

Chapter Six: This chapter presents the findings of the qualitative phase of this study. This chapter is based on a paper accepted for publication by the Journal of Clinical

Nursing; doi: 10.1111/jocn.14544. [Epub ahead of print]

Chapter Seven: This chapter presents the overall discussion of the main results of both phases (quantitative and qualitative) of this study and wraps up the findings of this thesis in relation to its strengths and limitations.

Chapter Eight: This chapter presents the conclusions of this study, sets out the implications of this work and makes recommendations for management, clinical practice and policy, and future research.

List of Abbreviations

ADA	American Diabetes Association
ADKnowl	Audit of Diabetes Knowledge
ANOVA	Analysis of Variance
BGM	Blood Glucose Monitoring
CASP	Critical Appraisal Skills Program
CCBG	Casual Capillary Blood Glucose
CFBG	Capillary Fasting Blood Glucose
DAS3	Diabetes Attitude Questionnaire
DBKT	Diabetes Basic Knowledge Tool
DFCKS	Diabetes Foot Care Knowledge Scale
DKSST	Diabetes Knowledge Survival Skill Tool
DM	Diabetes Mellitus
DMET	Diabetes Measurement Evaluation Tool
DMKA	Diabetes Management Knowledge Assessment
DSRT	Diabetes Self-Report Tool
ENT	Ear, Throat and Nose
ENs	Enrolled Nurses
FPG	Fasting Plasma Glucose
HbA1c	Glycosylated haemoglobin
ICU	Intensive Care Unit
KSA	Kingdom of Saudi Arabia
MOH	Ministry of Health
NADC	National Association of Diabetes Centres
OHAs	Oral Hypoglycaemia Agents
RN	Registered Nurse
SCFHS	The Saudi Commission for Health Specialties
T1DM	Type 1 Diabetes Mellitus
T2DM	Type 2 Diabetes Mellitus
UK	United Kingdom
USA	United States of America

Conference Papers and Publications Arising from the Thesis

Alotaibi A., Al-Ganmi, A., Gholizadeh, L., & Perry, L. (2016). Diabetes knowledge of nurses in different countries: An integrative review. *Nurse Education Today, 39*, 32–49. doi: 10.1016/j.nedt.2016.01.017.

Alotaibi A., Gholizadeh, L., Al-Ganmi, A., & Perry, L. (2017). Examining perceived and actual diabetes knowledge among nurses working in a tertiary hospital. *Applied Nursing Research, 35*, 24–29. doi:10.1016/j.apnr.2017.02.014.

Alotaibi A, Perry L, Gholizadeh L, Al-Ganmi A. (2017). Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview. *Journal of Epidemiology and Global Health*; 7(4):211–218.

Alotaibi A., Perry, L., Gholizadeh, L., & Al-Ganmi, A. (2016). Nurses' knowledge of diabetes in developed and developing countries, 16th *Clinical Nursing & Nurse Education Conference,* November 21–22, 2016 Melbourne, Australia, DOI: 10.4172/2167-1168.C1.03.

Alotaibi A, Perry L, Gholizadeh L, Al-Ganmi A. In press. Factors influencing nurses' knowledge acquisition of diabetes care and its management: a qualitative study. *Journal of Clinical Nursing.*, doi: 10.1111/jocn.14544. [Epub ahead of print].

Definition of Terms for this thesis

Diabetes Mellitus*:*

Diabetes mellitus is a group of metabolic disorders caused by insulin resistance and/or deficiency resulting in acute and/or chronic hyperglycaemia (American Diabetes Association, 2014)

Staff Nurse:

A registered nurse who works as part of the healthcare team to promote health, and to prevent and treat disease, who acts as a patient advocate, and who provides education regarding healthcare (American Nurses Association, 2016).

Diabetes Care:

All healthcare interventions carried out by nurses or other healthcare providers with the intention of maintaining and monitoring blood glucose within normal limits, reducing or preventing the complications of diabetes including pharmacological and non-pharmacological management methods (American Diabetes Association, 2014)

Diabetes Knowledge:

The understanding, awareness, familiarity and information required for healthcare providers to manage patients with diabetes to optimise blood glucose levels and reduce diabetes complications (Drass, Muir-Nash, Boykin, Turek, & Baker, 1989).

CHAPTER 1 Introduction

1.1 Chapter Introduction

Developed and developing countries are facing an increasing prevalence of type 2 diabetes. This disease poses a significant burden on patients and healthcare systems in terms of morbidity, mortality and healthcare costs (Blickem et al., 2013). As the natural history of diabetes and its associated complications predisposes patients with diabetes to require admissions to hospital, hospitalised patients often have diabetes as a co-morbid condition with other diagnoses (van Zyl & Rheeder, 2008). Although prevention of complications from diabetes occurs at the community level, effective management of diabetes requires that healthcare providers working in all healthcare settings obtain and maintain sufficient knowledge of the disease, its management, and of patients' needs. Knowledgeable health professionals delivering high quality diabetes care can reduce the risk of development of diabetes complications among the patients with diabetes. This is particularly important for nurses, as they are frontline care providers and interact frequently with patients with diabetes in various healthcare settings (van Zyl & Rheeder, 2008).

There is a general assumption that, as nurses care for patients with diabetes in all healthcare settings and diabetes is a common condition, they are knowledgeable about diabetes care and able to offer support and education to improve patients' self-management abilities and address related social and emotional issues (Burke, Sherr, & Lipman, 2014). However, studies evaluating nurses' diabetes management abilities have indicated significant gaps between nurses' attitudes, their perceived and actual knowledge of diabetes care (Gerard, Griffin, & Fitzpatrick, 2010; Nash, 2009; Yacoub et al., 2014). Knowledge discrepancies may detract from care of patients with diabetes

by decreasing efficiency in managing diabetes and its complications, with possible misunderstandings of diabetes treatment plans, medication errors and decreased quality of diabetes care (Sabaté, 2003).

1.2 Research Aim

The purpose of this study was to examine nurses' knowledge in relation to Diabetes Mellitus (DM) and its management in Saudi Arabia, and to identify factors that influence nurses' acquisition of DM knowledge.

1.3 Research Questions

This study aimed to answer the following main questions and sub-questions:

1. **What do nurses in Saudi Arabia know about diabetes assessment and management?**
   - **1.1.** What knowledge do nurses have in relation to diabetes pathology, its symptoms and management?
   - **1.2.** What knowledge do nurses have in relation to diabetes diet and nutrition?
   - **1.3.** What knowledge do nurses have in relation to diabetes foot care and complications?
   - **1.4.** What knowledge do nurses have in relation to blood glucose monitoring?
   - **1.5.** What knowledge do nurses have in relation to diabetes medications?
2. **What factors influence nurses' knowledge acquisition in relation to assessment and management of patients with diabetes in Saudi Arabia?**
   - **2.1.** What are the barriers that affect nurses' knowledge acquisition in relation to assessment and management of patients with diabetes?

2.2. What factors facilitate nurses' knowledge acquisition in relation to assessment and management of patients with diabetes?

1.4 The Theoretical Framework

Kanter's Theory of Structural Empowerment (Kanter, 1993) was used as the theoretical framework for this research study. This theory, developed in the US but widely applied within organisations internationally, relates to employees' attitudes and behaviours within an organisation (Nedd, 2006). Structural empowerment is defined as an organisation's power to offer access to information (refers to having the formal and informal knowledge), resources, (refers to one's ability to acquire the financial means, materials, time, and supplies required), support (involves receiving feedback and guidance from subordinates) and opportunity (refers to the possibility for growth and movement within the organization as well as the opportunity to increase knowledge and skills) in the work environment (Kanter, 1993; Orgambídez, Borrego-Alés, Vázquez-Aguado, & March-Amegual, 2017).

The choice of this theory emerged during the analysis of Phase Two data. These were qualitative data in which nurses discussed their working environment, particularly in relation to diabetes education and their diabetes knowledge. Kanter's (1993) theory was identified as relevant, appropriate and helpful as an explanatory framework to make sense of nurses' perceptions of their practice work environment. Furthermore, it focused primarily on the working conditions of nurses, which was relevant for this study of nurses as a workforce. In regard to workplace culture, empowerment of individual staff members is an important part of creating effective workplace cultures. The term 'culture' refers to the values, beliefs and practices shared across all groups within the organisation (Manley, Sanders, Cardiff, & Webster, 2011). The determination of the

values of groups in an organisation (e.g. lifelong learning, safety, teamwork and leadership development) contributes to changing nurses' attitudes and practices and to creating effective workplace cultures (Manley et al., 2011). This is important to enhance nurses' job satisfaction and the quality of care, and in terms of the experience and outcomes of patients with diabetes (Salmond & Echevarria, 2017).

Nurses may feel they have opportunities because, in an inpatient setting, they have many chances to increase their knowledge and improve their skills, and there are many avenues for career development available to them. However, nurses may not feel as though they have the power to make use of these opportunities (McHugh & Lake, 2010). Kanter defined power as the ability to access and use resources, information, and support (Kanter, 1993), and nurses may feel they lack this access or the ability to use available resources. In this situation, the nurses' perceptions of power and opportunity may determine their attitudes and practice in relation to diabetes patient care and education. Many nurses may be unaware of the resources available for patient education and care, and may feel uncertain about their level of knowledge and skills (Barber-Paker, 2002; Twinn & Lee, 1997).

Nurses also worry about time constraints, specifically when it comes to educating a patient, and that by spending time on patient education, they compromise the care of other patients (Garrett, 2008; Twinn & Lee, 1997). They may feel their educational skills are not adequate to help their patients and fear giving them incorrect information (Barber-Paker, 2002). Additionally, nurses can be unsure of the support of their supervisors and administrators since there are not always clear guidelines concerning nurses' role in diabetes care and education. They are aware that patient education is an integral part of nursing care but may be unclear about when and how to fulfil this role in everyday work (Friberg, Granum, & Bergh, 2012). Kanter's Theory of Structure

Empowerment may help understand some of the factors nurses report as influencing their knowledge acquisition for patient diabetes care and education, and this may contribute insight into the effectiveness of the ward workplace.

1.5 Saudi Arabia – Country Profile

This study was conducted in the Kingdom of Saudi Arabia, an Arab Islamic country that differs markedly in lifestyle, culture and religion from many other countries. Therefore, it is important to provide an overview of Saudi Arabia prior to addressing the research questions of this thesis. The following section will present a general overview of the history of Saudi Arabia, as well as its geography, demography, society and culture. A general description of the healthcare system will also be presented.

1.5.1 Saudi Arabia History, Geography, Society and Culture

The Arabian Peninsula has a long history and tradition. It is considered the source of Islam, and the centre of the holy lands of Islam are the cities of Makkah al Mukarrama and Al Madina Al Mnoura. The Prophet Mohammed (peace be upon him) founded Islam more than 1,400 years ago in Saudi Arabia and the holy Qu'ran (the holy book of Islam) is written in Arabic, the language that the Prophet Mohammed (peace be upon him) spoke. The Kingdom of Saudi Arabia (KSA) is the official name of the country (in Arabic, al-Mamlaka al-Arabiya as-Saudiya) and it is also called 'The Land of the Two Holy Mosques'. The KSA is one of the largest among the Gulf countries, occupying a total area of 2.24 million kilometres (Aldossary, While, & Barriball, 2008). Desert covers 95% of the country, with Alrub' Alkhali being the largest sand mass in the world (World Atlas, 2014). Its climate varies from region to region, depending on the location but is overall hot and dry. The main cities of Saudi Arabia, including the capital city of Riyadh, are shown in Figure 1.1 (World Population by Country, 2018).

The latest population figures show that in 2018 Saudi Arabia reached a population of 33.7 million, 70% of whom were Saudi nationals. With respect to composition, 90% of the native population are Arab and 10% are of a different descent. Overall, 78.4% of the population are urban-dwellers (26,304,988 people in 2018) (World Population by Country, 2018). The age distribution of the population reveals the median population value occurs within the 0-14 age group, which comprises 32.4% of the total population. Those aged 15-64 years comprise 64.8% of the total population (World Population by Country, 2018), with those aged 65 years and above comprising only 2.8% of the total population. For the total population, the mean sex ratio is 1.21 males per female (World Population by Country, 2018).

Figure 1.1: Saudi Arabian provinces and major cities (World Population by Country 2018).

The culture of Saudi Arabia states the principles and ethics of Islam and the Arab way of life. Therefore, Islam has a prominent role and influence over the lifestyle in Saudi Arabia (Ramady, 2010), including politics, economy, education, health and lifestyle. For instance, Saudi dietary and drinking habits, as Muslims, must follow the Halal dietary code, which necessitates that all beef, lamb, camel and birds are slaughtered in the Islamic way (Lawrence & Rozmus, 2001). In addition, Saudi people believe that illness and health all come from (Allah), like other Muslim people.

1.5.2 The Saudi Healthcare System

The KSA has one of the largest oil reserves in the world (Aldossary et al., 2008) and rapid socio-economic growth over the last few years has positively affected and significantly improved the healthcare system (Aldossary et al., 2008). Developing an efficient healthcare system has been a high priority for the Saudi Government (Almalki, Fitzgerald, & Clark, 2011a), resulting in considerable developments in health services nationwide.

The Ministry of Health (MOH) is mainly responsible for the healthcare system, with 60% of healthcare services being provided through this ministry, such as the primary and community healthcare centres, general and specialised hospitals (Al-sharqi, 2012; Aldossary et al., 2008). The remainder are managed by private organisations, but are bound to the national goal of monitoring and coordinating healthcare for the Saudi population and visiting Hajj pilgrims. According to the annual statistical book of the Ministry of Health for 2017, there are 45,895 nurses working in private hospitals around KSA, of which around 94% (n = 43,216) are non-Saudis (General Authority for Statistics, 2018). Other government agencies also have similar healthcare functions managed by other ministries; for example, the Prince Sultan Medical Military City (PSMMC) is managed by the Ministry of Defence, the National Guard Hospital by the

Ministry of National Guard, and King Faisal Specialist City (KFSC) by the Royal Court. These health agencies aim to provide healthcare for their own employees and their dependents and accept any emergency/critical cases under the MOH regulations to provide supportive medical services including primary and community care services (Albejaidi, 2010; Almalki et al., 2011a). The Saudi government has expended significant effort and resources to provide quality healthcare to the citizens of the KSA. Primary and community healthcare services have been established in both the MOH and government agencies, and are considered the gateway into healthcare services for the Saudi population (Al-Mazrou, Al-Shehri, & Rao, 1990; Almalki et al., 2011a). Around 420 public hospitals and over 2000 primary healthcare centres have been established to address population health concerns. Depicting the priority of the Saudi government, the Saudi healthcare system is ranked 26th among the world's best healthcare systems, above that of many developed countries such as the USA, the UK and Australia. As a result, the overall health status of the population has improved in recent years (Almalki et al., 2011a).

Nonetheless, there are still barriers to providing local people with optimum healthcare, predominantly due to lack of resources including shortages of staff, i.e. physicians and nurses, lack of health information systems and suboptimal utilisation of available electronic resources in the health sector. One of the challenges of the healthcare system is poor self-care of individuals, which adversely affects their health and wellbeing (Armstrong, Gillespie, Leeder, Rubin, & Russell, 2007). People tend to avoid regular health check-ups despite the availability of free services at the cost-free facilities. The government has recently focused on non-transmittable diseases, particularly diabetes, a disease that is among the most prevalent diseases in Saudi Arabia, affecting both men and women across all age groups and imposing a substantial economic burden on the

health care system (Sherif & Sumpio, 2015). This increasing burden of non-communicable diseases (NCDs) in the country is linked with the rapid changes seen in population lifestyles (Mokdad, 2016). There is a need to change the health-seeking behaviours of the population as it has been observed that people delay seeking care and only approach healthcare providers after they have developed the disease (El Bcheraoui et al., 2015). At times, healthcare providers do not provide sufficient and clear information regarding the health condition and complications for patients with diabetes. New strategies and policies are required to deal with these challenges faced by the MOH. Health promotion centres within the primary healthcare sector have been suggested, so that patients with chronic diseases, such as diabetes, can be guided in lifestyle modification and be supported to adhere to their treatment regimens while maintaining better self-care (Asiri, 2015). These centres can be made available for helping patients with diabetes to help them maintain healthy blood glucose levels and reduce the complications of diabetes. This should minimise the burden on the Saudi public health system through reductions in bed-occupancy of hospitals and numbers of visits to emergency departments which will, in turn, reduce the individual and economic burden of diabetes (Asiri, 2015). Managing the 'epidemic' of diabetes and the costs involved can only be effectively achieved at a population level and not just by individual health professionals; however, nurses can play a critical role in the management of the disease and reducing its complications.

1.5.3 The Contribution of the Nursing Profession

The nursing profession is a vital part of any healthcare system, playing an important role in the delivery of high-quality healthcare (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002). Nurses work in almost all healthcare settings: aged care, primary, secondary and tertiary care, community, and home care. Since 1992, many health

institutes in Saudi Arabia have offered a range of healthcare training programs for both males and females. Postgraduate education for nurses is offered by different institutions in the country both in Arabic and English languages. For example, hospitals in the country provide in-house training and seminars to their nurses based on the identified learning needs of their nurses. Also, several universities around the country offer a Masters degree in nursing.

The acute shortage of nurses, in both the government and private sectors, is a primary challenge for the MOH. To overcome this problem, the MOH has recruited foreign nurses from countries such as Australia, the United Kingdom, India, the Philippines, South Africa and the United States (Al-Homayan, Shamsudin, & Subramaniam, 2013). Currently, only 29.1 % of nurses working in the government sector are Saudi nationals; this falls to 4.1% in the private sector. The low number of Saudi nurses is due to numerous reasons, including sociocultural factors, lack of education opportunities and issues related to the work environment. Cultural aspects include that nursing is viewed as a female profession, and there is a generally negative image of nurses in society (Aboshaiqah, 2016). Expatriate nurses make up the biggest proportion of the nursing workforce in all Saudi healthcare systems, creating challenges in negotiating different cultures, religions, and languages (Almalki, FitzGerald, & Clark, 2011b). The majority of foreign nurses arrive with insufficient or incorrect knowledge of Saudi Arabia's culture, practice and religion, and are not able to speak the local language (Almalki et al., 2011a). Despite this diversity in the health workforce, health promotion and quality healthcare provision must be considered as an important role of all healthcare professionals, including nurses (Aldossary, Barriball, & While, 2012).

1.5.4 Diabetes Services and Education

More than 60% of healthcare facilities are government-provided and free to patients, and health education is regarded as an integral part of care for people with diabetes. Considering that type 2 diabetes is an insulin resistance disease characterized by obesity, elevated glucose level, hypertension, dyslipidaemia and lack of physical activity, management and education for these patients should focus on these areas. Patients with diabetes are given diet therapy, hypoglycaemic therapy, including insulin, along with health education, yet only about 79% of patients say they are offered and can adhere to this guidance (Dezii, Kawabata, & Tran, 2002). Lack of compliance with treatment and advice, negligence in following diet and physical activity recommendations all play a role in the low success rate in controlling Diabetes Mellitus (Al-Arfaj, 2010).

Living with diabetes requires access to accurate information and advice from healthcare providers or other reliable sources of information on the condition. Diabetes education is an ongoing process and is critical for effective diabetes management (Dunning & Ward, 2008). Diabetes education can be defined as ‘a planned learning experience using a combination of methods such as teaching, counselling, and behaviour modification techniques which influence a patient's knowledge and health behaviour' (Dunn, 1990, p. 282). The primary goal of diabetes education is to support patients to accept their diabetes condition, develop problem-solving skills, and improve their knowledge and skills in integrating self-care tasks into their lifestyles (Dunning & Ward, 2008; Funnell et al., 2011). Tracking the progress of diabetes, availability of treatment options, nutritional management and building physical activity into the patient's lifestyle, medication adherence and providing patients with support and advice on effective self-care are essential components of diabetes management programs. Patient education is

integral to diabetes management. Diabetes education is usually provided by a range of healthcare providers such as nurses, diabetes educators, physicians, dieticians and pharmacists (Funnell et al., 2011).

Though most nurses believe that diabetes education is significant, they often lack time and confidence in providing appropriate patient education to support patient self-care behaviours and patient adherence to treatment regimens (Jansink, Braspenning, van der Weijden, Elwyn, & Grol, 2010). In addition, several studies have indicated that patients and families are not always happy about nurses' knowledge in relation to diabetes care (Papaspurou et al., 2015; Vissarion, Malliarou, Theofilou, & Zyga, 2014). Without an adequate knowledge of diabetes, nurses, patients, and families face daily challenges in managing this chronic illness.

1.6 Nurses' Role in Diabetes Care and Education

Diabetes is a common chronic disease which currently affects 8.3% (371 million people) of the world's population (International Diabetes Federation, 2015), and the incidence and prevalence rates are rising globally (World Health Organisation, 2015). This metabolic disease is characterised by hyperglycaemia resulting from defects in insulin secretion, insulin action or both (American Diabetes Association, 2010a). Type 2 diabetes is characterized by obesity, hypertension, dyslipidaemia, and lack of physical activities. Diabetes is associated with a wide range of complications; it is the major cause of cardiovascular events, such as heart attacks and stroke, as well as chronic renal failure and blindness (Holt, 2010) and can result in non-traumatic lower extremity amputation (Al-Sarayra & Khalidi, 2012).

Appropriate care and management interventions have been shown to control the disease progression and reduce complications (World Health Organisation, 2015). General

management of all types of diabetes comprises multiple aspects of care such as medication, diet and nutrition, blood glucose monitoring, regular physical activity and screening for long-term complications (American Diabetes Association, 2015). Optimal diabetes care requires that both patients and healthcare providers, including nurses, have good understanding of diabetes care and its management. Nurses are considered the first line of healing, prevention and community health. Their major responsibilities include 'health promotion, disease prevention, providing care to patients, research, education and development of a healthy community' (Almalki, FitzGerald, & Clark, 2012).

To achieve high quality diabetes care it is important that nurses have an extensive understanding of all aspects of diabetes care and treatment to be able to support patients to effectively self-manage their condition (National Heart Foundation of Australia, 2011). Patient education needs to include details on diabetes diet, physical activity, cessation of smoking, management of hypertension and lipids through medication, and oral anti-hypoglycaemic medications and insulin therapy. Patients need to understand that diabetes is not a temporary condition; rather it is a chronic condition that, if not managed properly, can lead to various complications that adversely impact their overall quality of life and can prove fatal (Kent et al., 2013). Nurses are expected to take responsibility for educating patients (Bergh, Karlsson, Persson, & Friberg, 2012), but they often need to prioritise healthcare provision and acute care over health education and health promotion due to functional limitations and high workloads.

Research has shown that nurses can deliver health education efficiently and their counselling can significantly encourage and motivate their patients about diabetes self-management (Aldossary et al., 2012). A randomized controlled trial (RCT) to evaluate the effectiveness of a nurse-led 12-week diabetes self-management education program showed that patients who received the intervention had a significant improvement in

HbA1c, blood pressure, body weight, efficacy expectation, outcome expectation, and diabetes self-management behaviours (Azami et al., 2018). Another RCT conducted to evaluate the effectiveness of a nurse-led intervention using education, and acceptance and commitment therapy for people living with uncontrolled type 2 diabetes reported a significant reduction in HbA1c in the education intervention group (Whitehead et al., 2017). These two studies support the importance of educating patients with type 2 diabetes and the significant role of nurses in this process.

1.6.1 Nurses' Role in Diabetes Care and Education in the KSA

The Saudi healthcare system confronts various challenges in achieving the "gold standard" in nursing practice due to shortages of nursing staff, educational and socio-culture challenges, and lack of national or international benchmark databases (Alghamdi & Urden, 2016). Therefore, much effort, innovation and collaboration is required to up-skill nurses to meet standards of nursing diabetes practice to improve outcomes for patients with diabetes. Management of diabetes is complex and requires knowledge and skills on the part of both healthcare providers and clients. To encourage patients with diabetes to engage in healthy lifestyles, nurses need to develop and update their own knowledge of diabetes and effective behavioural strategies to effect change in patients' lifestyles (Hjelm, Mufunda, Nambozi, & Kemp, 2003). They need to have mastery of methods and strategies to obtain and apply up-to-date knowledge about diabetes to educate patients on management of blood glucose levels, nutrition, exercise and medications to minimise development and progression of the acute and chronic complications associated with poorly managed diabetes.

Numerous studies that have assessed nurses' knowledge of diabetes in the past have reported nurses' diabetes knowledge as suboptimal (Baxley, Brown, Pokorny, & Swanson, 1997; Drass et al., 1989; Gossain, Bowman, & Rovner, 1993; Jayne &

Rankin, 1993). Nurses' poor theoretical understanding of diabetes has been reported to negatively affect their practice, patient lifestyle behaviour modifications and outcomes (Aljoudi & Taha, 2009). Healthcare professionals' ineffective and insufficient knowledge of the disease can compromise the quality of patient care and result in unsafe practice (O'Brien, Michaels, & Hardy, 2003). Direct associations have been found between nurses' knowledge of diabetes and patients' involvement in diabetes related self-care behaviours (Kassahun, Gesesew, Mwanri, & Eshetie, 2016). The other important factors such as nursing shortages, language barriers, access to education, and empowerment should also be taken in consideration by healthcare facilities to improve the nurses' capability to function effectively in their roles in diabetes care and education (Mosadeghrad, 2014).

1.6.2 Nursing Policy and Regulation

The Saudi Commission for Health Specialties (SCFHS) provides certification for all international and local healthcare professionals. Nurses with a Diploma, Bachelor's, Master's or doctorate degree in nursing can receive certification in the nursing profession by meeting all requirements set by the SCFHS. The SCFHS also accredits and supports training programs for health professionals in Saudi Arabia and supervises the evaluation of health organisations and health professionals (Saudi Commission for Health Specialities, 2013). The SCFHS provides licensing for members of health professions including nursing (Almalki et al., 2011a; Saudi Commission for Health Specialities, 2013; Tumulty, 2001).

Several advances in the nursing profession have been achieved by the establishment of the Scientific Nursing Board. For example, formerly, there was no formal registration of nurses, no written exams and no accreditation for their continuing education. Currently, all nurses in Saudi Arabia are registered with the Scientific Nursing Board and must

complete required hours of continuing education programmes to be able to renew their annual registration (Abu-Zinadah, 2005). However, there is a lack of such programmes in many rural and remote areas, and particularly in the field of primary healthcare (PHC) nursing. The Scientific Nursing Board is operating under the authority of the SCFHS, which defines its scope, role and influence. In terms of certificate accreditation, the Saudi Commission for Health Specialities (2013) has determined that nurses who graduate from health institutes and junior colleges and hold diplomas are classified as technical nurses and senior technical nurses, respectively. Nurses with a Bachelor of Nursing degree are classified as specialists, while nurses with Master of Nursing Science and PhD degrees are classified as senior specialists. Nurses with PhD degrees and 3 years of clinical nursing experience are recognised as Nursing Consultants. There is, therefore, an established educational route for career advancement alongside a process designed to ensure a minimum level of up-dating for all nurses.

Although efforts are being made to advance the nursing profession in the country, it continues to face challenges that hinder the practice of advanced nursing practice. Currently, Saudi nurses who wish to develop their careers in Advanced Practice Nursing (APN) depend on international scholarships sponsored by government organizations. However, there is little information available on Saudi nurses who studied APN abroad regarding their career progression once they return to Saudi Arabia. One of the main reasons for the difficulty in career progression among Saudi APN graduates when they go back to the country is the absence of a standardized formal clinical career ladder along with titles and job descriptions reflecting the roles and scope of practice in the country. This causes confusion in the demarcation of roles between an RN and an APN. Furthermore, SCFHS designates nursing in line with level of education only. These designations, however, are currently not aligned with job description titles, experience,

roles or scopes of practice. This situation hampers the differentiation of clinical ladders, and deters senior nurses from staying in clinical practice, making it difficult to meet the nation's growing healthcare needs. This is also blamed for the insufficient number of nurses qualified to care for patients with chronic conditions in specialty areas; these nurses are hampered in development of nurse-led clinics by a lack of autonomy to assess, diagnose and prescribe (Hibbert et al., 2017).

1.7 The Significance of the Study

There has been an alarming increase in the incidence rate of diabetes over the last couple of decades, particularly in developing countries, mainly due to urbanisation and adoption of sedentary life styles (International Diabetes Federation, 2014). The incidence and prevalence rates of diabetes are particularly high in Saudi Arabia. According to the recent data from the Saudi Health Information Survey, 1,851,080 residents had diabetes in the country representing a prevalence rate of 13.2%. Of the total number, 1,077,000 were males (prevalence rate = 14.8%), and 774,080 were females (prevalence rate = 11.7%; Ministry of Health, 2014). The global economic burden of diabetes care was estimated to be $4.2 billion US in 2015, including the cost of pharmacological and other interventions such as education programs (Al-Nozha et al., 2007).

Since 1993, a number of studies relating to diabetes knowledge have been conducted to determine general nursing knowledge of diabetes care and management in various countries. The overall conclusion of these studies is that knowledge deficits exist in some aspects of diabetes care among nurses in the USA, UK and Jordan (Baxley et al., 1997; Jayne & Rankin, 1993; O'Brien et al., 2003; Yacoub et al., 2014). However, adequate knowledge is only a reasonable expectation where nurses are able to access

sufficient and comprehensive training programs in diabetes care. Assessing nurses' current level of knowledge and skills is a necessary prerequisite to development of such programs, which should then enable nurses to participate in delivering effective self-care programs that will ultimately enhance the quality of life of patients with diabetes.

The current study aims to contribute to developing in-depth understanding of nurses' knowledge of diabetes care in a Middle Eastern context. It fills a gap in the literature by examining the levels of nurses' diabetes knowledge of assessment and management of patients with diabetes in Middle East countries, specifically in Saudi Arabia. Additionally, it is imperative to explore what influences nurses' knowledge acquisition in assessing and managing patients with diabetes. The data gained from this study can be used to guide and improve the quality of nursing healthcare and diabetes management in multicultural healthcare settings, in Saudi Arabia and similar neighbouring Arab nations, and across the globe. The study may also provide insights into the continuous professional education needs of nurses and curriculum improvements for both undergraduate and postgraduate nursing programs.

1.8 Summary

The chapter began with an introduction to the research project and then provided the aim and the objectives of the thesis along with the theoretical framework. It provided background to the study with an outline of the Saudi Arabian healthcare system, brief descriptions of overall diabetes care and education, the nursing profession and policy and the nurses' role in diabetes care and education. The significance of the study in terms of its contribution to nursing knowledge was also justified. The following chapter provides an overview of the incidence and prevalence rates of diabetes in Saudi Arabia, highlighting the burden of diabetes in this country.

CHAPTER 2 Incidence and prevalence rates of diabetes in Saudi Arabia

2.1 Chapter Introduction

This chapter provides review of the literature on the incidence and prevalence rates of diabetes in Saudi Arabia based on the following publication.

Alotaibi A., Perry, L., Gholizadeh, L., & Al-Ganmi, A. (2017b). Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview. *Journal of Epidemiology and Global Health,* 7(4), 211–218.

This paper aimed to report the trends in incidence and prevalence rates of diabetes mellitus in Saudi Arabia between 1990 and 2015. It sought to collect, review and synthesize the current body of scholarly knowledge on incidence and prevalence rates of diabetes (types I and 2) in Saudi Arabia. This paper is published in the Journal of Epidemiology and Global Health. The published format of this article is provided in (Appendix A). This journal is operated by the Saudi Health Ministry and has an Impact Factor of 1.0. The journal's local focus gives authors the opportunity to convey their work to local healthcare professionals and health policy makers.

2.2 Introduction

Type 2 diabetes is a growing global health concern. In 2000, diabetes affected an estimated 171 million people worldwide; by 2011 this had increased to more than 366 million and numbers are expected to exceed 552 million by 2030 (International Diabetes Federation, 2015). The highest prevalence of diabetes overall is anticipated to occur in the Middle East and North Africa due to rapid economic development, urbanisation and changes in lifestyle patterns in the region (International Diabetes

Federation, 2015). According to the International Diabetes Federation (2013), the number of people with diabetes in the Middle East and North Africa region is projected to increase by 96.2% by 2035. The Kingdom of Saudi Arabia (KSA) is not excluded from this global epidemic (Alhowaish, 2013) and diabetes is the most challenging health problem facing this country (Tabish, 2007). The prevalence of diabetes in Saudi Arabia has been estimated at 13% in 2013 (Ministry of Health, 2014) and 18% in 2017 (International Diabetes Federation, 2017) in the adult population, but this varies depending on the population sampled, age, gender, and region. For example, the prevalence of diabetes was higher among males (14.8%) compared to females (11.7%). The prevalence in 2013 also varied between regions in the country, with the highest prevalence in the Hail region and lowest in the Jazan region (Ministry of Health, 2014).

This increasing burden of diabetes is due to various factors, including a rising obesity rate and an aging population (Kearns, Dee, Fitzgerald, Doherty, & Perry, 2014). Diabetes Mellitus (DM) is a group of diseases in which there is disturbance in metabolism and use of glucose that is secondary to a malfunction of the beta cells of the pancreas (DeWit, Stromberg, & Dallred, 2017). The three commonest types of diabetes are Type 1 Diabetes Mellitus (T1DM), Type 2 Diabetes Mellitus (T2DM) and Gestational Diabetes Mellitus (GDM) (International Diabetes Federation, 2014). T1DM is an autoimmune condition in which the body's immune system destroys insulin-producing beta cells. T1DM usually develops early in life and there is currently no known way to prevent it. Patients with T1DM require exogenous insulin to maintain life since their body can only produce small amounts or no endogenous insulin at all (DeWit, Stromberg, & Dallred, 2016). T2DM is thought to be caused by environmental-genetic interactions, which result in insulin resistance and, later on, decreased insulin secretion by beta cells. Obesity is present in 60% to 80% of patients with T2DM and

believed to be a major contributor to insulin resistance. Other major risk factors of T2DM are age, hypertension, physical inactivity, and family history (DeWit et al., 2016).

Patients with diabetes commonly experience other associated chronic conditions, resulting in serious complications (International Diabetes Federation, 2014). For example, the incidence of end stage renal disease is higher among patients with diabetes (Narres et al., 2016) accounting for between 24% and 51% of those receiving renal replacement therapy (Bell et al., 2015). Compared to the general population, patients with diabetes are two to four times more likely to develop cardiovascular disease, and two to five times more likely to die from this disease (Roper, Bilous, Kelly, Unwin, & Connolly, 2002).

In addition to its impact on individuals, diabetes places a significant burden on healthcare services and the community as a whole (Zimmet, Alberti, & Shaw, 2001). Globally, diabetes accounted for 11% of the total healthcare expenditure in 2011; in Saudi Arabia, the annual cost of diabetes has been estimated at more than $870 million (Naeem, 2015). It is essential to understand the epidemiology of diabetes in order to identify public health priorities, to generate policy initiatives and evaluate the effect of services in reducing the individual and social burden of diabetes (Tracey et al., 2016). Although prevalence estimates by countries and regions are provided by the International Diabetes Federation, there are substantial variations in time trends as these estimates are based on imputation (Tamayo et al., 2014). Incidence rates of T1DM differ geographically, with T1DM highest in the European region followed by South-East Asia, and North America and the Caribbean (Guariguata, 2011). To date, no systematic review has reported on the incidence and prevalence of diabetes in Saudi Arabia. Considering the major socio-economic changes that have occurred in this

country during the past few decades, and their marked impact on the lifestyles, eating habits and physical activities of the people of this region, along with the aging of the population, this is an important omission to address (Naeem, 2015). This review is the first to address the incidence and prevalence rates of diabetes mellitus in Saudi Arabia, using data published between 1990 and 2015.

2.3 Methods

2.3.1 Study Design

This review employed a descriptive design to review and analyse studies reporting on the incidence and prevalence rates of diabetes in Saudi Arabia. This approach is also referred to as correlational or observational design and is commonly used to obtain information about naturally occurring health states (Joanna Briggs Institute, 2014). This descriptive study followed the Joanna Briggs Institute (JBI) (2014) protocol for the review of prevalence and incidence studies, including search strategy, quality appraisal, data extraction and synthesis, presentation of results, discussion and conclusion.

2.3.2 Search Strategies

A systematic literature search was performed to identify publications reporting the incidence and prevalence rates of diabetes in Saudi Arabia. Included publications focused specifically on studies describing the incidence and prevalence rates in relation to either a diagnosis of diabetes, or explicit blood glucose-level criteria for diagnosis of diabetes. Studies considering type 1 or type 2 diabetes, or both, were included as these account for over 90% of all diabetes cases (American Diabetes Association, 2010b). Medical Subject Heading terms (MeSH) were used, including prevalence, incidence, diabetes mellitus, and Saudi Arabia. Synonyms for the identified search terms were generated including, ‘epidemiology’ and ‘trend’; ‘type 1 diabetes’ and ‘type 2 diabetes’.

These search terms were combined using Boolean Operators (AND, OR). Four academic databases (Medline, EBSCO, PubMed and Scopus) were searched for relevant literature. The search was limited to English language papers published between 1990 and 2015. Papers published in languages other than English, and publication types other than primary studies (such as systematic reviews and meta-analyses, discussion papers, conference abstracts and dissertations) were excluded (see summary in Table 2.1). In total, 106 citations of potential relevance were identified (Figure 2.1). Initial screening of titles and abstracts revealed that 90% of these retrieved studies did not meet the review inclusion criteria, with 16 papers retained for full-text evaluation. Full text screening for relevance resulted in the exclusion of a further five papers. Two articles were added from the reference lists of the reviewed articles and Google Scholar.

Table 2.1: Search terms, database and search output

Search No	Search Terms	Medline results	EBSCO results	PubMed results	Scopus results	Total
S 1	Prevalence or epidemiology or trend	579,280	1,061,711	2,656,747	2,749,216	7,046,954
S 2	Incidence	229851	249,619	2,355,894	1,014,650	3,850,014
S 3	Diabetes mellitus	495,873	258,094	564,756	699,008	2,017,731
S 4	Saudi Arabia	9627	59,039	44,900	34,024	147,590
S 5	S1 and S2 and S3 and S4 with limits: date (1990–2015), Peer Reviewed, Human, Journal Article and English Language)	12	15	61	18	106

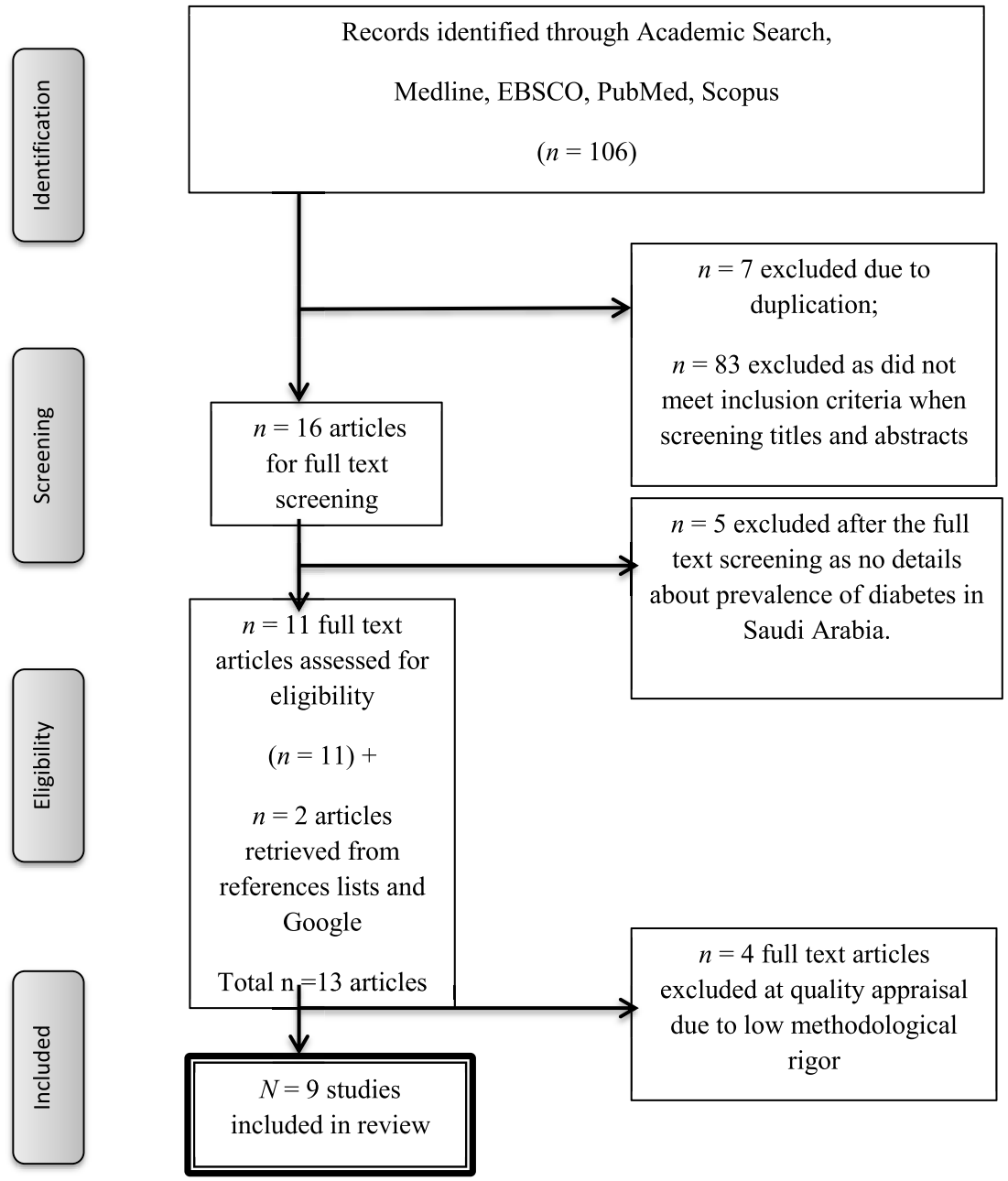


Figure 2.1: Flowchart of study selection

2.3.3 Methodological Quality

These 13 articles were critically appraised for quality using the JBI Critical Appraisal Checklist for studies reporting on prevalence data (Joanna Briggs Institute, 2014). All papers were evaluated on the basis of data relevance and methodological rigor, and

papers that met a minimum of five of the nine criteria (see column headings, Tables 2.2 and 2.3) were included. The process resulted in the exclusion of four papers (Table 2.2; Figure 2.1). The remaining nine studies employed appropriate quantitative designs for incidence and prevalence studies (Table 2.3).

2.3.4 Data extraction

Data were extracted using a specifically designed data extraction table (Table 2.4), and examined, compared, discussed and agreed by all authors. Data were analysed descriptively, comparing and contrasting results across studies, taking into consideration the differences in date of study, sampling technique and sample size, age, setting, methods and type of diabetes.

2.3.5 Data synthesis

Multiple sources of heterogeneity (research region and site, types of diabetes and age groups) were observed across the included studies. The heterogeneity was explored qualitatively by comparing the characteristics of the included studies. Studies were grouped according to the type of diabetes (Table 2.5).

Table 2.2: JBI* critical appraisal checklist applied for excluded studies reporting incidence and prevalence data (n=4)

Author Name/Year	Sample was representative?	Participants appropriately recruited?	Sample size was adequate?	Study subjects and the setting described?	Data analysis conducted	Objective, standard criteria, reliably used?	Appropriate statistical analysis used	Confounding factors/ sub-groups/ differences identified and accounted?	Sub-populations identified using objective criteria
Abou-Gamel et al. (2014)	No	No	No	Unclear	Yes	Yes	Unclear	Unclear	Unclear
(Al-Orf, 2012)	No	Unclear	No	Unclear	Yes	Yes	Yes	No	Unclear
(Alsenany & Al Saif, 2015)	Yes	No	No	Unclear	Yes	Unclear	Unclear	Unclear	Yes
(Karim, Ogbeide, Siddiqui, & Al-Khalifa, 2000)	Yes	No	Yes	No	No	Unclear	Unclear	Unclear	Unclear

*JBI: Joanna Briggs Institute

Table 2.3: JBI* critical appraisal checklist applied for included studies reporting incidence and prevalence data (n=9)

Author Name/Year	Sample was representative?	Participants appropriately recruited?	Sample size was adequate?	Study subjects and the setting described?	Data analysis conducted	Objective, standard criteria, reliably used?	Appropriate statistical analysis used	Confounding factors/ sub-groups/ differences identified and accounted?	Sub-populations identified using objective criteria
Abduljabbar et al. (2010)	Yes	No	Yes	Yes	Yes	No	Yes	Unclear	No
Al-Baghli et al. (2010)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Al-Daghri et al. (2011)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Al-Herbish et al. (2008)	Yes	Yes	Yes	Yes	Yes	No	Unclear	Unclear	Unclear
Al-Nozah et al (2004)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear
Al-Qurashi et al. (2011)	Yes	No	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Al-Rubeaan et al. (2015)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Al-Rubeaan (2015)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Habeb et al. (2011)	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

*JBI: Joanna Briggs Institute

Table 2.4: Summary of included studies (n=9)

Reference	Date of study	Sample size	Age	Type of diabetes	Sampling technique	Setting (urban / rural)	Method used	*Incidence* / prevalence per 100,000 or %		Overall per 100,000 or %
								Male	Female	
Abduljabbar et al. (2010)	1990–2007	438	<15 years	T1DM [a]	Not reported	Dhahran, Eastern KSA (urban) (urban)	Not mentioned	24.07	31.17	27.52 per 100,000 year
Al-Herbish et al. (2008)	2001–2007	45, 682	0–19 years	T1DM [a]	Multi-stage stratified random sampling	Nationwide (rural & urban)	Self-report	56.9	52.6	109.5 per 100,000 over 7 years
Habeb et al. (2011)	2004–2009	419	0–12 years	T1DM [a]	Not reported	Al-Madinah (urban)	Self-report	22.2	33.0	27.6 per 100,000 over 6 years
Al-Rubeaan (2015)	2007–2009	23,523	0– ≥ 18 years	T1DM [a] /T2DM [b]	Multistage stratified cluster sampling	Nationwide (urban & rural)	FPG[c]	44.32% (T1DM) 47.06% (T2DM)	55.68% (T1DM) 52.94% (T2DM)	10.84%
Al-Baghli et al. (2010)	2004–2005	197, 681	≥ 30 years	T2DM [b]	Convenience sampling (approached participants))	Eastern Province (urban & rural)	FPG [c] CFBG [d] CCBG [e] &	15.9%	18.6%	18.2%
Al-Daghri et al. (2011)	2011	9, 149	7–80 years	T2DM [b]	Cluster random sampling	Riyadh (Unknown)	FPG[c]	34.7%	28.6%	31.6%
Al-Nozha et al. (2004)	1995–2000	16, 917	30–70 years	T2DM [b]	2 stage, stratified cluster sampling	Nationwide (urban & rural)	FPG[c]	26.2%	21.5	23.7%
Alqurashi et al. (2011)	2009	6, 024	12–70 years	T2DM [b]	Convenience sampling (patients attending a primary care clinic)	Jeddah (King Fahad Armed Forces Hospital.)	Self-report	34.1%	27.6%	30.0%
Al-Rubeaan et al. (2015)	2007–2009	18, 034	≥ 30 years	T2DM [b]	Random sampling	Nationwide (urban & rural)	FPG[c]	29.1%	21.9%	25.4%

Note: [a] Type 1 Diabetes Mellitus, [b] Type 2 Diabetes Mellitus, ,[c] Fasting Plasma Glucose, [d] Capillary Fasting Blood Glucose, [e] Casual Capillary Blood Glucose.

Table 2.5: General characteristics of included studies (n=9)

Study	Region	Type of Diabetes	Age Group	Research Setting
Abduljabbar et al. (2010)	East	T1DM	Children/adolescent	Tertiary hospital
Al-Herbish et al. (2008)	Nationwide	T1DM	Children/adolescent	Nursing home & households
Habeb et al. (2011)	West	T1DM	Children/adolescent	Tertiary hospital
Al-Baghli et al. (2010)	East	T2DM	Adult	Tertiary hospital/ Primary healthcare center
Al-Rubeaan et al. (2015)	Nationwide	T2DM	Adult	Nursing home & households
Al-Daghri et al. (2011)	Central	T1DM & T2DM	Children/adolescent/Adult	Primary healthcare center
Al-Nozha et al. (2004)	Nationwide	T1DM & T2DM	Children/adolescent/Adult	Primary health care center
Alqurashi et al. (2011)	West	T1DM & T2DM	Children/adolescent/Adult	Tertiary hospital
Al-Rubeaan (2015)	Nationwide	T1DM & T2DM	Children/adolescent/Adult	Nursing home & households

2.4 Findings

Of the nine included studies, two examined incidence rates (Abduljabbar, Aljubeh, Amalraj, & Cherian, 2010; Habeb et al., 2011), four reported the prevalence rates of T1DM among children and adolescents (Al-Daghri et al., 2011; Al-Herbish, El-Mouzan, Al-Salloum, Al-Qurachi, & Al-Omar, 2008; Al-Rubeaan, 2015; Alqurashi, Aljabri, & Bokhari, 2011), while six studies reported the prevalence rate of T2DM among adults (Al-Baghli et al., 2010; Al-Daghri et al., 2011; Al-Nozha, Al-Maatouq, Al-Mazrou, & Al-Harthi, 2004; Al-Rubeaan, 2015; Alqurashi et al., 2011; AlRubeaan et al., 2015). These studies included only Saudi nationals, with sample sizes ranging from 419 to 45,682. The participants of these studies were recruited from different regions and healthcare settings in Saudi Arabia. The reported prevalence and incidence rates of diabetes varied widely across different geographical areas. Overall, the results of the

reviewed studies indicated rising incidence and prevalence rates of diabetes, particularly among females, older children/adolescents and in urban areas (Tables 2.4 and 2.5).

2.4.1 Type 1 Diabetes Mellitus (T1DM)

Two studies reported the incidence rates of T1DM between 1990 and 2009 in Dhahran, Eastern KSA (Abduljabbar et al., 2010) and in Al Madina, North West KSA (Habeb et al., 2011). The samples in these two studies were children and adolescents aged 0 to 14 years old. Data for these studies were obtained from paediatric centres using observational methods and were collected from inner city populations, so these results from urban centres could not be compared with rural populations or provide an accurate reflection of the incidence in all the provinces and regions of the KSA.

The cumulative incidence rates of T1DM among these children and adolescents were very similar, at 27.52 per 100,000 and 26.7 per 100,000, respectively (Table 2.4). The lowest incidence rate of 7.88 per 100,000 (in 1991) and the highest incidence rate of 52.93 per 100,000 (in 2007) were recorded in Dhahran. The TIDM incidence rate was lowest among children <5 years old (at 17.1 per 100,000) and highest among children 5 years and above (at 38.7 per 100,00) in Al-Madina. In the Dhahran study, an increasing trend in the incidence rates of T1DM in childhood and adolescence was observed between 1990 and 2007 (Figure 2.2). The incidence rates of T1DM doubled among children in less than two decades, from 18.05 per 100,000 children between 1990 and 1998 to 36.99 per 100,000 children between 1999 and 2007, indicating an average annual increase in incidence of 16.8% (Abduljabbar et al., 2010). In Al-Madina, no significant increase was observed in the overall annual incidence rate between 2004 and 2009 (Habeb et al., 2011); children aged 0 to 4 years had an estimated incidence rate of 17.1 per 100,000, while children aged 5 to 9 and 10 to 12 years had incidence rates of 30.9 and 46.5 per 100,000, respectively. Children aged 5 to 9, and 10 to 12 years had

1.8 and 2.7 times greater risk of developing T1DM than children aged 0 to 4 years (Habeb et al., 2011).

No nationwide study measuring the incidence rate of T1DM was conducted between 1990 to 2015 in Saudi Arabia. Unlike those reported by the International Diabetes Federation (Guariguata, 2011), the review revealed higher T1DM incidence among children <5 years old than older children. The higher rates of new cases among older children in Saudi Arabia may be due to the delayed or missed diagnosis because of subtle and misleading symptoms. Furthermore, the higher incidence of T1DM among girls compared to boys can be explained by the onset of puberty, which girls experience earlier than boys (Reinehr, 2013).

A nationwide study reported the prevalence of T1DM among children and adolescents aged up to 19 years at 109.5 per 100,000 between 2001 and 2007 (Al-Herbish et al., 2008). The prevalence rate was highest among adolescents aged 13 to 16 years (at 243 per 100,000) and lowest among children aged 5 to 6 years (100 per 100,000) (Al-Herbish et al., 2008). Another nationwide study found the prevalence of T1DM between ages 13–18 years (0.46%) to be higher than amongst those aged under 12 years (0.37%) between 2007 and 2009 (Al-Rubeaan, 2015). The highest number of cases of diabetes were observed in females who were living in urban areas with monthly income >8000 SAR (Al-Rubeaan, 2015).

Two studies conducted in Riyadh (Al-Daghri et al., 2011) and Jeddah (Alqurashi et al., 2011) found higher prevalence rates of diabetes at younger ages in female than male populations. The incidence of T1DM was significantly higher among females (at 31.17 per 100,000) than males (at 24.07 per 100,000) in Dhahran, KSA between 1990 and 2007 (Abduljabbar et al., 2010). In females the highest incidence rate was reported for

those aged 7–11 years and for males similar rates were reported for those aged 8–12 years (Abduljabbar et al., 2010). Females had significantly higher incidence rates than males (33.0 versus. 22.2 per 100,000 respectively) in Al-Madina between 2004 and 2009 (Habeb et al., 2011). Similarly, a nationwide study found that prevalence was higher among females than males between 2007 and 2009 (Al-Rubeaan, 2015). The highest prevalence rate (at 126 per 100,000) was recorded in the Central region where the capital city of Riyadh is located and the environment is mostly urban and the lowest prevalence rate (48 per 100,000) was reported in the Eastern region of KSA, which is predominantly rural (Al-Herbish et al., 2008). Between 2007 and 2009, the majority (77.2%) of T1DM cases was documented in urban rather than rural areas (22.7%) (Al-Rubeaan, 2015).

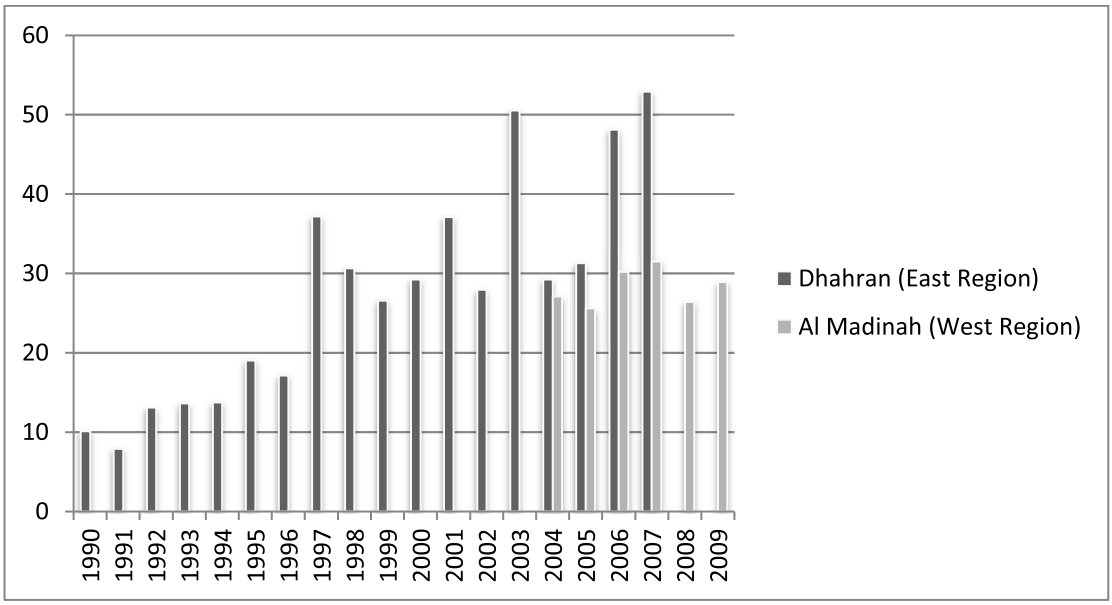
2.4.2 Type 2 Diabetes Mellitus (T2DM)

Prevalence rates of T2DM were reported in six studies, three of which were nationwide (Al-Nozha et al., 2004; Al-Rubeaan, 2015; AlRubeaan et al., 2015). Of the remainder, one study was conducted in Riyadh (Al-Daghri et al., 2011), one in Jeddah (Alqurashi et al., 2011) and one in the Eastern province (Al-Baghli et al., 2010). All these studies reported prevalence rates of T2DM in different years between 1995 and 2011 and included only Saudi nationals aged between 7 and 80 years (Table 2.4). The studies demonstrated varying prevalence rates in different geographical regions in the country, ranging from 18.2% in 2004–2005 in the study conducted in the Eastern province (Al-Baghli et al., 2010) to 31.6% in 2011 in the study conducted in Riyadh (Al-Daghri et al., 2011). Nationwide, the prevalence rate increased from 23.7% between 1995 and 2000 to 25.4% between 2007 and 2009 (Al-Nozha et al., 2004; AlRubeaan et al., 2015). When plotted figuratively, these six studies indicate a clear trend of overall increasing prevalence of T2DM with time (Figure 2.3).

Four studies reported significantly higher prevalence rates for T2DM in males than in females. One regional study from the Eastern province (Al-Baghli et al., 2010) and two nationwide studies, conducted between 2004 and 2005 (AlRubeaan et al., 2015) and between 2007 and 2009 (Al-Rubeaan, 2015) reported significantly higher prevalence rates for T2DM among females than males but these studies recruited by convenience and multistage stratified cluster rather than random sampling. Of the studies, which recruited using probability sampling (and one of the two studies that used convenience sampling), there was an increasing prevalence of T2DM for both genders between 1995 and 2011, with higher prevalence rates among males than females (Figure 2.3). Furthermore, T2DM was reportedly more prevalent among people in urban areas (at 25.5% compared to 19.5%) than in rural areas, and prevalence rates were highest in the northern region (27.9%) and lowest in the southern region (18.2%) between 1995 and 2000 (Al-Nozha et al., 2004).

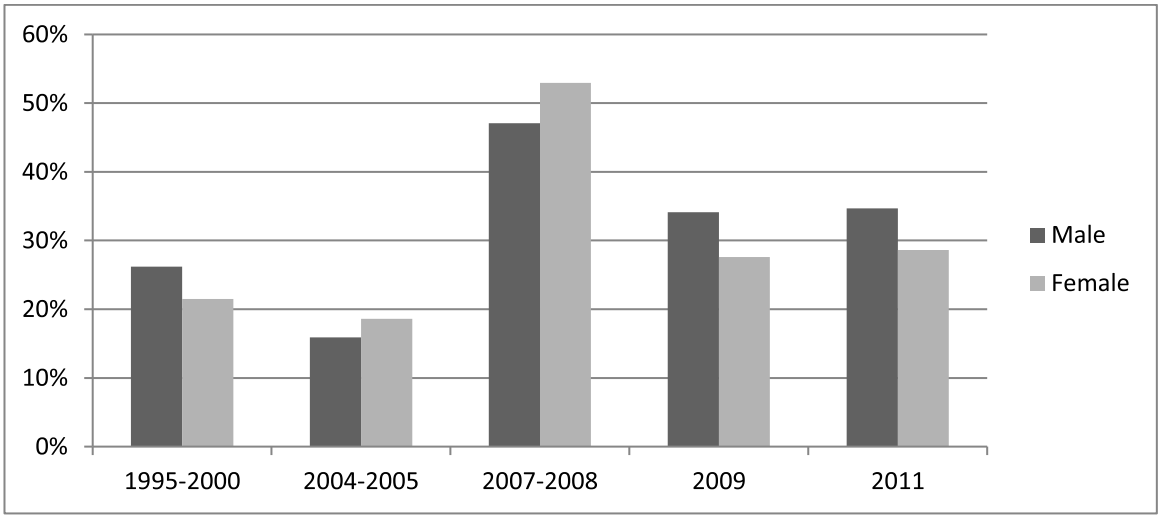
Between 2007 and 2009, prevalence rates amongst those with monthly incomes less than 4,000 SAR (SAR; approx. 1,067 USD) were higher among those in urban areas (27.2%) than those in rural areas (25.7%) (Al-Rubeaan, 2015). However, no significant difference was reported in prevalence rates of urban and rural residents with monthly incomes of 8,000 SAR (approx. 2,134 USD) and higher (AlRubeaan et al., 2015); at a certain level of wealth, affluence appears to overcome the influence of residential area. Other differences noted included the mean age of diagnosis of the disease, reported as 53.4 years for females and 57.5 years for males (Alqurashi et al., 2011). In geographical terms, T2DM was most prevalent in the northern regions and least in the southern regions between 1995 and 2000 (Al-Nozha et al., 2004). In terms of socio-demographic characteristics, in the Eastern province the prevalence of T2DM was higher in individuals who were widowed (39.1%), unemployed (31.9%), and had no education

(32.3%) between 2004 and 2005 (Al-Baghli et al., 2010). Overall, 23.4% (44,976) of the 197,681-study population were uneducated, of which, 75.1% were females.



Note: Adapted from (Abduljabbar et al., 2010) and (Habeb et al., 2011)

Figure 2.2: Incidence rate per 100,000 of Type 1 Diabetes Mellitus between 1995 and 2011 in Saudi Arabia (age range = 0 to 19 years)



Note: Adapted from (Al-Baghli et al., 2010; Al-Daghri et al., 2011; Al-Nozha et al., 2004; Alqurashi et al., 2011; AlRubeaan et al., 2015)

Figure 2.3: Prevalence rates of Type 2 Diabetes Mellitus between 1995 and 2011 in Saudi Arabia (age range = 0 to 80 years old)

2.5 Discussion

This review indicates that Diabetes Mellitus is a growing health problem in Saudi Arabia (International Diabetes Federation, 2015). The review findings broadly reflect high incidence rates of T1DM across the country, with rates rising particularly amongst children (Abduljabbar et al., 2010; Al-Rubeaan, 2015). One study conducted in the western region showed no increase in T1DM for the 5-year period between 2004 and 2009, but this may be due to the study's limitation of including children only up to 12 years old (Habeb et al., 2011). Other studies indicate a significant increase in incidence rates of T1DM amongst groups older than 12 years (Abduljabbar et al., 2010; Al-Herbish et al., 2008).

This review's findings concur with and expand on those of a report by the Saudi Arabian Ministry of Health (Abduljabbar et al., 2010) as well as the latest report of the International Diabetes Federation (2015). The findings are also broadly consistent with epidemiological studies from several areas of Asia, Europe and North America, where the annual growth rates for T1DM have been reported at 4.0%, 3.2% and 5.3%, respectively (Vlad & Popa, 2012). The latest report by the International Diabetes Federation cites 16,100 children aged 0–14 living with T1DM in Saudi Arabia, with an incidence of 31.4 new cases per 100,000 population (International Diabetes Federation, 2015). The national incidence rate is higher than the incidence rates in Dhahran (Abduljabbar et al., 2010) and Al-Medina (Habeb et al., 2011), reported in this review at 27.5 per 100,000 and 26.7 per 100,000, respectively. This implies an increase in new cases of T1DM in the country.

Overall, studies included in this review recorded a higher incidence of T1DM among females than males. The International Diabetes Federation reported that a higher incidence rate of diabetes is expected among females than males by 2030 (International

Diabetes Federation, 2015). The reason for this is uncertain; gender differences are often related to environment and culture, whilst genetic factors are generally assumed to play a major role in the development of T1DM (Dean & McEntyre, 2004). Contradicting this reported higher incidence among females, Cucca et al. (1998) found a greater prevalence among males. This seems to derive from the higher incidence rates of T1DM reported amongst males of European populations, which is not the case in non-European countries like Saudi Arabia (Hackett, 2015).

Regardless of the gender distribution, the high rates of T1DM among children in Saudi Arabia are likely to increase the burden on the country's healthcare systems, as T1DM is implicated in the development of a wide range of end-organ complications. Childhood diabetes been linked to the development of obesity in early adulthood (Szadkowska et al., 2015), which are independent risk factors for health problems such as cardiovascular disease and cancers.

As with T1DM, a steady rise was also noted in the prevalence rates of T2DM especially during the years 2004–2005 and up to 2011, affecting both genders. This finding is widely supported by a number of research studies conducted in Saudi Arabia and other Arabian countries (Alharbi et al., 2014). An alarming increase from 10.6% in 1989 to 32.1% in 2009 was documented in a systematic study conducted in Saudi Arabia, although some of those included in the review were non-Saudis (Alharbi et al., 2014). Increased obesity, the popularity of fast foods, smoking, and sedentary lifestyles may explain recent increases in the prevalence of T2DM; the incidence of obesity, for instance, has been reported to be as high as 75% among females living in Saudi Arabia (Alsenany & Al Saif, 2015). These factors have been well recognised as the most important risk factors in prevalent of T2DM worldwide (Al-Quwaidhi, Pearce, Sobngwi, Critchley, & O'Flaherty, 2014; Guh et al., 2009). The higher prevalence of

diabetes in urban rather than rural areas, where lifestyle changes are more prominent, lends support to the link between diabetes and life style risk factors. However, whilst affluence was clearly influential, so was poverty, in the Eastern province at least, and at higher incomes the link with urban living was lost (Al-Baghli et al., 2010).

Prevalence rates of T2DM were found to be higher among males than females although the age of onset was reported as earlier among females than males (53.4 years and 57.5 years, respectively) (Alqurashi et al., 2011). This finding is contrary to a study of Saudi adult patients at a primary healthcare centre, which reported a higher incidence among females (58%) than males (42%), but this discrepancy may be related to the well-recognised greater willingness of females than males to consult healthcare practitioners. In addition, females are reported as more willing than males to adhere to diabetes daily management (e.g. restricted diet, monitoring blood-glucose, taking medication and regular foot-care) (Albargawi, Snethen, Gannass, & Kelber, 2016).

These findings call for prompt attention by the Ministry of Health especially because the heaviest burden of diabetes (of both type 1 and type 2) is its potential to progress to serious complications (Alwakeel et al., 2008). Awareness campaigns are viewed as the best option to at least initiate recognition of the need to modify unhealthy lifestyles, although recent campaigns launched in Saudi Arabia have not been successful so far (Alharbi et al., 2014). Nationwide development and implementation of evidence-based, structured lifestyle programs are required to prevent or delay the onset of diabetes and promotes self-care and management of the disease.

2.5.1 Limitations of this Review

The review was limited to T1DM and T2DM; it did not include the prevalence and incidence rates of Gestational Diabetes Mellitus or childhood/adolescent onset of

T2DM. Future reviews should consider each of these types of diabetes. Second, differences in assessment and diagnosis methods for diabetes have resulted in changed diagnosis criteria over time and heterogeneous methods and criteria were observed over time, across regions, and for different types of diabetes in the studies, resulting in some lack of statistical precision.

Sites of recruitment may also have skewed findings, with, for example, Alqurashi et al. (2011) sampling attendees at a primary care centre. Also, studies used different methods and criteria, and demonstrated insufficient sample size, which may have prevented the identification of accurate prevalence rates. The studies have limitations in relation to representation of the total national population. The data of these studies were mostly collected from inner city populations, and the review could not compare urban with rural populations or provide an accurate reflection of the incidence in all regions of KSA. The data may not necessarily reflect the true prevalence at a national level, since patients were recruited from different regions and some failed to classify the newly identified cases into different types of diabetes.

2.6 Conclusion

This is the first comprehensive review of the incidence and prevalence rates of T1DM and T2DM in Saudi Arabia. These were found to be high and rising, affected by gender and age. Females had higher incidence rates of T1DM among children and adolescents than males, and older age groups of children and adolescents had higher incidence rates of T1DM than younger age groups. The incidence rate of T1DM was higher in the central region of the country. Greater prevalence of T2DM was reported among those living in urban than rural areas, but there were socio-economic as well as geographical predisposing factors. This review recommends that urgent attention be paid to develop,

support and implement health interventions, guidelines and policies nationwide, to assist in the prevention, diagnosis, management and promotion of self-management of diabetes. Well-designed epidemiological studies are required to allow for more accurate and regular monitoring of the incidence and prevalence rates of diabetes across Saudi Arabia.

2.7 Summary

This chapter provided evidence on the magnitude of diabetes in Saudi Arabia. The results of the studies conducted in different regions of Saudi Arabia and in different healthcare settings suggest that diabetes (both type 1 and type 2) is a common health problem among the Saudi population, specifically in females and urban areas. To reduce the burden of diabetes, the goal of diabetes management is to address all aspects of care and to enable self-care management to minimise the development of complications. As frontline healthcare professionals, nurses have a responsibility to present and implement treatment options for patients. They also have a responsibility to ensure that patients are provided with diabetes management education using accurate knowledge and skills. It is, therefore, imperative that nurses, as the largest component of the healthcare workforce in Saudi Arabia, be knowledgeable about diabetes and the associated complications.

The following chapter presents a literature review on the diabetes knowledge of nurses in developed and developing countries.

CHAPTER 3 Literature Review

3.1 Chapter Introduction

This chapter of the thesis is based on the following publication:

Alotaibi, A., Al-Ganmi, A., Gholizadeh, L. & Perry, L. 2016, Diabetes knowledge of nurses in different countries: An integrative review. *Nurse Education Today*, 39, 32–49.

The chapter provides a review of the literature on nurses' knowledge of diabetes and factors that function as barriers to nurses' acquisition of diabetes knowledge based on a paper which sought to collect, review and synthesise the current understanding of nurses' knowledge in relation to diabetes care and education in developed and developing countries. This paper was submitted to Nurse Education Today, a journal with an Impact Factor of 2.5. The published format of this article is provided in Appendix A. This journal was chosen because it focuses on nursing, midwifery and inter-professional healthcare education, and contributes to the advancement of educational theory and pedagogy that supports evidence-based practice for educationalists worldwide.

3.2 Background

Management of diabetes mellitus (DM) is complex and requires knowledge and skills on the part of both healthcare providers and clients. DM is a common chronic disease which currently affects 8.3% (371 million people) of the world's population (International Diabetes Federation, 2015) with incidence and prevalence rates rising rapidly across the globe (World Health Organization, 2015). This metabolic disease is characterised by hyperglycaemia resulting from defects in insulin secretion, insulin action or both (American Diabetes Association, 2010a). It is classified into three major

types: Type 1 diabetes mellitus is specifically defined as an autoimmune disease characterised by β-cell destruction, leading to absolute lack of insulin; Type 2 diabetes mellitus is due to a progressive insulin secretory defect on the background of insulin resistance; and gestational diabetes mellitus is defined as glucose intolerance of variable degrees which is usually diagnosed in the second or third trimester of pregnancy (American Diabetes Association, 2015). Diabetes is associated with a wide range of complications; it is the major cause of chronic renal failure and blindness (Holt, 2010) and can result in non-traumatic lower extremity amputation and cardiovascular diseases (Al-Sarayra & Khalidi, 2012). Appropriate care and management interventions have been shown to control disease progression and reduce complications (American Diabetes Association, 2015). General management of all types of diabetes comprises multiple aspects of care such as medications, diet and nutrition, blood glucose monitoring, regular physical activity and screening for long-term complications (American Diabetes Association, 2015).

Optimal diabetes care requires that both patients and healthcare providers, including nurses, are knowledgeable about diabetes care and its management. To achieve high diabetes care and self-management it is important that nurses have sufficient understanding of all aspects of DM care and treatment to inform their practice and support patients to effectively self-manage their condition (National Heart Foundation of Australia, 2011). Possession of adequate knowledge of diabetes can positively affect nurses' attitudes toward management of this disease (Unadike, 2010). To encourage patients with diabetes to engage in optimal self-management and healthy lifestyles, nurses need to update and develop their own knowledge of diabetes and of effective behavioural strategies to effect change in patients' lifestyles (Hjelm et al., 2003). They should master methods and strategies to obtain and apply up to date knowledge about

diabetes to educate patients on management of blood glucose levels, nutrition and medications so as to minimise development and progression of the acute and chronic complications associated with poorly managed diabetes (Wild, Roglic, Green, Sicree, & King, 2004). This review aimed to identify and synthesise evidence of nurses' knowledge of diabetes and identify factors that function as barriers to nurses' acquisition of diabetes knowledge.

3.3 Review Design and Methods

This review employed an integrative approach based on (Whittemore & Knafl, 2005), and entailed a five-stage approach: identification of the purpose of the review, literature search, data evaluation, data analysis and presentation of findings. This approach allowed the inclusion of different types of studies including quantitative, qualitative and mixed methods, and enabled analysis and critique of the literature to create new understanding of the topic under review (Soares et al., 2014).

3.3.1 Search Strategies

A systematic search strategy was developed to identify and retrieve the relevant literature. First, the components of review aims were identified: specifically, diabetes knowledge of nurses and factors influencing acquisition of this knowledge. Relevant Medical Subject Heading terms (MeSH) included: 'diabetes', 'knowledge' and 'nurses'. Synonymous keywords were generated for each component, including: "nurs*", "hyperglyc*", "hypoglyc*", "insulin*", "information", "awareness" and "perception". Search terms were appropriately truncated, with wildcards to address multiple spelling options; the "knowledge" and "nurses" terms were combined, for example as "nurs* knowledge", "nurs* information", "nurs* awareness" and "nurs* perception". Components were combined using the Boolean Operators (AND, OR) (Table 3.1).

Table 3.1: Search terms, database searches and results.

Search No.	Search Term	CINAHL results	MEDLINE results	EMBASE results	Education Research Complete results	Total
S 1	Diabet* or hyperglyc* or hypoglyc* or insulin*	102,930	734,124	734,130	276,851	1,745,207.93
S 2	Nurs* knowledge or nurs* awareness or nurs* information or nurs* perception	10,078	3633	3639	16,755	34,105
S 3	S1 AND S2	169	45	45	332	591
S 4	S3 with limits: date (2004–2018), Peer Reviewed, Human, Journal Article and English Language)	67	2	14	291	374

The Cumulative Index to Nursing and Allied Health Literature (CINAHL), MEDLINE, EMBASE and Education Research Complete databases were searched for the relevant literature. These databases were searched for articles published in English and in peer-reviewed journals between January 2004 and July 2018; a fourteen years date range was chosen to ensure there was sufficient breadth and depth in the retrieved literature. Papers in a language other than English were excluded as resources for translation were lacking. Papers other than primary studies, such as systematic reviews and meta-analyses, discussion papers, conference abstracts and dissertations were excluded, although their reference lists were searched for possible relevant papers. Papers focused

on healthcare professional groups other than nurses were excluded. In total the search strategies identified 374 citations of potential relevance (Table 3.1). Initial screening of the study titles and abstracts revealed that 90% of these retrieved studies did not meet the review inclusion criteria, with 67 papers retained for further evaluation. The full texts of these articles were then reviewed for relevance, with 41 articles subsequently assessed for quality. Three further articles were added from references lists of included articles, increasing the total number of included studies to 44 (Figure 3.1). All articles were then critically appraised for validity, importance, and applicability

3.3.2 Quality Appraisal and Assessment

The included articles were mainly quantitative studies (33), followed by qualitative studies (6) and mixed method studies (5). The quality of these papers was assessed using the JADAD scale for randomised controlled trials (Jadad et al., 1996), the McMaster University's critical appraisal checklist for other quantitative studies (Law et al., 1998) and the Critical Appraisal Skill Program (CASP) checklist for qualitative designs (Critical Appraisal Skills Programme, 2013). All papers were evaluated on the basis of data relevance and methodological rigor (design, sampling technique, validity/reliability of used instrument and data analysis), and papers that scored two points and less were excluded (Conn & Rantz, 2003). This full text quality appraisal resulted in exclusion of a further 19 articles**,** leaving 25 articles for inclusion in the review (Table 3.2).

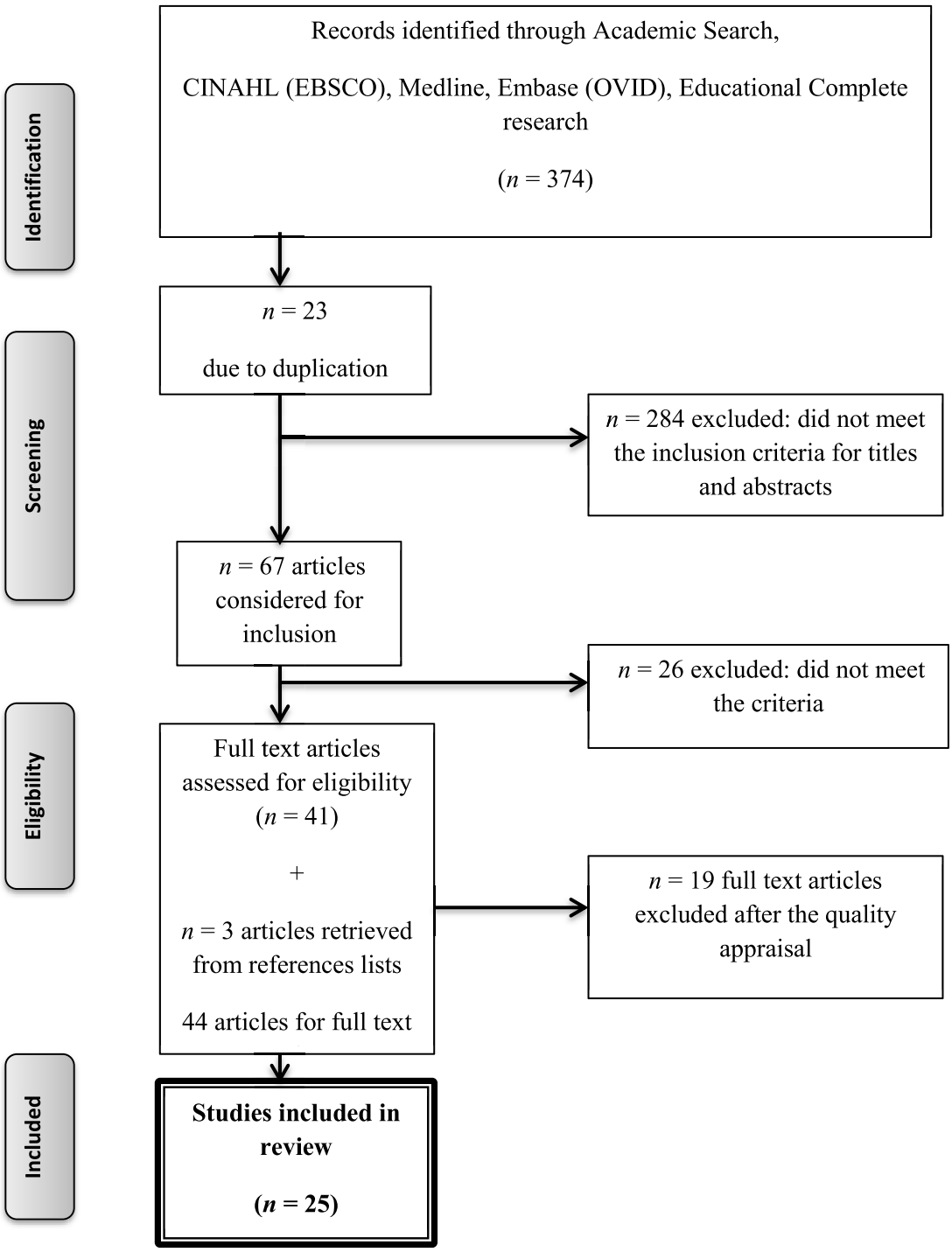


Figure 3.1: Flowchart of study selection for inclusion in review

3.3.3 Data Analysis

Data were extracted using specifically designed data extraction tables (Appendix B), and examined, compared, discussed and agreed with the other authors. Data were

analysed descriptively, comparing and contrasting results across the studies, taking into consideration the differences in study design, setting, populations and assessment tools (Table 3.3).

3.4 Review Findings

Of the 25 included studies, 17 studies employed quantitative approach and used a survey design, four studies employed a qualitative approach and used in-depth interviews, and four used mixed-methods. The studies originated from Africa, America, Asia, Australasia and Europe. Four studies were conducted in Europe including Sweden and the United Kingdom (UK); six studies were conducted in the United States (US); four studies were conducted in Southeast Asia, including South Korea, Singapore and Hong Kong, and two studies were carried out in the South Asia and the Middle East regions including Pakistan and Jordan. Five studies were conducted in Africa, including Nigeria, Kenya, South West Africa (Mauritius) and South Africa; four studies were conducted in Australia and New Zealand. Study settings included general hospitals (23 studies), community nursing (19), tertiary hospitals (13), primary and community care centers (9), specialised hospitals (2) and private hospitals (2) (Table 3.3).

Table 3.2: Critical appraisal: rigor of included studies (n=25)

Author / Year of published.	Design: Described in detail?	Sample: Described in detail?	Data analysis: Described in detail?	Validity, reliability and rigor of instrument examined?
* Ahmed et al. (2012)	Yes	Yes	Yes	Yes
* Chang and Zong (2007)	Yes	Yes	Yes	Yes
$ Daly et al. (2014)	Yes	Yes	Yes	Yes
* Eaton-Spiva and Day (2011)	Yes	Yes	Yes	Yes
* Gerard et al. (2010)	Yes	Yes	Yes	Yes
$ Hargraves (2014)	Yes	Yes but no response rate	Yes	Yes validity, No reliability
* Hollis et al. (2014)	Yes	Yes	Yes	No validity, Yes reliability
# Kassean (2005)	Yes	Yes	Yes	Yes
* Lee et al. (2013)	Yes	Yes	Yes	No
$ Livingston and Dunning (2010)	Yes	Yes	Yes	Yes validity, No reliability
* Modic et al. (2009)	Yes	Yes but no response rate	Yes	Yes validity, No reliability
* Modic et al. (2014)	Yes	Yes but no response rate	Yes	Yes
# Mutea and Baker (2008)	Yes	Yes	Yes	Yes
* Nash (2009)	Yes	Yes	Yes	No
# Olsen et al (2012)	Yes	Yes	Yes	No
* Oyetunde and Famakinwa (2014)	Yes	Yes	Yes	Yes
* Park et al. (2011)	Yes	Yes	Yes	Yes validity, No reliability
* Shiu and Wong (2011)	Yes	Yes but no response rate	Yes	Yes validity, No reliability
# Smide and Nygren (2013)	Yes	Yes	Yes	No
* Thomas (2004)	Yes	Yes	Yes	Yes
* Unadike and Etukumana (2010)	Yes	Yes but no response rate	Yes	No
* van Zyl and Rheeder (2008)	Yes	Yes	Yes	Yes
% Wakefield and Wilson (2014)	Yes	Yes but no response rate	Yes	Yes
$ Wellard et al. (2013)	Yes	Yes	Yes	Yes validity, No reliability
* Yacoub et al. (2014)	Yes	Yes	Yes	Yes

(*) A quantitative study, McMaster University's critical appraisal checklist was used , **($)** A mixed method study, CASP + McMaster University's critical appraisal checklist was used, **(#)** a quantitative study, CASP Checklist was used, **(%)** An RCT study, Jadad scale was used for quality assessment.

Table 3.3: Study classifications

Continent/ countries	Study designs	Study settings	Participants:		
			Gender	Registration/license	Education
Africa: Nigeria (2); Kenya; South West Africa (Mauritius); South Africa.	Survey design: n = 3; Qualitative design, with interviews: n = 2; mixed-methodology: n = 0.	General hospitals (6), community nursing (0), tertiary hospitals (4), primary and community care centers (5), specialised hospitals (0), private hospitals (0)	Total n = 600; Female n =374; not reported: 2 studies	Registered Nurses (n = 547), Enrolled Nurses (n = 36), Specialist Nurses (n = 0), Senior Registered Nurses (n = 17), Assistant Nurses (n = 0)	Diplomas (n =14), Bachelors (n = 525) and Masters degrees (n = 0); not reported: 1 study.
America: US; Georgia; Southern New England US; Southern New Jersey, Midwest US; Northeast Ohio.	Survey design: n = 5; Qualitative design, with interviews: n = 0; mixed-methodology: n = 1.	General hospitals (3), in-home community nursing (0), tertiary hospitals (1), primary and community care centers (2), specialised hospitals (X), private hospitals (0)	Total n = 3,114; Female (n = 2,891; not reported: 2 studies	Registered Nurses (n = 3,008), Enrolled Nurses (n = 0), Specialist Nurses (n = 106), Senior Registered Nurses (n = 0), Assistant Nurses (n = 0)	Diplomas (n = 0), Bachelors (n = 1,335) and Masters degrees (n = 66); not reported: 0 studies.
Asia: Karachi Pakistan; (2) Hong Kong; Singapore; Korea; Jordan	Survey design: n = 6; Qualitative design, with interviews: n = 0; mixed-methodology: n = 0.	General hospitals (9), in-home community nursing (0), tertiary hospitals (8), primary and community care centers (0), specialised hospitals (1), private hospitals (2)	Total n = 1,418; Female (n = 1,1361; not reported: 1 study	Registered Nurses (n = 1,341), Enrolled Nurses (n = 39), Specialist Nurses (n = 38), Senior Registered Nurses (n = 0), Assistant Nurses (n = 0)	Diplomas (n = 206), Bachelors (n = 564) and Masters degrees (n = 91); not reported: 1 study.
Australasia: New Zealand; (3) Australia	Survey design: n = 1; Qualitative design, with interviews: n = 0; mixed-methodology: n = 3.	General hospitals (4), in-home community nursing (0), tertiary hospitals (0), primary and community care centers (2), specialised hospitals (X), private hospitals (0)	Total n = 404; Female (n = 371; not reported: 1 study	Registered Nurses (n = 341), Enrolled Nurses (n = 35), Specialist Nurses (n = 28), Senior Registered Nurses (n = 0), Assistant Nurses (n = 16)	Diplomas (n = 21), Bachelors (n = 8) and Masters degrees (n = 0); not reported: 2 study.
Europe: UK (2); Sweden (2),	Survey design: n = 2; Qualitative design, with interviews: n = 2; mixed-methodology: n = 0	General hospitals (1), in-home community nursing (17), tertiary hospitals (0), primary and community care centers (0), specialised hospitals (1), private hospitals (0)	Total n = 334; Female (n = 21; not reported: 3 studies	Registered Nurses (n = 0), Enrolled Nurses (n = 32), Specialist Nurses (n = 302), Senior Registered Nurses (n = 0), Assistant Nurses (n = 0)	Diplomas (n = 27), Bachelors (n = 0) and Masters degrees (n = 0); not reported: 2 studies.

Table 3.4: Diabetes assessment tools

Name of Tool	Items and scoring	Content set	Validity test & score	Reliability test & score	Studies using tool
Diabetes Basic Knowledge Tool (DBKT)	45 multiple-choice questions	Aetiology of diabetes, basic treatment plan for type 2 diabetes, hypoglycaemia and insulin use	Content Validity Index (CVI) = 0.94	Cronbach's α 0. 79	(4) Studies Used DBKT and DSRT: (Eaton & Day, 2011), (Gerard et al., 2010), (Yacoub et al., 2014), Chang & Zong (2007)
Diabetes Self-Report Tool (DSRT)	22 items 5-point Likert scale	Diabetic ketoacidosis, stress effects on diabetes control, long-term complications, exercise and diet	CVI = 0.91	Cronbach's α 0.91	
Diabetes Measurement Evaluation Tool (DMET)	21 open-ended questions	Medications, in-patient and outpatient management	Not reported	Cronbach's α 0.71	(1) Study: (Ahmed, Jabbar, Zuberi, Islam, & Shamim, 2012)
Diabetes Management Knowledge Assessment (DMKA)	20 multiple choice questions	Hyperglycaemia, insulin therapeutics, hypoglycaemia prevention and management, and diabetes survival skill teaching.	CVI = 0.95	Cronbach's α 0.87	(1) Study: (Modic et al., 2014).
Diabetes Knowledge Survival Skill (DKSST)	20 item true–false questions	Diet, oral glucose-lowering agents, blood glucose monitoring, symptom management, and insulin administration	CVI = 0.90	Not reported	(1) Study: (Modic et al., 2009)
National Association of Diabetes Centres Knowledge (NADC)	14 multiple choice questions	Pathophysiology, blood glucose monitoring, dietary and medications	Not reported	Cronbach's α 0.94	(1) Study: (Hollis, Glaister, & Lapsley, 2014)
Diabetes Foot Care Knowledge Scale (DFCKS)	14 items true-false questions	Basic care, extrinsic factors, and risk management,	CVI = 0.94	Not reported	(1) Study:(Shiu & Wong, 2011)
Diabetes Knowledge Tool (O'Brien Tool)	66 items, multiple choice and opened-ended questions	Diabetes care knowledge: physiology, blood glucose monitoring, medications, hypoglycaemia, insulin use, hyperglycaemia, complications, diet, screening/ prevention, surgery and a general section.	Kappa coefficient 0.689	Cronbach's α 0.81	(1) Study: O'Brien et.al. (2003)
Diabetes Attitude Questionnaire (DAS3)	33 multiple choice questions	Seriousness of type 2 diabetes, the need for special training of healthcare workers, the value of tight glucose control, the socio-economic impact of diabetes, and the need for patient autonomy	CVI = 0.90	Cronbach's α 0.71	(1) Study: van Zyl & Rheeder, (2008)
Audit of Diabetes Knowledge (ADKnowl)	27 item-set (114 of true–false questions)	Diet, treatment, sick day, foot care, risk complications, hypoglycaemia, effects of smoking and alcohol	Not reported	Not reported	(1) Study: (Wellard, Rasmussen, Savage, & Dunning, 2013)

3.4.1 Participants

In total these 25 studies recruited 5,870 nurses; the majority of participants were female (N = 5,018), although some studies failed to report the gender of participants. Participants had differing nursing registrations and roles, including Registered Nurses (RNs), Enrolled Nurses (ENs), Specialist Nurses (SNs), Senior Registered Nurses (SRNs) and Assistant Nurses (ANs), although most were RNs (5,237). Participants' educational qualifications included Diplomas (268), Bachelors (2,432) and Masters degrees (157). Six studies did not report participants' educational backgrounds (Table 3.4). Participants had a minimum of one-year work experience.

3.4.2 Outcomes Assessment

Various diabetes assessment tools were applied to assess nurses' knowledge of diabetes. Some studies applied validated tools (Table 3.4), 10 studies employed researcher-developed questionnaires and four studies used interview techniques. Studies addressed nurses' knowledge in various themes of diabetes care: twelve papers reported nurses' knowledge of medication, seven included nutrition, seven assessed blood glucose monitoring, six examined diabetes complications, and nine diabetes symptoms, diabetes pathology and disease management. Factors affecting nurses' diabetes knowledge were identified in eleven studies. The identified themes are explained in the following section.

3.4.3 Medication

3.4.3.1 Oral Diabetes Medication

Studies of nurses' knowledge of diabetes medication showed markedly different results. Twelve of the 25 studies, conducted in different countries, addressed nurses knowledge of diabetes medication. These studies were summarised based on their research design,

objectives, study tool, study setting and findings. Seven of the 12 studies indicated that nurses lacked adequate knowledge of oral hypoglycaemia agents (OHAs) (Ahmed et al., 2012; Gerard et al., 2010; Livingston & Dunning, 2010; Olsen, Granath, Wharén, Blom, & Leksell, 2012; Unadike & Etukumana, 2010; Wellard et al., 2013; Yacoub et al., 2014). A survey from the US, using the Diabetes Basic Knowledge Tool (DBKT) and the Diabetes Self-Report Tool (DSRT) developed by Drass (1989), found that 34% of acute care nurses did not have sufficient knowledge of OHAs (Gerard et al., 2010). Another study from Jordan, using the same questionnaire, reported that 26.4% of RNs had poor knowledge of these medications (Yacoub et al., 2014). Nurses' lack of adequate knowledge of OHAs was also confirmed by qualitative (Olsen et al., 2012) and mixed methods studies (Livingston & Dunning, 2010; Wellard et al., 2013).

In Sweden, a qualitative study found 19 of 22 ENs displayed insufficient knowledge of OHAs (Olsen et al., 2012). Consistent with the results of above studies, two mixed method studies from Australia reported similar knowledge gaps of nurses in this country. One of these studies showed that four of the six nurses interviewed failed to identify OHAs from a provided a medication list (Livingston & Dunning, 2010). The other study reported that approximately 27% of nurses did not know how to administer prescribed OHAs, and 43% did not know how long before breakfast they should administer these medications (Wellard et al., 2013). A survey undertaken in Nigeria found that approximately 20% of nurses were not able to identify even one type of OHAs (Unadike & Etukumana, 2010). A similar study from Pakistan found 27% of RNs possessed inadequate knowledge of anti-diabetes medications (Ahmed et al., 2012). These results collectively suggest that nurses in both developing and developed countries have suboptimal knowledge of oral diabetes medications.

3.4.3.2 Insulin Therapy

Ten of the above mentioned 12 papers also examined nurses' knowledge of insulin therapy, including timing, storage, characteristics, prescription and injection sites. Three of these studies used the DBKT and the DSRT and were conducted in the US, the UK and Jordan (Gerard et al., 2010; Thomas, 2004; Yacoub et al., 2014). These studies showed that 48% of acute care nurses working in a community teaching hospital did not understand the importance of insulin administration timing and 34% did not know how to store insulin correctly (Gerard et al., 2010). In the UK study, 72% of paediatric nurses working in specialist paediatric and district general hospitals did not understand the importance of insulin timing and storage (Thomas, 2004). In the Jordanian study, 18.1% of the RNs recruited from different centres did not have accurate knowledge of insulin storage and handling and 12.3% did not know how to prepare a dose of insulin (Yacoub et al., 2014). Differences in these results can be attributed, in part at least, to differences in study designs and settings; the Jordanian study had a bigger sample size and recruited participants from a wider range of departments and healthcare centres.

Consistent with the above studies, a study conducted in regional and rural divisions of general practice in Australia, using a validated tool developed by the National Association of Diabetes Centres (NADC), demonstrated that practice nurses lacked understanding of insulin timing (38%) and insulin storage (31%) (Hollis et al., 2014). Similarly, a qualitative study conducted in Sweden using focus group interviews with 22 ENs working in home nursing care reported that nine of these participants needed additional education about insulin treatments (Olsen et al., 2012). A study from Pakistan which used the Diabetes Measurement Evaluation Tool (DMET) reported that 27% of RNs employed in tertiary and university teaching hospitals lacked knowledge of insulin treatment (Ahmed et al., 2012).

In the US (Modic et al., 2009; Modic et al., 2014) led two teams to conduct two quantitative studies using different validated tools. The first study, using the Diabetes Knowledge Survival Skill Tool (DKSST), revealed that experienced cardiovascular nurses employed in tertiary care centres had better knowledge of insulin therapy than less experienced nurses working in the same cardiovascular unit (58.3%) (Modic et al., 2009). A relatively recent study (2014), using the Diabetes Management Knowledge Assessment Tool (DMKAT), found that 38% of nurses working in a variety of clinical specialties in a large healthcare centre answered questions on insulin regimes incorrectly (Modic et al., 2014). Comparisons between these two studies were hampered by differences in study tools and settings.

A study from Singapore, using a questionnaire based on the American Diabetes Association (ADA) guidelines, reported that 12.9% of Singaporean nurses working in a tertiary hospital had inadequate knowledge of insulin characteristics and prescriptions (Lee, Liu, Quek, & Chew, 2013), and a study from the UK found that greater than 54% of paediatric nurses did not know the possible side effects of repeated injection of insulin into the same site (Thomas, 2004). In Nigeria, only a small number (approximately 6% of general nurses sampled) could not identify the different sites for insulin injection but rather more nurses (22.1%) failed to identify the different types of insulin (Unadike & Etukumana, 2010). The findings of these studies consistently suggested that nurses in many countries had knowledge deficiencies in at least some aspects of insulin therapy that can significantly impair their ability to manage diabetes effectively.

3.4.4 Nutrition

Nutrition is one of the most important content areas of diabetes care. Seven studies assessed nurses' knowledge of nutritional management for patients with diabetes (i.e.

non-atherogenic diets promoting weight reduction), and consistently reported inadequate knowledge in this area (Gerard et al., 2010; Hollis et al., 2014; Nash, 2009; Olsen et al., 2012; Oyetunde & Famakinwa, 2014; Park et al., 2011; Yacoub et al., 2014). Six of the seven studies used cross-sectional survey designs and one (Olsen et al., 2012) applied a focus group interview. The quantitative studies, conducted in Australia (Hollis et al., 2014), Jordan (Yacoub et al., 2014), Korea (Park et al., 2011), Nigeria (Oyetunde & Famakinwa, 2014), the UK (Nash, 2009) and the US (Gerard et al., 2010), consistently found that nurses had inadequate knowledge of various aspects of nutrition management for diabetes, and they generally did poorly in relation to meal planning for the patients.

The paper from the UK showed that psychiatric nurses were in need of further training in providing dietary advice (63%) and monitoring glucose intake (22%) (Nash, 2009), whilst the US study showed that 49% of acute care nurses were poor at meal planning (Gerard et al., 2010). In Jordan, 22.4% of RNs lacked knowledge of meal planning for patients with diabetes (Yacoub et al., 2014). Studies from Australia (Hollis et al., 2014) and Korea (Park et al., 2011) found 58% and 80% of practice nurses, respectively, scored poorly on questions relating to sources of carbohydrates, and Nigerian nurses fared even worse, with 79.8% of nurses having poor knowledge of diabetes diet (Oyetunde & Famakinwa, 2014). In Sweden, a focus group study with 22 participating ENs found knowledge deficits in relation to appropriate management of hypoglycaemia by providing extra glucose or a meal (Olsen et al., 2012). Studies were consistent in revealing substantial proportions of nurses sampled with suboptimal knowledge of nutrition management in diabetes care.

3.4.5 Blood Glucose Monitoring

Inadequate control of blood glucose levels in patients is a significant concern for nurses and other healthcare providers (Hargraves, 2014). Seven studies reported that nurses lacked skills in blood glucose monitoring (BGM). Four of these studies used quantitative designs (Gerard et al., 2010; Modic et al., 2009; Nash, 2009; Oyetunde & Famakinwa, 2014), two used qualitative approaches (Olsen et al., 2012; Smide & Nygren, 2013) and one applied mixed methods design (Hargraves, 2014). Two quantitative studies conducted in the UK and the US found that 68% of psychiatric nurses (Nash, 2009) and 27% of acute care nurses (Gerard et al., 2010) needed further training in BGM. In Nigeria, 75.1% of practice nurses had similar knowledge deficits (Oyetunde & Famakinwa, 2014). Another study from the US found that only 40% cardiovascular nurses with more than five years of experience had sufficient knowledge about BGM, and those with fewer years of experience had even poorer knowledge (Modic et al., 2009). Qualitative studies in Sweden supported the results of previous quantitative studies (Olsen et al., 2012; Smide & Nygren, 2013). All the 22 ENs in a Scandinavian study (Olsen et al., 2012), three of ten nurses in a pilot study (Smide & Nygren, 2013) and 33% of cardiovascular nurses in a US study (Hargraves, 2014) had insufficient knowledge related to BGM and could not identify the normal ranges of blood glucose in healthy and diabetic people. This is a concerning finding; nurses are expected to be knowledgeable about the normal ranges of blood glucose level because diabetes management, within nurses' scope of practice, may be altered on the basis of blood glucose values.

3.4.6 Knowledge of Diabetes Complications

Poor knowledge of diabetes-related complications can pose serious risks to the health of patients with diabetes and may result in serious complications such as lower limb

amputations, cardiovascular disease, and nephropathy in these patients. Six studies, conducted in different countries, found that nurses had suboptimal knowledge of diabetes complications (Daly, Arroll, Sheridan, Kenealy, & Scragg, 2014; Livingston & Dunning, 2010; Nash, 2009; Oyetunde & Famakinwa, 2014; Shiu & Wong, 2011; Unadike & Etukumana, 2010). Of these, two studies (Daly et al., 2014; Livingston & Dunning, 2010) used mixed methods and four a quantitative approach.

Three studies, conducted in the UK, Nigeria and Hong Kong, consistently revealed that nurses had poor knowledge about general foot care and diabetes wound care (Nash, 2009; Oyetunde & Famakinwa, 2014; Shiu & Wong, 2011). Nash (2009) found inadequate foot care knowledge and a need for training in 19% of psychiatric nurses, while (Oyetunde & Famakinwa, 2014) reported this problem in 65.5% of nurses. In Hong Kong, nurses incorrectly answered questions about the use of surgical spirit between patients' toes (83.1%), use of woollen socks (75.4%), and Hibitane antiseptic solution (73.8%) (Shiu & Wong, 2011). Similarly but more broadly, studies conducted in Australia (Livingston & Dunning, 2010), New Zealand (Daly et al., 2014) and Nigeria (Unadike & Etukumana, 2010) all reported limited knowledge of diabetes complications among nurses. Approximately 50% of participating nurses in these studies did not know that neuropathy, nephropathy, erectile dysfunction, cardiovascular and cerebrovascular diseases were related to diabetes. Collectively, the reviewed studies suggested that nurses need further education and training about diabetes complications in general, and foot care in particular.

3.4.7 Knowledge of Diabetes Pathology, Symptoms, and Management

Nurses' knowledge of the pathology of diabetes and its symptoms varied significantly across the nine included studies that addressed this topic (Ahmed et al., 2012; Daly et al., 2014; Gerard et al., 2010; Kassean, 2005; Olsen et al., 2012; Oyetunde &

Famakinwa, 2014; Smide & Nygren, 2013; Thomas, 2004; Unadike & Etukumana, 2010; van Zyl & Rheeder, 2008). Two qualitative studies from Sweden reported nurses' knowledge deficiencies in this area. In one of these studies, none of the 22 participating ENs could distinguish the different types of diabetes (Olsen et al., 2012); in the other study, nine of ten participants lacked adequate knowledge about the symptoms of diabetes (Smide & Nygren, 2013). Quantitative studies showed that 17% of primary healthcare nurses in New Zealand had insufficient knowledge of the pathology of type 1 diabetes and 22% lacked knowledge of type 2 diabetes (Daly et al., 2014). In the US study, 26% of acute care nurses were unaware of the genetic aspects of type 1 diabetes (Gerard et al., 2010) and in Nigeria, 50.9% of nurses could not identify any signs or symptoms of diabetes ketoacidosis and only 12% were able to recognise all diabetes symptoms (Unadike & Etukumana, 2010).

Four studies conducted in Pakistan (Ahmed et al., 2012), the UK (Thomas, 2004), South Africa (van Zyl & Rheeder, 2008), and Mauritius (Kassean, 2005) similarly reported that nurses had inadequate knowledge of diabetes pathology and symptoms. In the South African study, 28% of general nurses were not confident in managing diabetes (van Zyl & Rheeder, 2008); in Pakistan, only 16% and 12% of RNs knew the current American Diabetes Association guidelines for monitoring glycated haemoglobin (HbA1C) and the lipoprotein cholesterol goal for patients with diabetes, respectively (Ahmed et al., 2012). In the UK, 60% of paediatric nurses were unaware of the protocols relating to minor surgical procedures for patients with diabetes (Thomas, 2004). A qualitative study in Mauritius (Kassean, 2005) revealed that eight of ten participating nurses were at least familiar with the concept of holistic care for patients with diabetes. Overall, the analysis of these results indicates that insufficient knowledge

of the pathology of diabetes, its symptoms and management is a common concern amongst nurses in many countries.

3.4.8 Barriers to Diabetes Knowledge Acquisition

Several major obstacles were identified in the literature in relation to knowledge acquisition and development of good practice in diabetes care. These barriers were relatively commonly reported across healthcare settings and originated both from the individual nurses and the organisations in which they worked. Nurses experienced lack of adequate training and education about diabetes (Eaton & Day, 2011; Hollis et al., 2014; Kassean, 2005; Nash, 2009; Shiu & Wong, 2011), and lack of access to relevant educational resources was identified in many of the reviewed studies (Kassean, 2005; Mutea & Baker, 2008; Olsen et al., 2012). Work experience was also identified as a factor affecting nurses' knowledge of diabetes care and their practice; nurses whose work setting offered them more experience were found to be more knowledgeable than those with less work experience (Hollis et al., 2014; Kassean, 2005; Mutea & Baker, 2008; Nash, 2009; Oyetunde & Famakinwa, 2014; Shiu & Wong, 2011). Some differences, however, appeared in barriers experienced by nurses in different countries; for example, whilst poor attendance at continuing education programs was identified as the reason for poor diabetes knowledge by British nurses (Nash, 2009), nurses in developing countries were less likely to be provided with educational materials and resources and appropriate diabetes training programs (Oyetunde & Famakinwa, 2014). The wider employment milieu was also an influence, with nursing shortages, high workload and consequent low job morale of nurses identified as barriers influencing nurses' acquisition of diabetes (Mutea & Baker, 2008).

Some strategies were able to significantly improve nurses' diabetes knowledge and diabetes practice. Examples included a formal educational program (Modic et al., 2014),

provision of diabetes sessions every three months (Gerard et al., 2010), and diabetes resources groups, which entailed multidisciplinary teams of experts (e.g. doctors, pharmacists, nurses and diabetes educators) discussing updates on diabetes care and providing resources for bedside nurses and patients (Gerard et al., 2010). The groups also provided one-day diabetes seminars every year. These strategies were effective in increasing nurses' knowledge of diabetes and promoting high quality care (Gerard et al., 2010).

3.5 Discussion

This is the first study to comprehensively review nurses' knowledge of different aspects of diabetes care. Twenty-five studies were reviewed across a variety of geographical and healthcare settings and nurses with varying qualifications, enabling the identification of common themes in relation to nurses' knowledge of diabetes and diabetes care. In summary, findings indicate significant knowledge deficiencies in many core aspects of diabetes care among nurses, flagged to some extent in every study included in this review. In both developed and developing countries nurses show suboptimal knowledge in relation to insulin therapy, oral diabetes medications, nutrition, BGM, diabetes complications and foot care, diabetes pathology, symptoms and management. These findings are not new. Although this review focused on studies published in the last 10 years, earlier studies reported similar findings. For example, in 1989, a study in the US found that nurses could not correctly answer questions on BGM, insulin storage and handling (Drass et al., 1989); another study in 1993 reported that 89% of nurses answered questions about oral hypoglycaemic agents incorrectly (Jayne & Rankin, 1993), and in 1994, a significant proportion of nurses employed in long-term facilities incorrectly answered questions on diabetes diet (52%) and diabetes care and management (61%) (Leggett-Frazier, Turner, & Vincent, 1994). Similarly, in

2002 almost half of the RNs recruited from a teaching hospital in the UK had knowledge deficits for BGM (Findlow & McDowell, 2002).

Collectively, these results indicate a need for change in the current provision of diabetes education. Two main issues regarding education should be considered in order to improve the knowledge of nurses regarding diabetes: (1) improving the quality of post-graduate education, and (2) ensuring the availability and accessibility of educational opportunities. Healthcare professionals, particularly nurses, in both developed and developing countries, need to be provided with appropriate training opportunities to enable them to fulfil the requirements of their position as an influence on both knowledge and practice (Hollis et al., 2014; Kassean, 2005; Mutea & Baker, 2008; Nash, 2009; Oyetunde & Famakinwa, 2014; Shiu & Wong, 2011), this includes opportunities to work closely with patients with diabetes, and with staff who are proficient in this area. Many countries have transferred nurse education into the tertiary education sector; findings of this review clearly indicate that even a university education does not guarantee a high level of diabetes knowledge for nurses (Bell & Duffy, 2009).

Although pre-registration university education is important, nurses' knowledge needs to be reinforced and regularly updated through continuing professional education and training. Multiple methods, including online modules and other e-learning approaches as well as face to face sessions, can be used to educate and update nurses on diabetes care, and programs should be available on a regular basis (Hunt, 2015). Further, nurses' inadequate knowledge about diabetes and its management, found in both developing and developed countries and in different healthcare settings, might be addressed by establishing specialised workplace-based taught curricula (Hassan & Wahsheh, 2011). This may improve not just the knowledge but also the confidence of nurses, and as confidence and knowledge are intrinsically related, improvement of both may have

beneficial influence on nurses' clinical practice and management of patients with diabetes. As a result, patients should be better informed and supported to actively self-manage their disease (DeCleene et al., 2015). Limited professional exposure to patients with diabetes and lack of resources including access to knowledgeable practitioners are also factors influencing nurses' knowledge of diabetes practice (Oyetunde & Famakinwa, 2014). It is also possible that nurses lack the time and/or the energy to maintain and update their diabetes knowledge due to high workload demands of routine practice (Modic et al., 2014).

Factors such as nurses' attitudes and beliefs towards diabetes care should be considered and addressed through appropriate role models (Kenealy et al., 2004). For example, some nurses believe they have high levels of familiarity with diabetes management and this may prevent them recognising their need for updating on diabetes care. Such attitudes may consequently deter them from seeking further education (Ni et al., 2014). Also, in busy environments, some nurses may not see patients' diabetes-related needs as urgent priorities (Kenealy et al., 2004) and whilst they may have the necessary knowledge and skills, they may not give sufficient priority to diabetes care. Where nurses possess adequate knowledge related to diabetes care and management and try to educate patients with diabetes they may be challenged to deliver this due to high workloads and/ or low staff morale, which may undermine their work efforts (Mutea & Baker, 2008).

Nursing shortages commonly result in demanding workloads that prevent nurses attending diabetes education such as external conferences and hospital-based continuous education sessions. Some nurses with low-income may not have adequate financial resources to participate in external diabetes education programs and relevant conferences and seminars (Scheppers, Van Dongen, Dekker, Geertzen, & Dekker,

2006). This is true in some countries. For example, in Saudi Arabia, although health institutions provide in-house training/seminars to their nurses, nurses working from other hospitals may need to pay to participate in them. Moreover, training/seminars offered by other organizations usually require the nurses to pay, and this is seldom covered by the nurses' organization. Comprehensive diabetes educational programs and strategies should be enacted to improve nurses' knowledge of diabetes and overcome the known knowledge acquisition barriers.

Furthermore, the important role of government funding and support in nursing post-graduate education is highlighted. The Saudi Arabian government provides scholarships to fund Saudi nationals to study for Masters and Doctoral degrees in various universities around the world. For Saudi nurses, the Ministry of Education, Ministry of Health, and other government organizations support qualified Saudi nurses to pursue their post-graduate education abroad. Furthermore, several post-graduate education activities for nurses are offered by various organizations in the country. The Saudi Commission for Health Specialties (SCFHS) is the national body that approves and accredits all continuing medical education (CME) in Saudi Arabia. The SCFHS has imposed that all healthcare practitioners must acquire a certain number of CME hours as a prerequisite for re-licensing to practice in the Kingdom (Alkhazim & Althubaiti, 2014) There are several models of supporting CME in the country. For example, hospitals have allocated budgets for training and developing their staff members (i.e. sponsoring staff members to attend local and international scientific meetings). However, the provision of CME among healthcare institutions faces challenges in relation to its effectiveness and quality. Also, private hospitals' engagement in CME is minimal compared to government hospitals (Alkhazim, Althubaiti, Al-Ateeg, Alkhwaiter, & AlNasser, 2015).

3.5.1 Limitations of the Review

Studies reviewed demonstrated significant heterogeneity, as a result of which it was inappropriate to combine findings on nurses' knowledge of diabetes and diabetes care. Nonetheless, this descriptive summary indicates significant evidence of suboptimal diabetes knowledge among nursing staff, and it is strength of this review to be able to draw consistent messages from studies applying different research methodologies. Most survey studies used dichotomised and multiple-choice items to assess nursing knowledge of diabetes; although these types of questions can be designed with a high degree of trustworthiness, they have the disadvantage of not allowing participants to construct their own answers and offering them an opportunity to guess (Francisco, 2013). However, the consistency of findings from both qualitative and quantitative studies adds credence to the findings.

3.6 Conclusion

The findings of this review indicate that the nursing workforce internationally may experience significant knowledge deficits in many aspects of diabetes care, and that this is a long-standing and continuing problem. These findings are concerning, considering the dramatic rise in incidence and prevalence of diabetes worldwide and the importance of the nursing role in diabetes patient care and education (Burke et al., 2014; World Health Organization, 2015). Lack of effective continuing education and inadequate training on diabetes care with insufficient access to education or training; limited exposure to expert practitioners and diabetes care; the world-wide shortage of nurses, high nursing workloads and subsequent low staff morale were identified as the main barriers to knowledge acquisition.

In response, it is important that nursing programs provide ample opportunity for knowledge acquisition related to diabetes care. Both the knowledge and practice of nursing staff in relation to diabetes care should be regularly monitored and accessible, affordable continuing educational courses provided. Nurses should be encouraged and supported to take up diabetes education, whether provided internally or externally to their employment Further, given the limited successes of current educational provision flagged in this review, education providers should look to more innovative approaches to maximise learning for this time-poor workforce.

This review provides direction and support for future research not just into the area of diabetes knowledge acquisition, but also the application of this knowledge in practice. This review flags the need for development and evaluation of effective strategies to improve nurses' knowledge about diabetes and its management and the impact of knowledge acquisition on nursing practice and patients' outcomes. A needs assessment should be undertaken to address topics of interest to nurses and effective new educational methods should be developed and implemented to address the knowledge gap (Young, 2011).

3.7 Summary

This chapter presented an integrative review of diabetes knowledge among nurses working in developed and developing countries. Diabetes knowledge deficiencies in a variety of diabetes care aspects were found among nurses. Specifically, the review found knowledge deficits in several diabetes care areas, including medication regimens, nutrition, BGM, complications, pathology, symptoms and management. These findings were consistent overall but with some differences of emphasis across developing and developed countries. Barriers such as lack of diabetes education programs, lack of

nursing experience, lack of diabetes resources and access issues prevented nurses from acquiring diabetes knowledge. On the other hand, nurses highlighted facilitating factors that could improve their diabetes knowledge. This included continuing diabetes education programs and providing diabetes resources and access to these for nurses. The following chapter provides the methodology of the study.

CHAPTER 4 Methodology, Research Design and Methods

4.1 Chapter Introduction

This chapter describes the research design and methods used in this study. It outlines the research paradigm guiding the development of this study and the rationale for using mixed methods to conduct the data collection and analysis. The chapter also outlines the setting for the study, sampling methods and recruitment and the instruments used to collect and analyse quantitative and qualitative data. In addition, the strategies used to enhance the validity, reliability and rigor of the study are outlined and the ethical considerations discussed.

4.2 Research Aim

The purpose of this study was to examine nurses' knowledge in relation to diabetes and its management in Saudi Arabia, and to identify factors that influence nurses' acquisition of diabetes knowledge.

This study aimed to answer the following main questions and sub-questions:

1. **What do nurses in Saudi Arabia know about diabetes assessment and management?**
   - **1.1.** What knowledge do nurses have in relation to diabetes pathology, its symptoms and management?
   - **1.2.** What knowledge do nurses have in relation to diabetes diet and nutrition?
   - **1.3.** What knowledge do nurses have in relation to diabetes foot care and complications?
   - **1.4.** What knowledge do nurses have in relation to blood glucose monitoring?
   - **1.5.** What knowledge do nurses have in relation to diabetes medications?

2. **What factors influence nurses' knowledge acquisition in relation to assessment and management of patients with diabetes in Saudi Arabia?**

2.1. What are the barriers that affect nurses' knowledge acquisition in relation to assessment and management of patients with diabetes?

2.2. What factors facilitate nurses' knowledge acquisition in relation to assessment and management of patients with diabetes?

4.3 Mixed-Methods Research

Traditionally two main types of research design have been available to researchers: quantitative (positivist) and qualitative (naturalistic) approaches (Keele, 2011). By combining positivist and naturalistic research paradigms, a third research approach was developed (Jirojwong, Johnson, & Welch, 2011). Through this typology, called the mixed-methods approach, the researcher collects, analyses and mixes (integrates or connects) both qualitative and/or quantitative designs in a single study (Creswell, 2003).

Integrating qualitative and quantitative approaches in a single study is increasingly being utilised as a design structure in nursing research (Bryman, 2006). During the last 25 years, the mixed method design has become popular in many social studies and been applied in multidisciplinary research. This approach can help to provide a broader and deeper understanding of a research problem than a single method approach (Creswell, 2014). In addition, it helps to balance and overcome the weaknesses of qualitative and quantitative research, and this suits the purpose of the current study, to rigorously address its research problem (Tashakkori & Teddlie, 2003).

The current study applied the mixed-methods approach to collect both numeric and narrative data to answer its explanatory and exploratory research questions. Using two different strands in one study can be both complementary and enriching (Keele, 2011).

Collection of quantitative and qualitative data during a mixed-method inquiry attains multi-level perspectives on the topic under investigation (Jirojwong et al., 2011). Mixed-methods permit the discovery of the results from both core and supplemental components (Morse & Niehaus, 2009). Collecting and analysing quantitative data (core component) is expected to provide a general understanding of the study problem, but would not be able to explore barriers and facilitators. In contrast, collecting and analysing qualitative data (supplement component) allowed further exploration to capture the views of participants in more depth and to address component factors (Creswell & Clark, 2011; Punch, 2013).

The research design of this study has been based on the concurrent nested strategy for the mixed method approach (QUAN + qual). This design was chosen as the study has different types of questions requiring different types of data to answer the questions (Creswell & Clark, 2007). The quantitative and qualitative data were collected concurrently but with separate processes for data collection and analysis.

The quantitative phase involved a single cross-sectional survey that aimed to identify nurses' knowledge in relation to assessment and management of patients with diabetes. The purpose of the qualitative phase was to support the quantitative data enabling the researcher to gain a more comprehensive understanding of the topic of interest (Creswell & Clark, 2007; Johnson, Onwuegbuzie, & Turner, 2007). Data for the qualitative phase were collected through semi-structured individual interviews. The individual interview technique was deemed suitable for this phase of the study due to the fact that nurses in Saudi Arabia have diverse cultural and educational backgrounds and competency in spoken English, impeding effective conversations in focus groups or group interviews (Almalki et al., 2011a). Individual interviews provided a safe environment for individual respondents to answer the study questions freely. The

interviews focused around the perceptions of barriers and facilitators to diabetes knowledge acquisition by nurses in Saudi Arabia.

4.4 Pilot Testing

Pilot testing was conducted before delivery of the full-scale study. The goal of a pilot study is to identify any issues in the delivery of the project and assess the feasibility, adequacy of resources, timing, clarity and accuracy (Hertzog, 2008). This pilot study involved a small convenience sample of 25 nurses from the Nursing Education and Staff Development Department in the study hospital, who were excluded from participating in the main study. These nurses were experts; knowledgeable about the topic and able to provide feedback on the process, resources, management and content of the Phase One questionnaires (Thabane et al., 2010).

The methodology for the main study is described in detail below.

4.5 Phase One: Quantitative Study

4.5.1 Survey Design

This phase involved a single cross-sectional survey using a quantitative questionnaire. The main advantage of this design is that it is relatively quick and easy to manage with the data collected at one particular point in time (Jirojwong et al., 2011; Polit & Beck, 2010). The cross-sectional survey allowed the researcher to access a cross section of the target population and simultaneously collect data from nurses with differing nursing qualifications and sub-specialties (Parahoo, 2014).

4.5.2 Research Site

The Prince Sultan Military Medical City (PSMMC), formerly known as Riyadh Military Hospital, is located in Riyadh City, the capital of Saudi Arabia, and is considered one of

the most advanced centres in the Middle East. It is located in the heart of Riyadh, at a distance of approximately 20 kilometres from the city centre and easily accessible to the general population. It is the flagship of the PSMMC Program (formerly known as the Riyadh Military Hospital program). PSMMC is the Medical Services Department (MSD) of the Ministry of Defence and Aviation (MODA) (Al-Otaibi, 2014). This hospital is the largest referral hospital, with a bed capacity above 1,300 and a variety of medical and surgical departments. It was chosen as the study site because it covered all medical and surgical specialties in the Riyadh region.

There are about 3,000 nursing staff of multiple nationalities, positions and cultures working in the PSMMC. As in other large hospitals in Saudi Arabia, nurses are recruited from many countries other than Saudi Arabia, including Australia, the UK, India, the Philippines, South Africa and the US (Al-Homayan et al., 2013). As a result, the nursing workforce of Saudi Arabia is predominantly comprised of nurses who have been educated and trained in many other countries, under widely differing curricula. Therefore, they are likely to possess differing levels of knowledge and understanding of diabetes and its management, and of the diabetes-related education needs of patients.

4.5.3 Sampling Approach

The population for this study was nurses working at the PSMMC who met study inclusion criteria. Data relevant to PSMMC were obtained from the individual hospital departments' administration, which were located under the various specialties. At the time of data collection, of the 3,000 nurses working in this hospital, approximately 1500 (50%) had direct contact with patients. This study employed a convenience sampling method, meaning that all available potential participants (nurses who had direct contact with patients) in the PSMMC were invited to participate in the study, with preliminary self-screening of their eligibility according to study inclusion and exclusion criteria

(Teddlie & Yu, 2007).

Due to limitations on the researcher's time and access, the researcher applied strategies to recruit participants to the present study using the Nursing Education and Staff Development Department. The staff of Nursing Education and Staff Development Department was assigned to each sub-specialty at the research site. Phase One used a cross-sectional survey to examine nurses' diabetes knowledge and Phase Two entailed interviewing nurses to identify the barriers and facilitators influencing nurses' knowledge acquisition in relation to diabetes care. The study was advertised through posters posted in wards where eligible nurses worked and publicised in general nursing meetings at these wards in the hospital.

4.5.3.1 Inclusion Criteria

The selection of nurses for this study was based on the following criteria highlighted in the Participant Information Statement (Appendix C):

- Participants were willing (volunteered) to be part of the study.
- They had a minimum of six months clinical work experience in nursing.
- Both female and male nurses were invited to participate.
- Participants were both expatriate and local Registered Nurses (RNs), registered with the Saudi Commission for Health Specialties.
- Participants were recruited from a range of clinical specialties in the Prince Sultan Medical Military Hospital (PSMMC) such as medical, surgical, paediatric, neuroscience, nephrology, urology, cardiology obstetrics and gynaecology departments, and intensive care units.
- Participants were in front-line care roles, i.e. responsible for delivering care to patients.

4.5.3.2 Exclusion Criteria

- Nurses in managerial positions, such as charge nurses, head nurses, clinical directors and clinical instructors, were excluded since they were not dealing with patients with diabetes on a daily basis.
- Newly appointed nurses who were still in the orientation and preceptorship periods.
- Nurses who had been involved in the pilot study.
- Nurses who worked in service support departments such as operating rooms, radiology, dialysis, laboratory, and endoscopy were excluded because they only dealt with patients for short time periods.

The study inclusion and exclusion criteria were explained to participants in the Participant Information Statement and details were collected in the Socio-Demographic Data Sheet (Appendix D).

4.5.4 Sample Size

The nursing population of the research site numbered approximately 3,000, including nurses employed in managerial positions and service support departments. Excluding these groups, the estimated population comprised around 1500 front-line nurses. The sample size for this study was determined in consultation with a statistician, demonstrating a required sample size of 305 nurses to allow estimation of a moderate sized effect at 5% significance level with 80% power (Munro, 2005). A similar local study achieved a response rate of approximately 50% (Al-Otaibi, 2014). As a result, the study anticipated a response rate of 50% with an estimated 5% unusable (ineligible) questionnaires. The researcher therefore needed to distribute questionnaires to at least 640 participants. The questionnaire was distributed to $N = 700$ nurses working in the included hospital departments. In quantitative research, the largest possible sample size

is expected to increase the representativeness of the study (Polit & Beck, 2008). Therefore, 700 surveys were distributed to ensure an adequate response rate above 50%.

4.5.5 Survey Distribution

The staff of the Nursing Education and Staff Development Department at PSMMC distributed the questionnaires since they had easy access to all hospital departments. The surveys were distributed to nurses in each included ward or department using proportional sampling methods based on the distribution of the ratio of numbers of nurses in each of the included sub-specialties to the number of nurses in the hospital as a whole. The number of nurses to be recruited from each ward was calculated using the following formula.

N = Total sample size required × number of nurses in each ward/total number of nurses in the hospital.

4.5.6 Study Instrumentation

4.5.6.1 Socio-Demographic Data Sheet

The survey package contained the Participant Information Sheet and the study questionnaires which consisted of a number of validated assessment tools (Appendix E) and a Socio-Demographic Data Sheet seeking personal details (e.g. age, nationality, gender and religion), educational achievements (e.g. diplomas and degrees) and employment background (e.g. years of work experience, occupation/position, area of assignment, where the participant currently worked and the number of in-service diabetes education courses undertaken).

4.5.6.2 The Assessment Tools

The assessment tools consisted of the Diabetes Basic Knowledge Tool (DBKT) and the Diabetes Self-Report Tool (DSRT) developed by (Drass et al., 1989). The DBKT

assesses the actual knowledge of diabetes using multiple-choice questions and consists of 49 questions, categorised into five content areas including diabetes medication, diabetes pathology and its symptoms, foot care and complications, BGM, diet and nutrition (Drass et al., 1989). The DSRT consists of 15 question assessing various diabetes-related content areas such as diabetes aetiology, basic treatment plans for diabetes types 1 and 2, surgical nursing care of the patient with diabetes, performing and interpreting blood glucose levels, diabetes education and diabetes complications, and management of 'sick day rules' in a patient with diabetes. Responses used a Likert-type scale format ranging from 1 (strongly disagree) to 4 (strongly agree) (Drass et al., 1989). An additional nine questions were used to address concerns about education of patients with diabetes and diabetes complications. These questions were adopted from the Diabetes Knowledge Questionnaire (DKQ) and the Diabetes Survival Skill Knowledge Test (DSSKT) developed by O'Brien et al. (2003) and Modic et al. (2009), respectively. These assessment tools were used to assess knowledge of diabetes in relation to assessment and management of patients with diabetes in nurses working in Saudi Arabia. The items of the first section of the tool, which measured the self-perceived knowledge, were scored using a Likert scale. The items measuring the actual knowledge were multiple-choice questions.

The tools were selected based on their validity and successful prior use in similar situations. The chosen assessment tools are the most commonly used tools to obtain a wide range of information about diabetes care and management. Their use would also facilitate comparison of findings to those of nurses in other studies.

4.5.6.3 Validity and Reliability of the Assessment Tools

Content validity index scores previously demonstrated for the Diabetes Knowledge Survival Skill Test, the Diabetes Knowledge Questionnaire, the Diabetes Self-Report

Tool and the Diabetes Basic Knowledge Tool were 0.90, 0.68, 0.91 and 0.94, respectively (Modic et al., 2009; van Zyl & Rheeder, 2008; Yacoub et al., 2014). The most recently reported Cronbach's alpha coefficient scores demonstrating the internal consistency of the Diabetes Knowledge Questionnaires, the Diabetes Self-Report Tool and The Diabetes Basic Knowledge Tool were 0.81, 0.80 and 0.77, respectively (van Zyl & Rheeder, 2008; Yacoub et al., 2014). To assess the validity of these questionnaires for the current study, four content experts with extensive experience in diabetes education and management from Jordan, Saudi Arabia, the US and the United Arab Emirates reviewed the instruments using the content validity index. The wording of some items was slightly revised based on received comments; the overall content validity index of the study questionnaires was 0.98.

To test the reliability, the study questionnaires were completed at two time points (test-re-test) with a 10-day interval between tests by 25 RNs in the Nursing Education and Staff Development Department at the PSMMC. The test and re-test correlation value for the perceived diabetes knowledge questionnaire (Diabetes Self-Report Tool) was $r = 0.835$, $p < 0.01$, and for the actual diabetes knowledge questionnaire (Diabetes Basic Knowledge Tool), $r = 0.727$, $p < 0.01$.

4.5.7 Recruitment

Once all the human research ethical approvals had been obtained, including approval to access the study site, nurses eligible to participate were recruited. First, the researcher met with the directors of the nursing education department and the clinical directors or head and charge nurses of each sub-specialty unit to inform them about the study and discuss the recruitment process. Prior to distribution of the survey, the researcher (i) advertised the study using posters in each unit (Appendix F), (ii) provided information sessions about the study to nurses during staff meetings and (iii) addressed their

enquiries about the study. This was carried out with the coordination of the Nursing Education and Staff Development department. The researcher and Nursing Education and Staff Development Department reminded potential study participants that participation was voluntary. Potential participants for Phase Two (qualitative study) were invited to contact the researcher by an email address provided in the posters and in the Phase One Participant Information Statement.

4.5.8 Data Collection Procedure

The survey packages were assembled containing the Participant Information Statement, the Socio-Demographic Data Sheet, the survey questionnaire and a return envelope (Appendix C, D & E). The survey packages were distributed to potential participants via the Nursing Education and Staff Development department of PSMMC and were located in the nursing stations of each included department in the study. The researcher allowed four weeks for potential participants to complete and return the questionnaires by placing them in secure boxes in the charge nurses' offices of each department clearly labeled as 'Diabetes Knowledge Survey'. To enhance the response rate, the researcher advertised and reminded staff of the survey through notice board advertisements and using the nursing office of each participating department, coordinated by the Nursing Education and Staff Development department.

4.5.9 Data Entry and Analysis

The survey data were entered into a personal computer using the Statistical Package for Social Science (SPSS), version 23 and were checked for accuracy, missing data, outliers and normality (Hair, Black, Babin, Anderson, & Tatham, 2006)**.** Data analysis included calculation of descriptive statistics, such as frequency and percentage tables to summarize categorical data, means and standard deviations to summarise numerical data. The Pearson correlation coefficient was used to examine relationships between the

nurses' knowledge and their socio-demographic profiles. If data were normally distributed, parametric tests such as t-test and ANOVA were used to identify statistically significant differences between groups with different characteristics (e.g. gender, education level, assignment areas). Appropriate non-parametric tests were employed if data were non-normally distributed.

4.6 Phase Two: Qualitative Study

4.6.1 Qualitative Design

The qualitative (naturalistic) approach typically explores real world experience (Taylor, Kermode, & Roberts, 2006) and helps understand essential aspects of phenomena from differing human perspectives (Curry, Nembhard, & Bradley, 2009). Qualitative studies usually focus on the meaning of human action and interaction and collect textual/verbal or descriptive data rather than numeric or predictive data (Bryman, 2012). Qualitative research can be defined as 'a systematic, subjective approach used to describe life experience and give them meaning' (Keele, 2011, p. 44). An exploratory-descriptive qualitative design was applied in this phase of the study. The purpose of this design is to provide detailed insight into a clinical or practice problem (Burns & Grove, 2010). Through this research design and the use of semi-structured individual interviews, the researcher collected in-depth and quality information about nurses' perceived barriers and facilitators to acquisition of diabetes knowledge in assessing and managing patients with diabetes.

4.6.2 Semi-Structured Interviews

Semi-structured interviews are a flexible and helpful method of collecting qualitative self-report data and employed once researchers know what they want to ask; however, they cannot anticipate what the answers will be (Polit & Beck, 2004). The rationale for

using this technique is that it allows the researcher to ask and the respondent to provide individual responses, so that valuable and potentially sensitive data about the research topic can be obtained (Dearnley, 2005). This interview method allows the interviewer the flexibility to digress and probe an interviewee for more information to explore related issues that arise during the interview (Parahoo, 2006). It involves using open-ended questions based on an interview guide, which offers a list of questions to be covered (Jirojwong et al., 2011). The questions in the interview guide (Appendix F) were reviewed and revised as the data collection progressed to allow the interviews to further explore issues raised in previous interviews. In keeping with the semi-structured format, the interviewer used the questions as a guide only rather than as a script (Jirojwong et al., 2011).

4.6.2.1 The Interviews

The interview guide for this study (Appendix F) was developed based on the previous literature reviews. It included a combination of open questions and related probes. The interview guide questions included “Can you tell me how diabetes is managed in this hospital?,” “How would you describe nursing professional practice in managing patients with diabetes?,” “What factors can affect nursing professional practice in managing patients with diabetes?,” “How can nurses’ knowledge of diabetes care and management be improved?” and “What barriers do you think affect nurses’ knowledge acquisition of diabetes care and management?”. Data on participants’ professional experience, nationality and educational qualifications were collected through the interviews. Probing and thought- provoking comments were also used carefully to support and encourage in-depth replies.

4.6.3 Sampling Strategy and Sample Size

The qualitative phase employed convenience sampling to recruit participants for qualitative interviews. During Phase One (questionnaires distribution) the researcher and the staff of Nursing Education and Staff Development Department invited potential participants by advertising the study using posters; those who were interested could send an email to the researcher. The participants who expressed interest in participating in the qualitative phase and met the study inclusion criteria received an email about the interviews. Interviews were anticipated to take approximately one hour; times and venues were arranged in negotiation with the participants. The interviews were planned to continue until data saturation was reached.

Data saturation is a guiding principle of qualitative approaches by which sampling continues until interviews do not provide any new data (Janice, 2007). The term saturation in the current study meant that data collection became repetitive and no new data were detected in the interviews (Taylor et al., 2006).

It was estimated that a sample size of 15 to 20 nursing participants from different departments would be adequate. The researcher received 20 emails from nurses volunteering to participate in the interviews. Convenience sampling was used to recruit nurses who met the inclusion criterion and were willing to participate. Participants were chosen based on their availability within a range of different nursing sub-specialties and their willingness to participate in this study (Onwuegbuzie & Collins, 2007). This sampling approach enabled speedy, easy, and cost effective recruitment (Etikan, Musa, & Alkassim, 2016).

4.6.4 Recruitment

Recruitment for Phase Two was conducted simultaneously with Phase One survey data

collection. All participants in Phase One were asked through the Participant Information Statement for the questionnaire and on posters in staff areas of the hospital if they were willing to participate in a semi-structured interview for Phase Two. If they agreed to be interviewed, they had the researcher's contact details on the Information Statement and the promotional poster (Appendix G) to communicate this. Additionally, information sessions were provided to prospective participants at staff meetings, to explain the study's aims and objectives, the voluntary nature of participation, and what was expected from participants. Upon making contact with the researcher, arrangements were made for potential interviewees to receive information about the interviews, to discuss any questions or any concerns, and if agreeable to schedule a convenient interview time. Interested participants, who had contacted the researcher via email, received an email including the Consent Form (Appendix H), the Participant Information Statement (Appendix C) and the Socio-Demographic Data Sheet (Appendix D) by return email. The recruitment process continued until data saturation was reached; this was when no new data emerged during interviews. The study recruited nurses from a range of ethnic backgrounds; consideration was given in preparation and during the interview to any cultural or religious factors.

4.6.5 Data Collection and Management

Members of the research team jointly developed the interview guide questions (Appendix F), which included: 'Can you tell me how diabetes is managed in this hospital?', 'How would you describe nursing professional practice in managing patients with diabetes?', 'From your point of view, what factors can affect nursing professional practice in managing patients with diabetes?', 'How can nurses' knowledge of diabetes care and management be improved?', 'What barriers do you think affect nurses' knowledge acquisition of diabetes care and management?' Responses were collected

through individual face-to-face in-depth semi-structured interviews conducted in English. Data on participants' professional experience, nationality and educational qualifications were collected at this time.

4.6.5.1 Pre-Interview Stage

The pilot study tested the interview guide and recruitment procedures, as discussed earlier in this chapter. The time and date of each interview was arranged at the convenience of individual interviewees. The interviews were scheduled for a non-prayer time for Muslim participants. They were held in a convenient, comfortable, quiet and private room which allowed participants to share their views about the topic of discussion with no distractions and in privacy (Whiting, 2008). Arrangements were confirmed with participants one hour before the interviews. The interviews were conducted in English and lasted about one hour.

4.6.5.2 Interview Stage

At the beginning of each interview, the interviewer thanked the interviewees for participating in the study, introduced himself and reminded them of the purpose of the study, the topic to be discussed and estimated interview time (Laforest, Bouchard, & Maurice, 2012). The interviewer assured the interviewees that confidentiality and privacy would be maintained during the interviews. The consent forms were collected prior to the interview commencing and the interviews were recorded using a digital audio recorder (Philips DVT-1150 digital voice device) with handwritten notes taken to assist with analysis of the transcribed data.

4.6.5.3 Post Interview Stage

Before concluding each interview, the interviewer made sure that all interview topics had been discussed and the participant had the chance to add any further comments. The interviewer again thanked the interviewees for their participation and asked permission

from the intervieiwees to send the data to their emails in order to confirm the content or to add comments or clarification after transcribed. Finally, the interviewer confirmed that written notes and audio recordings were completed before closing the session (Laforest et al., 2012).

4.6.6 Data Analysis

Data collection and data analysis for the qualitative phase of the study were conducted simultaneously to help identify and build on the emerging themes (Polit & Beck, 2014). Thematic analysis was used to identify, analyse and report patterns of themes in the data collected through the interviews (Braun & Clarke, 2006). This method allows the researcher to determine themes in a variety of ways, and offers opportunities to understand the possibility of any problems extensively (Marks & Yardley, 2004). It also allows the researcher to seek similarities and differences in patterns across the qualitative data set (Braun & Clarke, 2006). Thematic analysis was conducted in six steps as prescribed by Braun and Clarke (Braun & Clarke, 2006): 1) transcribing the tape recorded interview data into written format, followed by close and extensive reading; 2) creating codes for each participant transcript using a software program (NVivo version 11); 3) using codes to develop themes by combining similar codes together; 4) reviewing and reading themes to capture the contours of the coded data; 5) ongoing analysis to refine and name the themes; 6) writing the final report and supporting themes with selected participant quotes.

4.6.7 Trustworthiness of Qualitative Research

In qualitative research, rigour is important in order to ensure the quality of the research data and findings. Rigour in the current study was established using the Lincoln and Guba (1985) framework (Polit & Beck, 2010). The framework contains four criteria as follows:

4.6.7.1 Credibility

The researcher demonstrated the value and the believability of the qualitative findings using a number of strategies, including interviewees verifying their interview transcript and the researcher debriefing the research supervisors during the data collection and analysis (Polit & Beck, 2010). To achieve this, the researcher spent time studying the nurses' cultural and religious backgrounds, and engaged with their work regulations and surroundings. The researcher examined all relevant issues concerning the nurses to enhance his understanding of the interview and maximise the findings' credibility. Within the cultural norms, nurses used their own words to explain their opinions during the interviews; these were then used as direct quotations when the findings were reported. The researcher sent the transcribed data to the participants via email for them to confirm the accuracy of data.

4.6.7.2 Dependability

Dependability refers to the consistency or stability of the data collected and findings when the same measurement process is repeated after a certain time (Polit & Beck, 2010). To establish this principle and to enhance dependability in this study, the process of transcribing and coding data were clearly reported and described in detail. The results, interpretations and conclusions were also audited with the research supervisors (Polit & Beck, 2010).

4.6.7.3 Confirmability

Confirmability refers to the extent to which the findings are realistic and reflect the actual responses of participants without any bias or motivation from the researcher. To demonstrate confirmability in this study, a clear and correct research process was presented and one of the supervisors and external editing were involved to confirm the accuracy and relevance of the primary data (Polit & Beck, 2010). To ensure

confirmability in this study, the researcher audio recorded the semi- structured interviews, and followed clear steps of documentation so that all that participants said was recorded and then transcribed. The supervisor listened to the audio recordings and compared them to the transcripts of the interviews. These documents were revised and corrected by the researcher and approved by the supervisor. In order to obtain descriptive validity the researcher analysed the data independently and then consulted with research supervisors. After many discussions the researcher and supervisors agreed on the themes and their corresponding sub-themes.

4.6.7.4 Transferability

Depth and breadth of descriptions and explanations of the results were presented in this study to better demonstrate its transferability to other contexts (Polit & Beck, 2010).

4.6.8 Data Integration and Management

After analysing the qualitative and quantitative data separately, the findings were narratively integrated and synthesised through the interpretation phase of this study to generate final results in answer to each of the research questions. In this study, the researcher primarily selected a "staged narrative approach" for reporting both quantitative and qualitative findings. Quantitative and qualitative findings were separately published (McGregor, 2017).

4.7 Ethical Considerations

This study was conducted in accordance with ethical standards established by the Australian Research Council and the National Health and Medical Research Council (National Health and Medical Research Council, 2015).

4.7.1 Ethical Approvals

Ethical approvals for this study were obtained from the Hospital Research Centre, Saudi Arabia (Project No.750) (Appendix H) and Human Research Ethics Committee of the University of Technology Sydney, Australia (Reference No. 2015000302) (Appendix J).

4.7.2 Informed Consent

Prior to conducting the research, informed and voluntary consent to participate was obtained from each participant (National Health and Medical Research Council, 2015). Verbal and written information was provided to participants to enhance their understanding of the research and the expectations of their role. The Participant Information Statement contained a description of the purpose and procedures of the study as well as rights, benefits and risks to participants (Appendix C). Participation was entirely voluntary and participants had the right to withdraw at any time from the study without explanation (Jirojwong et al., 2011). In Phase One (survey), consent was implied by the participants' completion and return of the study questionnaires. Initial consent from the participants in Phase Two (interviews) was implied when they contacted the researcher through an email to express an interest in being interviewed. Verbal and written consents were obtained from all participants prior to conduct of the interviews.

4.7.3 Anonymity and Confidentiality

To maintain the privacy and confidentiality, the identities of the participants were not disclosed. The survey was anonymous and in the interview phase of this study, pseudonyms were used to protect the participants' identities (Keele, 2011). A number of stratgies were followed for both Phase One and Phase Two to ensure an suitable degree of confidentiality given the cultural and organisational issues encountered. As

mentioned above, participants were provided with an envelope in which they could seal a completed or blank survey form so that although the staff of the Nursing Education and Staff Development Department would be aware of their placing the survey envelope in secure boxes they would not be aware of the contents. Staff of the the Nursing Education and Staff Development Department were made aware of ethical principles and asked to respect that staff participantion in the survey and interviews was voluntary; non-participation must not have any adverse effect on working relationships. Interviews were conducted in private rooms or offices allocated by PSMMC in order to provide a private setting for the sake of confidentiality. Complete anonymity was not possible for the interview participants as their identity was known to the researcher. The interviews' location was selected so that both the researcher and the participant were able to enter the room at a convenient time and were able to do so without being observed by other non-participant nurses.

To promote confidentiality of data, the researcher first assigned the interviewee a code (using a specialty name) known only to the researcher; this code was then attached to the recording and the transcript of the interview. It was explained to participants how the data they provided would be used. To preserve confidentiality, all written and electronic data and materials were password protected and access was limited to the researcher and research supervisors. Throughout the period during which the research was conducted, the collected data were secured in the personal computer of the researcher in password-protected electronic form and hard copies of the returned surveys and interview transcripts were locked in the researcher's personal office, accessible only by him. On completion of the study, all completed surveys from Phase One and the audio recordings and printed transcripts from Phase Two were stored in a

secure storage facility in the Faculty of Health at the University of Technology Sydney, to be retained for a period of five years.

4.8 Budget

This study was funded by the Saudi Arabian Cultural Mission (SACM). The breakdown of the study costs is presented in the (Table 4.1) below.

Table 4.1: The study cost

	Detailed Fund Items	Amount $
Travel	Ticket cost to and from Sydney, Australia ($1500 x 2) (for data collection in Saudi Arabia)	3000
Equipment	Print and photocopy (package of study) ($1 x $500)	500
	Transcribe and digital audio recorder accessories ($250 x 2)	500
Others	Accommodation in Riyadh ($350 x 4 months)	1500
	Phone call cost ($40 x 4 months) (frequent contact with nursing education department during the process of survey distribution)	160
Total		5660

4.9 Summary

This chapter presented the methodology and provided justification for the use of mixed-methods research design in this study. The two concurrent phases of the study were described in detail along with the methods employed to collect and analyse the study data. The strategies used to increase the quality of data were explained, as well as the ways in which validity, reliability and rigour were addressed. Additionally, the ethical considerations taken into account during the conduct of the study were described. The results of the quantitative phase of the study (survey results) are presented in the following chapter.

CHAPTER 5 Phase One: Survey Results

5.1 Chapter Introduction

This chapter of the thesis is based on the following publication:

Alotaibi A., Gholizadeh, L., Al-Ganmi, A., & Perry, L. (2017). Examining perceived and actual diabetes knowledge among nurses working in a tertiary hospital. *Applied Nursing Research,* 35, 24–29. doi:10.1016/j.apnr.2017.02.014

This chapter presents the findings from Phase One, the quantitative study. It aimed to examine nurses' perceived and actual knowledge of diabetes and its care and management in Saudi Arabia. This chapter first presents the participants' demographic data followed by the study findings in relation to the perceived and actual diabetes knowledge of the participating nurses. Finally, factors that the nurses' identified as influencing their knowledge about diabetes are presented. This paper was published in Applied Nursing Research (Appendix A). This journal was chosen because its scope aligned to the content of the paper and its readership and quality were indicated by its impact factor of 1.2.

5.2 Introduction

The role of nurses in caring for and educating patients with diabetes has dramatically increased in scope and scale with the worldwide increase in the incidence and prevalence of diabetes. There are currently 415 million people diagnosed with diabetes globally (International Diabetes Federation, 2015); this is projected to rise to 642 million by 2040. People from low/middle-income and developing countries such as Saudi Arabia are, in particular, at increased risk due to socio-economic changes and urbanization. Effective management of diabetes is essential to reduce the early and long

term complications of diabetes and to prevent the onset of associated chronic diseases (Hark, Deen, & Morrison, 2014). Management of Type 2 diabetes requires individualized patient-centered care focused on serum glucose control, patient education to prevent development of complications, and promote medication and dietary management. Patients' outcomes have been demonstrated to improve when they receive up-to-date, complete and accurate information about diabetes and its care and management (American Diabetes Association, 2013).

Nurses are an indispensable part of this process, guiding patients' self-care practices through education and counselling (Coulter, Parsons, Askham, & Organization, 2008). However, studies have indicated knowledge deficits among nurses in various areas of diabetes care and management. Previous studies indicate that nursing workforces globally may experience significant knowledge deficits across many areas of diabetes care (Alotaibi et al., 2016). However, no study was found that investigated nurses' knowledge of diabetes and its care and management in the Saudi healthcare system. This study, conducted in a large Saudi governmental hospital, offers a first look at the level of diabetes knowledge held by nurses in Saudi Arabia and helps to fill this gap in the literature.

5.3 Phase One Aim

The aim of Phase One of this study was to examine nurses' perceived and actual knowledge of diabetes and its care and management in Saudi Arabia.

The specific objectives were to:

1) Identify nurses' perceived knowledge and skills in relation to diabetes and its care and management.

2) Assess the accuracy of nurses' knowledge (actual knowledge) of diabetes and its care and management.
3) Examine relationships between nurses' actual knowledge of diabetes and their perceived knowledge, socio-demographic and practice related data.
4) Identify factors predicting nurses' perceived and actual knowledge of diabetes and its care and management.

The methods of this study are set out in Chapter four (sections 4.2-4.5. and 4.7).

5.4 Results

5.4.1 Participants' Characteristics

The participants comprised a total of 423 hospital nurses (60.4% response rate) employed at PSMMC. This convenience sample were all nurses holding a Saudi registered nurse license. A total of 500 out of 700 questionnaires were returned but 77 were discarded as incomplete.

The ages of participants ranged from 23 to 63 years with a mean age of 31.8 years (SD = 6.8). Most (338, 79.9%) were from the Philippines, 30 (7.1%) were of Saudi origin, 23 (5.4%) were from India and 32 (7.6%) listed 'other' as their nationality on the demographic survey. Most nurses surveyed were female (345; 81.6%). Most participants had a Bachelor degree (353; 83.6%), followed by those with Diplomas (56; 13.2%), and Masters degrees (14; 3.3%). The number of years of nursing experience was reported in four categories (e.g. 1-5 years, 6-10 years, 11-15 years, 16 years and over).

The work setting listed 11 categories of nursing services: medical, surgical, neurology, urology, nephrology, cardiology, paediatric, intensive care, obstetrics/gynecology, neurosurgery, and others. Due to small numbers of respondents in some of the nursing

services categories (such as rehabilitation, psychiatry, nephrology, urology, neurosurgery, oncology, ophthalmology, orthopedics, ear, nose and throat (ENT), neurology, neurosurgery, plastic surgery and dermatology), these groups were combined for statistical purposes. Collapsed categories were as follows: urology, nephrology, oncology, dermatology, psychiatry, neurology and endocrinology were combined with medical nurses; ENT, ophthalmology, orthopedics, rehabilitation, plastic surgery and neurosurgery were combined with surgical nurses; Emergency, intensive care and isolation were combined under critical care. The final analysis was performed with the following seven nursing-services categories; medical (34.8%), surgical (19.9%), critical care (14.2%), cardiology (13%), paediatric (6.4%), obstetrics/gynecology (6.1%) and primary healthcare (5.7%) (See Table 5.2).

The socio-demographic data sheet also requested information about attendance at any diabetes in-services program in the past years.

5.4.2 Perceived Diabetes Knowledge and Skills

Participants' perceived knowledge of diabetes and its care and management was calculated using the Diabetes Self-Report Tool (Drass et al., 1989). Of a maximum possible score of 60, response scores ranged from 30 to 60, with a mean score of 46.9 (SD = 6.1). This represents an equivalent score of 78.2%, which is comparable to a score of 3 (or 'agree') on the original scale of 1–4, indicating that these nurses generally had a positive view of their diabetes knowledge. Over 70% of the nurses demonstrated good knowledge about serum glucose levels and more than 75% had adequate knowledge on foot care and complications. These findings indicate that the nurses were familiar with these basic components of diabetes care.

5.4.3 Accuracy of Nurses' Diabetes Knowledge

The accuracy of nurses' knowledge of diabetes and its care and management was calculated for each nurse using the Diabetes Basic Knowledge Tool (Drass et al., 1989). Of a maximum possible score of 49, response scores ranged from 2 to 35 with a mean score of 25.4 (SD = 6.2). None of the nurses answered all of the multiple-choice questions correctly and the mean score represents an equivalent score of 52.3% correct. Nurses' responses demonstrated particularly low accuracy in questions related to diet and nutrition questions (41.1% correct), diabetes pathology and symptoms (42.7% correct) and diabetes medications (45.7% correct). Greater accuracy in their diabetes knowledge was demonstrated for BGM (71.4% correct) and diabetes foot care and complications (75.6% correct) (Table 5.1).

Table 5.1: Descriptive Statistics for Diabetes Knowledge items (N = 423)

Variables	N	No of items	Mean	Std. Deviation	Percentage (%) score
Knowledge of diabetes pathology, its symptoms and management	423	14	5.9	2.3	42.7%
Knowledge of diabetes diets and nutrition	423	6	2.5	1.2	41.1%
Knowledge of diabetes foot care and complications	423	7	5.3	1.5	75.5%
Knowledge of blood glucose monitoring	423	6	4.3	1.3	71.3%
Knowledge of diabetes medications	423	16	7.3	2.8	45.7%

5.4.4 Relationships Between Nurses' Characteristics and Diabetes Knowledge

Nurses' actual knowledge of diabetes correlated positively but only moderately with their perceived knowledge of diabetes (Pearson's $r = 0.424$, $p < .001$). Perceived and

actual diabetes knowledge scores differed significantly according to nurses' socio-demographic and practice details. Results demonstrated some highly significant differences: for example, in relation to gender, providing diabetes care, access to diabetes management policies and guidelines, any attendance at diabetes education programs and country where the nursing education was received differed between males and females. Compared to female nurses, male nurses had significantly higher perceived diabetes knowledge ($t = 2.94$, $p = 0.003$), but lower actual diabetes knowledge ($t = -1.95$, $p = 0.02$). Compared to those who said they did not deliver diabetes care, nurses who reported current delivery of diabetes care had significantly higher scores for both perceived ($t = 6.41$, $p < 0.001$) and actual diabetes knowledge ($t = 5.39$, $p < 0.001$) (Table 5.2 and Table 5.3).

Compared to those without access, those who had access to diabetes policies and guidelines had significantly higher scores for both perceived ($t = 5.14$, $p < 0.001$) and actual diabetes knowledge ($t = 4.36$, $p = 0.03$). Those who attended any diabetes education programs had significantly higher scores for both perceived ($t = 3.63$, $p < 0.001$) and actual diabetes knowledge ($t = 2.08$, $p = 0.004$) than those without specialist post-registration diabetes education (Table 5.2 and Table 5.3).

Table 5.2: Participants' perceived diabetes knowledge scores of Diabetes Self Report Tool (DSRT) (Drass et al., 1989) in relation to demographic and practice related characteristics (N = 423)

Variables		Mean (SD) perceived DSRT score	Test values	*df*	P-values
Gender	Male (n = 78,18.1%) Female (n = 345, 81.4%)	48.6 (7.1) 46.4 (5.8)	$t = 2.94$	421	0.003**
Provides diabetes care	Yes (n = 278, 65.7%) No (n = 145, 34.3%)	48.1 (6.1) 44.3 (5.1)	$t = 6.41$	421	< 0.001***
Has access to diabetes management policies or guidelines	Yes (n = 240, 56.7%) No (n = 183, 43.3%)	48.1 (6.3) 45.1 (5.3)	$t = 5.14$	421	< 0.001***
Has attended diabetes education programs	Yes (n = 62, 14.7%) No (n = 361, 85.3%)	49.4 (7.3) 46.4 (5.7)	$t = 3.63$	421	< 0.001***
Highest qualification	Diploma (n = 56, 13%) Bachelor (n = 353, 83.5%) Master (n = 14, 3.3%)	45.4 (6.7) 46.9 (5.9) 49.7 (5.7)	$F = 3.27$	2,420	0.03*
Country where received nursing education	Philippines (n = 338, 79.9%) India (n = 23, 5.4%) Saudi (n = 30, 7.1%) Other (n = 32, 7.6%)	47.3 (6.1) 45.9 (7.1) 43.6 (5.1) 45.8 (4.9)	$F = 3.94$	3,419	0.01*
Perceived competency in diabetes care	Excellent (n = 7, 1.7%) Good (n = 80, 18.9%) Fair (n = 275, 65%) Poor (n = 61, 14.4%)	46.1 (9.9) 43.5 (4.4) 46.4 (5.2) 53.4 (6.3)	$F = 41.50$	3,419	< 0.001***

Note: (*t*) T test, (*df*) degrees of freedom, (*F*) one-way ANOVA, (*) significant at 0.05, (**) significant at 0.01 & (***) significant at 0.001.

Table 5.3: Participants' actual diabetes knowledge scores of Diabetes Basic Knowledge Tool (DBKT) (Drass et al., 1989) in relation to demographic and practice related characteristics (N = 423)

Variables		Mean (SD) actual DBKT score	Test values	df	P-value
Gender	Male (n = 78, 18.1%) Female (n = 345, 81.4%)	24.1 (6.9) 25.6 (6.1)	$t = -1.95$	421	0.02*
Provides diabetes care	Yes (n = 278) (65.7%) No (n = 145, 34.3%)	26.5 (5.2) 23.1 (7.1)	$t = 5.39$	421	< 0.001***
Has access to diabetes management policies or guidelines	Yes (n = 240, 56.7%) No (n = 183, 43.3%)	26.4 (5.4) 23.8 (6.7)	$t = 4.36$	421	0.03*
Has attended diabetes education programs	Yes (n = 62, 14.7%) No (n = 361, 85.3%)	26.8 (4.7) 25.1 (6.3)	$t = 2.08$	421	0.004**
Highest qualification	Diploma (n = 56, 13%) Bachelor (n = 353, 83.5%) Master (n = 14, 3.3%)	22.3 (7.9) 25.7 (5.7) 28.2 (4.9)	$F = 8.78$	2,420	< 0.001***
Country where received nursing education	Philippines (n = 338, 79.9%) India (n = 23, 5.4%) Saudi (n = 30, 7.1%) Other (n = 32, 7.6%)	26.1 (5.5) 23.2 (7.1) 20.6 (9.3) 23.1 (6.1)	$F = 10.53$	3,419	< 0.001***
Perceived competency in diabetes care	Excellent (n = 7, 1.7%) Good (n = 80, 18.9%) Fair (n = 275, 65%) Poor (n = 61, 14.4%)	17.7 (11.1) 23.6 (7.0) 25.5 (5.9) 27.8 (3.6)	$F = 9.66$	3,419	< 0.001***

Note: (*t*) t-test, (*df*) degrees of freedom, (*F*) one-way ANOVA, (*) significant at 0.05, (**) significant at 0.01 & (***) significant at 0.001.

The total mean scores of perceived and actual diabetes knowledge varied according to country where the nursing education was obtained, highest qualification and perceived competency in delivery of diabetes care. Ex-patriate nurses scored significantly higher for perceived ($F = 3.94$, $p = 0.01$) and actual diabetes knowledge ($F = 10.53$, $p < 0.001$) than locally trained Saudi nurses. There was a statistically significant difference in

perceived diabetes knowledge according to highest education qualification; nurses with Bachelor or Masters degrees had significantly higher scores for perceived ($F = 3.27$, $p < 0.03$) and actual diabetes knowledge ($F = 8.78$, $p < 0.001$) than nurses who had a Diploma in nursing. However, nurses who reported poor competency with diabetes care scored significantly higher for both perceived ($F = 41.50$, $p < 0.001$) and actual diabetes knowledge ($F = 9.66$, $p < 0.001$) than those who evaluated themselves as having excellent, good and fair competency (Table 5.2 and Table 5.3).

Nurses' perceived and actual diabetes knowledge scores were examined in relation to their specialty groups using one-way Analysis of Variance (ANOVA) with *post-hoc* analysis using the using *Scheffe* multiple comparison method. Significant differences were demonstrated in perceived diabetes knowledge between nursing groups ($F_{4,418} = 3.52$, $p = 0.008$), with the critical care group reporting significantly greater perceived diabetes knowledge than the medical group. Statistically significant differences were demonstrated between nursing groups for actual diabetes knowledge of BGM, diabetes medications, diabetes diet/nutrition, diabetes foot care and complications ($F_{4,418} = 3.73$, $p = 0.01$). The medical group had significantly less accurate knowledge of BGM ($F_{4,418} = 3.05$, p = 0.03) and of diabetes medications ($F_{4,418} = 4.44$, $p = 0.03$) than the women and children's group, and significantly more accurate knowledge of diabetes diet/nutrition than the ambulatory care group ($F_{4,418} = 3.74$, $p = 0.01$). The medical and surgical groups had significantly less accurate knowledge of diabetes foot care and complications than the critical care group ($F_{4,418} = 4.74$, $p = 0.02$) (Table 5.4).

Table 5.4: Diabetes knowledge scores of the Diabetes Basic Knowledge Tool (DBKT) (Drass et al., 1989) by nursing working groups

Mean (SD) scores	Medicine (*n* = 147)	Critical care (*n* = 115)	Surgery (*n* = 84)	Women and children's (*n* = 53)	Ambulatory care (*n* = 24)	Total (n = 423)
Perceived diabetes knowledge	46.2 (6.1)	48.8 (6.1)	46.9 (6.6)	45.5 (4.7)	45.7 (3.6)	46.9 (6.1)
Diabetes pathology/symptoms	5.7 (2.4)	6.2 (2.1)	5.9 (2.2)	6.1 (2.2)	5.9 (2.7)	5.9 (2.3)
BGM	4.1 (1.4)	4.4 (1.1)	4.2 (1.3)	4.7 (1.1)	4.2 (1.8)	4.2 (1.3)
Diabetes medication	6.8 (2.7)	7.7 (2.3)	7.3 (2.8)	8.2 (2.2)	6.3 (2.5)	7.3 (2.6)
Diabetes diet/nutrition	2.6 (1.1)	2.3 (0.9)	2.4 (1.1)	2.5 (1.3)	1.7 (1.1)	2.4 (1.1)
Diabetes foot care and complications	5.1 (1.5)	5.7 (1.2)	4.9 (1.7)	5.6 (1.3)	5.0 (1.3)	5.2 (1.4)

Note: BGM Blood Glucose Mentoring

5.4.5 Factors Explaining Nurses' Perceived and Actual Diabetes Knowledge

Multiple linear regression analysis was conducted to model factors explaining perceived and actual diabetes knowledge; regression equations for perceived and accurate diabetes knowledge were: *Constant value + (unstandardised coefficient "B" * predicted variables)*.

The model that best explained perceived diabetes knowledge scores included perceived competency, current provision of diabetes care, education level and attendance at any diabetes education programs (Table 5.5).

The regression equation for perceived diabetes knowledge = 39.74 + (3.41* perceived competency) + (–2.17 * provision of diabetes care) + (1.97 * degree level of education) + (1.97 * attended diabetes education programs).

Table 5.5: Explaining perceived diabetes knowledge scores (DSRT) (Drass et al., 1989) using linear regression

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	*t*	Sig.
(Constant)	39.740	2.609		15.230	<.001
Competent	3.411	.447	.350	7.636	<.001
Care	-2.176	.590	-.169	-3.689	<.001
Qualification	1.971	.664	.127	2.968	.003
Courses	-1.977	.747	-.114	-2.646	.008

a. Dependent Variable: DSRT

The model that best explained actual diabetes knowledge scores included currently providing diabetes care, degree level education, perceived competency, gender (being female) and access to diabetes management policies or guidelines. The regression equation for accurate diabetes knowledge scores = 14.12 + (–2.37 * provision of diabetes care) + (3.15 * degree level of education) + (1.80 * perceived competency) + (2.81 * gender) + (–1.42 * access to diabetes management policies or guidelines) (Table 5.6).

Table 5.6: Explaining actual diabetes knowledge scores (DBKT) (Drass et al., 1989) using linear regression

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	14.126	2.820		5.009	<.001
Diabetes Care	-2.370	.663	-.181	-3.578	<.001
Qualification	3.155	.706	.201	4.469	<.001
Perceived competency	1.803	.478	.182	3.770	<.001
Gender	2.819	.729	.176	3.867	<.001
Access to diabetes management	-1.424	.634	-.112	-2.245	.025

a. Dependent Variable: DBKT

Regressing the independent variables of perceived competency, current provision of diabetes care, education level and attendance at any diabetes education programs, gender (being female) and access to diabetes management policies or guidelines on the total scores of perceived and actual diabetes knowledge, the models explained 23% of the variation in perceived diabetes knowledge ($F_{4,418} = 31.71$, $p < .001$, $R^2 = 0.23$) (Table 5.7), and about 17% of the variation in actual diabetes knowledge ($F_{5,417} = 17.42$, $p < .001$, $R^2 = 0.17$) (Table 5.8).

Table 5.7: Regression modelling of potentially explanatory variables for the total score of perceived diabetes knowledge (DSRT) (Drass et al., 1989).

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.483[a]	.233	.225	5.38502	
Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	3678.632	4	919.658	31.714	<.001[b]
Residual	12121.336	418	28.998		
Total	15799.968	422			

a. Dependent Variable: DSRT

b. Predictors: (Constant), perceived competency, current provision of diabetes care, education level and attendance at any diabetes education programs.

Table 5.8: Regression modelling of potentially explanatory variables for the total score of actual diabetes knowledge (DBKT) (Drass et al., 1989).

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.483[a]	.173	.163	5.6964	
Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	2809.923	5	561.985	17.421	<.001[b]
Residual	13451.736	417	32.258		
Total	16261.660	422			

a. Dependent Variable: DBKT

b. Predictors: (Constant), currently providing diabetes care, degree level education, perceived competency, gender and access to diabetes management policies or guidelines

5.5 Discussion

This study found differing patterns of knowledge and insight among nurses working in Saudi Arabia. Nurses generally saw themselves as well informed about the disease, but knowledge gaps existed (i.e. diabetes pathology and symptoms, medications, foot and surgical care, BGM, diet and complications) and nurses' perception of what they knew of diabetes mellitus differed from what they actually knew. The low level of actual knowledge poses a concern since it may significantly affect nurses' competency in caring for patients with diabetes. Numerous studies have found inadequacies in nurses' knowledge of diabetes (Drass et al., 1989; Findlow & McDowell, 2002; O'Brien et al., 2003; Yacoub et al., 2014). For instance, inadequate knowledge of medication has been found among American and Jordanian nurses (Gerard et al., 2010; Yacoub et al., 2014) and insufficient knowledge of insulin treatment among 27% of Pakistani registered nurses (RNs; Ahmed et al., 2012). Australasian studies found that some 50% of participating nurses did not know that neuropathy, nephropathy, erectile dysfunction, cardiovascular and cerebrovascular diseases were complications of diabetes (Daly et al., 2014; Livingston & Dunning, 2010). Studies in the US and the UK also indicated RNs needing further training in blood glucose monitoring (BGM) (Gerard et al., 2010; Nash, 2009), as was also the case for 75.1% of Nigerian nurses (Oyetunde & Famakinwa, 2014). In a Korean study, 80% of practice nurses scored poorly on diabetes dietary questions relating to sources of carbohydrates for diabetes patients (Daci, Elshani, & Beretta, 2013). A qualitative study conducted in Sweden reported that none of the 22 participating enrolled nurses could distinguish the different types of diabetes or the symptoms of diabetes (Olsen et al., 2012). This is important because lack of knowledge among nursing staff can affect management of diabetes and patients' education and support for self-care activities. Nurses have a responsibility to educate patients with

accurate and up-to-date information, therefore, their knowledge should be maintained at an appropriate standard (Al Habashneh, Khader, Hammad, & Almuradi, 2010).

The present findings may be related to the very low numbers of nurses who attended diabetes education programs. Hence, hospitals could provide more opportunities for their nurses to attend such programs to improve their knowledge. Also, this finding has implications for the health policy makers in the country, such as the Ministry of Health, to provide more post-graduate programs focused on diabetes management.

This study indicated that nurses were more familiar with the practical skills of managing diabetes (such as BGM) than with theoretical aspects of the disease. This was also reported in a study which compared the knowledge of doctors and nurses in managing diabetes and found that questions relating to the physiology and complications of diabetes were scored higher by the doctors, whereas the nurses scored better on the questions relating to practical management of the disease (O'Brien et al., 2003). This is common in most disciplines as theory is forgotten over time but experience and wisdom often ensure quality work. For at least a substantial proportion of the nurses, this indicates the presence of a gap between their knowledge of theory and of practice; nurses may know how to perform certain procedures but may not be aware of, or may be confused by, the underpinning theory.

This study found that nurses' actual knowledge of diabetes correlated positively but only moderately with their perceived knowledge of diabetes. This supported the findings of Yacoub et al. (2014) about nurses' perceived and actual of diabetes knowledge, but was contrary to the study of Drass et al. (1989), which indicated a moderate low-moderate negative correlation between their perceived and actual knowledge of diabetes. Further, Baxley et al. (1997) claimed that nurses' perception of

knowledge was not significantly correlated with their actual knowledge. These studies support the need to have continuing in-service diabetes education programs that update nurses' knowledge and provide opportunities to obtain new information on diabetes, its care and management.

Furthermore, the findings indicate that there is a gap between the perceived and actual knowledge of the nurses. The results showed that the nurses perceived their knowledge higher than their actual knowledge scores (78.2% versus 52.3%). They thought that they had adequate knowledge, but in reality, they had lower knowledge than was their perception. This finding is critical as it may influence nurses' decisions to seek opportunities to improve their knowledge. This may also explain the low number of nurses who had attended educational programs on diabetes.

A gender difference appeared in the perceived and actual knowledge of diabetes. Male nurses perceived that they had greater knowledge about diabetes, its care and management than female nurses, but they scored worse on the actual diabetes knowledge questions. This concurs with findings of a US study that reported lower female than male nurses' self-evaluations of their performance and confidence levels regarding educating patients (Beyer & Bowden, 1997). It is important to understand the causes of negative self-perceptions amongst nurses that may enable nursing administration to improve these biases and achieve high quality diabetes care (Beyer & Bowden, 1997). This suggests that 'unconscious ignorance' may pose a greater barrier to diabetes education for at least some males compared to female nurses.

Study findings also revealed that nurses trained in Saudi Arabia had less knowledge about diabetes than ex-patriate nurses. This might be related to the quality of education in the country, which is always a major concern of Saudi officials (Khashoggi, 2014).

Jiffry (2013) noted that a number of Saudi organisations preferred to employ ex-patriate health professionals to be able to improve the quality of healthcare provided. This finding offers a challenge to the government to improve the educational system of the country, and thereby enhance the quality of the professionals produced, especially in the field of healthcare.

Nurses working in differing specialties reported differing patterns of diabetes knowledge. Those working in the medical specialty, for example, had less accurate knowledge of diabetes medications, foot care and complications than those working in women and children's, critical care, and surgical groups. Internationally, a number of barriers have been reported to contribute to nurses' failure to acquire or retain adequate diabetes knowledge. These include lack of adequate training, lack of access to relevant resources, limited experiences in caring for patients with diabetes and poor attendance at diabetes continuing education (Alotaibi et al., 2016). These factors also featured for these nurses in Saudi Arabia and may at least have contributed to the differences in knowledge among and between groups of nurses.

Intuitively, it might have been anticipated that medical nurses would have better knowledge of diabetes than nurses working in other specialties where patients with diabetes might be scarcer. One explanation for this might be the documented phenomenon of pressure on beds causing high movement and numbers of 'outliers' (patients warded outside their diagnostic specialty areas) resulting in dilution of medical nurses' skills (Duffield, Diers, Aisbett, & Roche, 2009). High workloads and low job morale have also been identified as barriers to nurses' knowledge of diabetes, its care and management (Alotaibi et al., 2016). It is important that hospitals focus on addressing these barriers, to enhance nurses' knowledge of diabetes.

Several strategies may be implemented to enhance nurses' knowledge in diabetes care and management. Continuing education is an integral component in supporting nurses to update their knowledge of managing patients with diabetes (Gerard et al., 2010). One study suggested developing and implementing 'tailor-made' educational programs to meet the learning needs of each sub-group of nurses (Chan & Zang, 2007). In this study four factors were found to explain nurses' perceived knowledge of diabetes: education level, current provision of diabetes care, attendance at diabetes education programs and perceived competency. Factors explaining accurate diabetes knowledge scores were identical but included gender. These results emphasise that clinical experience and continuing education are essential to ensure safe and effective care of patients with diabetes. However, it is also worth noting that continuing education on diabetes was identified as a significant factor influencing the perceived knowledge but not the actual knowledge. This may be due to the low number of nurses (17%) who had attended such educational activities, which might have hampered the ability to detect a significant association. Nevertheless, a commitment to lifelong learning is a professional responsibility that nurses owe to themselves and to their patients if excellence and safety in practice are to be achieved (Witt, 2011). This finding underscores the need for additional educational programs for the nurses, most specifically those that do not have prior diabetes education and those new in the clinical area. This strategy may be used to improve the diabetes knowledge of nurses working in hospitals with limited resources for continuing education. A similar point was made by El-Deirawi and Zuraikat (2001), who reported significant relationships between nurses' education and their knowledge of diabetes. The study findings suggest that overall nurses possess insufficient diabetes knowledge in some (i.e. diet and nutrition, diabetes pathology and symptoms, and diabetes medications) or all areas that preclude them from providing the full array of

quality diabetes care in line with best practice recommendations or to teach patients appropriately.

5.5.1 Study Limitations

Study participants were a self-selected sample of nurses. Although the response rate was acceptable (at 60.4%) this still means almost 40% of those invited declined to complete the survey. This limits the generalizability of survey findings.

This study used self-report tools to measure the perceived and actual diabetes knowledge of nurses, and it must be noted that self-report tools are prone to report bias. As nurses were issued the survey and allowed to complete and return it in their own time, it is possible that they may have consulted colleagues, books or the internet to complete the knowledge questions, and their actual knowledge may be even lower than survey results indicate.

The survey was focused on diabetes knowledge *per se* and did not assess the knowledge of the nurses regarding cardiovascular risk factors (blood pressure, smoking, and dyslipideamia). Future studies could incorporate tools assessing this aspect of diabetes care to have a greater understanding of the overall knowledge of nurses.

Careful consideration must be given to the generalisability of results. The sample in this study comprised mostly expatriates, principally from the Philippines. Whilst this may reflect a common staffing profile amongst major Saudi Arabia acute hospitals, due to the small number of Saudi nurses in the sample, the results cannot be generalized to Saudi nurses overall. Even though the study size was adequate, careful attention must be paid when comparing the results for sub-groups and when considering the transferability of findings. Future studies could consider incorporating the effect of clustering and sub-sampling. Study findings reinforce the need for further research in

terms of knowledge, attitudes, behaviours and competencies among nurses working in Saudi Arabia and other Middle Eastern countries, particularly in light of the burden of diabetes among Middle Eastern populations.

5.6 Conclusions

The findings suggest significant gaps between the perceived and actual knowledge of diabetes among nurses in Saudi Arabia, which is concerning as knowledge has a significant impact on nurses' ability in caring for patients with diabetes. These findings have important implications for nursing practice, policy and education. Factors likely to influence both perceived and actual of diabetes knowledge indicated potential success strategies likely to improve nurses' knowledge. These include increasing the availability of degree level nursing education and access to specific diabetes education programs; providing skills training to enhance perceived competency; and ensuring that all staff have ready access to diabetes management policies or guidelines. Nurse managers should take opportunities to devise strategies to improve nurses' knowledge in all areas of diabetes care.

The implications of this study for nurse managers and educationalist are that nurses' knowledge should be assessed in order to identify their specific learning needs, and these should be addressed in the education programs. Rotations could be arranged to provide opportunities to work with experienced diabetes clinicians and gain increased experience of providing diabetes care. When hiring new staff, those with degree level education could be preferred as they are more likely to have better knowledge. In addition, nurses' attendance in continuing educational programs and diabetes seminars and conferences should be encouraged and supported by nurse managers. Finally, nurses themselves should be encouraged to take the initiative to explore and engage in

all possible avenues to improve their knowledge regarding diabetes, as well-educated nurses can educate other nurses and can better contribute to patients' education and outcomes.

5.7 Summary

This chapter (Phase One) presented the quantitative findings of diabetes knowledge among nurses working in a tertiary hospital in Saudi Arabia. Knowledge deficiencies in most aspects of diabetes care were found among these nurses working in Saudi Arabia. For example, inadequate knowledge in relation to diabetes medications was highlighted among nurses working in different specialities in the hospital. This paper (Phase One) also revealed that nurses had poor knowledge in relation to nutrition management of diabetes, diabetes pathology and its symptoms and management. Nurses had good knowledge on practical aspects of diabetes care such as BGM and diabetes complications and wound care.

The following chapter provides the findings of the qualitative phase of the study, which aimed to explore factors influencing nurses' knowledge acquisition in relation to diabetes care in Saudi Arabia.

CHAPTER 6 Phase Two: Findings of the Qualitative Study

6.1 Chapter Introduction

This chapter of the thesis is based on the following manuscript, which is now in print:

Alotaibi A, Perry L, Gholizadeh L, Al-Ganmi A. In press. Factors influencing nurses' knowledge acquisition of diabetes care and its management: a qualitative study. *Journal of Clinical Nursing;* doi: 10.1111/jocn.14544. [Epub ahead of print]

This chapter presents the findings from Phase Two, the qualitative component of the study. Phase Two of the study aimed to identify the factors that influence nurses' knowledge acquisition in relation diabetes care. The findings of the study were organised under themes and sub-themes, which are reported with support from selected verbatim quotations. This paper was published online in the Journal of Clinical Nursing (Appendix A). This journal was chosen because it seeks to promote the development and exchange of knowledge that is directly relevant to all ranges of nursing practice, and because of the journal's wide range of readership and impact factor of 1.2.

6.2 Introduction

Diabetes mellitus is a major health concern around the world. Type 2 diabetes mellitus is characterised by high glucose levels in the blood caused by insulin resistance driven by obesity, while type 1 diabetes mellitus is an autoimmune disease (International Diabetes Federation, 2015). The commonest variety (Type 2 diabetes mellitus) can be controlled in the initial stages by lifestyle modifications that include changes in diet and increasing physical activity, but once diabetes becomes chronic, medication is necessary to control the condition (American Diabetes Association, 2015). In 2000 the prevalence of diabetes mellitus was estimated at 2–8% world-wide, and this is expected to rise to

about 10% by 2030 (International Diabetes Federation, 2015). In Saudi Arabia, although socioeconomic developments have resulted in health improvement among the general population, lifestyles have become more sedentary. An increase in meal portion size and an inclination towards fast foods and other diet modifications have led to an increase in obesity, a major risk factor for diabetes. Physical activity and exercise are not a regular part of the daily routine for most Saudi Arabians. The country has a high rate of diabetes (International Diabetes Federation, 2017; The Ministry of Health, 2015) and 20% of the nation's health expenditure is reserved for diabetes (Al-Nozha et al., 2004; Alotaibi et al., 2017b).

Living with diabetes requires access to accurate information with education available from healthcare providers and other reliable sources of information. Multidisciplinary teams need to be able to share information about new healthcare developments and make decisions regarding the effectiveness and cost-effectiveness of self-management approaches and other healthcare interventions (Tocchi, McCorkle, & Knobf, 2015). The primary goal of diabetes education is to encourage patients to accept their condition, to improve their knowledge and skills in diabetes self-management, and develop problem-solving skills to integrate necessary self-care tasks into their lifestyles (Dunning & Ward, 2008; Funnell et al., 2011). Nurses, as key members of multi-disciplinary diabetes teams, play an essential part in educating patients with diabetes to adjust with their health condition in order to best live the rest of their lives (Hoffman, 2013).

6.3 Background to Phase Two

Internationally, nurses working in a variety of healthcare settings have been shown to have knowledge deficits in all aspects of diabetes care and its management (Alotaibi et al., 2017a; Gerard et al., 2010; Olsen et al., 2012; Yacoub et al., 2014). A study from

Saudi Arabia found that nurses knowledge had poor accuracy in relation to diet/nutrition, diabetes medications, diabetes pathology, symptoms and management (Alotaibi et al., 2017a). They are not unique in this: a Swedish study found that enrolled nurses could not distinguish the different types of diabetes or their symptoms (Olsen et al., 2012), and inadequate knowledge of diabetes medications was found among nurses in the United States and Jordan (Gerard et al., 2010; Yacoub et al., 2014). Nurses indicated that knowledge deficiencies resulted from barriers preventing them achieving full understanding of diabetes.

Barriers were reported across different healthcare settings and identified by both individual nurses and the organisations in which they were employed. Lack of adequate training and education related to diabetes care was highlighted by participants working in Georgia in the United States (Eaton & Day, 2011), in Australia (Hollis et al., 2014) and in Hong Kong (Shiu & Wong, 2011). Lack of access to educational resources relevant to diabetes care influenced diabetes knowledge acquisition for nurses working in Mauritius, South Africa (Kassean, 2005) and Sweden (Olsen et al., 2012). Factors such as lack of diabetes nursing experience was found to affect British and Nigerian nurses' knowledge of and confidence about diabetes care and its management (Nash, 2009; Oyetunde & Famakinwa, 2014). Some differences were noted in the barriers encountered by nurses in different countries: while poor attendance at continuing education programs was identified as the main reason for poor diabetes knowledge by British nurses (Nash, 2009). Nurses working in developing countries were less likely to have access to educational materials and resources and appropriate diabetes training programs (Oyetunde & Famakinwa, 2014). The wider employment milieu was also an influence, with nursing shortages, high workloads and consequent low job morale

identified as barriers to nurses' acquisition of adequate diabetes knowledge (Alotaibi et al., 2016; Mutea & Baker, 2008).

Studies have also identified factors that facilitate nurses' diabetes knowledge acquisition and practice. Examples include participation in formal educational programs (Modic et al., 2014), provision of regular diabetes sessions (Gerard et al., 2010), diabetes resources groups, continuing in-service diabetes education, discussion of updates on diabetes care, and provision of resources for bedside nurses (Alotaibi et al., 2016; Gerard et al., 2010). There is, however, limited evidence of which factors facilitate or hinder diabetes knowledge acquisition of nurses in Saudi Arabia. Given the high local prevalence of diabetes, this is important. This study, conducted in a Saudi governmental hospital, offers a first look at the factors influencing nurses' knowledge acquisition in relation to diabetes care and its management and helps to fill this gap in the literature.

6.4 Aim/Objectives

The aim of Phase Two of this study was to identify and explore the factors nurses perceive as influencing their knowledge acquisition in relation to diabetes care and its management in Saudi Arabia. The specific objectives were to identify and explore the barriers that nurses perceive to hinder their knowledge acquisition in relation to diabetes care and its management, and to identify and explore the facilitators that they perceive to support their knowledge acquisition in relation to diabetes care and management.

The methods of Phase Two are described in Chapter Four (section 4.6).

6.5 Data Analysis

All the interviews were immediately transcribed verbatim. Transcripts were saved on a password-protected computer to ensure confidentiality and backed up to prevent data loss. Qualitative data were entered into the software program NVivo Version 11 and analysed using thematic analysis, conducted in the six steps prescribed by Braun and Clarke (2006) (See Table 6.1). The transcripts were first open coded (labelled), then axial coded (categorised) and thematically analysed (Appendix K). The researcher and supervisors reviewed the codes and discussed the categories and themes to ensure that the participants' perspectives were accurately and appropriately represented. Identification codes were developed based on each participant's current specialty in order to label verbatim quotes without breaking confidentiality.

Table 6.1: The steps of thematic analysis (Braun & Clarke, 2006)

Steps	Explanation
1	Transcribe the tape-recorded interview data into written format, followed by close and extensive reading;
2	Create codes for each participant transcript using a software program (NVivo)
3	Use codes to develop themes by combining similar codes together
4	Review and read themes to capture the contours of the coded data
5	On-going analysis to refine and name the themes
6	Write the final report and supporting themes with selected participant quotes

6.6 Results

6.6.1 Participants' Characteristics

Data saturation was reached after 16 (80%) semi-structured interviews with RNs working in a variety of settings (Table 6.2). Twelve participants were female (81.3%) and four were male (18.8%); all were aged between 30 and 50 years (with a mean age of

33 years), and most had nursing experience ranging from 6 to 11 years (62.5%). More than half the participants (56%) were from the Philippines; all held at least a Bachelor's degree in nursing (Table 6.2).

The findings of the study were organised under three main themes: diabetes care and education; barriers affecting nurses' acquisition of diabetes knowledge; and factors supporting nurses' acquisition of diabetes knowledge (Table 6.3).

Table 6.2: Participants' characteristics (n = 16)

Characteristic	**Value**
Gender; n (%)	
Male	n = 4 (18.3%)
Female	n = 12 (81.5%)
Age; years, Mean (SD)	33.3 (6.5)
Years of experience; Mean (SD) Range	2.2 (0.85); 6-11
Department Category; n (%)	
Cardiology	n = 1 (6.3%)
Medical	n = 8 (43.8%)
Surgical	n = 4 (31.3%)
Emergency	n = 1 (6.3%)
Obstetric/Gynaecology	n = 1 (6.3%)
Intensive Care Units	n = 1 (6.3%)
Qualification; n (%)	
Bachelor Degree	16 (100%)
Nationality; n (%)	
Philippines	n = 9 (56.3%)
India	n = 3 (18.8%)
Saudi	n = 4 (25%)

Table 6.3: Summary of the study themes

Themes Categories	Sub-Themes	Meaning Units
1- Diabetes care and education	The reality of the nursing role in diabetes care	• Contributing to the initial assessment • Administering in-patients medications • Following up the treatment plans, hospital policies and specialist team instructions • Contribution in practical aspects of diabetes care
	Overlapping diabetes care and education	• Overlap with dietician in relation to diet consultation and instruction • Overlap with diabetes educators in relation to self-care activities and other holistic care
2- Barriers affecting nurses' acquisition of diabetes knowledge	Individual level	• Lack of interest in gaining new knowledge • No/limited time to attend any available diabetes continuing education programs • Lack of clinical experience • Family-related issues, and the lack of priority
	Organisational level	• Lack of resources • Lack of access to relevant information • Lack of opportunities due to staff shortages and high workloads • Lack of institutional support, motivation and incentives • Difficult interact with other members of the multidisciplinary healthcare team
3- Factors supporting nurses' acquisition of diabetes knowledge	Organisational factors to enhance diabetes-related knowledge	• Provide a route for diabetes knowledge exchange across professional groups • Support for continuing diabetes education and training • Improve institutional resources, such as increasing staffing numbers and expertise • Provide printed learning and materials
	Environmental factors to enhance diabetes knowledge	• Effective inter-and intra-professional interaction, communication and collaboration

6.6.2 Diabetes Care and Education

Participants believed that caring for and educating patients with diabetes required a multidisciplinary team with knowledge of different aspects of diabetes care (e.g. diet instruction, medication management, and other aspects of holistic care). The nurses expressed that they should have a major role in diabetes care and education, since they are the predominant group that asks about, listens to and notes patients' care needs, spending more time with hospitalised patients than any other professional healthcare group, including physicians or diabetes specialists (e.g. diabetes educators, dieticians). They felt it was important for patients to be able to make use of this degree of contact to update and consolidate their knowledge for diabetes self-management. However, they found their roles overlapped those of other diabetes care providers: for example, diet instruction was also given by dieticians; diabetes educators also taught patients about checking blood glucose levels and taking diabetes medications. This gave rise to two sub-themes: the reality of the nursing role in diabetes care and overlapping diabetes care and education.

6.6.2.1 The Reality of the Nursing Role in Diabetes Care

Nurses in this study took care of patients with diabetes whether they were admitted to hospital for reasons directly related or incidental to their diabetes. They described the reality of their nursing role in diabetes care as contributing to the initial patient assessment, administering diabetes medications, and implementing treatment plans as ordered by the physician or other diabetes care providers. It was also their responsibility to identify patients who did not adhere to their prescribed medications and diabetes diet plans, and to refer these patients to a dietician or diabetes educator for further education and reinforcement. Nurses, however, felt they were side-lined and did not play a big part in the diabetes team.

From the neonatal clinic, patients (mothers with Gestational Diabetes Mellitus) are already aware and educated about diabetes when they come up here to our ward; nurse role is to make sure that they comply with the diabetes plan given by dieticians or diabetes educators in relation to the diabetes treatment and stick to diabetic diet. ***(Obstetric/Gynaecology nurse)***

Nurses talked about their role in relation to the practical aspects of diabetes care, such as controlling and monitoring blood glucose levels, documenting the results in a sliding scale form, and informing the doctor to review any patient whose blood sugar level was not within the recommended range. Most nurses felt that their role was restricted to practical aspects such as checking and observing blood glucose levels.

*Nurse usually check, observe and write the blood sugar level every six hours unless the doctor ordered hourly check. (**ENT nurse)***

Many nurses believed that the reality of their nursing role in diabetes care was to follow hospital policies and specialist team instructions regarding diabetes treatment plans. For example, they assessed patients for diabetes complications such as diabetic wounds or ulcers, and followed the wound care team's plans in dressing patients' wounds, or they administered insulin as prescribed on medication charts with consideration of the patients' blood glucose levels. Prior to discharge, diabetes educators and other specialists (such as the wound care team, as appropriate) took over and assumed full responsibility for educating patients about diabetes self-management.

My role in managing a patient with diabetes is that I give instructions to the patient; like, for example, give insulin and diabetes medications to them depending on their blood sugar level, and proper hygiene and sterile dressing if there is open wound. ***(Nephrology nurse)***

The nurses reported following the hospital's policies and procedures for diabetes care. They were aware of their roles in diabetes nursing management, which were intended to

dovetail with, rather than overlap, the work of other healthcare providers such as diabetes educators and dieticians; in reality they reported having little or no opportunity to be involved in educating diabetes patients about self-care and diet. They felt that their role in providing diabetes education was eroded by the work of other team members with specialist roles, and that ambiguous wording in their job descriptions served to limit nurses in their understanding of their full role.

6.6.2.2 Overlapping Diabetes Care and Education

Some aspects of the nurses' roles in diabetes care and education overlapped those of other multidisciplinary team members. For example, they noted that dieticians were fully responsible for providing diet instruction, and other elements of holistic care for patients with diabetes were divided between nurses and diabetes educators. The nurses felt they had limited authority to educate patients with diabetes in regard to diet planning, and were only authorised to refer patients to a dietician for intensive dietary instructions and consultation. They noted that dieticians were available in every in-patient department and were responsible for educating patients and coordinating their diet plans.

> *Nurses inform dieticians in each assigned area to see patients with diabetes in order to control, coordinate and educate patients about diabetes diet.* ***(Neurosurgery nurse)***

Nurses stated that diabetes educators had the primary responsibility for provision of diabetes self-care management and education. This included ensuring that patients had a sound understanding of diabetes and received the support they needed to make informed lifestyle and treatment choices, such as to incorporate physical activity into their daily life, and to adhere to their medication regimens. Some respondents claimed that it was the responsibility of diabetes educators to educate patients with diabetes about how to

use diabetes medications and about insulin injections before discharge. Nurses explained that they would call diabetes educators if patients with diabetes required extensive self-management education in relation to diabetes care in business working hours. Nurses themselves played only a small role in education of diabetes patients – on public holidays and after-hours, when dieticians and diabetes educators were not available. In this case, they documented patients' educational needs in their medical records and followed up with a referral of the patients to an on-call dietician or diabetes educator.

> *Truly, there's a person responsible (for patient education), the diabetes educators are responsible to educate the patient. We're only assisting the patient and giving regular medications. We're only calling them to educate the patient. Diabetic educators are the ones advising, instructing the patient prior to discharge as well as teaching the patient how to inject the insulin, to take oral medication and to use machine for checking blood glucose level by themselves.* ***(Nephrology nurse)***

These nurses felt they were not authorised or enabled to educate patients with diabetes in relation to different aspects of diabetes care. Due to the overlapping of their role in patient education with that of diabetes educators, nurses felt that their authority and space for providing diabetes care was reduced.

6.6.3 Barriers Affecting Nurses' Acquisition of Diabetes Knowledge

Nurses were clear that they have an important role in caring for the increasing number of patients with diabetes. To support these patients effectively, nurses require comprehensive understanding of all aspects of diabetes care and treatment. However, nurses in this study identified various barriers to improving their diabetes knowledge. These barriers were categorised at individual and organisational levels.

6.6.3.1 Barriers at an Individual Level

Some participants expressed a lack of interest in gaining new knowledge because they felt that diabetes care was long-term, and that more education and knowledge of individual nurses would not lead to better outcomes. A few nurses working in acute care specialties believed that there was no reason to update their diabetes knowledge because they thought of the disease as a chronic condition with no cure:

> *Nurses just do it as routine because diabetes is long-term care and a common disease in Saudi Arabia, which causes lack of interest among nurses to improve their knowledge of diabetes care.* ***(Neurosurgery nurse)***

In addition, nurses claimed that they did not have time to attend available diabetes continuing education programs, especially those scheduled out of work hours. Feeling tired after work and having family responsibilities were individual-level barriers to participation in education highlighted by some respondents. Nurses who were close to retiring expressed a lack of motivation in keeping themselves up to date with diabetes care. In addition, age was believed to be a factor affecting some nurses' capacity, both physically and intellectually, to acquire new knowledge. Some nurses claimed that older nurses, pre-retirement, were unwilling to update their knowledge of diabetes management, which was consequently out-dated.

> *For example, one thing is age. If you are already old, I will just sit and lie down at home. Why should I attend the study days? I'm very tired of working … I spend my day off just to relax.* ***(Cardiology nurse)***

Lack of clinical experience was identified as another individual-level barrier. Junior nurses claimed that they had knowledge deficits in diabetes care, particularly diabetes foot care and management of severely ill diabetes patients including those in coma, as they were not generally involved in the care of diabetes patients. Lack of previous

experience and perceived knowledge deficits were viewed by junior nurses as affecting their confidence in providing care to diabetes patients:

> *If I'm a newly hired staff…just passed the board exam, I don't have much experience about diabetes care. I don't have any experience in seeing patients with diabetes … the experience about the complications of it and how it is managed. It affects my care of patients. If I'm just new, of course I don't have much experience, so maybe the care would not be that excellent.* ***(ENT nurse)***

A few nurses also raised personal concerns, such as family-related issues. Many expatriate nurses experienced problems such as stress and homesickness that influenced their knowledge and practice, the standard of diabetes care they delivered, and their capacity to acquire diabetes knowledge. Some nurses argued that more professional assistance and motivation from senior nurse colleagues and nursing managers would have a positive impact on their wellbeing, and would promote more positive attitudes to safe and up-to-date practice amongst nurses:

> *The head nurse or supervisor is not motivating you that much or encouraging you to learn new things. Why would you read if you don't have the mood to study? For example, if you have a family problem, do you think you have the time to read? Of course you don't.* ***(Surgical nurse)***

6.6.3.2 Barriers Relating to the Organisation

Most nurses identified organisational barriers related to the acquisition of diabetes knowledge, including lack of resources, lack of access to relevant information, lack of opportunities due to staff shortages and high workloads, lack of institutional support, motivation or incentives, and difficulty interacting with other members of the multidisciplinary team. While nurses in medical departments had access to regular, continuing diabetes education, many of those in non-medical specialties reported a lack of diabetes information resources, such as pamphlets, posters and guidelines, as an on-

going challenge; they did not even have sufficient diabetes-related resources for the patients with diabetes in their care:

> *We don't have enough resources in our department to properly manage and educate patients. If we had sufficient resources, we could do it. These resources are provided only to the endocrinology department.* ***(Neuroscience nurse)***

Many nurses said that they missed continuing educational opportunities because they were not informed about the time and venue of these programs, and believed that these programs were neither advertised nor arranged appropriately:

> *Head nurses do not tell their nurses about planned diabetes in-service education programs, even nurses on the ward on the day of the programs. The only time we know about in-service training is via the intranet. In addition to the absence of direct notices, no one tells us that we need really to attend in-service diabetes programs.* ***(Neurology nurse)***

Many said they were willing to increase their diabetes knowledge and skills by reading electronic guidelines and attending diabetes education sessions and workshops provided by the nursing education and staff development unit.

> *The provision of Internet access in nurses' flats and guidelines online would enable nurses to update their diabetes-related knowledge.* ***(Oncology nurse)***

Nurses in different specialties had differing perspectives of the quality of the existing diabetes educational programs. Some believed they had gained little or no knowledge from the programs they had attended, citing poor content, poor presentation or communication skills of the educator. Some felt that a lack of specialist lecturers in this field affected the quality of the education provided:

> *Yeah, the hospital management usually provides lectures and study days every year. However, they don't always have professionals to present the lecture or oversee the study days.* ***(Paediatric nurse)***

The nurse–patient ratio at the unit level was another major concern for nurses, perceived as having a negative impact on nursing education and development. Heavy workloads affected their ability to take part in relevant sessions/workshops inside or outside the hospital:

> *In our hospital, we handle four to six critical cases every shift. We're too busy with patient care to discuss diabetes control with the patient. We can't attend workshops inside or outside the hospital due to our workload and shortage of staff.* ***(Orthopaedic and Ophthalmology nurse)***

A few nurses also reported difficulties interacting with members of the multidisciplinary healthcare team because of poor inter-professional communication. For instance, they reported that some physicians disrespected the nurses in clinical settings and took no account of their opinions about diabetes care, making it difficult for nurses to speak for their patients:

> *Sometimes, some of the doctors are very dominant. They ask the nurses unprofessionally, like they raise their voice, interrupt them; of course if you are going to talk to them in that way I am not going to talk with you properly what is happening with the patient.* ***(Cardiology nurse)***

6.6.4 Factors to Support Nurses' Acquisition of Diabetes Knowledge

6.6.4.1 Organisational Factors to Enhance Diabetes-Related Knowledge

The majority of nurses believed that the organisation played an important role in improving nurses' knowledge of diabetes care by organising workshops and seminars. Managers' support for nurses to participate in continuing diabetes education and training was perceived as a priority, as was the introduction of an information dissemination system and improving institutional resources, such as staffing numbers and expertise. Nurses considered that making printed learning materials available in the

hospital wards would facilitate updating of their diabetes knowledge and practice and help close knowledge gaps in different aspects of diabetes care.

> *If diabetes resources and materials were provided to the different departments to educate nurses as well as patients, these would help nurses improve their diabetes-related knowledge and diabetes care skills.* ***(Neuroscience and Urology nurse)***

Nurses believed that the provision of high-quality continuing diabetes education and in-service training programs by expert educators would enable them to improve their knowledge of diabetes care and management and make them better nurses. A few nurses suggested that the provision of education sessions by nurse educators on pharmacological and non-pharmacological diabetes treatment was essential to improve nurses' knowledge of diabetes management:

> *The provision of incentives would encourage nurses to attend these programs or symposiums. Of course, if they are free!* ***(ENT nurse)***

Nurses reported that increasing institutional resources was conducive to knowledge building and knowledge acquisition of diabetes care and management. They also highlighted that local guidelines and protocols, in addition to institutional support and motivation, would facilitate nurses' ability and willingness to update their knowledge and management of diabetes. Somewhat simplistically, perhaps, the implementation of common guidelines and protocols was identified as important to guide the care of diabetes patients:

> *If we all follow the same guidelines and protocols, we will be able to provide good nursing care to the diabetic patient.* ***(Paediatric nurse)***

6.6.4.2 Environmental Factors to Enhance Diabetes-Related Knowledge

It was considered important that the members of multidisciplinary teams have opportunities to talk to each other about diabetes care and exchange information and

experiences. Considering the local environment and ward culture, nurses perceived that putting processes in place for professional interaction and knowledge exchange between nurses and other diabetes care providers was necessary to provide quality diabetes care and management. They felt that such processes would encourage good working relationships among all diabetes care providers, and support knowledge sharing in relation to diabetes care; would encourage nurses to be present at ward rounds and facilitate the exchange of diabetes-related knowledge with other healthcare professionals. Such professional interaction would provide opportunities for nurses to discuss or ask questions about patient care and to update their knowledge about medications, diabetes pathophysiology or other aspects of care:

> *Multi-disciplinary team interaction is important in diabetes care. If there is a problem, the team members will be able to share their knowledge. If one person has insufficient diabetes knowledge, the other members of the multi-disciplinary team can fill that gap, and the others can learn from that person* ***(ICU and Emergency nurse)***

6.7 Discussion

This is the first study conducted in Saudi Arabia to explore the factors influencing nurses' knowledge acquisition in diabetes care and its management, a topic that will only become more important in coming years, given the high and rising prevalence of diabetes in the country (Alotaibi et al., 2017b).

6.7.1 Nurses' Views of their Role in Diabetes Care

Nurses declared that their roles were limited in managing patients with diabetes. Their responsibilities were mostly to contribute to an initial assessment of care, to administer in-patient medications, to follow up on treatments planned based on policy and guidelines, and to contribute to practical aspects of care. Their descriptions of care showed a lack of role clarity, caused by overlapping roles in diabetes care and patient

education between nurses and other diabetes care providers, and conflicting attitudes amongst nurses that could lead to misinformation and misconceptions about diabetes care. For example, nurses stated that diabetes diet instructions were provided by dietician staff, while diabetes educators were responsible for self-care activity in this hospital. Nurses were expected to follow up with the patients and ensure care planned by other professional groups was understood and delivered to the patients, yet the nurses themselves were not always clear about this.

6.7.2 Nurses' Views of the Barriers and Facilitators to Acquisition of Diabetes Knowledge

Whilst both organisational and individual barriers and supports to diabetes education were reported, the findings emphasized that most of the barriers encountered by most nurses were structural, and little support or incentives were provided for them to attend educational sessions. The findings highlighted that the barriers nurses encountered were primarily organisational: lack of time, lack of priority, lack of access to education and lack of clinical experience deterred nurses from updating their knowledge and skills in relation diabetes care. Nurses themselves were clear that their most immediate barriers originated at the organisational level, such as lack of resources, lack of access to relevant information, lack of opportunities due to staff shortages and high workloads. They saw this lack of institutional support, associated with subsequent individual factors such as poor motivation, as making it more difficult for nurses to interact on an informed basis with other members of the multidisciplinary healthcare team.

Considering the factors that nurses reported as facilitating acquisition of diabetes knowledge, once again organisational factors were stressed. Most nurses interviewed suggested that the organisation should provide printed learning materials, routes for diabetes knowledge exchange across professional groups, support for continuing

diabetes education and training, and improve institutional resources such as staffing numbers and expertise.

Nurses mainly described themselves as responsible for the practical aspects of diabetes care rather than being involved in patient education, a responsibility mainly placed on dieticians, diabetes educators and other multi-disciplinary team members. Similar experiences have been reported elsewhere. A Canadian study that explored inter-professional collaboration in diabetes care found poor interaction between dieticians, diabetes educators and nurses caused by overlapping or shared role boundaries (Gucciardi, Espin, Morganti, & Dorado, 2016). This situation appeared to strongly influence the attitudes of the nurses towards diabetes care and patient education, which may also be the case not only in Saudi Arabia but in other parts of the world (Dubois & Singh, 2009; Eijkelberg, Spreeuwenberg, Wolffenbuttel, van Wilderen, & Mur-Veeman, 2003).

The varying nature of inter-professional role boundaries and the scope of practice of specialist diabetes educators and nurses may mean that the roles of different members of the healthcare team are not clearly understood, particularly in a multi-national workforce. The nurses in this study reported widely varying attitudes, with evidence of uncertainty and ambivalence about what their roles could, should and did entail. This lack of role clarity and definition may perhaps have contributed to the low motivation to improve their diabetes knowledge reported by some participants. This reinforces the importance of role clarity for each profession, irrespective of the nationality of origin, so that nurses are confident and can develop competence in their specific responsibilities and know when to refer the patient to which other diabetes specialist. Better understanding is required of local job descriptions, specifically related to diabetes management, by all members of the healthcare team to prevent overstepping or gaps in

responsibilities, and to improve autonomy of practice (Braithwaite et al., 2012). Nurses have historically provided the principle diabetes education but they need to be equipped with adequate knowledge of diabetes care in order to be effective (King, Nancarrow, Grace, & Borthwick, 2017). Many nurses saw their roles in relation to diabetes care and education as eroded and limited by other diabetes specialists, yet asked for multidisciplinary collaboration as a way to enhance their knowledge of diabetes care. A multidisciplinary team approach is best suited for diabetes care, to achieve the high demands of patients, utilise the best diabetes resources, and provide positive measurable outcomes (Codispoti, Douglas, McCallister, & Zuniga, 2004).

Nurses recognised their limited knowledge regarding diabetes-self-management and felt that this limited their roles in diabetes care. Empowerment skills support the educational performance of nurses by making them aware of the significance of patient education to resolve patients' needs as well as to boost self-confidence and create strategies for mutual trust with other multi-disciplinary team members involved in diabetes care (Aslani, Alimohammadi, Taleghani, & Khorasani, 2016; Tol, Alhani, Shojaeazadeh, Sharifirad, & Moazam, 2015b). The role of nurses in the diabetes care team is vital because of their regular contact with the patient (Aalaa, Malazy, Sanjari, Peimani, & Mohajeri-Tehrani, 2012). Not all nurses interviewed were, or perceived other nurses as, motivated to learn. However, given their 24/7 presence and monitoring function, nurses necessarily serve as the out-of-hours and weekend 'safety net' for patient education and care. They need to be knowledgeable to fulfil this duty, and this can be achieved through continuing education and effective inter- and intra-disciplinary teamwork and collaboration (Young, 2011).

Studies suggest that the content, amount, relevance and complexity of nurses' knowledge plays a critical role in the impact of education for patients (Fabrigar, Petty,

Smith, & Crites Jr, 2006). Provision of education does not guarantee good nursing practice, but knowledge is a necessary precursor of behaviour and the influence of knowledge on a person's attitudes and behaviours is well established (Curtis, Fry, Shaban, & Considine, 2017). There is an association between nurses' educational achievement and their clinical competence (Cruz, 2017). Deficiencies in nurses' diabetes knowledge may contribute to development of negative attitudes towards diabetes care, which may further translate into poor nursing practice in diabetes care (Curtis et al., 2017). Future studies of the effect of nurses' knowledge on their competence in providing diabetes care should test this assumption. Some (but not all) nurses saw a need for, and believed that they should have, a wider role in patient education. Given the high and rising prevalence of diabetes in Saudi Arabia and worldwide (Alotaibi et al., 2017b) and its strong links to behavioural risk factors, involving members of the multi-disciplinary team is important for the effective management of diabetes.

There were some misperceptions about diabetes management among nurses in this study. Some viewed diabetes as a chronic condition with no cure and did not believe that nurses' knowledge or patient education could do any better for the disease management. These misconceptions about diabetes management among healthcare professionals need to be addressed. Many barriers to managing diabetes and educating patients with diabetes were determined from the perspectives of these nurses; many have also been identified in other studies from other nations (Kassean, 2005; Oyetunde & Famakinwa, 2014). Many issues can deter nurses from fulfilling their potential role in care of patients with diabetes, from lack of access to high-quality in-service education and training, through perceived limitations in managerial support, to the personal and professional issues of a largely multi-national, expatriate workforce. As a professional

group, the nurses in this study reported many barriers and some appeared fundamentally conflicted in their attitudes to diabetes care: in the importance they accorded this, and in relation to their motivation to update their diabetes knowledge. Many appeared to lack understanding and appreciation of the impact of diabetes as a disease spanning acute and life-threatening events through to life-style related disorder, none of which can be managed without good knowledge of diabetes in health professionals and effective involvement of patients in self-care activities (Mensing, Boucher, Cypress, & Weinger, 2004). A vicious cycle is in evidence: lack access to up-to-date diabetes information or lack of motivation results in poor and out-dated knowledge, attitude and practices, which perhaps are the source of the physicians' poor regard for nurses' knowledge which so demotivated some nurses (Amsalu, Boru, Getahun, & Tulu, 2014). Lack of effective multi-disciplinary collaboration, and disrespect from physicians, is clearly a disincentive to nurses to contribute to case discussions; possibly to further diabetes education (Burgess & Purkis, 2010). This is unacceptable and should not be the culture in a healthcare organization or elsewhere.

There were also clearly very real workload barriers, but few nurses anywhere, worldwide, would not report this as an issue (Mwebaza, Katende, Groves, & Nankumbi, 2014). Inadequate diabetes education programs, lack of institutional support and materials, heavy workloads and shortages of nursing staff have also been identified in studies from UK, the United States, Australia, Jordan and Nigeria (Alotaibi et al., 2016). Healthcare organizations should develop strategies to support, motivate, and encourage nurses to attend educational programs. For instance, organizations should offer educational programs that result in qualifications that are recognized not only across the country but in other countries as well. This will ensure the transferability of qualifications, which is important considering that most countries have a sizable

proportion of their nursing workforce originating outside the country (Masselink & Jones, 2014). Also, attendance at these educational opportunities should be recognized, promoted, and considered in relation to nurses' salary scales. In this way, nurses may be motivated to participate in continuing education.

The classification of other nurses by some young nurses as 'too old' or 'too tired' to learn seems extraordinary. Young but inexperienced nurses were more willing to acquire new diabetes care knowledge and skills, and such participant nurses might be the role models for the future, to empower other nurses to provide better diabetes care and improve patient health outcomes (Aslani et al., 2016). However, it is quite reasonable that nurses nearing retirement age will be less interested in additional workload including further education. Clinical nursing is often very tiring with shift work, in addition to the roles people have in their family; not withstanding the obligation to remain up to date, it is perhaps reasonable to anticipate that nurses who are near retirement will be less willing to attend educational sessions. Hence, younger nurses should understand this predicament and not see this as a role model discouraging their attendance at educational programs.

Some nurses' lack of interest in obtaining new knowledge accompanied by lack of encouragement and motivation from nursing managers was also reported by Atefi, Abdullah, Wong, and Mazlom (2014) in Iran. In this study, a number of strategies were suggested to improve nurses' knowledge in relation to delivery of diabetes care and education. Supportive nursing management was thought likely to result in better diabetes education and care among nurses, while lack of attention to nurses' own problems (e.g. workload) might have the opposite effect (Farsi, Dehghan, Negarandeh, & Broomand, 2010). Nurse managers have a role to play in creating a positive work environment, influencing nurses by motivating and encouraging them to improve their

diabetes knowledge, involving nurses in policy-making, especially where policies affect nursing staff directly and may enhance or detract from nurses' diabetes knowledge (de Oliveira, Mazzaia, & Marcolan, 2015). Effective inter- and intra-professional communication and collaboration and diabetes knowledge exchange could be effective; even the simple availability of printed learning materials, and increasing institutional resources and support for continuing diabetes education and training (Gerard et al., 2010; Modic et al., 2014). Effective collaboration of nurses with other healthcare teams is important for improving diabetes care (Rejeh, Ahmadi, Mohammadi, Anoosheh, & Kazemnejad, 2008). In a rapidly changing field such as diabetes, continuing education is essential to update nurses' knowledge of diabetes care and education (Gerard et al., 2010), and to provide nurses with empowerment skills to effectively involve patients in their treatment processes and self-care activities (Tol et al., 2015b).

These findings make clear that, with barriers operational at both the individual and organisational levels, initiatives to redress deficits in nurses' diabetes knowledge also need to operate at both levels. Organisations need systems to monitor local care processes and patient outcomes, to inform managers on practice performance in relation to established 'best practice' and how this relates to patient outcomes. This could encourage organisations to prioritise development of diabetes care polices and education programs (Atefi et al., 2014; Rejeh et al., 2008) and enable development of targeted improvement plans and contribute to better performance indicators. Individuals need clear understanding of what is expected of their and other healthcare professionals' roles; access to education and training to ensure they maintain adequate up-to-date knowledge to deliver this, and respect for each others' contributions to diabetes team care.

6.7.3 Limitations of the Study

The analysis of interview data in this study led to the identification of barriers and facilitators to nurses' acquisition of diabetes knowledge. In considering the transferability of these findings to the wider population of nurses, the origin of the research in a single hospital, and the particular characteristics of that research site, should be born in mind.

Another limitation is that the study interviewed only 16 nurses, which may not represent the total population under study, although data saturation was achieved at this site. Many of the nurses interviewed in the study were from departments where the average length of stay is short (e.g. cardiology). This is a challenge that many nurses face: to educate patients in a meaningful way in a short space of time, often while patients are undergoing or recovering from surgery. This might have affected the findings of the study. Hence, future studies should include nurses from other areas where contact is more prolonged (e.g. nurses who follow up patients in community settings), who have more time to conduct patient teaching in relation to diabetes care.

All interviews with Muslim female nurses were attended by a female member of the nursing education department, and this may have limited open discussion of personal and organisational barriers to diabetes knowledge by these nurses. Further exploration of nurses' diabetes knowledge acquisition and their role in diabetes is required, to include the perspectives of other members of the diabetes team (educators, dieticians, physicians and managers, for example), and of the patients and families themselves. Broader recruitment across other sites and specialty groups could develop the breadth of understanding of this topic.

6.8 Conclusion

The findings of this study provide insights into factors that affect nurses' knowledge acquisition related to diabetes care, and flag opportunities for future translational research to determine how 'best practice' diabetes care can be developed amongst a nursing workforce such as this. Nurses confront many obstacles to improving their diabetes knowledge, which include both individual and organisational barriers, and require an empowerment program through, for example, action research, which can result in change and improvement in the nurses' knowledge and practice in relation to diabetes care (Aslani et al. 2016). Such programs should address attitudes and beliefs among nurses regarding diabetes management, and nurses should be supported to develop a rational and consistent view of the role that their knowledge, attitudes, and practice can play in diabetes management. In addition, nurses' diabetes knowledge may be improved by changes to policies, in relation to job descriptions and role clarity, inter- and intra-professional communication; and by changes to practice, in terms of the availability of diabetes resources and managerial practices in human resource management and access to continuing education. High quality, well-organised, accessible continuing education programs and in-service courses are clearly an essential component to improve nurses' knowledge about diabetes care and its management. When multiple disciplines work together in diabetes care they can deliver comprehensive care and address the patients' needs better.

6.9 Relevance to Clinical Practice

Diabetes is a significant health issue globally. As the largest group of healthcare professionals, nurses should be actively and professionally engaged in multidisciplinary collaboration to effectively address prevention and management of diabetes. The findings of this study can help to inform policies and guidelines for diabetes care and

management for safe implementation of nursing practice. It also can support those who design nursing curricula to shape the nursing role in diabetes care and education. Further research is needed to explore how best to enable nurse education in diabetes care, for the development of nursing practice and patient education. More professional development opportunities for nurses should be offered to increase nurses' knowledge and practice in relation to diabetes care, and ways to encourage uptake explored, including, for example, mandatory up-dating to maintain registration. Overall, the outcomes reported here provide important insights for policy makers on how to improve the quality of healthcare and job satisfaction.

6.10 Summary

This chapter presented the research findings from the analysis of data collected by the semi-structured interviews. Exemplars from the interview transcripts demonstrated the various ways participants' practice was influenced by their knowledge of diabetes care and treatments, and therefore how the education of patients with diabetes may be influenced, mainly negatively, by a variety of local circumstances, many of which may well occur more widely. The effects of individual and organisational factors on various aspects of nurses' diabetes knowledge and care were illustrated with excerpts from the narratives of interviewed participants. The survey results and the findings of the qualitative study are integrated and discussed in the following chapter.

CHAPTER 7 Discussion

7.1 Chapter Introduction

This chapter presents a discussion of the overall contribution of this thesis, in which findings were analysed to enhance understanding of the diabetes knowledge of nurses in Saudi Arabia and the factors that facilitate and act as barriers to this. The major findings are discussed in relation to research aims, the theoretical framework and relevant literature. This chapter first provides a summary of the key findings of each component of the work as set out in Chapters Two, Three, Five and Six. It then integrates and discusses findings from the two phases of the study in relation to Kanter's theory (Kanter, 1993). The thesis as a whole is considered and discussed in relation to its strengths and limitations.

7.2 Summary of Key Findings

7.2.1 Diabetes in Saudi Arabia

As set out in Chapter Two, diabetes has become a leading health problem in the world and is reaching epidemic status in many countries (International Diabetes Federation, 2015). This is a particular problem for Saudi Arabia, now listed in the top 10 countries for diabetes prevalence in the world, with 18.5% of the 30,770,00 adult population affected, especially those between ages 30–70 years (International Diabetes Federation, 2017). This increase in diabetes is attributed to adoption of 'western' eating habits (e.g. sugary beverages, high calorie/ high fat and 'fast' foods) and little exercise, with cars, elevators and escalators reducing daily physical activity for most Saudi people (Mohieldein, Alzohairy, & Hasan, 2011). As the incidence of diabetes increases, more people require care from health professionals to effectively manage their disease and promote healthy lifestyles. Lessening the overall burden of the disease requires

improved primary, secondary and tertiary prevention efforts and access to healthcare services. To support this, the healthcare system needs all healthcare professional staff to be well-educated in diabetes care. To achieve this, healthcare systems should provide diabetes education programs for 'the educators' as well as for the population, to promote the knowledge and skills that they require and to provide high quality diabetes care and management. With the increasing incidence of diabetes in Saudi Arabia, it is particularly important for nurses, as the largest group of health providers, to be well equipped with knowledge and skills to empower them to manage diabetes effectively and prevent the disease symptoms from escalating (Al-Nozha et al, 2004).

7.2.2 Nurses' Diabetes Knowledge and Role

Literature reviewed in Chapter Three indicated that nurses in developed and developing countries had knowledge deficits in relation to essential aspects of diabetes care and management, such as insulin therapy, oral diabetes medications, nutrition, BGM, diabetes complications and foot care, diabetes pathology, symptoms and management (Alotaibi et al., 2016). The literature indicated a variety of barriers influencing nurses' knowledge acquisition in relation to diabetes care. Nurses in different countries and workplaces reported lack of provision of adequate training and education about diabetes, lack of access to relevant educational resources and work experience, nursing shortages, high workloads and consequent low job morale (Alotaibi et al., 2016). These barriers hindered nurses' acquisition of up-to-date knowledge of diabetes care and management. Saudi Arabia was not represented in this literature; no studies originating from Saudi Arabia were found to assess the situation in this country. This is an important gap in knowledge because the profile of nurses and key characteristics of nursing in Saudi Arabia differ from that of nursing in most other countries.

Expatriate nurses form a large proportion of the nursing workforce in Saudi Arabia (World Health Organization, 2013), and a statistical report of the Saudi MOH showed that, of a total of 181,693 nurses working in Saudi healthcare facilities in 2017, only approximately 36.7% were of Saudi origin (The Ministry of Health, 2015). A large proportion of the nurses originated from the Philippines and India, but also from a wide range of nationalities including Sudan, Egypt, Jordan, the UK and the US. These nurses come with a variety of differing nursing educational preparation, qualifications and experience from their countries of origin and differ culturally and linguistically from their Saudi patients, all of which may or may not be beneficial for the overall quality and safety of the diabetes care and management these patients receive (Aldossary et al., 2008; Tumulty, 2001).

Comparing the characteristics of the samples recruited for the two phases of this study, the majority of participants in both phases were expatriate nurses, but the percentage of expats in the quantitative study (92.9%) was higher compared than in the qualitative study (75.0%). Samples were otherwise similar, with the mean age of the sample in the quantitative study 31.9 years, while in the qualitative study it was 33 years. Regarding gender, the proportions of genders in both studies were almost equal, where females in the quantitative study constituted 81.5% of the total sample, and 81.3% of the qualitative phase sample.

In Chapter Five, the findings of the survey study (Alotaibi et al., 2017a) demonstrated the knowledge deficiencies of nurses in a major metropolitan hospital in Saudi Arabia in relation to diabetes care and its management. There were similarities to findings reported internationally (Alotaibi et al., 2016). None of the nurses answered all of the multiple-choice questions correctly. The mean score represented an equivalent score of 52.3% correct responses, which was 10% lower than findings from studies in the US

and Jordan (Gerard et al., 2010; Yacoub et al., 2014). Nurses working in the US and Jordan had knowledge deficits in regard to diabetes medications and meal planning (Gerard et al., 2010; Yacoub et al., 2014). These nurses in Saudi Arabia showed knowledge deficiencies across the board: about diabetes, its causes, pathology, symptoms and treatment. Most notably, nurses showed inadequate knowledge about diabetes medication and its administration – a core responsibility for nurses. They also had little knowledge about managing diabetes through life-style modifications and diet adjustment, or about self-management, including diet and nutrition. However, they were more competent in practical aspects of care that were their daily responsibilities, such as monitoring blood glucose levels, monitoring complications and caring for wounds.

There was also a gap between their perceived knowledge and their actual knowledge scores, with many nurses perceiving their knowledge of diabetes and its management as better than indicated by their actual knowledge scores. Notably, expatriate nurses scored significantly higher for perceived and actual diabetes knowledge than locally trained Saudi nurses.

Another important finding of the study was that very few (17%) of the nurses had received any diabetes education, which may have influenced their level of knowledge as those with rather than without prior education had better knowledge scores.

Another critical finding of the study was that perceived competency, current provision of diabetes care, education level and attendance at any diabetes education programs explained the nurses' perceived knowledge, while currently providing diabetes care, degree level education, perceived competency, gender (being female) and access to diabetes management policies or guidelines explained the accuracy of their actual diabetes knowledge. These are obviously important findings in relation to nursing's

contribution, present and future, to patient education for effective diabetes self-management or even diabetes prevention.

Nurses described what they perceived as their key role in diabetes care in the interview findings in Chapter Six. They reported conducting patient assessments, administering medications for in-patients in hospital and delivering or following up on treatment plans originating from physicians and other specialist diabetes care providers. They saw themselves playing an important role in practical aspects of diabetes care and its management such as BGM (Alotaibi et al., 2017a). They felt their constant presence with the patient meant they were best placed to assess and monitor the patients' understanding of their condition, and ability to successfully self-manage this. Medication management and smoking cessation, in addition to hyperglycaemic management, are also essential areas of diabetes management and patient education where nurses play critical roles. However, effective delivery of this role is largely dependent on nurses' own knowledge and understanding of diabetes and its management.

The nursing role was seen as overlapping with that of other healthcare professionals, as a result whilst nurses sometimes took a lead with certain aspects, it was not always clear when and how this should occur, or how these role responsibilities should be allocated. This was further complicated by the highly multi-national characteristics of this workforce. How these roles are delivered in Saudi Arabia is clearly different to the way nurses work in other countries. Nurses described their roles in terms of conducting patient assessments, administering medications for in-patients in hospital and delivering or following up on treatment plans from physicians and other specialist diabetes care providers and monitoring practical aspects in relation to diabetes care and its management. They believed that the reality of their role in diabetes care was to follow

hospital policies and specialist team instructions regarding diabetes treatment plans including, for example, wound care plans. This suggests that hospital-based Registered Nurses in Saudi Arabia have little opportunity to contribute to, or play a part in, patient education on self-care and decision-making about the management of patients with diabetes. By contrast, in other countries nurses are recognised as highly skilled healthcare practitioners in diabetes care and education who are able to lead, motivate, counsel, educate, coordinate and help manage the care of the patient with diabetes (Abdulhadi, Al-Shafaee, Wahlström, & Hjelm, 2013; Daly et al. 2014).

7.2.3 Barriers to Nurses' Knowledge Acquisition

Chapter Six explored those barriers, situations or perceptions that discouraged or prevented nurses from updating their diabetes knowledge in relation to diabetes care and education by interviewing 16 nurses (12 expatriate and four local nurses). Nurses experienced barriers in maintaining up-to-date knowledge in diabetes at both individual and organisational levels. At an individual level, barriers included lack of interest or motivation in obtaining new knowledge due to perceptions such as diabetes is a chronic condition with no cure; due to inability to attend educational programs during work hours; due to feeling tired after work and having other family responsibilities; and due to lack of clinical experience around diabetes. Immigrant nurses also complained about the lack of support for family-related issues.

At an organizational level nurses were hindered by lack of resources, including specific resources for diabetes care, institutional materials and support. Nurses felt they lacked managerial encouragement and support to advance their knowledge; they complained of poorly designed or poorly organised diabetes education programs; of the unavailability of information resources on diabetes such as pamphlets, and of poor inter-professional communication. Similar barriers have been expressed by nurses working in other

healthcare settings and countries including the US, Australia, Nigeria, the UK, Sweden, South Africa and Hong Kong (Alotaibi et al., 2016).

7.2.4 Factors Supporting Nurses' Acquisition of Diabetes Knowledge

Chapter Six also reported what nurses suggested as factors that could help them acquire knowledge about diabetes. Effective professional communication and collaboration between care providers was suggested, such as involvement of nurses in clinical rounds, and dedicated routes for knowledge exchange between healthcare professional groups such as online or forum discussions. Nurses felt they should receive the support they required to further their education and training about diabetes care. They felt that increased institutional resources would be helpful and an information dissemination system should be introduced. Technology and treatments in the healthcare sector change rapidly and nurses need both to be deliberately involved by their managers and to involve themselves in lifelong learning. Similar facilitating factors were suggested by nurses working in the UK and the US to help improve nurses' knowledge acquisition in relation to diabetes care and education (Gerard et al., 2010; Modic et al., 2014).

7.3 Consideration of the Findings in Relation to Kanter's Theory of Structural Empowerment

The details of nurses' diabetes knowledge deficits were determined from survey findings and sources attributed to these deficits were identified from analysis of their qualitative interview responses. In this study, Registered Nurses provided in-depth details and perspectives on the existent, causes and effects of nurses' diabetes knowledge, as well as strategies to update nurses on diabetes care and management. International evidence supported participants' perspectives and substantiated these insights (Alotaibi et al., 2016). Some characteristics of the context of care and findings may be specific to Saudi Arabia and its particularly rich and diverse mix of nurses in the

workforce. However, this situation is not entirely unique; nursing shortages have forced many countries to look to immigrant nurses to maintain a sufficient workforce. Many countries manage, to some extent, issues related to diversity within its workforce (Jeon & Chenoweth, 2007); with only 29% native-born nurses, Saudi Arabia perhaps presents a more extreme, but nonetheless widely relevant, example.

Kanter's Theory of Structural Empowerment (Kanter, 1993) can be applied to discuss the integrated findings of the two phases of the study (survey results and qualitative findings). As described in Chapter One, this theory relates employees' attitudes and behaviours within an organization to the degree of power, resources/information, support and opportunity they perceive (Kanter, 1993). Acquisition and updating of diabetes knowledge is clearly not just necessary but essential for nurses to be able to educate patients with diabetes about all aspects of diabetes care as nurses are responsible for delivering this care at the bedside every day. However, as Kanter's Theory indicates nurses' attitudes towards diabetes care and practice appeared to be influenced by their perceived role and power within the workplace.

7.3.1 Powerlessness in Relation to Diabetes Care and Education

Kanter (1993) highlighted that formal power derives from employees' roles that are observable, acknowledged, and essential to the goals of the organisation, and is relative to this. Findings indicated that nurses perceived they had limited roles and authority with regard to diabetes patient education, with a range of different factors and issues contributing to this perception.

Many nurses felt they lacked knowledge to complete work activities due to lack of educational opportunities and limited competence in diabetes care. The lack of time to attend education, especially when scheduled outside of work hours, undermined nurses'

professional development. However, this was not just about knowledge deficits but how this affected their power in relation to the diabetes education role. Nurses felt disempowered to fulfil their role in diabetes care and education due to number of reasons. Nurses' sense of powerlessness resulted in lower knowledge of some aspects of their caring role for patients with diabetes and reliance on other healthcare professionals, or the patient, to be knowledgeable about diabetes. Particularly in non-endocrinology specialist settings, some nurses considered diabetes a co-morbid disease, not an important or primary focus of care. Other nurses regarded it as a chronic and hopeless condition, which could be neither cured nor improved. These attitudes originated from lack of awareness of the effectiveness of diabetes management programs and resulting in their perceiving the disease as hopeless (i.e. feeling powerless to manage the diabetes effectively). These nurses, therefore, placed less priority and were less concerned about educating patients about diabetes.

Clinical experience may also have influenced the level of empowerment among nurses, reflected through their years in post but also where this entailed greater exposure to diabetes care. This was confirmed by the survey results, which demonstrated that nurses who frequently provided diabetes care had higher perceived as well as actual diabetes knowledge. Kanter's theory states that employees' behaviour directly correlates with the power and opportunity they perceive they have within their organisation. Therefore, this indicates that these factors may have negatively influenced nurses' empowerment to provide diabetes care effectively and led to knowledge deficits in aspects of diabetes care (Chew, Shariff-Ghazali, & Fernandez, 2014). Hence, working collegially and respectively within the healthcare team may empower the nurses in terms of their diabetes care roles. (Alotaibi et al., 2017a).

A number of nurses identified role overlap with other multidisciplinary team members (for example, with dieticians and diabetes educators) regarding patients' education, which made this aspect of care challenging for them and led to a sense of powerlessness, lack of clarity and responsibility for decision-making. According to Kanter's theory, a clear role description provides formal power to nurses, in this case to be confidently engaged in diabetes care. Responsibilities for diabetes care and education were distributed among the multidisciplinary team (Bowen & Rothman, 2010). For example, dieticians were responsible for diet instruction while diabetes educators were primarily responsible for educating patient about other self-management activities (e.g. using diabetes medication). Nurses working in specialist areas, particularly, have an important function as educators for their patients. However, they also need to consider on-going education for themselves; to adopt lifelong learning to keep up with ongoing development in the explosion of evidence-based practice and remain current and expert in their field (Anderson, 2010), to be able fulfil their role within the multi-disciplinary team.

Nurses' disempowerment may also have been related to the local ward cultures. Nurses interviewed flagged the failure of nurse managers in some areas to motivate or provide their nurses with the necessary continuing education on diabetes. This was felt to be because nurse managers did not see diabetes knowledge as a priority for their nurses as they focused solely on ensuring that required care was delivered without regard to the knowledge, skills and motivation nurses need to continue delivery of high quality care. In this situation, nurses are unlikely to be able to exert influence to the contrary and there is a risk that the quality both of care and the workplace environment will be affected. However, this situation should be understood within the confines of staff numbers and resource limitations. The inability of nurse managers to motivate nurses to

participate in educational programs may be due to several factors, such as inadequate numbers of staff to relieve staff members to attend educational programs during working hours. Another potential reason is the availability of funding to support the continuing education of nurses.

Some nurses reported conflicts and lack of knowledge sharing in relation to diabetes care and diabetes self-management activities with members of the multi-disciplinary team or nurse managers. The migrant status of many of these nurses may have been a contributing factor. Nursing workforce shortages in many developed nations have fuelled international migrations of nurses – across Europe, Asia and Australasia as much as the Middle East (Pittman, Aiken, & Buchan, 2007). Whilst not discussed in these terms by these study participants, they complained that issues related to their migrant status were not acknowledged. This may have contributed to their isolation from the multi-disciplinary team, contributing to lack of informal power as defined by Kanter's theory. This may also have contributed to nurses' failure to take up opportunities to enhance their capabilities and competencies or to extend their scientific potential (Al-Enezi, Chowdhury, Shah, & Al-Otabi, 2009). Where the ward culture excluded nurses from professional multi-disciplinary discussions, this may have increased nurses' powerlessness and reduced opportunities to form relationships with other healthcare providers. This, in turn, may have influenced their positions within workplace and social networks and thereby limited their ability to grow their knowledge and skills through networking (Gibson, Hardy Iii, & Ronald Buckley, 2014).

7.3.2 Access to Resources and Information

As Kanter (1993) states, access to resources/information, whether financial, material or human in nature, are key indices in the operation of power. In this case, nurses need to have access to diabetes resources to be empowered to provide high quality diabetes care

and education, and to increase and develop their knowledge and skills within the organisation. In this and many other studies, time is the most valuable, and considered an essential resource as defined in Kanter's theory. Nurses highlighted the lack of time to attend educational programs due to workload; others referred to high nurse-patient ratios and shortage of nursing staff. Winston and Patterson (2006) and Hebenstreit (2012) highlighted that increasing the nursing resource in terms of nursing hours would provide additional time to prepare and meet role expectations. This may provide additional time for nurses to participate with other health care professionals in providing diabetes education (Gerard et al., 2010). However, given the economic climate in many countries, including Saudi Arabia, increase in the nursing establishment of wards and departments is probably not an avenue likely to be adopted (Kingma, 2007). However, if nurses feel their organisation does not provide adequate essential resources in the form of nursing hours, they may feel they lack resources as defined by Kanter's theory.

Nurse managers have responsibility for how the nursing resource (time) in their area is allocated. Nurses perceived lack of motivation by nursing management to enable their educational up-dating or development by allocating sufficient resource to this. Nursing managers also have responsibility for the standards of care in their areas. They should be aware if their nurses lack knowledge about aspects of diabetes care and should take steps to address this. This should include making accessible to nurses in their areas specialist resources to direct diabetes care such as local standards of care, policies or guidelines. These must be available in each in-patient department, to provide readily accessible resources for nurses, so nurses can refer to them when they face challenges during diabetes care and education. Survey results showed that, compared to those lacking access, nurses who had access to diabetes policies and guidelines had

significantly higher scores in perceived and actual diabetes knowledge, flagging their importance as sources of information.

Some participants directly referred to lack of hospital/administrative support for patient education. Educational printed materials such as pamphlets and the time commitment of diabetes educators were considered resources that can lead to improved nursing knowledge in diabetes care and education, both for nurses and patients (Gerard et al., 2010). Nurses in some clinical settings reported inadequate print materials both to educate themselves and patients; one (medical) department had access to educational materials and diabetes educators at least for some time. These resources were seen as facilitating nurses to educate patients as well as updating their own knowledge and skills in self-management activities (Gerard et al., 2010). Interestingly, in the survey results, medical nurses had lower overall average scores than nurses working in non-medical departments in some aspect of diabetes care, so the availability of such resources was obviously not adequate of itself. However, these could be seen as useful resources in line with Kanter's theory, which may facilitate nurses to update their knowledge.

Continuing diabetes education programs seemed to be an important resource for information as defined by Kanter's theory. Most of the interviewed nurses argued they had inadequate support to attend diabetes education programs, and that this may affect their knowledge and practice in relation to aspects of diabetes care (Saleh, Afnan, Ara, Mumu, & Khan, 2017). Nurses who self-reported attending in-services for diabetes education had significantly higher scores in perceived and actual diabetes knowledge than those who did not. Despite the lack of consensus on the quality of these programs, this perhaps confirms that nurses should have access to such resources/information. As an element of empowerment, enabling access to diabetes resources/information is

important in relation to improving nurses' knowledge and attitudes toward diabetes care and education (Tol, Alhani, Shojaeazadeh, Sharifirad, & Moazam, 2015a).

7.3.3 Nursing Wards as Effective Workplace Cultures

Hospital managers play an important role in creation of workplace cultures (Tillott, 2013). Effective managers recognise the physical, psychological and social needs of all nursing staff in the workplace and focus on ways to empower nurses to be effective and find creative and innovative solutions to care challenges (Manley et al., 2011). The ward culture reflects the values, beliefs, and practices of individuals, and has been suggested as having an important influence on multidisciplinary team communication and collaboration, including the ways people react to healthcare (Rejeh et al., 2008). Effective ward cultures are considered to have considerable benefits for nursing staff, creating working conditions that enable the determination of lifelong learning, safety, leadership development and teamwork. Commitment to lifelong learning is a professional responsibility which is essential in ensuring effective cultures and safe practice are to be achieved (Alotaibi et al., 2017a).

If the workplace cultures do not support lifelong learning, safety, leadership development and teamwork, nurses may feel lack of power to make a difference and may develop negative attitudes towards professional development resulting in an ineffective workplace environment. Interviewed nurses highlighted lack of institutional support (e.g. failure to create a learning atmosphere for individuals), lack of motivation, incentives (e.g. support and trust were absent) and role clarity in relation to diabetes care and education among the multidisciplinary team. Difficulty interacting with other members of the multidisciplinary team prevented nurses taking this avenue to update their knowledge and practice in relation to diabetes care and its management. Once again, this indicated a workplace where communication was not optimal and

collaboration between groups limited. The consequences of this were demotivation and lack of commitment to organisational goals and objectives, disempowerment and disengagement of at least some of these nurses. The potential effects of this for their patients include that the standards, goals and objectives of care may not be met for individuals, teams or the organisations, negatively impacting on the quality and safety of care delivered. The nurses interviewed were ward RNs and as such they did not talk about their experiences in terms of what this meant for their wards as effective workplaces. Nonetheless, the characteristics that some described flag their wards as possessing features recognised as ineffective. Clearly the knowledge deficits of at least some of these nurses were reflective of deficiencies beyond the individual level.

7.3.4 Opportunity for Advancement

Kanter's theory defined opportunity and support as employees' expectations and hope for future development and growth. This might entail, for example, providing routes to nursing diabetes expertise through diabetes knowledge exchange across professional groups, support for attendance at continuing diabetes education and training, by providing printed learning materials, improving institutional resources such as staffing numbers and expertise, and encouraging effective inter- and intra-professional interaction, communication and collaboration. Many nurses made reference to opportunities within the nursing education department for ongoing knowledge acquisition and training by continuing diabetes education programs. Diabetes knowledge improvement has been seen with diabetes in-services programs in previous research (El-Deirawi & Zuraikat, 2001; O'Brien et al., 2003; Sargant, 2002). However, the degree to which any changes may be anticipated in nursing practice as a consequence of changes in nurses' diabetes knowledge remains unclear. It, therefore, follows that nurses also need to be empowered through resources/information, support

and opportunities to effectively involve themselves with patient care and education activities (Tol et al., 2015b).

Nurses also need support from their nursing or hospital administrations to be empowered in their workplace, to be more confident in their knowledge and skills, to find meaning in their roles and work autonomously (Wang & Liu, 2015). Where this is achieved, it may engender confidence in their ability to carry out their roles and responsibilities, empowering nurses in the practice setting, contributing to patient safety outcomes and increasing the quality of nurses' work life and workplace environment (Wang & Liu, 2015).

Nurses also identified effective inter-and intra-professional interaction, communication and collaboration as important factors supporting career growth and mobility and providing opportunities to increase diabetes knowledge among nurses. Environments which promote inter-professional communication and collaboration may provide opportunities for nurses to meet a variety of healthcare professionals, learn about their roles, increase their knowledge and confidence, and eventually share in decision-making regarding diabetes care and in creating strategies to solve challenges experienced in the clinical setting (Pfaff, Baxter, Jack, & Ploeg, 2014). When this level of collaboration includes nurses, this would increase opportunities for nursing advancement as well as improving diabetes care.

7.3.5 Enabling Features and Empowerment

Structural empowerment, or the provision of power, support, opportunity, information and resources to nurses as a group (rather than to specific individuals) was found in this study, in at least some locations, to be limited or non-existent. Increasing nurses' opportunities and encouragement to access resource is recognised as boosting their level

of structural empowerment and increasing their perception of autonomy and control; such feelings of confidence increase their ability to deal with nursing demands in a professional manner (Harwood, Ridley, Wilson, & Laschinger, 2010). Studies of occupational therapy students in the United States found that professional development enhanced students' values and skills and acted as an incentive to take on roles beyond what was essential for course completion (Eta, Atanga, Atashili, & D'Cruz, 2011; Hanson, 2011). Access to professional development opportunities was linked to job satisfaction among nurses from multicultural backgrounds working in Kuwaiti hospitals (Al-Enezi et al., 2009). Nurses interviewed in this study, also working in a multicultural practice setting, identified a need for professional development that would empower them to educate patients with diabetes.

Another element of structural empowerment is collaboration; in a hospital setting this enhances self-confidence and motivation, enables nurses to work better with multi-disciplinary teams and gives them sufficient autonomy to initiate measures to improve diabetes patients' health outcomes (Almost & Laschinger, 2002). Nurses' relationships with the multi-disciplinary team change, developing a greater sense of trust and respect, leading to more open communication and clarifying the various specialist and generalist roles in diabetes healthcare. It also allows more effective assignment of work tasks (Almost & Laschinger, 2002). Non-collaborative work environments may contribute to role dissatisfaction, fragmentation of care, and strain health professionals who are responsible for ensuring high quality care (Almost & Laschinger, 2002).

In the current study, lack of collaboration and communication was linked to nurses' lack of interest in updating their knowledge and skills in diabetes care and education, and to an unclear understanding of their particular roles in diabetes care and education. In such an atmosphere, expatriate nurses in Saudi Arabia are likely to feel isolated in the

workplace, and to feel dissatisfied with the support and professional opportunities they receive. Unspoken but relevant to this is that these nurses have to adapt to working in a country whose distinct culture, social practices and organisational structures may be very different from those of their countries of origin (Al-Enezi et al., 2009). The development of a culture of collaboration and teamwork may help in defining the importance of nursing roles and how they are assigned, either officially as part of care design or organically as clinical routine, and may help nurses understand how multidisciplinary care teams function in the workplace (Stenfors & Kang, 2014).

The need for resources and professional information is another element that has been identified as necessary for the structural empowerment of nurses (Kanter, 1993). Continuing education programs in diabetes care, such as workshops and study days for nurses working in different wards, can help in applying theoretical knowledge and skills to clinical practice. Nurses in this study laid much weight on the need for understanding and empathy, many claiming that nursing managers offered no encouragement for them to complete nursing roles, did nothing to resolve overlaps in job descriptions, and did not respond sympathetically to their private issues (e.g., family and migration problems). Managers need to focus on developing cultures where lifelong learning, safety, leadership development and teamwork are part of the organisational structure to enable practice transformation and to provide high quality care for patients (Manley et al., 2011). If some of these concerns are addressed, better job satisfaction might result; in turn absenteeism may decrease, employee retention may improve with consequently increased productivity and enhanced nursing performance (Stewart, McNulty, Griffin, & Fitzpatrick, 2010).

According to Kanter's (1993) theory of Structural Empowerment, nursing managers need to understand the workplace environment they are responsible for before they can

generate strategies to empower nurses in their roles and responsibilities in relation to diabetes care and education. The ability to do this is important because study findings showed that nurses who reported having opportunities to access knowledge and support demonstrated greater knowledge acquisition. This finding aligns with Kanter's theory (Faulkner & Laschinger, 2008; Hauck, Quinn, & Fitzpatrick, 2011) that empowerment in the workplace is necessary to create a flexible professional staff capable of operating effectively in a complex organisational environment (Stewart et al. 2010), and achieving patient satisfaction, cost-effective and high quality patient care (Bradbury, Sambrook, & Irvine, 2008; Matheson & Bobay, 2007).

7.4 Strengths and Limitations of the Study

Based on the published research, this study is the first to examine hospital-based nurses' knowledge of diabetes and identify the factors that influence nurses' knowledge acquisition in relation to diabetes care in Saudi Arabia. The results of this study are important because they provide baseline data on the diabetes knowledge and insights into diabetes practices of nurses working in this context of tertiary hospitals in a Middle Eastern culture and in a highly multicultural workforce. The findings can be used as a point of reference for similar studies in the region, as well as across similar workforces.

This study provides a comprehensive overview of the knowledge and roles of hospital-based nurses in the management of diabetes care provided to an urban population of diabetes patients. It makes a valuable contribution to the relatively sparse body of quantitative and qualitative international research on nursing knowledge, practice and workplace cultures in relation to diabetes.

Strengths also include the use of mixed methods: a combination of a cross-sectional survey in the quantitative phase and semi-structured interviews in the qualitative phase,

providing a better understanding of the given problem and enhancing the rigor of the work as a whole. In addition, the planned sample size of the study was achieved, with a satisfactory response rate for the DSRT and DBKT survey instruments in Phase One and data saturation was achieved with Phase Two interviews. To the best of our knowledge, this is first time the DBKT and DSRT survey instruments have been applied to nurses working in the Gulf nations, and specifically in Saudi Arabia. However, construct validity could not be measured for the DBKT as the content sub-categories did not have sufficient numbers of items. The study instrument itself (DBKT and DSRT) was limited and only measured nurses' perceived and actual diabetes knowledge: it did not address knowledge of other commonly required aspects of care for people with diabetes including hypertension, lipid and smoking. Factors influencing nurses' knowledge acquisition and their attitudes and beliefs regarding diabetes care and its management emerged during the in-depth interviews.

The limitations of this study include the sampling of a single tertiary hospital. Collection of data from additional tertiary hospitals would have strengthened the generalizability of results; although there is no reason to think that findings from this one site were any different from what might have been found in any other tertiary hospital in the country. Further, community-based nurses were not sampled, and future studies should include this group to better understand the issue under study. In future, random sampling might provide a more representative sample.

Another limitation lies in the use of the Nursing Education and Staff Development Unit to distribute the surveys. Perhaps the staff of the Nursing Education and Staff Development Unit chose, no matter how subconsciously, to distribute the survey to nurses who might be expected to possess more or less knowledge, or to hold opinions of a certain type. In addition, as the surveys were collected and returned by the Nursing

Education and Staff Development Unit, there is a possibility that nurses who believed that they had performed poorly might not have returned their surveys, in order not to appear in a bad light to these senior nurses: this might explain the low numbers from sub-specialties. However, the advantages of the use of these staff were not just that they facilitated the successful and timely completion of the data collection phases, but that they engaged with the work. In the future, disseminating the findings locally and taking forward this work through initiatives to address the problems identified, will rely heavily on the engagement of these senior nurses. That they have already engaged with the work will be an advantage.

The actual diabetes care provided by these nurses was not investigated, due to time constraints and the time commitment of observational work. This remains an opportunity for future work.

The majority of interviewed nurses were expatriate females, of Filipino, Indian and diverse cultural backgrounds, which may have made them reserved in providing some information because the researcher was a male from the country where they worked. The interviewed nurses also might have been reluctant to talk in depth about issues during face-to-face interviews since they were still working at the research site. Moreover, female Muslim nurses were interviewed with members of the Nursing Education Unit present, which may also have constrained their contributions. Future studies should consider using a female research assistant to facilitate disclosure of relevant information.

This study focused on the diabetes knowledge of ward nurses responsible for delivering front-line care. Insights emerged on the ward cultures in which they work and indicated how this affected their knowledge acquisition. In the future, these insights might be

expanded through inclusion of nurse managers and other members of the multi-disciplinary diabetes team.

7.5 Summary

This chapter discussed the findings of the study in relation to the knowledge of nurses in Saudi Arabia of diabetes care and its management as well as perceived barriers and facilitators to knowledge acquisition and provision of diabetes care from the perspectives of the nurses. The results of the two phases of data collection for this study were integrated, reviewed and considered through the lens of Kanter's (1993) theory. The study revealed that the nurse participants, irrespective of whether local or expatriate, were not equipped with adequate knowledge regarding diabetes care and its management. Their knowledge deficits were described as resulting from many barriers that influenced nurses' ability to acquire diabetes knowledge. Analyses revealed a range of underpinning problems many of which were related to nurses' disempowerment, lack of access to resources and opportunities, and ineffective ward cultures that challenged their knowledge acquisition and roles in relation to diabetes care. The next chapter examines the conclusions, implications and recommendations of this research.

CHAPTER 8 Conclusion of the study

8.1 Chapter Introduction

This chapter provides the conclusion of the thesis and discusses the implications and recommendations of the study findings for nursing practice and policy, education and further research. Suggestions are posed in relation to policies and procedures established for the future, not just of the study site in Saudi Arabia, but also for other major hospitals in Middle Eastern areas and similar cultural contexts.

8.2 Conclusion

This is the first study to examine nurses' knowledge of diabetes care and its management, and to identify barriers and facilitators influencing diabetes knowledge acquisition among nurses in Saudi Arabia. The findings from the quantitative and qualitative phases complemented and supported each other. The results of the survey demonstrated knowledge gaps in many aspects of diabetes care and its management. In the interviews, the nurses revealed that they confronted barriers at individual, ward and organisational levels to updating their diabetes knowledge and delivering their roles in diabetes care as they saw them. Regardless of these perceived barriers, nurses identified strategies that could be implemented to facilitate knowledge acquisition in relation to diabetes care and its management for Saudi nurses.

The two data sets were integrated and considered in relation to Kanter's (1993) Theory of Structural Empowerment to develop understanding of the nursing situation, nurses' knowledge and the factors influencing knowledge acquisition in relation to diabetes care and its management in practice. Kanter's theory was used as the theoretical framework to explore nurses' perspectives of empowerment in diabetes care and education in the

practice environment, and used as an *a priori* template to organise study data and develop further interpretation of study data.

8.3 Implications of the Study

Considering the significant burden of diabetes for individuals, health care systems and the wider society of Saudi Arabia, it is essential that health care professionals, including nurses, are well-prepared and empowered to contribute to tackling diabetes at the individual and community levels. However, nurses demonstrated deficits in the basic information and skills needed for diabetes education and care, derived from barriers and challenges at the individual, ward and organisational levels. These findings may be indicative of similar deficits in other settings across the country and the Middle East. The results of this study have implications for nurses, for nursing management, clinical practice and education, and future research.

8.3.1 Implications for Nurses

This study found that nurses reported lack of access to resources and information surrounding health care policies and guidelines. The study findings from the interviews clearly indicated that individual and organisational factors at the workplace, such as perceived imbalanced nurse-patient ratios, inadequate staffing, heavy workloads, lack of time, lack of professional autonomy, lack of organisational and management supports were barriers to the provision of effective diabetes care and its management. These factors were compounded by the overlapping of the nursing role in diabetes with the role of other disciplines. This situation left the nurses experiencing job distress, powerlessness and dissatisfaction with their workplace. This, combined with their knowledge deficits identified in the survey, may mean that practice falls short of that recommended in policy and evidence-based guidelines and may mean that nurses were

not able to contribute effectively in multi-disciplinary efforts to improve healthcare outcomes for their patients.

Any such theory-practice gap would add to job stress for the nurses who are responsible for their own health professional development (Baingana et al., 2010). The results of this study broaden the scope of structural empowerment in exploring how nurses in this study may be able to create actions to deal with and manage their diabetes-nursing roles and responsibility. The interviewed nurses suggested strategies including organisational and environmental factors (e.g. effective inter-and intra-professional interaction, communication and collaboration) to enhance their knowledge and care for patients with diabetes in everyday clinical practice. This may help them to update their knowledge and skills in relation diabetes care and education. As a result, these nurses may be better able to deal with the complex situations of their workplaces.

Understanding the circumstances that influenced nurses' diabetes practice, as identified in the survey findings, may enable a more comprehensive and targeted approach to improve diabetes care. Without adequate support to manage significant challenges, nurses may become unfulfilled, demotivated, and mentally and physically fatigued, eventually damaging their ability to carry out their roles and responsibilities in diabetes care and education. This also may increase role tension between nurses and managers and across disciplines with doctors and dieticians in the workplace. This is particularly important because nurses on the front-line of care act as patient advocates and are responsible for the appropriateness and coordination of patient care, including the oversight of potentially conflicting treatment and medications.

The major implications of this study for individual nurses are the essential need for intervention to facilitate nurses' professional role and responsibilities in relation to

diabetes care. Intervention is essential to protect nurses from job stress and to maintain their roles and responsibilities while they work in multiple-disciplinary care settings. Education should address not just their knowledge needs but also effective practices for stress management, to assist in reducing the potentially negative effects of accrued, unresolved work distress, job dissatisfaction and the risk of burnout of nurses in the health care system. Healthcare organisations need to provide nurses with access to support and resources within the clinical environment to enable them to speak out about their role and responsibilities, to obtain assistance and become better able to deal with diabetes care and education in a creative way. Study findings show that, in at least this Saudi Arabian tertiary hospital, skills such as conflict resolution and effective communication need to be developed to help empower nurses.

However, conflict resolution cannot be achieved on an individual level only. Creating a hospital culture that respects, understands, motivates, and appreciates individual members of the healthcare team can foster better working relationships and may prevent conflicts. Furthermore, a healthcare model where every member of the healthcare team is seen as a collaborator in care may break down the barriers to communication and team work which were reflected in these study findings.

8.3.2 Implications for Nursing Management

Most of these interviewed nurses reported lack of opportunity for professional development. There is a need for nursing managers to recognise and gain an understanding of any such inadequacies of knowledge and skills, and create appropriate solutions. Another important research finding of concern for nursing managers was the reported lack of access to relevant information, lack of opportunities due to staff shortages and high workloads, lack of motivation and incentives. This affected nurses' professional accountability for provision of effective diabetes care. Nursing

management is responsible for providing resources and information regarding diabetes care policies and guidelines, but many nurses did not seem to have access to these. Nurse managers have principal responsibility to enhance organisational performance through coordination of care, arranging continuing in-service education for nurses, ensuring effective models of care and the integration of corporate and clinical practice initiatives. The findings of this study appeared to indicate that nursing management had generally not adequately defined the scope of nursing practice in diabetes. Overall, nursing practice in diabetes appeared to lack specific frameworks for standard practice in diabetes assessment and its management; if such frameworks or guidance existed, nurses interviewed appeared to lack awareness or access to them.

Nurses claimed that working without access to information or resources related to diabetes care may create role conflict and ambiguity about their professional identity. Therefore, nursing managers should develop and disseminate documents setting out the scope of nursing practice, diabetes care standards, and clinical practice guidelines for nursing management of patients with diabetes. Clinical practice guidelines for nursing diabetes management should be structured to reflect and reinforce nursing competencies, to ensure essential aspects of diabetes care and its management. These documents should provide clear direction for a range of activities, such as assessing diabetes to support both pharmacological and non-pharmacological treatments, appropriate for different levels of clinical experience.

In addition, study findings emphasized the need for modification to current working conditions and environment so as to enable nurses to effectively provide diabetes care for their patients with diabetes. Nurses perceived working conditions, such as inadequate staffing, heavy workloads and time constraints, forced them to deliver task-oriented nursing in order to finish their tasks quickly (Manley et al., 2011). This reduced

their ability to provide effective diabetes care for their patients. Therefore, initiatives that improve effective diabetes management practice for patients with diabetes, such as diabetes education programs, could be implemented.

Research has found that this can bring a number of benefits to patient care, such as the improved quality of patient care experience and enhanced patient and healthcare provider satisfaction (Charmel & Frampton, 2008). Considering issues of inadequate staffing and nursing workloads, the study findings further emphasized that hospital management need to ensure an appropriate working environment and adequate resources for nurses to be able to provide quality nursing care (e.g. diabetes care). Nurse managers need to take responsibility for adequate staffing, including nursing. It is imperative that nurse managers are aware of the clinical implications of resource shortfalls, not only for the nursing care provided but also for nursing staff. Managers need to focus on nurses' safety as this has the potential to impact the organisational outcomes. Improving nurse staffing levels may reduce burnout and job dissatisfaction, in turn decreasing nursing workforce turnover rates (Aiken et al., 2002). Research evidence has shown that adequate staffing and balanced workloads are vital to achieving quality patient outcomes, nurses' job satisfaction, and healthy financial outcomes (Aiken et al., 2002).

8.3.3 Implications for Clinical Practice and Education

This study found knowledge gaps in diabetes care and its management documented in the quantitative results while the qualitative findings identified factors that caused the knowledge deficits and prevented nurses updating their diabetes knowledge. By understanding the results that describe the nurses' level of knowledge regarding diabetes care and its management, nurses can use the results to create future plans for improving their own knowledge and skills, enrolling in educational programmes that

provide knowledge and skills in diabetes.

This study also provided insights into factors that may hinder the delivery of effective diabetes care and its management. Therefore, nurses may acquire greater understanding of these factors and make decisions on appropriate actions to address these barriers in the workplace. Nurses can use study results in meetings with hospital administrators, indicating necessary changes to improve the quality of nursing care for patients with diabetes. Nursing managers need to support collaborative practice environments for nurses that enable the provision of effective care for patients, and that maintain autonomous practice to benefit nurses, patients, the practice setting and the organisation. Strategies to strengthen nurses' collaboration with medical colleagues can enhance their access to effective support and resources, and thus overcome their feelings of powerlessness.

A team-based approach to healthcare and to diabetes management is essential to support teamwork interaction, enhance multi-disciplinary team relationships and assist the team in managing their work environment and the coordination of diabetes care. Teamwork or collaboration approaches have long been used in healthcare to achieve effective and efficient care (Poole & Real, 2003). Previous studies have demonstrated that professional collaboration among team members improves team members' understanding of each other's knowledge and skills, leading to improved decision making and increased job satisfaction, developing organisational commitment and increasing productivity (Adams & Bond, 2000; Keller, Eggenberger, Belkowitz, Sarsekeyeva, & Zito, 2013).

Nursing education staff may use the results of this study in developing educational strategic plans. They may consider expanding the teaching of diabetes assessment and

management in the nursing curriculum or in orientation days for new nursing staff. This could be an expanded component of undergraduate and postgraduate nursing programmes, to prepare future nurses for providing culturally competent nursing care for patients with diabetes. To resolve communication issues with other multi-disciplinary teams, in-service education programmes must be designed to teach nurses and other healthcare providers about professional communication and how to deal with other healthcare employees in professional ways, providing respect and trust. Further education is required to help nurses understand the local language that most Saudi patients and staff use in their daily communication.

Previous studies indicate the need for specific content to improve effective nurse-doctor collaboration including a clear understanding of each other's roles and responsibilities, confidence in their own abilities, recognition of the boundaries of each discipline and commitment to the values and ethics of their own profession, knowledge of their own discipline, and effective communication among team members (Orchard, Curran, & Kabene, 2005; Rowland, 2014). Understanding and preparing a policy response to the role and responsibilities for health promotion and disease prevention among all members of the healthcare team including nurses is critical for effective healthcare at all levels, primary as well as tertiary healthcare (Keleher & Parker, 2013).

8.3.4 Implications for Hospital Management

The poor knowledge revealed in the survey results indicates the need for further support and education development from hospital management. Organizational barriers affecting nurses' acquisition of diabetes knowledge, such as lack of resources, lack of access to relevant information, lack of opportunities due to staff shortages and high workloads, lack of institutional support, motivation or incentives, and difficulty interacting with other members of the multidisciplinary team, were identified by these

nurses. These findings indicate that hospital management can play a vital role in ensuring nurses can acquire adequate knowledge of diabetes and its care and management. Adequate governmental funding for continuing education for nurses should be readily available for high quality, professional staff education. Hospitals should have access to such funding to ensure the delivery of education for their staff. Ideally, hospitals should provide free continuing educational programs for their staff.

In addition, resources such as reading materials (e.g. journals, books, pamphlets, and posters) should be available in all areas of the hospital. Internet access should be available in the hospital in order to provide readily available educational resources to the nurses. Attendance at continuing education should also be included in staff evaluation for promotion and salary increases. This may motivate the nurses to participate in continuing education.

8.3.5 Implications for Future Research

This study addresses the diabetes knowledge of nurses at a tertiary hospital in Saudi Arabia, examining its relationship to a number of target variables. Findings from this study can inform the development of future programmes of research and be linked to findings to develop the recommendations.

This study indicates that research is needed to develop and trial different methods of education for nurses about diabetes. The study suggests that research is needed to examine the wider culture of diabetes care not only to empower nurses but because this impacts patients' perceptions, perspectives, beliefs and outcomes.

The perspectives of the other members of the diabetes team and family involvement in diabetes self-management activities should be investigated in future research. Studies of diabetes care currently provided in primary and acute care settings can provide insights

into the quality of nursing care and the role that nurses can play in improving quality care to diabetes patients.

Research is required to describe the roles and responsibilities of nurses in health promotion and disease prevention in primary care settings and nurses' scope of practice in diabetes (Keleher & Parker, 2013). Programmes of nursing education and empowerment are needed, with evaluation of the outcomes in relation to nurses' knowledge, attitudes and behaviours in diabetes care.

Following the implementation of educational programmes, research should focus on the impact of in-service educational programmes on nurses' diabetes care outcomes in hospitals across Saudi Arabia. Further research is also required on diabetes knowledge and practices in rural areas of Saudi Arabia, compared to findings from metropolitan areas of Saudi Arabia. This could then lead to development, implementation and evaluation of targeted nurse-led initiatives to educate nurses and the community in different regions of the country. It is also important to explore factors that influence professional competency, job satisfaction and the commitment of nurses working in multicultural and clinical environments.

8.4 Recommendations of the Study

The study recommendations are particularly directed to management, hospital policy, nursing clinical practice and education. The following section will present a summary of recommendations arising from this study.

8.4.1 Recommendation for Nursing Clinical Practice

It is recommended that hospital management provide strategies to facilitate and support nurses in managing their professional development effectively. This will help nurses

cope with difficult situations within the workplace, maintaining their role and responsibility in diabetes care. This can be done through:

1. Providing support for nurses and improving working conditions such as stress management and decision-making training.
2. To support collaborative environments, nursing managers should ensure that empowering structures are in place and that nurses experience high levels of empowerment in order to realise their role potential, engage effectively in patient care, prevent and reduce burnout (Orgambídez et al., 2017).
3. A preceptorship programme should be maintained at each hospital speciality so that experienced nurses could preceptor nurses who are inexperience in diabetes care. This will have a positive effect for inexperience nurses and will providing excellent role models and increasing their clinical experience related to diabetes care.
4. Increasing the proportion of indigenous as well as expatriate nurses, and addressing some aspects of culture which may make working in nursing more compatible with being a Saudi national.
5. Provide free and internationally accredited continuing education programs that are funded by the government through the hospitals.

8.4.2 Recommendations for Nursing Management

It is recommended that

1. Nursing managers should arrange regular meetings with other administrators to provide opportunities to discuss concerns, seek support, and make suggestions for change.

2. Opportunities for on-going advancement and development, growth, and education be provided in the clinical setting for career promotion, to increase job satisfaction and to empower nurses in their diabetes care and education (Al-Enezi et al., 2009).
3. Study nurses experienced challenges such lack of clinical experience, limited support and resources, conflict issues, and limited authority for care and education (Orgambídez et al., 2017). Nursing administration should recognise and act on challenges to nurses' experience in the practice setting, to increase access to structural empowerment components (e.g. diabetes related resources, information, power, opportunity and support).
4. Nursing managers need to support nurses by providing clinical rotations to expand their knowledge and experience related to diabetes care (Stayt & Merriman, 2013).
5. Nurse managers are responsible for development of appropriate resources and facilities including providing more nursing staff to adequately cover nursing workloads, and clarifying nursing roles, responsibilities and performance expectations so that nurses are able to deliver nursing practice based on their knowledge and competencies.
6. Promote a culture of collegiality and respectful team working in hospitals.

8.4.3 Recommendations for Nursing Policy

1. Policy should mandate professional roles and responsibilities for role clarity, valuing the holistic skills of diabetes nurses and the practical experience of other healthcare professionals as members of collaborative diabetes teams.
2. Managers should develop policies to address diabetes medication and diet-related knowledge to ensure consistent practice across multidisciplinary teams.

3. Policy should address diabetes knowledge regarding assessment and management of patients with diabetes among new migrant nurses, setting out competency guidance for appointment and strategies to support effective diabetes care and positive patient outcomes.
4. Policy makers and regulators should pay attention specifically to nursing diabetes care standards. They should establish and monitor standards for diabetes care and management as recommended by the International Diabetes Federation.
5. The potential influence of cultural factors for practice should be considered, and policy changes introduced through recruitment processes or through the design of short cultural awareness educational programmes or workshops. Such programmes should enhance international nurses' and nursing managers' awareness of Saudi culture. This will create a collaborative work environment for international nurses by establishing agreed nursing practice, thereby providing optimal diabetes care and education.

8.4.4 Recommendations for Nursing Education

It is recommended that:

1. Education to address identified deficits should highlight identified research and practice gaps.
2. For continuing education in diabetes care and management, a focused approach to education and practice in nursing diabetes management is recommended, based on conducting continuing in-service, short-course activities and workshops that cover diabetes care and its management among nurses, evidence-based practice and review of current practices.
3. Research is required to focus on the impact of in-service educational

programmes aimed at improving nurses' practice of diabetes care and its management.

4. There is a need to further develop continuing education and training courses for nurses. The training should include knowledge and skills regarding the pathology of diabetes, pharmacological and non-pharmacological approaches to diabetes care and its management.
5. The need for further diabetes assessment after the administration of medication was not fully understood by the participants. This is of particular concern in multicultural and multi-linguistic healthcare settings such as that of Saudi Arabia. Thus, further training in diabetes care and cultural competency could improve their knowledge regarding these concerns.

8.4.5 Recommendation for Future Research

1. This study was conducted in one hospital in a single region of Saudi Arabia. It is recommended to expand the study to other hospitals. Specifically, as this study was conducted in a large major hospital, the situation in small local hospitals should also be investigated.
2. Future research should examine nurses' knowledge in relation to diabetes care and its management among non-Saudi and Saudi nurses who work in other healthcare sectors, such as private hospitals and primary care, with different working conditions and facilities.
3. Further research is needed to examine multidisciplinary teams' knowledge, attitude and practice in relation to diabetes care and its management. It may also prove useful to explore the factors influencing healthcare in related to diabetes within various workplace environments.
4. Further research is needed to explore the perception of nurse managers and head

nurses in their job satisfaction and how they see their role in creating creative effective workplace culture, including for immigrant nurses.

5. Future research should use a female research assistant to facilitate disclosure of additional relevant information.

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Appendix A: Publication from this thesis

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Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview

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ABSTRACT

Objective: This study aimed to report on the trends in incidence and prevalence rates of diabetes mellitus in Saudi Arabia over the last 25 years (1990–2015).
Design: A descriptive review.
Methods: A systematic search was conducted for English-language, peer reviewed publications of any research design via Medline, EBSCO, PubMed and Scopus from 1990 to 2015. Of 106 articles retrieved, after removal of duplicates and quality appraisal, 8 studies were included in the review and synthesised based on study characteristics, design and findings.
Findings: Studies originated from Saudi Arabia and applied a variety of research designs and tools to diagnosis diabetes. Of the 8 included studies; three reported type 1 diabetes and five on type 2 diabetes. Overall, findings indicated that the incidence and prevalence rate of diabetes is rising particularly among females, older children/adolescent and in urban areas.
Conclusion: Further development are required to assess the health intervention, polices, guidelines, self-management programs in Saudi Arabia.

Contents

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Review

Diabetes knowledge of nurses in different countries: An integrative review

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ABSTRACT

Objective: The aim of this study was to identify, critically appraise and synthesise evidence of nurses' knowledge of diabetes and identify factors that function as barriers to nurses' acquisition of diabetes knowledge.
Design: An integrative review
Methods: A systematic search was conducted for English-language, peer reviewed publications of any research design via CINAHL, Medline, EMBASE, and Education Research Complete databases from 2004 to 2014. Of 374 articles retrieved, after removal of duplicates and quality appraisal, 25 studies were included in the review and synthesised based on study characteristics, design and findings.
Findings: Studies originated from developed and developing countries and applied a variety of research designs and tools to assess nurses' knowledge of diabetes. Assessed aspects of diabetes care included knowledge of diabetes medications (12 studies), nutrition (7), blood glucose monitoring (7), diabetes complications (6), and pathology, symptoms and diabetes management (9). Factors/barriers affecting nurses' acquisition of diabetes knowledge were identified (11). Overall, findings indicated wide-spread serious and sustained deficiencies in nurses' knowledge of diabetes and diabetes care.
Conclusion: With nurses demonstrating significant and long-standing knowledge deficits in many aspects of diabetes care, strategies are urgently required to overcome the identified barriers to knowledge acquisition.

Background

Management of diabetes mellitus (DM) is complex and requires knowledge and skills on the part of both healthcare providers and clients. DM is a common chronic disease which currently affects 8.3% (371 million people) of the world's population (International Diabetes Federation, 2014) with incidence and prevalence rates rising rapidly across the globe (World Health Organization, 2015). This metabolic disease is characterised by hyperglycaemia resulting from defects in insulin secretion, insulin action or both (American Diabetes Association, 2010). It is classified into three major types: type 1 diabetes mellitus is specifically defined as an autoimmune disease characterised by β-cell destruction, leading to absolute lack of insulin; type 2 diabetes mellitus is due to a progressive insulin secretory defect on the background of insulin resistance; and gestational diabetes mellitus is usually diagnosed in the second or third trimester of pregnancy (American Diabetes Association, 2015).

Diabetes is associated with a wide range of complications; it is the major cause of chronic renal failure and blindness (Holt, 2010) and can result in non-traumatic lower extremity amputation and cardiovascular diseases (Al-Sarayra and Khalidi, 2012). Appropriate care and management interventions have been shown to control disease progression and reduce complications (World Health Organisation, 2015). General management of all types of diabetes comprises multiple aspects of care such as medications, diet and nutrition, blood glucose monitoring, regular physical activity and screening for long-term complications (American Diabetes Association, 2015). Optimal diabetes care requires that both patients and healthcare providers, including nurses, have good understanding of DM and its management. To achieve high diabetes care and self-management it is important that nurses have sufficient understanding of all aspects of DM care and treatment to inform their practice and support patients to effectively self-manage their condition (National Heart Foundation of Australia, 2011). Possession of adequate knowledge of diabetes can positively affect nurses' attitudes toward management of this disease (Unadike, 2010). To encourage patients

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Examining perceived and actual diabetes knowledge among nurses working in a tertiary hospital

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ABSTRACT

Background: With the worldwide increase in the incidence and prevalence of diabetes, there has been an increase in the scope and scale of nursing care and education required for patients with diabetes. The high prevalence of diabetes in Saudi Arabia makes this a particular priority for this country.
Aim: The aim of this study was to examine nurses' perceived and actual knowledge of diabetes and its care and management in Saudi Arabia.
Methods: A convenience sample of 423 nurses working in Prince Sultan Medical Military City in Saudi Arabia was surveyed in this descriptive, cross-sectional study. Perceived knowledge was assessed using the Diabetes Self-Report Tool, while the Diabetes Basic Knowledge Tool was used to assess the actual knowledge of participants.
Results: The nurses generally had a positive view of their diabetes knowledge, with a mean score (SD) of 46.9 (6.1) (of maximum 60) for the Diabetes Self-Report Tool. Their actual knowledge scores ranged from 2 to 35 with a mean (SD) score of 25.4 (6.2) (of maximum of 49). Nurses' perceived and actual knowledge of diabetes varied according to their demographic and practice details. Perceived competency, current provision of diabetes care, education level and attendance at any diabetes education programs predicted perceived knowledge; these factors, with gender predicted, with actual diabetes knowledge scores.
Conclusion: In this multi-ethnic workforce, findings indicated a significant gap between participants' perceived and actual knowledge. Factors predictive of high levels of knowledge provide pointers to ways to improve diabetes knowledge amongst nurses.

1. Introduction

The role of nurses in caring for and educating patients with diabetes has dramatically increased in scope and scale with the worldwide increase in the incidence and prevalence of diabetes. There are currently 415 million people diagnosed with diabetes globally (International Diabetes Federation, 2015); this is projected to rise to 642 million by 2040. People from low/middle-income and developing countries such as Saudi Arabia are, in particular, at increased risk. Effective management of diabetes is essential to reduce the early and long term complications of diabetes and to inhibit the onset of associated chronic diseases (Hark, Deen, & Morrison, 2014). Diabetes self-management requires dietary management, adherence to medication regimens and blood glucose monitoring. Patients' outcomes have been demonstrated to improve when patients receive up-to-date, complete and accurate information about diabetes and its care and management (American Diabetes Association, 2013). Nurses are an indispensable part of this process, guiding patients' self-care practices through education and counselling (Coulter, Parsons, & Askham, 2008).

However, studies have indicated knowledge deficits among nurses in various areas of diabetes care and management. Inadequate knowledge of medication has been found among American and Jordanian nurses (Gerard, Griffin, & Fitzpatrick, 2010; Yacoub et al., 2014) and insufficient knowledge of insulin treatment among 27% of Pakistani registered nurses (RNs) (Ahmed, Jabbar, Zuberi, Islam, & Shamim, 2012). Australasian studies found that some 50% of participating nurses did not know that neuropathy, nephropathy, erectile dysfunction, cardiovascular and cerebrovascular diseases were associated with diabetes (Daly, Arroll, Sheridan, Kenealy, & Scragg, 2014; Livingston & Dunning,

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Original Article

Factors influencing nurses' knowledge acquisition of diabetes care and its management: a qualitative study

Abdulellah Alotaibi, Leila Gholizadeh, Ali Hussein Alek Al-Ganmi, Lin Perry

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Abstract

Aim

The aim of this qualitative study was to identify and explore the factors nurses perceive as influencing their knowledge acquisition in relation to diabetes care and its management in Saudi Arabia.

Background

Diabetes continues to pose major healthcare challenges despite advances in diabetes

Appendix A: Critical appraisal: papers excluded on the basis of quality assessment

Author / Year of published.	Design: Described in detail?	Sample: Described in detail?	Data analysis: Described in detail?	Validity, reliability and rigor of instrument examined?
* Abduelkarem and El-Shareif (2013)	No	No	Yes	No
* Bar-Dayan et al. (2014)	Yes	No	Yes	No
$ Carney et al. (2013)	No	Yes	Yes	No
* Chinnasamy et al. (2011)	Inadequate details	No	No	No
% Correa, et al. (2012)	Yes	No	Yes	No
* Craig and Seller (2004)	Yes	No	No	No
# Croser and McDowell (2007)	Yes	Yes	No	No
* Engvall et al. (2014)	Yes	No	No	Yes reliability, No validity
* Hemingway et al. (2013)	No	Inadequate details	Inadequate details	No
* Jones and Gorman (2004)	Yes	No	No	No
* Kaur and Wakia (2007)	No	No	No	No
* Meetoo (2004)	No	No	No	No
* Odili and Eke (2010)	Yes	No	Yes	No
* Parry et al. (2014)	No	Yes	Yes	No
# Pennafort et al. (2014)	Yes	No	Yes	No
* Sharpe (2012)	No	No	No	No
* Tweary, et al. (2014)	Yes	No	No	No
* Veall and Bull (2009)	No	No	No	No

Appendix B: Included Studies Table

Authors	Design	Method	Aim	Setting and Location	Sample & strategy	Methods of analysis	Key findings
Ahmed et al. (2012)	Cross-sectional survey design Multicenter study	- The DMET used, piloted and developed by at Thomas Jefferson University Hospital, Philadelphia. - Validity and reliability checked.	To evaluate and compare the knowledge related to the management of diabetes among registered nurses (RN) and trainee residents.	5 tertiary care university/ teaching hospitals in Karachi, Pakistan.	- The questionnaire was sent out to 472 doctors and nurses, 381 (80%) responded, 169 (90%) internal medicine residents (IMR), 27 (83%) family medicine residents FMR, 86 (75%) surgery residents SR & 99 (73%) Registered nurses	- ANOVA, Bonferroni correction & Pearson Chi-square.	Inpatients and outpatient settings: - RNs had better inpatient management than outpatients' knowledge of diabetes, 40% and 16% of RNs respectively. - 16% of RNs aware of HbA1C and 12% knew LDL goals. Medications: - 38% of all participants were familiar with the duration of action of various insulin analogs with RNs displaying the lowest score (2%). - Suboptimal of knowledge related to insulin and anti diabetes medications were found in (27%) of RNs
Chan and Zang (2007)	A quantitative exploratory correlation study	DSRT & DBKT -Validity & reliability checked.	To understand perceived and actual level of diabetes knowledge among nurses working in both local hospitals.	2 local Hospitals, Hong Kong	- 245 nurses completed a structured questionnaire with 61.1% response rate.	Cronbach's alpha, Akaike's Information Criterion (AIC), & the ratio of distance measures.	- Cluster 1 (C1: 99) had relatively good competence & high score in MDSRT and MDBKT (86%, 77.3 & 71.6%) respectively. - C2 (106) had moderate competency, MDSRT & MDBKT (78%, 70,7 & 64.2%) respectively. - C3 (44) had low competence, MDSRT & MDBKT (71.6%, 65.6% & 59.4%) respectively.
Daly et al. (2014)	Mixed methodology cross-sectional survey and telephone interview.	- A survey & telephone interviews were conducted. - Questionnaire tool and interview questions developed by the author. - Validity and reliability checked.	To quantify and compare diabetes knowledge held by each of the three main groups of nurses providing community care for diabetes patients.	Primary health care centers in large urban areas of New Zealand	- 1091 PHC nurses identified, 383 randomly selected from different nursing categories, invitations were sent out to 335 nurses, 287 (86%) participated, 287 completed interviews, 284 completed the self-report questionnaires & 98% were female.	Multivariate analyses, Chi-square, Mantel-Haenszel Relative Risks & Multiple Logistic Regression Analyses (Barbara, 201).	- 96% identified that the major risk factor for type 2 diabete was obesity. - Major cardiovascular risk factors and cardiovascular complications were not well identified. - Less than half identified that neuropathy, ulcers and peripheral vascular disease are associated with diabetes complications, 14% identify stroke as complication. - Other major modifiable risk factor such as hypertension and smoking did not stated by (31% & 17%) respectively. - Diabetes aetiology: a minority of nurses stated that type 1 diabetes was autoimmune disorders (14%). - 28% %19%, respectively, stated insulin resistance &lack of glucose into cells as the pathology of type 2 diabetes. -17% & 22% do not know the pathology of type 1 & 2 diabetes respectively.

Eaton-Spiva and Day (18)	Descriptive, quasi-experimental design	Educational intervention based on CBL module, DSRT & confidence in teaching diabetes education scale were utilised via and intranet site. - Validity & reliability checked.	- To assess nurses' perceptions of their knowledge in diabetes care and confidence in teaching about diabetes to patients about diabetes	- Community acute care hospital in Georgia	-541 nurses attended the CBL module (58% response rate), 407 nurses completed the pretest survey (a response rate of 44%) & 84 nurses answered the posttest survey (a response rate of 9%).	Descriptive & inferential statistics.	-Mean pre-test survey score was 66.34% -Mean pre-test survey score was 17.24% -Mean post-test survey score was 67.78%. - Mean post-test survey score of confidence in teaching diabetes education scale was 18.68%. - No statistically significant difference related to nurses' knowledge, skill and confidence of diabetes care between pre- and post-intervention surveys. - (58%) of nurses noted that CBL extended their knowledge.
Gerard et al. (2010)	A descriptive correlation design	DSRT and DBKT based Jane Drass (1989) were used. -Validity and reliability checked.	To examine the levels of perceived and actual knowledge of diabetes among acute care registered nurses (RNs)	Community teaching hospital Southern New England, US	86 out of 93 acute care RNs were recruited with (93% response rate), of whom 55 (59%) were white, 18 (19%) black and 11 (12%) Asian nurses.	Power analysis, Cronbach alpha value & Univariate analysis	- DSRT: scores ranged 50% to 70%. - DBKT: The mean score was 67.97 (SD=11.14). - No significant relationship between DSRT and DBKT. - Low scores in diabetes knowledge for: - New medication action, treatment of hypoglycaemia, genetic basis of type 1 diabetes, blood testing, meals, oral medication, insulin timing & storage: 8%, 14%, 26%, 27%, 49%, 34%, 48%, 34%, respectively.
Hargraves (2014)	Mixed-methodology design	- Insulin Infusion Protocol (IIP) & Clinical Practice Guidelines used for BGL monitoring, - Pre, post-tests and observation of BGL were conducted. - Validity of tests checked.	To measure critical care nurses' knowledge of glycemic control in cardiac surgery before and after educational intervention.	The Atlantic Care Regional Medical Center, an integrated health cares system based in southern New Jersey	-30 cardiovascular unit nurses were invited via internal email, n-29 completed pretest & n-27 completed posttest, 76 Electronic health records reviewed BGL data 2 months before and after practice change	Descriptive & inferential statistics & 1 tailed t test.	- Pretest- 6 nurses (21%) correctly answered of the range of BGL. - Posttest- (52%) nurses correctly selected the range of BGL and, 15% selected correctly choice, while, 33% selected incorrect choice. - BGL post-test improved with 148mg/dl & the incidence rate of hypoglycaemia was reduced from 2.09% to 0.22%. -The target of BGL monitoring was less than 180mg/dl (88.30%). - The score of definition of hypoglycaemia through pre & posttests were (83% & 89%) respectively.
Hollis et al. (2014)	Non-experimental, cross sectional survey design.	- Questionnaire used and adapted from NADC. Piloted and validated were checked (Berg & Latin, 2004)	To determine the diabetes related knowledge levels of practice nurses in a regional/ rural setting in Australia.	A regional /rural Division of General Practice Australia	- The questionnaire was distributed to all 52 PNs via the internal mail system, 29 PNs participated with 57% response rate.	Descriptive analysis	Pathophysiology & BMG: - Mean scores 88% & 87% (good level of knowledge). Diet (carbohydrate sources): - Carbohydrates sources identified, 58% correct. Medication management: - Lack of knowledge in medication management, insulin timing and storage in 54%, 38% & 31%, respectively. Those with ≥2 years experience and involved in diabetes services had a higher score than with <2 years' experience and not involved in diabetes services; 88.6% & 71%, respectively.

Kassean (2005)	Phenomenology design	Semi-structured interviews with open-ended questions, conducted between 28 of June and 10 July 2004. - Rigor checked.	To explore how far nurses are able to fulfill their role of providing care to type 2 diabetes patients in community health centres.	- Five different community health care centres in Mauritius	-10 nurses from different health centers participated, 5 female & 5 male were chosen in relation to inclusion criteria.	- Colaizzi (1978) model	- Management of care: The majority of nurses did not know abou the holistic care. - Barriers to caring: The main barrier was lack of information regarding the diabetes; patients did not take their disease serious patients did not value nurses' services; lack of time; shortage of staff & material resources. -Lack of interaction with patients due to lack of proper training i the diabetes areas. -Needs for training and education.
Lee et al. (2013)	Survey design	- The survey was based on ADA (American Diabetes Associated, 2010)	To assess insulin-related knowledge among healthcare professionals working in a tertiary hospital.	A tertiary hospital in Singapore.	- 417 questionnaires were delivered to doctors, pharmacists & nurses during small meetings & nursing shift changes, 375 completed with (89.9%) overall response rate. - 138 (86.3%) physicians, 209 (92.5%) nurses and 28 (90.3%) pharmacists.	Interquartile ranges (IQRs), Mann-Whitney U and the Kruskal-Wallis tests & Bonferroni correction	Comfort level: 84.7% of physicians, 95.7% of nurses and 82.1% pharmacists were comfortable with their knowledge of diabetes care. - Insulin characteristics and prescriptions: pharmacists and physicians scored the higher than nurses scored (100%, 79.0% & 12.9 respectively). -Insulin preparation and administration: the highest scores from nurses and pharmacists were (5, IQR 4-6 & 6, IQR 6-7), respectively. - No statistical correlation between comfort level and insulin knowledge.
Livingston and Dunning (2010)	Descriptive & exploratory design.	- Cross-sectional survey and individual interviews were developed and conducted by the authors. - Piloted by four panels and 10 nurses from Division (A) to check the validity.	To explore PNs' roles, knowledge and beliefs about diabetes education and management in rural and remote general practice.	3 divisions of general practice, Victoria, Australia.	- Invitation packages delivered to General practice support officer (GPSO) then GPSO transferred packages to practice manger, distributed to nurses via internal mail, (33 %) n-21 participants surveyed & invited to interview (6). .	- The Mann-Whitney U test & analysis of variance .	- Diabetes risk factors: nurses identified obesity & family history (80% & 74%) respectively. - 4 nurses identified physical inactivity & hypertension. - 4 respondents did not identify the list of oral hypoglycaemia ag (OHA) treatments - Lack of knowledge of diabetes complication, neuropathy, cardiovascular & cerebrovascular disease & erectile dysfunction (42.1%, 36.8%, 5.3% &11.2%) respectively.

Modic et al. (2009)	Prospective, cross-sectional, correlational design	- Survey carried out with cardiac registered nurses by using DKSST. - Validity checked by 13 experts.	To examine diabetes knowledge of nurses working in medical cardiology and cardiovascular surgical intermediate care units	A tertiary care center in Northeast Ohio, USA	Questionnaire was sent via mailbox or handed out at a routine meeting. 90 RNs, participated, 83.0% were female and 84% were full time nurses.	Correlation & comparative statistical tests.	- Oral Glucose Lowering, symptoms management & blood glucose monitoring: the higher scores found with generally older age, in 46,5%, 65% & 40%, respectively. - Insulin therapy: 58.3% found with greater years of experience in the area with - Diet: Nurses with the highest quartile, aged 37 years or old scored 20% in this area. - No difference in test score based on educational background and sex in five content areas. - The total score of DKSST was 50%, which is considered a low score on this scale.
Modic et al. (2009)	Descriptive design.	- Pretest and posttest methods conducted prior & after to a 4-hour diabetes management course. - DMKAT developed by the authors. - Validity and reliability checked.	To examine nurses' knowledge of inpatient diabetes management principles before and after a structured diabetes education program.	Large healthcare center in the Midwest US	- 2250 nurses, from various specialties were recruited.	- Pearson's correlation, Spearman's, ANCOVA & A paired t-test.	- No difference in knowledge via DMKAT based on education level and years of experience. - Nurses had high-level of comfort & familiarity for patients with diabetes care. - 38% (n-817) did not correctly answer questions of posttest on insulin regimens part.
Mutea and Baker (2008)	Descriptive exploratory design.	- Face-to-face interview with Kenyan registered nurses (RNs), 23 questions developed by the authors, 3 nurses piloted questions and a few modifications were made. - Rigor established.	To examine nurses' involvement in the management of diabetic patients in a western Kenya Hospital.	University teaching and referral hospital in Keynya's Rift Valley Province. Kenya	- 15 face-to-face interviews were conducted with Kenyan nurses, with participants selected based on their ward assignment.	A grounded theory model used in the data analysis process.	- Most of nurses had adequate knowledge about diabetes mellitus. Although they all had an interest in teaching patients about diabetes self-care, but they had challenges that prevented them to doing so accurately. - The shortage of nursing staff, lack of materials, drugs, equipment, poverty, patient support activities & patient illiteracy prevented teaching the patients with diabetes
Nash (2009)	Exploration design.	- Survey used with mental health nurses.	To explore the impact of diabetes care, for type 1 and 2 diabetes on mental health nurses' workload, their past education and training.	An inpatient and community setting in two London NHS trusts. UK	- Mental health nurses: 220 questionnaires sent out, 138 returned, with 63% response rate,	Descriptive analysis	Knowledge of diabetes: - 40% had fair knowledge. - 24% had good knowledge. -15% had very good knowledge. Past training: - 39% (n-54) had no diabetes training or education. - Nurses need further training in diabetes care such as foot care (19%), dietary advices (63%), and monitoring glucose intake (22%) & blood glucose monitor (68%)

Olsen et al (2012)	Phenomenological design	- Three Focus group interviews were conducted with enrolled nurses ENs: focus group interviews contained 6 to 8 ENs.	To explore the perceived knowledge of diabetes among personnel practicing in municipal care.	7 of municipal home care groups & 5 municipal nursing home groups in Dalarna Sweden	- 5-unit managers selected the ENs from each work groups; the numbers of participants were 25 ENs were invited. 22 responded, 21 female and one male.	Interviews were recorded and transcribed verbatim & Content analysis used according to Kvale and Brinkmann (2009).	Basic skills, symptoms and causes: - ENs identified the difference between type 1 & type 2 diabetes but they failed to explain these differences & normal blood glucose levels. - Lack of knowledge about once patients requirement for extra glucose or food so as to raise the (BGL). Intervention: - Lack of knowledge once (BGL) dropped, how to stabilise BGL by providing a proper meal. Another factors affected care situation such as lack of time, faulty routine & inadequate report between ENs. Treatment: - 19 ENs needs additional knowledge about the effect of different types of tablet & (9) about insulin treatment.
Oyetunde and Famakinwa (2014)	Cross-sectional survey design.	- Survey design. - The questionnaire was developed by the author. - Validity and reliability checked.	To assess whether or not nurses have adequate knowledge about nutrition, exercise, glucose monitoring, foot and skin care in the management of diabetes	Six government hospitals in Ondo State. Nigeria	- 410 copies of questionnaires sent out to nurses employed in various wards of the nominated hospitals, 401 completed, with (97.80% response rate), 80% of nurses were female.	Analysed using frequencies and percentages.	- 79.8% had inadequate knowledge regarding diabetes diets. - 75.1% had inadequate knowledge related to activity & exercise activity. - 75.1% had inadequate knowledge related to blood glucose monitoring. - 65.6% had inadequate knowledge of foot/skin care. - Nurses with 1 to 5 years of experience scored higher than those who had more years of experience.
Park et al. (2011)	Quantitative study, cross-sectional survey design	- A questionnaire developed by the authors. - Validity checked by 9 experts	To investigate the level of nutritional knowledge and ability of nurses to provide dietary education to patients with diabetes and CVD,	3 largest general hospitals. Korea	- 506 nurses participated with 85% response rate. .	Nutritional knowledge scores relating to diabetes, obesity & CVD compared by ANOVA.	- 68% correct diabetes-related nutritional knowledge. - 90% agreed patients with diabetes could consume fruit, - 40% didn't know patients with diabetes should limit animal fat intake. - 70% were unaware of the need for patient with diabetes to consume complex carbohydrates rather simple carbohydrates.

Shiu and Wong (2011)	Cohort study design.	- A survey was carried out with a cohort of registered nurses (RNs); the DFCKS was developed and validated.	To examine the level of diabetes foot care knowledge in a cohort of nurses.	In diabetes care specialty services. Hong Kong	- The RNs who enrolled in the course were invited for the study, 65 RNs participated.	Statistical analysis package used.	- Nurses with prior training in diabetes foot care management scored higher than those RNs who did not have prior training (N= 28, Mean DFKS, 43.1, SD 5.6) & (N=37, M=40.1, SD 5.8) respectively. - Those with greater years of experience in diabetes care scored higher than those with fewer years experience (N=22, M=41.5, SD 7.3) & (N=43, M41.3, SD 6.1). - Wrong answers were demonstrated in surgical spirit between toes, use of woollen socks and Hibitane antiseptic solution (83.1%, 75.4% & 73.8%).
Smide and Nygren (2013)	Qualitative, case study design	- Individual interviews were conducted.	To determine levels of diabetes knowledge among health care workers.	5 nursing homes, Sweden	- 10 healthcare workers selected for interview in 5 nursing homes.	The text was analysed using content analysis according to Graneheim & Lundman (2004).	- Case description: 9 of the 10 had below adequate knowledge about diabetes symptoms. - General diabetes knowledge: - 3 of 10 had below adequate knowledge of blood glucose monitoring. 2 of the 10 had below adequate knowledge in foot care.
Thomas (2004)	Quantitative approach using an exploratory survey design.	- The DSRT and the DBKT based on Jane Drass (1989); piloted.	To ascertain whether paediatric ward nurses' knowledge of diabetes was up to data and whether perceived of knowledge and confidence matched actual knowledge.	- One SPH & DGH, (UK)	- 174 nurses, 86% response rate, 127 nurses (84%) from the SPH and 47 nurses (88%) from the DGH selected by author.	- ANOVA used to compare the mean diabetes knowledge scores according to socio-demographic data.	- Significant correlations between the actual, & perceived knowledge and confidence scores for blood glucose, diet, illnesses & aetiologies. - 88.5% able to identify the causes of type 1diabetes. - 54.5% did not know about the insulin action. - 72.9% did not know about the side effects of repeat injection of insulin in the same site. - 60% did not know about the protocol for minor surgery procedure. - Overall nurses had diabetes knowledge deficits.

Unadike and Etukumana (2010)	Cross-sectional survey design.	- Survey was carried out with nurses.	To determine the awareness and knowledge levels of diabetes mellitus amongst nurses in a tertiary hospital.	The University of Uyo Teaching Hospital, Nigeria	- Nurses were drawn from various wards, 113 nurses completed the questionnaire.	Descriptive analysis	Knowledge of diabetes and clinical features of hyperglycaemia: - 86.7% knew the definition of diabetes while 13.3% did not. - 33% of nurses only addressed three clinical features of DM while 10% identified five clinical features. - 50.9% identified one of the classifications of diabetes ketoacidosis. Management of diabetes: 80.7% identified the most common method of diabetes management as insulin therapy, while, 5.3% did not answer this question. - 7.1% stated that insulin therapy could treat hypoglycemia coma - 22.1% & 6.2% of nurses, respectively, could not identify any type of insulin and all sites of insulin injection. - 67.2% identified two oral hypoglycemia agents while, 20.4% failed to identify even one. Complications of diabetes mellitus: - 43.4% identified that diabetes affects the nervous system, 56.6% that it affects the kidneys, 32.7% that affects blood vessels
Van Zyl and Rheeder (2008)	Survey design	The Diabetes Knowledge Tool (O'Brien et al., 2003) and the DAS3 (Anderson et al., 1998) were distributed to doctors & nurses during a unit meeting. - Validity and reliability checked.	To assess knowledge and attitudes of doctors and nurses caring for patients with diabetes.	A secondary hospital in Pretoria, Africa	- 115 healthcare providers participated, 54 (47%) doctors and 61 (53%) nurses with 82% response rate.	Descriptive analysis	- Nurses lacked knowledge of diabetic management with median score 2 out of 5. - 28% nurses worried regarding inpatient diabetes management, 65% do not worried & 7% do not know. - The best site for insulin injection, 22 (36%) cited in the forearm, 50 (82%) thigh, 53 (87%) the abdomen, and 4 (7%) the upper arm. - Symptoms of hypoglycaemia: 12 (20%) sweaty cold skin, 3(5%) dizziness, 11(18%) coma, 35(57%) considered that blood glucose less than 3mmol/l as hypoglycaemia. - DAS3: all professional staff aware about the need for special training in the diabetes management.

Wakefield and Wilson (2014)	Prospective, randomised controlled trial	-Educational intervention program developed and evaluated pre and posttests; survey questionnaire within two groups, intervention and control groups. - Pilot test and validity and reliability were checked.	To enhance the nurses' knowledge regarding the complex care for hospitalized patients on insulin.	One South Texas Hospital system cooperated with three rural and three urban hospitals. USA	- Unit managers invited 202 nurses via posted fliers, internal mail and multiple announcements, 118 nurses participated, 45 intervention & 73 control groups.	Mixed models analysis (descriptive & inferential statistics) & multivariate analysis	- Both groups over two points in time: Significant difference pre versus post- intervention (Part 1 v part 2). - Pretest score 51.3%. - Posttest, intervention 69.7%, controls 55.5%. - Intervention groups over three points (pre, post & 3 month of intervention: - Scores of post 69.7%, three months after the intervention 67.3% were higher than pretest scores (51.2%) in intervention group.
Wellard et al. (2013)	Concurrent mixed method study design	Three phases were used: - Cross-sectional survey: the ADKnowl and vignettes were used & internationally validated. - Focus group interviews. - Case file audit.	To explore staff diabetes medication knowledge and practice in regional residential care.	2 government (public) residential aged care facilities (RACFs) in regional Victoria, Australia	450 questionnaires were sent, across all clinical areas, 68 registered nurses (RN), enrolled nurses (EN) & patients care attendants (PCA) completed with response rate 12.5%, 3 participants willing to participate in the focus group interview, & 96% were female.	Descriptive statistics procedure t-test, Chi-square test; The qualitative content analysis & Dunning's framework (2005)	- Staff had suboptimal knowledge, described system issues and poor health literacy about medicines. - The major barriers confronting staff during medication administered were lack of time, residents' characteristics, and, communication issues. - Knowledge deficits in 49% of ENS and PCAs related to glucose lowering medicines. - 45.6% answered correctly a question about crushing OHA.
Yacoub et al. (2014)	- Cross sectional survey study.	- The DSRT and the DBKT based on Jane Drass (1989); piloted and modified. - Validity & reliability checked.	To assess the level of Jordanian nurses' perceived and actual knowledge of diabetes.	3 public, 2 private & 2 university -affiliated hospitals, Jordan	- 277 register nurses invited, 62% response rate; 61.7% (n: 171) were female.	- Cohen's d table, independent t-test, Pearson's &Spearman's correlation coefficients, ANOVA.	DSRT results: mean score of nurses knowledge in DSRT was 78.94 (SD=9.84), MDBKT results: nurses with a family history of diabetes had higher scores (M=30.71) than those with no family history of diabetes (M=27.81). - The university-affiliated hospitals nurses had higher MDBKT scores with (M=32.08) - Lack of knowledge in insulin storage and preparation, hypoglycaemia treatment, meal planning & duration of action with hypoglycaemic agents (18.1%, 46.4%, 22.4% & 26.4%) respectively.

Abbreviation: ADA, American Diabetes Association, ADKnowl Audit of Diabetes Knowledge, BGL blood glucose level, BGM blood glucose monitoring, CBL computer-based learning, CVD cardiovascular disease, DAS3 Diabetes Attitude Questionnaire, DBKT Diabetes Basic Knowledge Tool, DFCKS Diabetes Foot Care Knowledge Skill, DGH district general hospital, DSRT, Diabetes Self-Report Tool, DKSST Diabetes Knowledge Survival Skill, DMET Diabetes Measurement Evaluation Tool, DMKA Diabetes Management Knowledge Assessment, HbA1C glycated haemoglobin, LDL lipoprotein cholesterol, NADC National Association of Diabetes Centres, OHAs oral hyperglycaemia agents, SPH specialised paediatric hospital.

Appendix C: Participant Information Statement

Project Title: Nurses' knowledge of diabetes for patient self-management support and education

Researcher: Mr. Alotaibi Abdulellah (PhD candidate: University of Technology Sydney, Faculty of Health, , Local Mobile: ( ).

Supervisors: Professor Lin Perry, , M. (+61), T (+61) and Dr. Leila Gholizadeh, , T. (+61 2 95144814)

Dear Sir/Madam

You are invited to participate in a PhD research project (identified above) being undertaken by research student Alotaibi Abdulellah and supervised by Professor Lin Perry and Dr. Leila Gholizadeh from Faculty of Health, University of Technology Sydney. Please read this information sheet carefully and make sure that you understand its contents before deciding to participate. If you have further questions about the research project, please feel free to contact the primary researcher, Alotaibi Abdulellah or one of his supervisors using the above contact details.

WHO IS DOING THE RESEARCH?

My name is Alotaibi Abdulellah PhD candidate and supervised by Professor Lin Perry and Dr. Leila Gholizadeh from Faculty of Health, University of Technology Sydney

WHAT IS THIS RESEARCH ABOUT?

The research is to examine diabetes knowledge of nurses in Saudi Arabia and factors that influence nurses' acquisition of diabetes knowledge.

IF I SAY YES, WHAT WILL IT INVOLVE?

If you agree to participate in this study, you will be required to complete a survey questionnaire, which will take about 30 minutes to complete. As part of this study, we also would like to identify the barriers that prevent nurses from developing and updating their knowledge of diabetes. As such, we will interview a sub group of nurses about these barriers. If you are also interested to participate in the interview, which will take about one hour, please express your interest by emailing Mr. Alotaibi Abdulellah, . All information will be kept confidential and any information you provide will be de-identified before analysis.

ARE THERE ANY RISKS/INCONVENIENCE?

There is potential for participants to disclose lack of knowledge, incompetence and perceived risk for female Muslim nurses being interviewed by male researcher. Participants' answers will be kept strictly private and not be disclosed to anyone at the hospital. The survey will be anonymous. When interviewing a female Muslim nurses, a female member of nursing education department will be present during the interview.

WHY HAVE I BEEN ASKED?

You are able to give me the information I need to examine nurses' knowledge of diabetes care in Saudi Arabia and to determine factors that influence nurses' acquisition of diabetes knowledge.

DO I HAVE TO SAY YES?

You do not have to say yes because participation in the research is voluntary.

WHAT WILL HAPPEN IF I SAY NO?

Nothing. I will thank you for your time so far and won't contact you about this research again.

IF I SAY YES, CAN I CHANGE MY MIND LATER?

You can change your mind at any time and you don't have to say why. I will thank you for your time so far and won't contact you about this research again.

WHAT IF I HAVE CONCERNS OR A COMPLAINT?

If you have concerns about the research that you think my supervisor or I can help you with, please feel free to contact me (us) on the above email. If you have any complaints about the ethical conduct of this research, you may contact the Ethics Committee through the Research Ethics Office at University of Technology Sydney, City campus, 15 Broadway Ultimo NSW 2007, T +61 2 9514 2000 or email; and contact Senior Consultant: Al-Asmari Abdulrahman, Director of Research Center at Prince Sultan Medical Military City (PSMMC) Tel, +966114777714, # 25100 or email; Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

Thank you for your participation. Please keep this participation information sheet with you.

Your Sincerely

Abduellah Alotaibi **Professor. Lin Perry** **Dr. Leila Cholizedah**

Appendix D: Socio-Demographic Data Sheet for nurse participants in Phases One and Two (Survey and Interviews)

The following questions are derived from previous surveys of nurses' knowledge of diabetes and diabetes management guidelines.

Please remember that this is not an examination. It is intended to give an indication of nurses' knowledge of diabetes care and its management.

1. **Were you involved in the pilot study of this survey and interview?** ☐ Yes ☐No
   *If YES, sorry **YOU ARE NOT ELIGIBLE TO PARTICIPATE** in the survey and interview phases in this study.*

2. **What is your gender?** ☐ Male ☐ Female

3. **What is your age? ……....Years**

4. **In which country did you obtain your nursing degree?**
   ☐ Saudi ☐ Philippines ☐ India ☐ UK ☐ USA
   ☐ Australia ☐ other please specify:……..

5. **What is your ethnicity/race?** ☐ Arab ☐ Asian ☐ African ☐ European
   ☐ other, please specify…….....

6. **What is your highest nursing qualification?** ☐ Diploma ☐ Bachelor degree
   ☐ Master degree ☐ Doctoral degree

7. **Have you completed the orientation period and preceptor ship period in Saudi Arabia?** ☐ Yes ☐ No
   *If no, sorry **YOU ARE NOT ELIGBLE TO PARTICIPATE** in the study.*

8. **Years of clinical nursing experience:.....Years**
   *If you have less than **SIX MONTHS** of clinical nursing experience **YOU ARE NOT ELIGIBLE TO PARTICIPATE** in this study*

9. **Current working area (department/unit):**

☐Medical ☐Surgical ☐Neurology ☐Urology ☐ Nephrology ☐ Cardiology

☐Paediatrics ☐ Intensive Care ☐Neurosurgery ☐Obstetrics and gynecology

☐Others: please specify.....

If you work in support service departments such as radiology, dialysis, endoscopy, operating room, laboratory units. ***YOU ARE NOT ELIGIBLE TO PARTICIPATE IN THIS STUDY.***

10. **Do you currently provide direct diabetes nursing care to patients?** ☐ Yes ☐ No

If so, please estimate the percentage, on average, of your day that is spent caring for patients with diabetes:-……%

11. **Do you have diabetes management policy guidelines on your ward/unit?**

☐ Yes ☐No

12. **Are these accessed and used in your ward/unit?** ☐Yes ☐ No

If so, please specify which guidelines you use:……

13. **How often do you refer to the diabetes management guidelines/policy when providing care to patients with diabetes?** ☐Very rarely ☐Rarely ☐Sometimes ☐Frequently ☐Always

14. **Have you attended any courses, workshops or conferences in the past years about diabetes assessment or management?** ☐ Yes ☐ No

If so, please specify what you attended and month/ year

……..month/ year

……..month/ year

……..month/ year

……..month/ year

……..month/ year

15. How competent do you feel in providing nursing care to patients with diabetes?

☐Excellent ☐Good ☐ Fair ☐ Poor

Appendix E: Diabetes Assessment Tools (the survey)

Instructions:

- Thank you for complete questionnaire. For each item, please select the one best answer to the question. The last answer r to each question, 'I do not know', should only be used if you truly do not know the answer.
- Please circle the letter corresponding to your answer on this sheet.

This first section asks some questions about what you know about diabetes, and what you are comfortable to teach patients.

1 I can describe the etiology of Type 1 diabetes

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

2 I can describe the etiology of Type 2 diabetes

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

3 I can identify the long-term complications associated with diabetes

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

4 I can explain/describe the action and effect of insulin

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

5 I can instruct a person with diabetes on self-care management for a ‘sick day

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

6 I can instruct on daily personal care for someone with diabetes

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

7 I am generally comfortable teaching patients about oral glucose-lowering agents

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

8 I am generally comfortable teaching patients about insulin therapy

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

9 I am generally comfortable teaching patients about management of diabetes symptoms

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

10 I am generally comfortable teaching patients about blood glucose monitoring

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

11 I can describe the diet recommendation for someone with diabetes

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

12 I can describe the basic treatment plan for diabetes

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

13 I can list the steps of insulin administering

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

14 I can describe the action and effect of oral hypoglycaemic agents

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

15 I can assess sign and symptoms of diabetes ketoacidosis

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree

The next section asks a few more questions about diabetes knowledge.

Item (One): Diabetes pathology, symptoms and management

16 A nurse should recognize which of the following assessment factors as one of the best indicators of a client's control of his/her diabetes during the preceding 2 to 3 months?

a. Oral glucose tolerance test
b. A glycosylated hemoglobin test (HgA1C)
c. The client's verbal report of his symptoms
d. I don't know

17 For the past two days, a patient with diabetes has demonstrated wide fluctuation in blood glucose levels over several hours, often unrelated to meals; elevated blood glucose levels upon awaking, preceded by nocturnal sweating, nightmares or headache; 3 a.m. blood glucose level of 40 mmol/L followed by 8 a.m. blood glucose level of 230 mmol/L

Based on this assessment data, which is the patient demonstrating?

a. Pass-through or flashback phenomenon
b. Somogyi or rebound effect
c. Dawn phenomenon
d. I do not know

18 Which statement is characteristic of the etiology of type 1 diabetes?

a. Strongly associated with obesity
b. Predominantly genetic
c. Autoimmune, viral or toxic destruction of the beta cells
d. I do not know

19 Which the most effective statements about the management of type 1 diabetes is true?

a. Insulin injections are necessary to maintain life
b. Insulin injections are not always necessary if diet and exercise are well controlled
c. Oral hypoglycemic agents are sufficient for blood control in most patients
d. I do not know

20 Which statement is characteristic of the etiology of type 2 diabetes?

a. Predominantly non-genetic
b. Frequently associated with obesity and resistance to insulin
c. Autoimmune, viral or toxic destruction of the beta cells
d. I do not know

21 Which of the most effective statements about management of type 2 diabetes is true?

a. Insulin injections are necessary to maintain life
b. A controlled diet and exercise program is the most effective treatment
c. Oral hypoglycemic agents are always effective
d. I do not know

22 One possible symptom of hypoglycemia is:

a Frequent urination
b Dry mouth and dry skin
c. Nervousness
d. Glucosuria

23 What is one cause of hyperglycemia?

a . Decreased food intake
b . Infection
c . Excessive insulin
d. I do not know

24 What effect does illness (for example, a "sick day") have on insulin requirements?

a. Illness causes a decrease in insulin requirements
b. Illness causes an increase in insulin requirements
c. Illness causes no changes in insulin requirements
d. I do not know

25 In general, changes in the pattern of insulin administration for the patient with diabetes undergoing surgery might include which of the following?

a. Increase the dose of long-acting insulin the night before and the morning of surgery
b. Discontinue all subcutaneous insulin the day of surgery and instead infuse

long-acting insulin intravenously at a constant drip

c. On the day of surgery, reduce the AM dose of insulin and give subcutaneous or IV boluses of regular insulin based on blood glucose monitoring results

d. I don't know

26 One sign/symptom associated with diabetes ketoacidosis in the person with type 1 diabetes is:

a. Cold, clammy skin
b. Acetone (fruity) breath
c. Negative urine for glucose
d. I do not know

27 What is one cause of diabetes ketoacidosis in the person with type 1 diabetes?

a. Excessive exercise
b. Excessive intake of diet soft drinks over a prolonged period
c. Failure to take daily insulin dose
d. I do not know

28 Which of the following factors is not associated with increasing incidences of diabetes in Saudi Arabia?

a. High carbohydrate diets
b. High protein diet
c. Decrease amounts of physical activity and
increase of incidence of obesity in children and adolescents

d. I do not know

29 Studies have found a clear genetic link in the onset of type 2 diabetes and little or no environmental factors leading to the development of this disease?

a. True
b. False

c. I do not know

Item (Two): Blood glucose monitoring and diabetes complications

30 Which of the following steps will provide the most accurate test results obtained with most blood glucose monitors?

a. Fingertip vigorously milked for blood sample
b. Fingertip pricked when still wet from alcohol wipe
c. Appropriate size and placement of the blood sample on strip
d. I don't know

31 Normal fasting blood glucose level can best be described as:

a. Below 150 mg/dL or mmol/L
b. Between 100 and 200 mg/dL or mmol/L
c. Below 110 mg/dL or mmol/L
d. I do not know

32 In surgical patient with diabetes, maintaining normal blood glucose levels are important because:

a. High blood glucose levels are associated with impaired response to infection and poor wound healing
b. Low blood glucose levels can lead to ketoacidosis and electrolyte imbalances
c. High and low blood glucose levels can increase the amount of anesthesia needed
d. I do not know

33 What effect does exercise have on blood glucose when less than 250 mg/dl or mmol/L?

a. Decreases blood glucose

b. Increases blood glucose
c. Has little effect on blood glucose
d. I do not know

34 If a person with known diabetes is found unresponsive, which of these assumptions about the person's blood glucose should guide your initial actions?

a. It may be very high
b. It may be very low
c. It may be normal
d. I do not know

35 The American Diabetes Association's goal for optimal glycemic control is a glycated hemoglobin of:

a . Less than 7%
b . 7-9%
c . 9-11%
d . I do not know

36 Why is it necessary that people with diabetes pay special attention to proper care of their feet?

a. Several years of injecting insulin into the thighs can cause edema in both the legs and the feet
b. Flat feet are commonly associated with diabetes unless preventive measures are routinely used
c. Persons with diabetes often have changes in sensation and poor circulation to their feet
d. I do not know

37 A person with diabetes has a small corn on the right foot and wants it removed. What should be done first?

a. Use a liquid corn remover, following the directions carefully
b. Refer the person to a podiatrist
c. Carefully trim the corn with a sterile cutting instrument
d. I do not know

38 A person with diabetes has just received a minor abrasion on the left leg. What treatment interventions should the nurse teach the patient for an abrasion?

a. Wash gently with mild soap and water, dry with clean towel and observe carefully for any signs of infection
b. Wash gently with mild soap and water, apply a small amount of betadine, and observe carefully for any sign of infection
c. Apply a small amount of iodine or me-thiolate and call the doctor
d. I do not know

39 A person with type I diabetes who is insulin-dependent fails to take insulin regularly; he/she is at risk for which of the following complications?

a. Ketoacidosis
b. Hypoglycemia
c. Pancreatitis
d. I don't know

40 Which of the following long-term complications are associated with poorly controlled diabetes?

a. Pulmonary changes and infection
b. Cardiovascular and renal changes
c. Deep vein thrombus and anemia
d. I do not know

41 The most acutely dangerous complication of sulfonylurea (Glibenclamide, Glyburide, Gliclazide, Glimepiride, etc.) therapy is:

a . Weight gain
b . Skin rashes
c. Hypoglycemia
d. I don't know

42 Controlling blood pressure is important in patients with nephropathy?

a. True
b. False
c. Only if they are also obese
d. I do not know

Item (Three): Diabetes diet/nutrition

43 What effect does increased exercise have on food intake needs if the person has well-controlled type 1 diabetes?

a . Decreases the need for food
b. Increases the need for food
c. Has little effect on the need for food
d. I do not know

44 A person with type 1 diabetes does not like one of the food items on the meal tray. What would be the best action for the nurse to take?

a . Instruct the patient to eat all other items on the tray and omit that one item
b . Instruct the patient to omit that one item and adjust the next scheduled insulin dose to accommodate this deletion
c. Give the patient a replacement carbohydrate food or drink if the disliked food contains carbohydrate
d. I do not know

45 The main objective when developing a meal plan for the person with type 2 diabetes is:

a. A calorie-controlled diet that will achieve and maintain ideal body weight
b. A high-carbohydrate, high-protein diet to increase body protein reserves
c. A low-carbohydrate, high-protein diet that will prevent blood glucose fluctuations
d. I do not know

46 A diabetes diet is calculated for which of the following nutrients:

a. Carbohydrates, proteins and fats
b. Meats, fruits, vegetables, milk and breads
c. Proteins, grains, milk products
d. I do not know

47 A patient with diabetes has refused an evening snack of fruit juice and one half of a sandwich. You should substitute/replace with:

a. Five small pieces of bread and 8 ml. of plain yogurt
b. Six bread and 2 cc/ml of cheese
c. A piece of fresh fruit, 1cc/ml. of peanut butter and six bread
d. I do not know

48 Which is the most appropriate initial action to take for a person with type 1 diabetes who is having a hypoglycemic reaction?

a. Drink 4 ml. of regular soda
b. Drink 4 ml. of orange juice with 2 tsp. of sugar
c. Eat 4 cakes with butter or margarine
d. I do not know

Item (Four): Diabetes medications

49 The action of exogenous glucagon is to:

a. Stimulate hepatic glucose release
b. Counteract hyperglycemia
c. Delay gastric emptying and increase the postprandial glucose
d. I do not know

50 The nurse is preparing to give an insulin injection. Which of the following insulin preparations cannot be mixed with any other insulin?

a NPH Insulin
b. Lantus Insulin
c. Humalog (Regular) Insulin
d. I don't know

51 A client is diagnosed with diabetes type 1. The primary healthcare provider is planning to prescribe a Humalog or Novolog insulin regimen administered subcutaneous each morning and evening for this client.

How soon after administration must the meal be eaten?

a . 30 minutes
b. Immediately
c. 15 minutes
d. I don't know

52 Which type of insulin is required in insulin pumps?

a. Short-acting (Humulin-Regular, Novolog, Humalog)
b. Intermediate insulin (NPH)
c. Lantus
d. I don't know

53 Which of the following is one benefit of insulin pump therapy?

a . Poor insulin utilization
b . Strict mealtime planning
c. Improved insulin absorption
d. I don't know

54 An oral agent for diabetes that is especially useful in patients who have type 2 diabetes with elevated triglycerides and Low-density lipoprotein cholesterol and/or overweight is:

a . Glyburide (Diabeta or Micronase)
b . Glimepiride (Amaryl)
c. Metformin (Glucophage)
d. Acarbose (Precose)

55 What effect does insulin have on the blood glucose level?

a . Insulin causes blood glucose to increase
b. Insulin causes blood glucose to decrease
c. Insulin has no effect on blood glucose
d. I do not know

56 Which are physiological actions of insulin?

a. Transports glucose across cell membranes for use by the cells
b. Slows the rate of glycogen storage in the liver, muscle and other tissue
c. Enhances the breakdown of fat cells into free fatty acids that are used for energy
d. I do not know

57 The maximum effect (peak) of regular insulin occurs:

a. 2-4 hours after injection
b. 6-12 hours after injection
c. 24-28 hours after injection
d. I do not know

58 The maximum effect (peak) of both NPH and Lente insulin occurs:

a . 2-4 hours after injection
b. 6-12 hours after injection
c. 24-28 hours after injection
d. I do not know

59 Where should someone store insulin that is presently being used?

a . In the refrigerator near the freezer section
b . In the refrigerator away from the freezer section
c. In the refrigerator at temperature 2-8°C
d. I do not know

60 A person with diabetes contaminates the needle while preparing an insulin injection. What would be the best action to take?

a. Dispose of the contaminated insulin syringe and start preparation again

b. Wipe the needle with an alcohol sponge and continue preparing the injection

c. Continue to prepare the injection after wiping the injection site thoroughly with alcohol

d. I do not know

61 When short-acting (regular) and intermediate-action (NPH) are ordered to be given by injection at the same time, the nurse should:

a . Use separate syringes to administer each insulin

b . Mix them in the same syringe drawing up the intermediate- acting insulin first

c. Mix them in the same syringe drawing up the short-acting insulin first

d. I do not know

62 The duration of action for glyburide (Diabeta or Micronase) is:

a . 6-12 hours

b . 10-18 hours

c. 16-24 hours

d. I do not know

63 What is one cause of hypoglycemia when a person with diabetes is taking insulin or oral hypoglycemic agents?

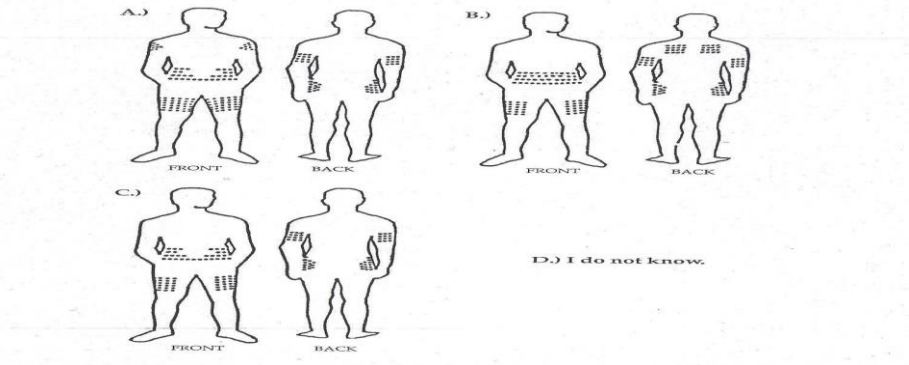
a. Skipping meals

b. Illness

c. Too little exercise

d. I do not know

64 Which of the following figures best illustrates the correct sites for subcutaneous



insulin administration?

a . From diagram above

b . From diagram above

c. From diagram above

d. From diagram above

Appendix F: Poster: Volunteers needed for research study:

Nursing knowledge of diabetes

for patient-self management support and education in Saudi Arabia

We are conducting research to examine:

- **Nurses' knowledge of diabetes care and management and**
- **Factors that affect nurses' ability to be knowledgeable about diabetes**

➢ Inclusion criteria: ARE YOU -

- An expatriate or local Registered Nurses (RNs), registered with the Saudi Commission for Health Specialties.
- With a minimum of six months' work experience in nursing care.
- Participants must be in front-line care roles.

➢ Exclusion criteria: YOU ARE NOT ELIGIBLE IF YOU -

- Are in a managerial positions (Clinical directors, Head and Charge nurses)
- Newly appointed nurses (under orientation and preceptor ship period)
- Were involved in the pilot study.
- Work in services support departments (such as operating room, dialysis, endoscopy, laboratory units and etc.)

➢ **There are two separate parts to this research**

If you are eligible (see above) you can take part in either or both parts

- **Part one (Survey study):**
  If you wish to participate in the survey, please help yourself to one of the survey packages in your department in the nursing station.
- **Part two (Interview study):**
  If you wish to participate in the interviews contact the researcher by email (or).

Appendix G: Interview Guide

Time:……

Date:…… **Location:** ……

Research Topic: Nursing diabetes knowledge for patient self management support and education in Saudi Arabia

Aim: To identify the factors/barriers affect nurses' diabetes knowledge acquisition at the healthcare setting in Saudi Arabia

Pre-interview stage:

The researcher will thank the research participants for being willing to take part in this interview. The researcher will introduce him-self to the research participants and explain the purpose of study.

Following this stage:

- This interview will take one hour.
- The audio-recorded and written note will be used for the purpose of accuracy of the interview transcription.
- All the information given by the research participants will be kept strictly confidential and without identification transcription.
- The researcher would like to know the participants' experience and thoughts about the diabetes care and management, how the participants manage and assess patients with diabetes.
- The consent form is required prior to commencing the interview and the participants have the right to withdraw at any time or refuse to answer any question without giving a reason and consequences.

Interview stage:

At the beginning, can you tell me about yourself, for example?

1- Professional experience
2- Nationality
3- Education background

4- What is your role in managing patients with diabetes?

Interview Questions:

- **Can you tell me about how diabetes is managed in the hospital?**
    - How would you describe nursing professional practice in managing patients with diabetes?

Probes:

- What things do you think increase nursing professional practice in managing patients with diabetes?
- What things do you think decrease nursing professional practice in managing patients with diabetes?

- **What factors do you think improve nurses' knowledge acquisition of diabetes care and management?**

  Prompt if not mention:
    - Sufficient interaction between nurses and other diabetes care team is important and what do you think improve nurses' knowledge related to diabetes care? Why?
    - What do you think produce a formal educational program improve nurses' knowledge about diabetes care?
    - Create resources groups contain nurses, pharmacists, doctor and other healthcare team involved in diabetes care and those healthcare providers are responsible to provide resources and update diabetes care guidelines every year, Do you think improve the nurses' diabetes knowledge? Why?

- **What barriers do you think affect nurses' knowledge acquisition of diabetes care and management?**

  Prompt if not mention:
    - Do you think lack of training and education programs affect nurses' knowledge related diabetes care? Why?

- Do you think not attend in-service diabetes education influence nurses knowledge in managing patients with diabetes? What are the reasons behind this?
- Do you think nurses' attitude and behaviour affect diabetes knowledge of nursing staff? How?
- Do you think less nursing experience in managing patients with diabetes affect nurses knowledge?

Post interview stage:

- Before we close the interview, the researcher would to know if there is anything else you would like to say about the research topic we have discussed.
- The researcher will confirm that written note and audio recording are clearly completed.
- The researcher will again thank the research participants about their participation in the interview.

Appendix H: Consent Form for Interview

I _____ agree to participate in the research project entitled **nursing knowledge of diabetes for patient self-management support and education in Saudi Arabia** (Approval Number) being conducted by Abdulellah Alotaibi (PhD candidate), Professor Lin Perry, and Dr. Leila Gholizedah, University of Technology Sydney, Australia.

I understand that the purpose of the study is to examine nurses' knowledge in relation to different aspects of diabetes care to determine factors that influence nurses' acquisition of diabetes knowledge in Saudi Arabia.

I understand that my participation in this research will involve an interview, which will take approximately one hour to complete. The will be recorded and transcribed, and the data analysed.

I am aware that my responses will remain confidential, and I will not be identified in any report, presentation, or publication about the study.

I am aware that I can contact the Human Research Ethics Committee, the University of Technology Sydney NSW 2007 T, +612 9514 9772 or email; , and Research Center at Prince Sultan Medical Military City (PSMMC) Riyadh, T +966114777714, # 40062 or email; . If I have any concerns about the research, I also understand that I am free to withdraw my participation from this research project at any time I wish, without consequences, and without giving a reason.

I agree that_____ has answered all my questions fully and clearly.

I would like to receive the results of the research project.

Yes / No

_____

_____

Signature (participant) Signature (Researcher)

___/___/_____

___/____/_____

Please return this sheet to the researcher. (*Participants should be given a photocopy of this sheet after if has signed)*

Appendix I: PSMMC Ethical Approval

M.S.D.

PRINCE SULTAN MILITARY MEDICAL CITY

P.O. Box 7897, Riyadh 11159
Kingdom of Saudi Arabia

RESEARCH CENTER

Research Ethics Committee
(Reg. # HAP-01-R-015)

31 December 2015

MR. ABDULLELAH ALOTAIBI
Student
University of Technology Sydney

Re: Nursing diabetes knowledge for patient self-management support and education in Saudi Arabia: A mixed methods study

This is in reference to your submitted proposal which has been reviewed by the appointed members of the committee through an expedited review process. On the recommendation of the board of review on the ethical aspects of the proposal, Research Ethics Committee is pleased to approve and grant permission to conduct your study.

Your research protocol has been documented under:

Project No.	750
Date Approved	29 December
Series of	2015

Kindly quote the project number indicated herein in all transactions and communications. You are advised to submit a report in relation to this research scheme to update the committee of its progress.

Also, please note that this approval is valid only for one year commencing from the date of this letter.

I trust your research scheme proves fruitful and beneficial to the PSMMC.

Best regards,

Production Note:
Signature removed prior to publication.

DR. SAEED KADASAH
Chairman, Research Ethics Committee
First Floor, Building 15

Appendix J: UTS Human Research Ethics Committee Approval

UTS UNIVERSITY OF TECHNOLOGY SYDNEY

Human Research Ethics Committee
Ethics Secretariat
C/O Research and Innovation Office
15 Broadway, Ultimo NSW 2007

T: +61 2 9514 9681
Research.Ethics@uts.edu.au

PO Box 123
Broadway
NSW 2007 Australia
www.uts.edu.au

UTS CRICOS PROVIDER CODE 00099F

22 January 2016

Professor Lin Perry
Faculty of Health
UNIVERSITY OF TECHNOLOGY SYDNEY

Dear Lin

UTS HREC 2015000302 – Professor Lin Perry, Dr Leila Gholizadeh (for Abdulellah M. Alotaibi, PhD student) – "Nursing diabetes knowledge for patients self-management support and education in Saudi Arabia"

Thank you for your response to the Committee's comments. Your response satisfactorily addresses the concerns and questions raised by the Committee who agreed that the application now meets the requirements of the NHMRC National Statement on Ethical Conduct in Human Research (2007). I am pleased to inform you that ethics approval is now granted.

Your approval number is UTS HREC REF NO. 2015000302
Approval will be for a period of five (5) years from the date of this correspondence subject to the provision of annual reports.

Please note that the ethical conduct of research is an on-going process. The *National Statement on Ethical Conduct in Research Involving Humans* requires us to obtain a report about the progress of the research, and in particular about any changes to the research which may have ethical implications. This report form must be completed at least annually, and at the end of the project (if it takes more than a year). The Ethics Secretariat will contact you when it is time to complete your first report.

I also refer you to the AVCC guidelines relating to the storage of data, which require that data be kept for a minimum of 5 years after publication of research. However, in NSW, longer retention requirements are required for research on human subjects with potential long-term effects, research with long-term environmental effects, or research considered of national or international significance, importance, or controversy. If the data from this research project falls into one of these categories, contact University Records for advice on long-term retention.

If you have any queries about your ethics clearance, or require any amendments to your research in the future, please do not hesitate to contact the Ethics Secretariat at the Research and Innovation Office, on 02 9514 9772.

Yours sincerely,

Production Note:
Signature removed prior to publication.

Professor Marion Haas
Chairperson
UTS Human Research Ethics Committee

Kingdom of Saudi Arabia
Ministry of Defence
Chief of Staff
Medical Services Department
Prince Sultan Military Medical City

المملكة العربية السعودية
وزارة الدفاع
رئاسة هيئة الأركان العامة
الإدارة العامة للخدمات الطبية بالقوات المسلحة
مدينة الأمير سلطان الطبية العسكرية

TO WHOM IT MAY CONCERN

Regarding test and retest reliability of the survey

Dear Sir/Madam,

This letter is to confirm that Alotaibi Abdulellah PhD candidate at University of Technology Sydney (UTS) has completed test and retest reliability of the survey with 25 senior nurses working at nursing education and staff development department in Prince Sultan Medical Military City (PSMMC).

Best regards

Production Note:
Signature removed prior to publication.

Eltoma Saleh

Clinical Director of Nursing Education And

Staff Development Department

Kingdom of Saudi Arabia
Ministry of Defence
Chief of Staff
Medical Services Department
Prince Sultan Military Medical City

المملكة العربية السعودية
وزارة الدفاع
رئاسة هيئة الأركان العامة
الإدارة العامة للخدمات الطبية بالقوات المسلحة
مدينة الأمير سلطان الطبية العسكرية

TO WHOM IT MAY CONCERN

Regarding Pilot Study Phase of Diabetes Knowledge Instrumentation

Dear Sir/Madam,

This letter is to confirm that Alotaibi Abdulellah PhD candidate at University of Technology Sydney (UTS) has completed pilot study with 25 senior nurses working at nursing education and staff development department in Prince Sultan Medical Military City (PSMMC).

Best regards,

Nursing Administration 19/7/2016

Production Note:
Signature removed prior to publication.

Eltoma Saleh
Clinical Director of Nursing Education And
Staff Development Department

Appendix K: Sample of Transcribe and Code of Qualitative Data

Participant ID / Pseudonym: Cardiology nurse (Nurse 1)
Interview Date: 21/05/2016 Interview venue: cardiology department

Colours for initial coding

1. Turquoise colour------ diabetes management
2. Blue colour-------diabetes education resources
3. Green ------ Barriers influence nurses' knowledge acquisition
4. Red------ Factors improve nurses' knowledge acquisition
5. Pink------things help
6. Grey------things hinder
7. Brown------background information

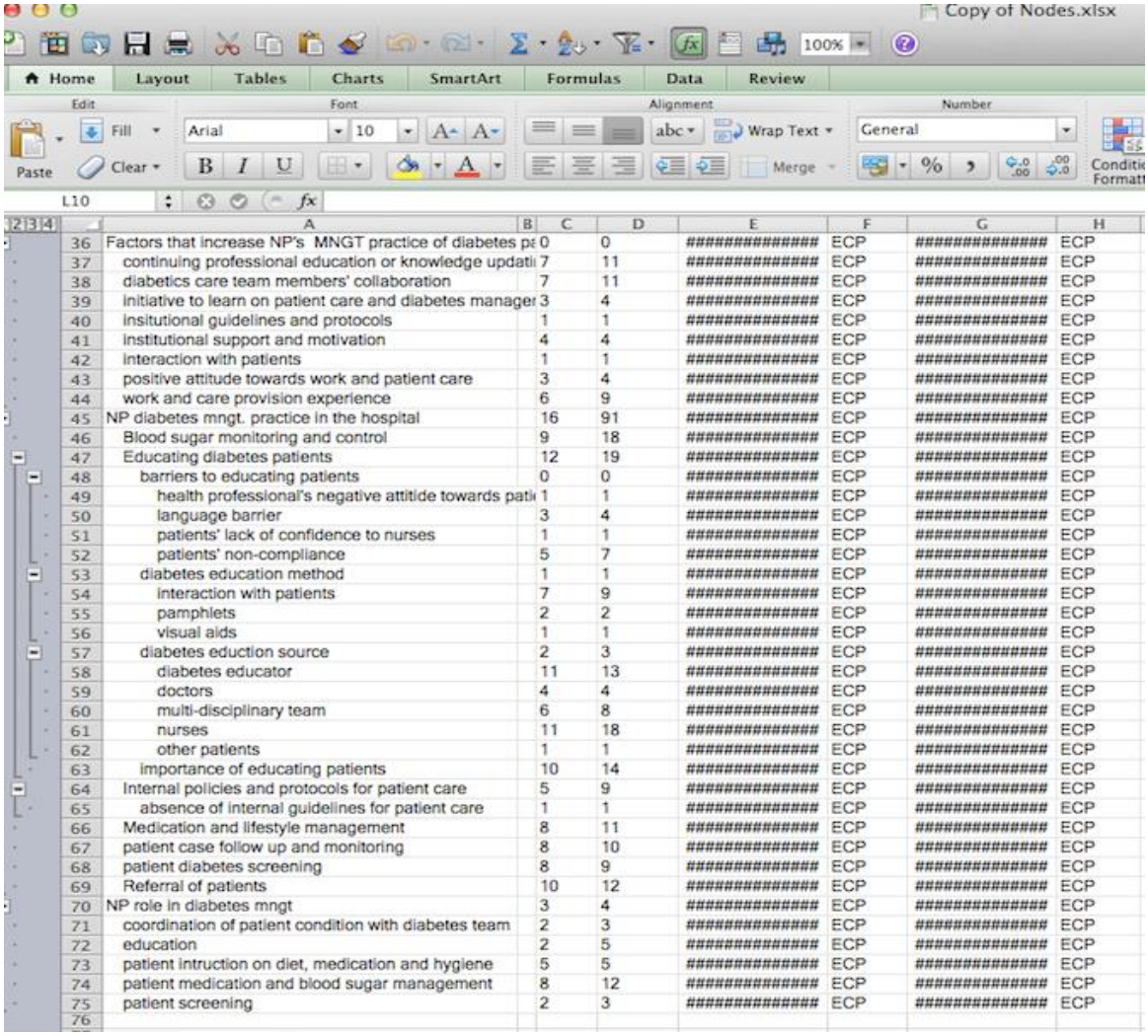
8. Yellow------ for general data and this colour will be classified to some other colours later after all transcripts revealed.

Participant ID / Pseudonym: Cardiology nurse (Nurse 1)
Interview Date: 21/05/2016 Interview venue: cardiology department

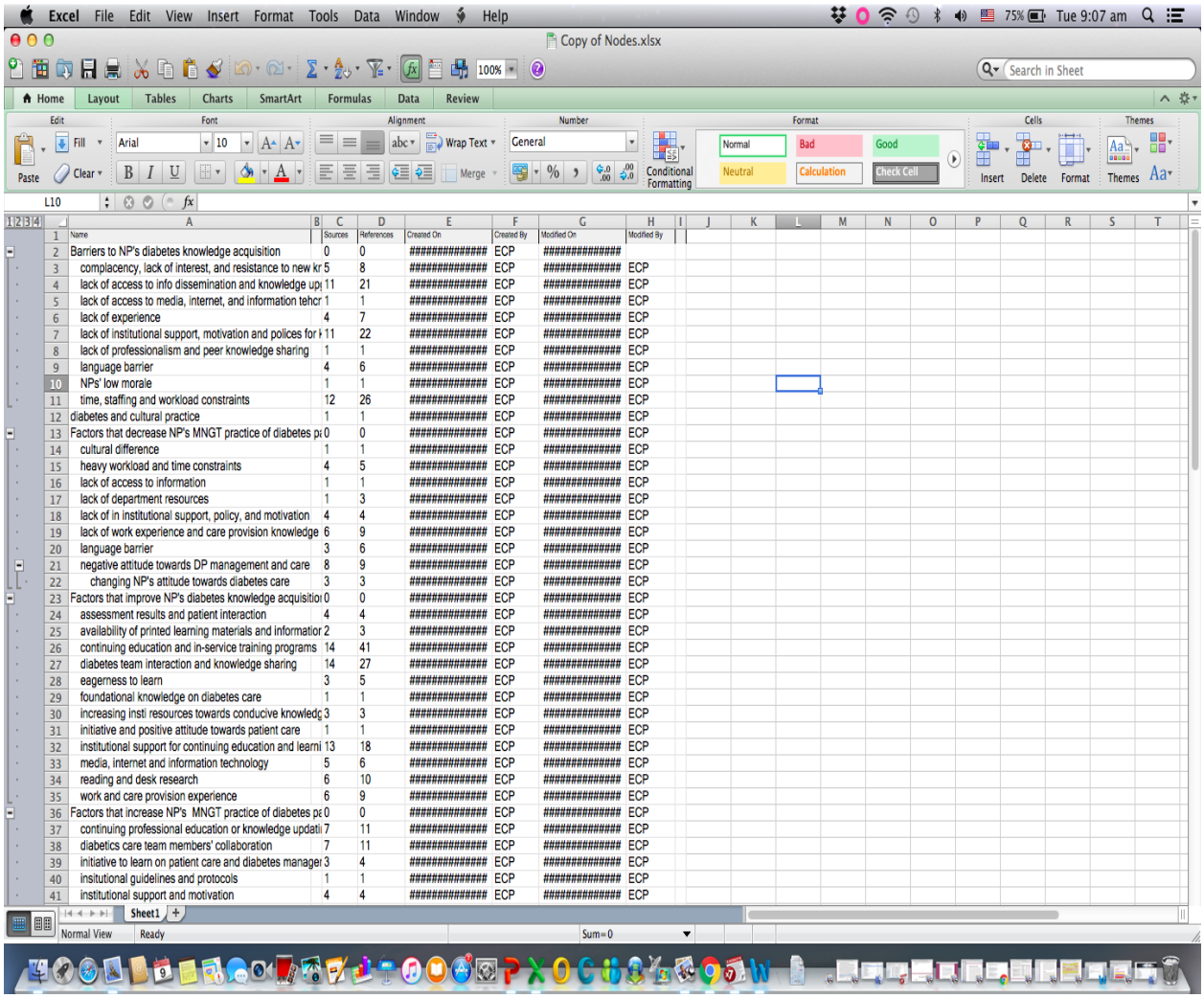
Interview transcript	Initial coding
1. ***Interviewer***: Good morning! Thank you to participate in this interview. I am _Alotaibi Abdulellah, PhD candidate from UTS, the purpose of this interview to examine factors that influences nurses' acquisition of diabetes in Saudi Arabia. My research topic will be about Nursing diabetes knowledge, management and patient support and education in Saudi Arabia. The interview will take approximately one hour and audio recording and written note will be used for the purpose of accuracy of the interview transcription. All information that you will supply will be kept strictly confidential and no individual participant will be able to be identified. Have you signed the consent?	• Background information • Diabetes management
2. The first stage of this interview, please tell me about yourself for example how many years of professional experience do you have?	• Diabetes education resource
3. ***Nurse (1)***: By the way I am cardiology nurse, 32 years old and I'm working here since 2008, I have been here for seven years already. I'm a Filipino.	
4. ***Interviewer***: What is your highest education qualification?	
5. ***Nurse*** **(1)**: Graduated Bachelor degree in Nursing.	
6. ***Interviewer***: What is your role in managing patients with diabetes?	
7. ***Nurse*** **(1)**: Our role is to educate them about their diet regimen and what are there treatment regimens they are taking to treat their diabetes mellitus. Here in Prince Sultan Cardiac Centre, we use to have this diabetic educator and they are the one giving the full education before and after discharging the patient.	
8. ***Interviewer***: Can you tell me about how diabetes is managed here in this centre?	
9. ***Nurse (1)***: Here in the hospital, maybe 90 % of our patient here has with diabetes mellitus so most of them is on oral hyperglycaemic agent like metformin and some of them are taking insulin as well, some multiple dose of insulin and we use to monitor their response in their treatment, how the sugar level is, how is the trends, is it going down or going up or its very controlled. You see if uncontrolled we use to refer to the main consultant. And the main consultant of the patient and he is the one going to refer this patient to the other disciplines like the endocrine department, the diabetic doctor, and we refer the patient also to the dietician.	

Participant ID / Pseudonym: Cardiology nurse (Nurse 1)
Interview Date: 21/05/2016 Interview venue: cardiology department

patient?	
22. ***Interviewer:*** What factors do think can improve nurses' acquisition of diabetes knowledge? How does this occur? What can be the main factors that can improve nurses' acquisition of diabetes knowledge?	
23. ***Nurse (1):*** Maybe their…the time spent to the patient, patient don't have time to research about that diabetes mellitus. One thing is the time, if you don't have time how are you going to research about it. Of course their eagerness of the nurse to learn. If I don't care about this diabetes mellitus, I will not be going to research about it. So that's one is eagerness. Yes, eagerness. No. 2 is the …	• Factor improve nurses' knowledge acquisition of diabetes care
24. ***Interviewer:*** What do you mean by eagerness?	• Barrier affect nurses' knowledge acquisition
25. ***Nurse (1):*** It's my enthusiasm to learn. If I am not interested about diabetes mellitus I will not be going to research about it. That is what I'm taking about eagerness.	
26. ***Interviewer:*** What else do you have, think about factors that can improve nurses knowledge?	
27. ***Nurse (1):*** Hospital management. Some other supervisor or some hospital supervisors they don't push these nurses to do research about diabetes mellitus for example I am your supervisor, "I don't care about you, I don't want you to learn something", "I don't push you to learn about diabetes mellitus and how these nurses will learn. It's about the hospital program in how these nurses learn about these things, about these diseases.	
28. ***Interviewer:*** They have to provide what for nurses?	
29. ***Nurse (1):*** For example study days.	
30. ***Interviewer:*** What else do you think?	
31. ***Nurse (1):*** That is the only thing I can think of ….	



	A	B	C	D	E	F	G	H
36	Factors that increase NP's MNGT practice of diabetes pa		0	0	##########	ECP	##########	ECP
37	continuing professional education or knowledge updati		7	11	##########	ECP	##########	ECP
38	diabetics care team members' collaboration		7	11	##########	ECP	##########	ECP
39	initiative to learn on patient care and diabetes manager		3	4	##########	ECP	##########	ECP
40	insitutional guidelines and protocols		1	1	##########	ECP	##########	ECP
41	institutional support and motivation		4	4	##########	ECP	##########	ECP
42	interaction with patients		1	1	##########	ECP	##########	ECP
43	positive attitude towards work and patient care		3	4	##########	ECP	##########	ECP
44	work and care provision experience		6	9	##########	ECP	##########	ECP
45	NP diabetes mngt. practice in the hospital		16	91	##########	ECP	##########	ECP
46	Blood sugar monitoring and control		9	18	##########	ECP	##########	ECP
47	Educating diabetes patients		12	19	##########	ECP	##########	ECP
48	barriers to educating patients		0	0	##########	ECP	##########	ECP
49	health professional's negative attitide towards patie		1	1	##########	ECP	##########	ECP
50	language barrier		3	4	##########	ECP	##########	ECP
51	patients' lack of confidence to nurses		1	1	##########	ECP	##########	ECP
52	patients' non-compliance		5	7	##########	ECP	##########	ECP
53	diabetes education method		1	1	##########	ECP	##########	ECP
54	interaction with patients		7	9	##########	ECP	##########	ECP
55	pamphlets		2	2	##########	ECP	##########	ECP
56	visual aids		1	1	##########	ECP	##########	ECP
57	diabetes eduction source		2	3	##########	ECP	##########	ECP
58	diabetes educator		11	13	##########	ECP	##########	ECP
59	doctors		4	4	##########	ECP	##########	ECP
60	multi-disciplinary team		6	8	##########	ECP	##########	ECP
61	nurses		11	18	##########	ECP	##########	ECP
62	other patients		1	1	##########	ECP	##########	ECP
63	importance of educating patients		10	14	##########	ECP	##########	ECP
64	Internal policies and protocols for patient care		5	9	##########	ECP	##########	ECP
65	absence of internal guidelines for patient care		1	1	##########	ECP	##########	ECP
66	Medication and lifestyle management		8	11	##########	ECP	##########	ECP
67	patient case follow up and monitoring		8	10	##########	ECP	##########	ECP
68	patient diabetes screening		8	9	##########	ECP	##########	ECP
69	Referral of patients		10	12	##########	ECP	##########	ECP
70	NP role in diabetes mngt		3	4	##########	ECP	##########	ECP
71	coordination of patient condition with diabetes team		2	3	##########	ECP	##########	ECP
72	education		2	5	##########	ECP	##########	ECP
73	patient intruction on diet, medication and hygiene		5	5	##########	ECP	##########	ECP
74	patient medication and blood sugar management		8	12	##########	ECP	##########	ECP
75	patient screening		2	3	##########	ECP	##########	ECP
76								



	Name	Sources	References	Created On	Created By	Modified On	Modified By
2	Barriers to NP's diabetes knowledge acquisition	0	0	##########	ECP	##########	
3	complacency, lack of interest, and resistance to new kr	5	8	##########	ECP	##########	ECP
4	lack of access to info dissemination and knowledge up	11	21	##########	ECP	##########	ECP
5	lack of access to media, internet, and information tehcr	1	1	##########	ECP	##########	ECP
6	lack of experience	4	7	##########	ECP	##########	ECP
7	lack of institutional support, motivation and polices for k	11	22	##########	ECP	##########	ECP
8	lack of professionalism and peer knowledge sharing	1	1	##########	ECP	##########	ECP
9	language barrier	4	6	##########	ECP	##########	ECP
10	NPs' low morale	1	1	##########	ECP	##########	ECP
11	time, staffing and workload constraints	12	26	##########	ECP	##########	ECP
12	diabetes and cultural practice	1	1	##########	ECP	##########	ECP
13	Factors that decrease NP's MNGT practice of diabetes pa	0	0	##########	ECP	##########	ECP
14	cultural difference	1	1	##########	ECP	##########	ECP
15	heavy workload and time constraints	4	5	##########	ECP	##########	ECP
16	lack of access to information	1	1	##########	ECP	##########	ECP
17	lack of department resources	1	3	##########	ECP	##########	ECP
18	lack of in institutional support, policy, and motivation	4	4	##########	ECP	##########	ECP
19	lack of work experience and care provision knowledge	6	9	##########	ECP	##########	ECP
20	language barrier	3	6	##########	ECP	##########	ECP
21	negative attitude towards DP management and care	8	9	##########	ECP	##########	ECP
22	changing NP's attitude towards diabetes care	3	3	##########	ECP	##########	ECP
23	Factors that improve NP's diabetes knowledge acquisitio	0	0	##########	ECP	##########	ECP
24	assessment results and patient interaction	4	4	##########	ECP	##########	ECP
25	availability of printed learning materials and informatior	2	3	##########	ECP	##########	ECP
26	continuing education and in-service training programs	14	41	##########	ECP	##########	ECP
27	diabetes team interaction and knowledge sharing	14	27	##########	ECP	##########	ECP
28	eagerness to learn	3	5	##########	ECP	##########	ECP
29	foundational knowledge on diabetes care	1	1	##########	ECP	##########	ECP
30	increasing insti resources towards conducive knowledg	3	3	##########	ECP	##########	ECP
31	initiative and positive attitude towards patient care	1	1	##########	ECP	##########	ECP
32	institutional support for continuing education and learni	13	18	##########	ECP	##########	ECP
33	media, internet and information technology	5	6	##########	ECP	##########	ECP
34	reading and desk research	6	10	##########	ECP	##########	ECP
35	work and care provision experience	6	9	##########	ECP	##########	ECP
36	Factors that increase NP's MNGT practice of diabetes pa	0	0	##########	ECP	##########	ECP
37	continuing professional education or knowledge updati	7	11	##########	ECP	##########	ECP
38	diabetics care team members' collaboration	7	11	##########	ECP	##########	ECP
39	initiative to learn on patient care and diabetes manage	3	4	##########	ECP	##########	ECP
40	insitutional guidelines and protocols	1	1	##########	ECP	##########	ECP
41	institutional support and motivation	4	4	##########	ECP	##########	ECP

Appendix L: Permission letter of using publications in this thesis

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If I may be of further assistance, please let me know.

Best of luck with your thesis and best regards,
Laura

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