Exploring Healthcare Professionals Physical Activity Promotion for Adults with Type 2 Diabetes in Oman

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Abstract

Background: Physical activity is recommended as a key component of type 2 diabetes care and management. However, globally and in Oman, people with type 2 diabetes are less physically active than the general population. It is recommended that healthcare professionals (HCPs) should promote physical activity to this population, yet they report challenges to doing this in practice. Developing a better understanding of the influences on HCPs' physical activity promotion could support them in this area of diabetes care.

Methods: Study one was a mixed-methods systematic review that followed the Joanna Briggs Institute methodological procedures with the Theoretical Domains Framework as an a priori framework. Study two was a qualitative online interview study exploring HCPs influences on physical activity promotion for patients with type 2 diabetes in Oman. Study three was a qualitative online interview study exploring the perspectives of Oman policymakers regarding type 2 diabetes and physical activity promotion.

Results: Study one identified a dominance of barriers compared to facilitators. Barriers included a lack of resources and organisational support, limited time, increasing workloads, and a lack of education and training on physical activity and its promotion. Study two reported findings similar to those of Study one, in addition to environmental, cultural, and social norms as barriers to physical activity promotion. Study three identified the lack of prioritisation of physical activity in healthcare policy and planning, collaboration challenges amongst sectors, and a lack of local physical activity research as barriers to physical activity promotion.

Conclusions: The findings of this research programme highlight the need for changes at the HCP, organisational, environmental, and policy levels to bridge the gap between research, practice and policy. Recommendations include behavioural science-informed CPD training

for HCPs, improved cross-sectoral collaboration, conducting local implementation research, and the continued use of the MRC framework and implementation science frameworks and health psychology theory to develop interventions to support HCPs.

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Abbreviations

ADA	American Diabetes Association
ANOVA	Analysis of Variance
BCT	Behaviour Change Technique
BCW	Behaviour Change Wheel
BMI	Body mass index
CAUTI	Catheter-associated urinary tract infections
CDE-RD	Certified Diabetes Educator Registered Dietician
CME	Continuing medical education
COM-B	Capability, Opportunity, Motivation, Behaviour Model
COVID	Coronavirus disease
CIFR	Consolidated Framework for Implementation Research
CPD	Continuing professional development
EPPI	Evidence for Policy and Practice
GDP	Gross domestic product
GP	General practitioner
HbA1c	Glycosylated haemoglobin
HCP	Healthcare professional
IDF	International Diabetes Federation
IDF-MENA	International Diabetes Federation Middle Eastern and North African
IMG	International Medical Graduate
IPA	Interpretative Phenomenological Analysis
JBI	Joanna Briggs Institute
MECC	Making Every Contact Count
MENA	Middle Eastern and North African
MeSH	Medical subject heading
MMSR	Mixed method systematic review
MoH	Ministry of Health
MRC	Medical Research Council

NCBI	National Center for Biotechnology
NCD	Non-communicable disease
NICE	National Institute for Health and Care Excellence
NIDDM	Non-insulin dependent diabetes mellitus
PIO	Population/problem/patient; intervention/issue; outcome
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QualRIS	Qualitative Research in Implementation Science
RCT	Randomised controlled trial
SMART	Small, measurable, achievable, realistic, timely
T2D	Type 2 diabetes
T2DM	Type 2 diabetes mellitus
TDF	Theoretical Domains Framework
TTM	The Transtheoretical Model
UK	United Kingdom
USA	United States of America
USD	United States Dollars
WHO	World Health Organization

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Chapter One: Introduction

1.1 Context of the Research

1.1.1 An Overview of Oman

The Sultanate of Oman is located on the Arabian Peninsula and is a part of Western Asia, bordering the United Arab Emirates, Saudi Arabia, and Yemen. The main religion in Oman is Islam (Ziaka & Papageorguiu, 2020). Until 1970, Oman was an underdeveloped nation, but after the rise of Sultan Qaboos Bin Said, the country has been through rapid urbanisation and development. Oman is now considered a high-income country within the Middle East and North Africa (MENA) Region (Benkari, 2017). Oman had a gross domestic product (GDP) in 2021 of US$88.19 billion (Trading Economics, 2024); according to the World Bank, this represents 0.04% of the world economy.

Oman is a large, bio-diverse, rich country characterised by a desert landscape, coastal areas, wadis, rugged mountain ranges, cliffs, and planes. The total area of Oman is approximately 309,500 km2, with a population of 4,527,46, with approximately 41% of this figure being expatriates or non-nationals (National Centre for Statistics and Information, 2021). In coastal areas, the climate is hot and humid in the summer; in the interior, it is hot and dry, while in the Dhofar region in southern Oman, it is a moderate climate throughout the year. Oman is administratively divided into 11 provinces, referred to as governorates, each considered a health region (Ministry of Health [MoH], n.d.).

1.1.2 The Political Context of Oman

Oman is a hereditary monarchy ruled by the Sultan (the ruler of the state) who is the head of state, head of the government and supreme leader of the armed focus (Rubin, 2012). The Sultan has the ultimate power over the legislative, executive and judiciary arms of government (Rubin, 2012). There are more than 20 Ministries, including the MoH, in Oman.

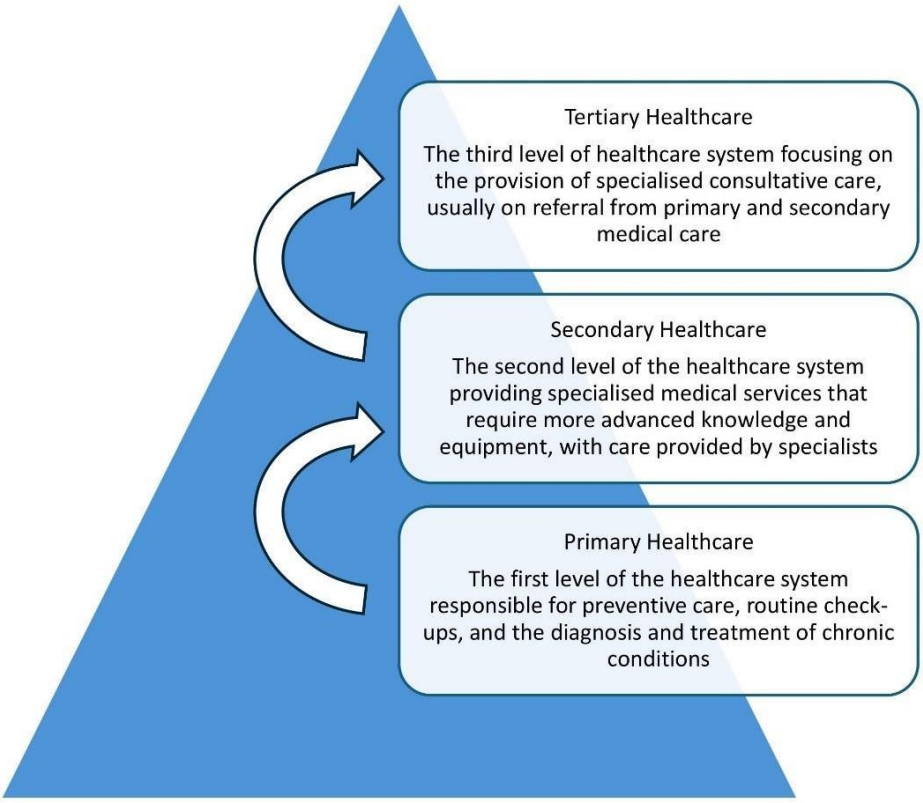
Ministers are appointed by the Sultan and are responsible for making economic, social, security, welfare and administrative recommendations to the Sultan for their respective domains (MoH, n.d). The Ministers together make up the Council of Ministers. Within each Ministry, policymakers are appointed to provide expertise, analysis and implementation support for the policies that are then approved or not by the Sultan; this plays a crucial role in shaping the healthcare system in Oman, influencing how it is funded, managed, and reformed (Al-Sabahi et al., 2023).

1.1.3 The Healthcare System in Oman

Healthcare in Oman is run by the government, with the MoH as the main provider, which provides approximately 83.1% of hospitals and about 92.5% of hospital beds at primary, secondary and tertiary levels (Al-Jabri et al., 2021). The MoH is responsible for developing health policies and plans and monitoring the implementation of these (Al-Mahrezi & Al-Kiyumi, 2019). Healthcare services are provided free of charge to all Omani citizens and residents working in the public sector through clinics and hospitals at the primary, secondary, and tertiary levels, which are linked through referral systems (Figure 1.1) (Alghafri et al., 2018). Given the increasing prevalence of type 2 diabetes in Oman, screening and management of the disease were introduced as priority areas for the healthcare sector to focus on in 2003 (MoH, 2016).

Figure 1.1

The Organisational Structure of the Health System in Oman



Note. The arrows on the figure represent the referral system from primary through to tertiary healthcare.

All three levels of care provide services to diabetes management dependent on the severity and clinical indications of the patient's disease. Within primary health care, which is the focus of this study, diabetes is addressed using either a preventative approach, screening within a general practitioner clinic or a management/promotion approach within diabetes management clinics (Al-Alawai et al., 2019). Overall, the MoH operates 116 health centres, 24 sub-regional hospitals, and four national hospitals. Within Muscat, the capital of Oman and the focus of this thesis, there are 27 primary healthcare centres, 26 of which offer diabetes management services. Diabetes clinics within primary healthcare centres use three models of service delivery (Al-Alawi et al., 2019). The first type is a regular morning diabetes

management clinic that offers a combined service for patients with diabetes or hypertension. The second is an afternoon clinic exclusively for diabetic patients, and the third is a general clinic for all patients, including those with type 2 diabetes. The first clinic, the regular combined morning clinic, usually operates four to five days per week between 8 am and 2 pm. The second afternoon clinic is in addition to the morning clinic and is only for patients with diabetes; this is usually provided twice a month between 3 pm and 7 pm and is primarily for patients with uncontrolled diabetes or more complicated cases. Finally, the third general clinic model is open to all patients, and recommendations state that these clinics should be managed by multi-disciplinary teams of HCPs, including but not limited to physicians, general practitioners (GPs), nurses, dietitians, health educators and pharmacists (MoH, 2015). Despite these recommendations, research suggests that within the current healthcare context, multidisciplinary teams are not possible due to staff and resource constraints (Al-Alawi et al., 2019).

The MoH (2015) recommends that treatment of type 2 diabetes within primary healthcare should include education, diet, nutrition and weight management, physical activity, smoking cessation and medication (e.g., oral hypoglycaemic medication, insulin, etc). Specifically relating to physical activity, the current national guidelines state that HCPs should recommend 30 minutes of walking each day for five days a week for patients with type 2 diabetes (MoH, 2015). Whilst physical activity is an integral component of type 2 diabetes management (Hamasaki, 2016), in Oman, this is not well addressed in the current healthcare system where a biomedical approach (medication, bariatric surgery) to tackling the problem is prioritised (Alghafri et al., 2018).

1.2 Type 2 Diabetes Overview

1.2.1 What is Type 2 Diabetes?

Diabetes is a collective term for a group of chronic metabolic disorders characterised by hyperglycaemia due to deficient insulin secretion, insulin action, or both (American Diabetes Association [ADA], 2014). Insulin is an essential hormone produced by the β-cells in the pancreas that controls blood sugar levels. Glucose from carbohydrates is transported by insulin from the bloodstream into cells in the body, providing energy to these cells to function. In diabetes, if there is insufficient insulin, these cells fail to take up glucose from the body, causing blood glucose levels to increase, resulting in hyperglycaemia. It is estimated that approximately 90% of all cases of diabetes are type 2 (International Diabetes Federation, [IDF], 2020). Initially, too much insulin is produced in the body's attempts to achieve a normal glucose level (Fonseca, 2009). This eventually becomes inadequate to overcome insulin sensitivity, particularly in obese individuals, producing increased glucose in the liver (Fonseca, 2009). At this stage, the individual may be diagnosed with pre-diabetes, meaning that glucose levels are high but still below the type 2 diabetes diagnostic range. If glucose levels are left unmanaged, the disease continues to disrupt the metabolism of carbohydrates, fat, and protein, leading to hyperglycaemia (high blood sugar levels), in which the β-cells in the pancreas cells fail to compensate for insulin resistance with excess insulin output and is unable to keep up with the increasing demand (Zaccardi et al., 2016), and ultimately, develop into type 2 diabetes. The cells within the body can then become desensitised and fail to respond to the insulin being produced, meaning that the glucose remains in the bloodstream, keeping blood sugar levels high. The accumulation of fat in the liver, muscles, and pancreas causes inflammation, oxidative and endoplasmic reticulum stress, increased lipid levels, amyloid accumulation, gastrointestinal tract hormones, and the nervous system contributes to the dysfunction of the β-cells and insulin resistance (Fonseca, 2009; Zaccardi et al., 2016).

Early diagnosis is vital, and a treatment plan that includes glucose-lowering medications and lifestyle modification can reduce complications of type 2 diabetes, such as heart and nerve damage, as well as prevent, delay or even reverse type 2 diabetes (Hallberg et al., 2019; Kahn & Davidson, 2014).

1.2.2 The Global Impact and Burden of Diabetes

Diabetes affects approximately 537 million adults (20-79 years) worldwide (IDF, 2021). It is estimated that this will rise to 783 million by 2045, a 37% increase, with the most significant increases occurring in countries that move from low to middle-income economic status (IDF, 2021). Diabetes is one of the four main types of non-communicable diseases (NCDs) alongside cancer, cardiovascular disease and chronic respiratory disease; together, these account for 41 million deaths worldwide (WHO, 2024), the equivalent of 74% of deaths worldwide. The IDF (2021) has estimated that the number of deaths aged 20-79 attributable to diabetes in 2021 was 6.7 million, compared to 4.2 million in 2019 (IDF, 2019) and 3.96 million in 2010, with over half of these resulting from cardiac events and 48% occurring before the age of 70 (WHO, 2019) (Table 1.1). Worryingly, with increasing levels of overweight and obesity among children, adolescents, and young adults, what was once considered a chronic disease of older adulthood is becoming increasingly prevalent in the younger population (Lascar et al., 2018). It has been suggested that earlier onset of type 2 diabetes may have a more rapid and disruptive natural history than type 2 diabetes manifesting in later adulthood as there is more prolonged exposure to hyperglycaemia, resulting in a greater risk for long-term complications, early morbidity, and reduced quality of life (Lascar et al., 2018).

Table 1.1

Global Estimates of Diabetes in Adults (20-79 years old) in 2019 to 2045 (IDF, 2021)

Overview	2019	2021	2030	2045
Total global population (billions)	7.7	7.9	8.6	9.5
Global prevalence of diabetes	9.3%	10.5%	11.3%	12.2%
Total diabetes cases (millions)	463.0	536.6	642.7	783.2
Total diabetes-related deaths (millions)	4.2	6.7	-	-
Total health costs of diabetes (USD billions)	760	966	1,028	1,054

1.2.3 Impact and Burden of Type 2 Diabetes in Oman

The IDF is a non-profit umbrella organisation comprising over 240 national diabetes associations across 161 countries and territories (IDF, 2024). These countries and territories are grouped into seven overarching regions: Africa, Europe, the MENA region, North America and the Caribbean, South and Central America, South-East Asia, and the Western Pacific (IDF, 2024). The IDF MENA region, within which Oman is included, represents 29 diabetes organisations across 21 countries and territories (IDF, 2024). Out of the seven overarching regions of the IDF, the -MENA region has the highest comparative prevalence of diabetes with an estimated 72.7 million adults aged 20-79 years, or 18.1%, living with the disease diabetes (IDF, 2021). This is predicted to rise to 135.7 million (19.3%) by 2045. The MENA region also has the second-highest predicted increase of people with diabetes to 135.7 million (86%) by 2045 (Sun et al., 2022). Within the MENA region, Oman is ranked 12th for the prevalence of diabetes, with estimates of 445,600 diagnosed cases of diabetes (13.8% of the population aged 20-79 years), with a further 222,800 undiagnosed cases (IDF, 2021).

1.2.4 Economic Burden of Type 2 Diabetes

The increasing prevalence of type 2 diabetes has placed a significant economic burden on global healthcare systems and the global economy and a financial burden on individuals and families affected by the disease (IDF, 2019). The economic burden includes direct medical costs and indirect costs, such as unemployment and productivity loss, premature death, and disability (IDF, 2019). The costs of diabetes have risen exponentially and are approximately two-fold higher for people with diabetes than those without (IDF, 2019). In 2007, the IDF reported a total global health expenditure on diabetes of USD 232 billion; this has since risen to USD 760 billion in 2019, and by 2021, this had further increased to USD 966 billion, with projections that by 2030, this will rise to USD 1,028 billion and by 2045 to USD 1,045 billion. In the MENA region, the total healthcare expenditure for diabetes in 2021 was 32.6 billion USD, predicted to rise to 46.3 billion by 2045. In Oman, it is estimated that the annual diabetes expenditure per person is 845.2 USD per person each year (IDF, 2021), with estimates of this increasing to as much as 1,986.80 USD per person by 2050 (Awad et al., 2021).

1.2.5 Risk Factors

The aetiology of type 2 diabetes is complex, and the risk factors for the disease can be divided into modifiable and non-modifiable. Non-modifiable factors include a person's genetics, age, ethnicity and cultural background, and a family history of the disease (Herder & Roden, 2011; Sami et al., 2017). Modifiable factors include being overweight or obese, high blood pressure or cholesterol, an unhealthy diet, a sedentary lifestyle, and smoking (Herder & Roden, 2011).

1.2.6 Symptoms, Complications, and Comorbidities

The characteristic symptoms of type 2 diabetes include excessive thirst, frequent urination, increased hunger, unintentional weight loss, blurred vision, fatigue, frequent infections, slow-healing sores and dry skin (IDF, 2019). More severe clinical manifestations associated with type 2 diabetes include ketoacidosis or a nonketotic hyperosmolar state, resulting in vomiting, dehydration, coma, and rarely death (IDF, 2019). Type 2 diabetes symptoms are generally initially mild or even absent for a significant period as a result of the slow pace at which the hyperglycaemia is worsening (Campbell, 2002). As such, although pathological and functional changes may be present for a long time, testing for type 2 diabetes may not occur, which eventually results in increased complications at diagnosis (Campbell, 2002). It is estimated that there are at least 240 million undiagnosed cases of diabetes globally (IDF, 2021).

People with type 2 diabetes are at risk of developing many comorbidities and complications. When hyperglycaemia is uncontrolled, the heart, blood vessels, kidneys, nerves, and teeth can be negatively affected (Mohajan & Mohajan, 2023). There is an increased risk of infections, such as foot, yeast, and urinary tract infections, coronary heart disease, peripheral vascular disease, stroke, and microvascular complications such as end-stage renal disease, retinopathy, neuropathy, as well as lower-extremity amputations, dementia, cancers, and liver disease (Harding et al., 2019; IDF, 2019). People living with type 2 diabetes and a high body mass index (BMI) (≥ 25) are at an increased risk of cancer. In women, the strongest associations are with breast and endometrial cancer, and in both sexes, colorectal and liver cancer (IDF, 2019; Pearson-Stuttard et al., 2016). Not only are there physical complications seen in type 2 diabetes, but there is also a bi-directional relationship between depression and type 2 diabetes, double that of the general population (Nouwen et al., 2010; Rotella & Mannucci, 2012).

1.2.7 Diagnosing Type 2 Diabetes

The four diagnostic criteria to determine the presence of type 2 diabetes are measurement of fasting plasma glucose, two-hour plasma glucose after a 75 g oral glucose load, HbA1c, and a random blood glucose test (WHO, 2019). Individuals with characteristic symptoms of diabetes and who have a fasting plasma glucose value of ≥7.0mmol/L (126 mg/dL) or two-hour plasma glucose ≥11.1mmol/L (200 mg/dL) or HbA1c ≥ 48 mmol/mol (equivalent to 6.5%) or a random glucose > 11.1mmol/L (200 mg/ dL) are considered to have type 2 diabetes (Table 1.1). Guidelines state that the general target for glucose control is HbA1c <7% or <6.5% (IDF, 2017), with the risk of complications of type 2 diabetes decreasing as HbA1c also reduces.

Table 1.2

Overview of Diagnostic Criteria for Type 2 Diabetes (IDF, 2017; WHO, 2019)

Diagnostic test	**Pre-diabetes**	**Type 2 diabetes**
Fasting plasma glucose	6.1-6.9mmol/L, 110-125 mg/dl	7.0mmol/L, 126 mg/dL
Two-hour plasma glucose after oral glucose tolerance test	7.8-11.0mmol/L, 140-199 mg/dL	≥11.1mmol/L, 200 mg/dL
Random plasma glucose	NA	> 11.1mmol/L, 200 mg/dL
Glycosylated haemoglobin (HbA1c)	NA	≥ 48 mmol/mol, ≥6.5%

1.3 Treatment Options for Type 2 Diabetes

1.3.1 Medication and Surgery

Metformin (Glucophage) is the recommended first-line pharmacotherapy for type 2 diabetes in 50-90% of patients (IDF, 2017). Metformin alone may not adequately control blood sugar levels (HbA1c), and other medications may be required, such as additional glucose-lowering drugs, including sulfonylureas (except glibenclamide/glyburide), a DPP4 inhibitor, or an SGLT2 inhibitor. When oral hypoglycaemic medication (e.g., metformin) can no longer control HbA1c levels effectively, insulin alone or in combination with other glucose-lowering medication is used in the later stages of the disease (IDF, 2017). In some instances, bariatric surgery is recommended in people with type 2 diabetes with a BMI ≥35 kg/m² or between 30 and 35 kg/m² when the response to treatment has been sub-optimal (Cummings & Cohen, 2016).

1.3.2 Lifestyle Approaches to Type 2 Diabetes Management

It is suggested that the pharmacological approaches to treating type 2 diabetes will only ever be partially effective in the long term and that lifestyle modification is a core component of its effective management (Borse et al., 2021). Two prominent factors related to the increasing prevalence rates of type 2 diabetes are the rise in unhealthy, energy-dense diets and sedentary lifestyles (Hamilton et al., 2014; Joseph et al., 2016; Sami, 2017). Being overweight or obese accounts for 80-85% of the risk of developing type 2 diabetes (Diabetes UK, 2019). It is now well established that reducing body weight in pre-diabetic populations by 5% to 7% can prevent or delay type 2 diabetes onset (Lingvay et al., 2022) and reducing body weight by at least 10% in type 2 diabetes populations can result in the reversal of the disease (Hallberg et al., 2019). As such, lifestyle modification focusing on weight loss through diet and physical

activity plays a fundamental role in type 2 diabetes care and management (ADA, 2018; Cradock et al., 2017). Randomised controlled trials (RCTs) and observational studies have demonstrated the efficacy of adopting a healthy diet in improving glycaemic control and metabolic outcomes in people with type 2 diabetes (Pastors & Franz, 2012).

1.3.3 Physical Activity Recommendations for Adults with Type 2 Diabetes

Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure above the resting metabolic rate and is characterised by modality, frequency, intensity, duration, and context of practice (Thivel et al., 2018). Unlike exercise, which is a sub-category of physical activity and is planned, structured, and repetitive with an aim to improve or maintain physical fitness, physical activity is generally done in leisure time. It includes any movement that occurs throughout the day that is not sitting or lying down; examples of daily physical activity include walking to and from work, gardening, taking the stairs, or cleaning (WHO, 2022).

Clinical guidelines recommend that adults with type 2 diabetes should engage in at least 150 minutes of moderate-intensity physical activity or 75 minutes of vigorous-intensity physical activity per week (Colberg et al., 2016; Diabetes UK, 2022; IDF, 2023; WHO, 2019). The IDF (2023) further asserts that at least 275 minutes of physical activity per week may be required for weight loss and to avoid weight regain. The ADA (2016) also recommends two to three resistance training (where a person lifts or pulls against resistance, e.g. weights) sessions for older adults on non-consecutive days or flexibility and balance training. People with type 2 diabetes engaging in at least the recommended amount of physical activity each week have reported wide-ranging benefits, including weight loss, clinically significant improvements in glycaemic control, blood lipid profile, reducing cardiovascular risk factors, reducing or eliminating the need for oral hypoglycaemic

medication (Thomas et al., 2006; Hamasaki, 2016; Umpierre et al., 2011) and in some cases even reversal of type 2 diabetes (Hallberg et al., 2019).

1.3.4 Prevalence of Physical Activity in Adults with Type 2 Diabetes

Despite the evidence demonstrating the positive outcomes related to physical activity, many people with type 2 diabetes do not meet the recommended levels to achieve these. Research has reported that adults with type 2 diabetes are less physically active and more sedentary than the general population, and adherence to physical activity interventions is low (Kennerly & Kirk, 2018; Morrato et al., 2007). For example, a study by Martin et al. (2021) examining physical activity and type 2 diabetes reported that in a sample of 495 adults, the level of physical activity was below the recommended levels (at least 150 minutes each week) for 52.3% of the participants. Furthermore, a study in the United Arab Emirates reported that only 3% of the sample (n =390) achieved the recommended weekly physical activity. Other studies have reported that compared with the general population, people living with type 2 diabetes report fewer steps per day, lower energy expenditure, shorter length of physical activity (Fagour et al., 2013), lower cardiorespiratory fitness (Ozdirenc et al., 2004), and lower muscle strength (Sayer et al., 2005).

People living with type 2 diabetes report multiple barriers to physical activity, including lack of time, lack of knowledge, lack of infrastructure and facilities, lack of motivation, social and cultural issues, fatigue, physical limitations, obesity, fear of hyperglycaemia, negative self-image, shame/embarrassment, depression, the weather, inadequate emphasis on physical activity promotion and lack of understanding of the guidelines by health professionals (Advika et al., 2017; Duclos et al., 2015; Egan et al., 2013; Korkiakangas et al., 2011).

1.3.5 Prevalence of Physical Activity in Adults with Type 2 Diabetes in Oman

Although physical activity is considered an integral component of type 2 diabetes management, this is poorly addressed in Oman, where a biomedical approach using medication and bariatric surgery is favoured (Alghafri et al., 2018); as such, there is a paucity of research examining physical activity and type 2 diabetes. One study has examined the prevalence of physical activity in this population and reported that only 21.6% of the adult population with type 2 diabetes were meeting the recommended physical activity levels of at least 150 minutes per week (Alghafri et al., 2017). Barriers to physical activity reported by participants in this study included lack of willpower, time, resources, social support, skills, and fear of injury (Alghafri et al., 2017).

1.3.6 Biological Mechanisms of Physical Activity for Type 2 Diabetes

Over the years, progress has been made in understanding the mechanism of physical activity in preventing and treating type 2 diabetes. It is now widely established that a critical process involved in insulin resistance is the decrease in the expression of the glucose transporter four (GLUT-4) protein in the muscle, which is crucial for glucose uptake in skeletal muscle (dos Santos et al., 2015). It has been found that long-term regular physical activity, in both healthy individuals and those with type 2 diabetes, can significantly increase the expression of the GLUT-4 protein in the skeletal muscle cells and promote its translocation to the cell membrane, which enhances the ability of the skeletal muscle to increase glucose uptake and transport (Hussey et al., 2012). Physical activity can also improve insulin sensitivity; specifically, resistance training can increase skeletal muscle strength, increasing insulin receptors, thus improving insulin sensitivity (Yang et al., 2019). Yang et al. (2019) highlight the multiple pathways in which physical activity can improve type 2 diabetes, including

improvements in glucose metabolism, insulin sensitivity, lipid metabolism, the protection of pancreatic β-cells function, and the alleviation of systematic inflammation.

1.3.7 Effectiveness of Physical Activity for Improving Type 2 Diabetes Health Outcomes

Systematic reviews have demonstrated robust evidence supporting the role of physical activity on health outcomes for people with type 2 diabetes. For example, Avery et al. (2012) examined evidence from 17 RCTs to establish the effect of physical activity interventions on people with type 2 diabetes. The findings from this systematic review demonstrated that physical activity interventions (compared with usual care) significantly increased objectively measured and self-reported physical activity. Statistically and clinically significant findings were also reported for HbA1c and BMI (Avery et al., 2012). These are not isolated findings; for example, another systematic review of 37 studies conducted by Pan et al. (2018) reported that compared with no exercise, supervised aerobic and supervised resistance exercise demonstrated significant reductions in HbA1c. Furthermore, the supervised aerobic exercise showed significant improvements in total cholesterol, triacylglycerol, and LDL cholesterol compared to no exercise. In comparison, supervised resistance compared with no exercise improved systolic blood pressure and total cholesterol (Pan et al., 2018).

Additional systematic reviews focusing on duration and type of physical activity have reported that exercising ≥3 times per week leads to significant improvements in insulin sensitivity in people with type 2 diabetes and that these benefits persisted between 48 -72 hours after the physical activity session (Way et al., 2016). Zaho et al. (2021) reviewed the literature on the effectiveness of combined aerobic and resistance training on obese and overweight individuals with type 2 diabetes. They reported that combined aerobic and resistance training significantly reduced HbA1c, BMI, homeostasis model assessment of insulin resistance, serum insulin and diastolic blood pressure. The findings from these reviews

demonstrate the effectiveness of physical activity for type 2 diabetes outcomes and emphasise the importance of supporting individuals with type 2 diabetes to increase their physical activity as part of a management approach.

1.4 Physical Activity Promotion in Healthcare Settings for People Living with Type 2 Diabetes

Given the wealth of empirical evidence demonstrating the wide-ranging benefits of physical activity on health outcomes for people living with type 2 diabetes (e.g., Avery et al., 2012), the promotion of physical activity has become a treatment priority within healthcare and is considered to be a cornerstone of type 2 diabetes management by leading authorities (e.g., ADA, 2016; IDF, 2017). As a result, there is a consensus that HCPs, particularly those in primary healthcare, should explicitly advise, encourage, support, and counsel patients living with diabetes on physical activity as part of ongoing diabetes education and self-management (IDF, 2017). The IDF (2017) provides the following recommendations to HCPs caring for people with type 2 diabetes:

- Provide advice to people with type 2 diabetes on physical activity modification.
- Gradually introduce physical activity into consultations by being aware of the person's motivation and ability to be physically active and set individually tailored goals.
- Encourage the patient to increase their weekly moderate-intensity aerobic physical activity to at least 150 minutes per week, or 30-45 minutes 3-5 days a week.
- If there are no contraindications, resistance training should also be recommended three times a week.

- Provide guidance to patients on modifying the type, intensity and duration of physical activity.

The IDF (2017) also states that HCPs must be knowledgeable, skilled, and capable of promoting physical activity for this approach to be effective. Recommendations similar to those noted above from the IDF (2017) are reflected in many global guidelines (e.g. Canadian Diabetes Association, 2018; Sinclair, 2011).

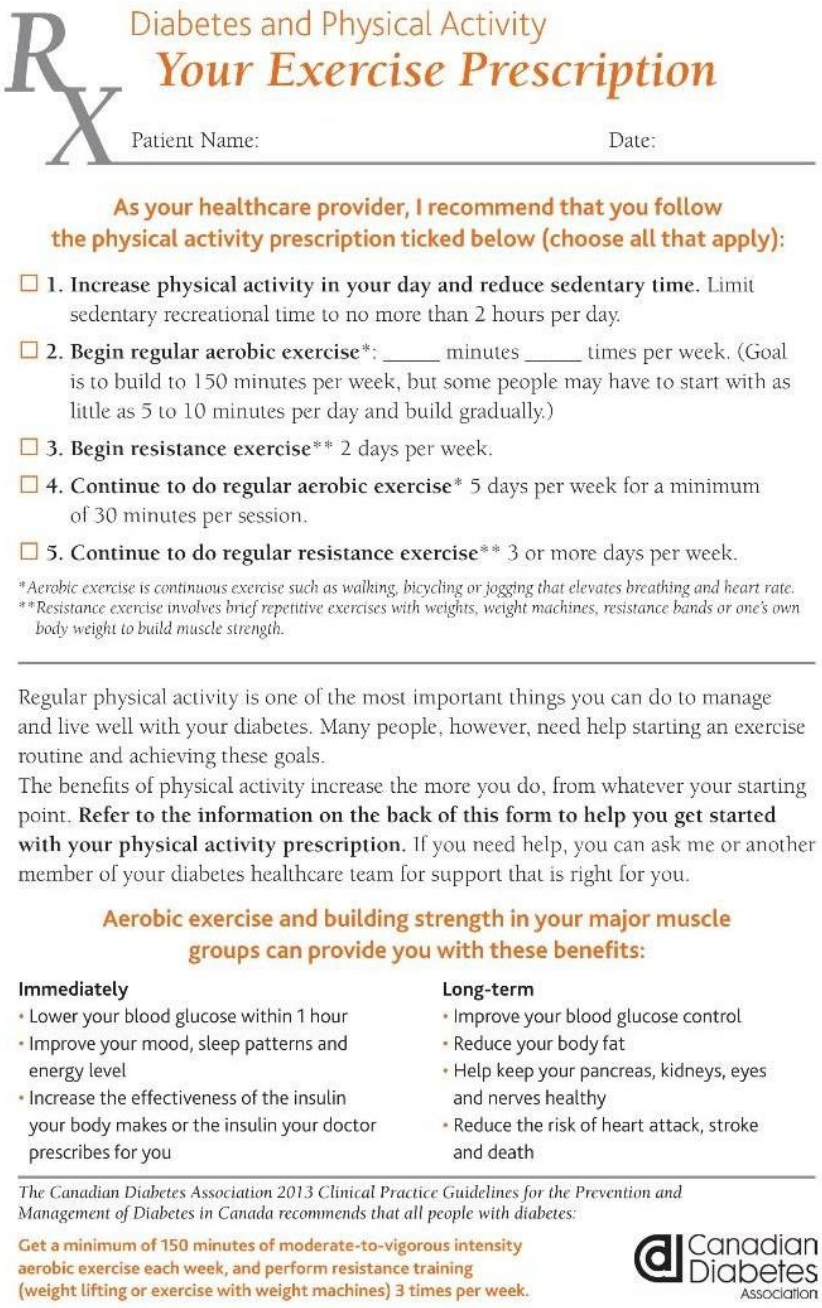
1.4.1. Approaches to Physical Activity Promotion in Healthcare Settings

Considering the recommendations for HCPs to promote physical activity through structured or opportunistic contact with patients (e.g., IDF, 2017), a number of initiatives have been developed to help integrate physical activity promotion into everyday clinical practice; an overview of these will now briefly be discussed.

1.4.1.1 Physical Activity Prescription. Physical activity prescription is a health promotion approach that HCPs can provide to promote physical activity in patients with, or at risk of, type 2 diabetes and other chronic diseases (O'Hagan et al., 2013). A physical activity prescription is given to the patient and should specify the type of physical activity, duration, intensity, and frequency in line with the recommended guidelines discussed above (e.g., IDF, 2017). Figure 1.2 provides an example of a physical activity prescription from the Canadian Diabetes Association (2018).

Figure 1.2

Example of a Physical Activity Prescription (Canadian Diabetes Association, 2018)



Diabetes and Physical Activity

Your Exercise Prescription

Patient Name: Date:

As your healthcare provider, I recommend that you follow the physical activity prescription ticked below (choose all that apply):

☐ **1. Increase physical activity in your day and reduce sedentary time.** Limit sedentary recreational time to no more than 2 hours per day.

☐ **2. Begin regular aerobic exercise***: _____ minutes _____ times per week. (Goal is to build to 150 minutes per week, but some people may have to start with as little as 5 to 10 minutes per day and build gradually.)

☐ **3. Begin resistance exercise**** 2 days per week.

☐ **4. Continue to do regular aerobic exercise*** 5 days per week for a minimum of 30 minutes per session.

☐ **5. Continue to do regular resistance exercise**** 3 or more days per week.

**Aerobic exercise is continuous exercise such as walking, bicycling or jogging that elevates breathing and heart rate.*
***Resistance exercise involves brief repetitive exercises with weights, weight machines, resistance bands or one's own body weight to build muscle strength.*

Regular physical activity is one of the most important things you can do to manage and live well with your diabetes. Many people, however, need help starting an exercise routine and achieving these goals.

The benefits of physical activity increase the more you do, from whatever your starting point. **Refer to the information on the back of this form to help you get started with your physical activity prescription.** If you need help, you can ask me or another member of your diabetes healthcare team for support that is right for you.

Aerobic exercise and building strength in your major muscle groups can provide you with these benefits:

Immediately
- Lower your blood glucose within 1 hour
- Improve your mood, sleep patterns and energy level
- Increase the effectiveness of the insulin your body makes or the insulin your doctor prescribes for you

Long-term
- Improve your blood glucose control
- Reduce your body fat
- Help keep your pancreas, kidneys, eyes and nerves healthy
- Reduce the risk of heart attack, stroke and death

The Canadian Diabetes Association 2013 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada recommends that all people with diabetes:

Get a minimum of 150 minutes of moderate-to-vigorous intensity aerobic exercise each week, and perform resistance training (weight lifting or exercise with weight machines) 3 times per week.

Canadian Diabetes Association

Canadian Diabetes Association

You can be physically active. Becoming physically active may seem challenging, but it can be easier than you think. This information will help you get started with your physical activity prescription.

1. **Increase physical activity in your day and reduce sedentary time.** Choose active options when you can, such as taking the stairs or walking to do errands. Include more activities that you may already do, such as walking the dog, gardening, curling or playing golf. Limit TV or recreational computer use to no more than 2 hours per day and reduce or break up the time you spend sitting.
2. **Begin regular aerobic exercise.** At least every second day, do activities like brisk walking, cycling or swimming, for at least 10 minutes at a time. Each week, add 5 minutes to every activity session you do.
3. **Begin regular resistance exercise.** With the help of a qualified exercise professional, diabetes educator or exercise resource (such as a video or brochure) learn how to do a muscle strength building routine using weight machines, free weights (such as lifting a barbell or dumbbell), resistance bands or your own body weight. You will need to work most of the muscles in your body with 8 to 10 different exercises. Do each exercise 10 to 15 times each at a light to moderate intensity. Repeat this routine if you can.
4. **Continue to do regular aerobic exercise.** Do at least 150 minutes of aerobic activity every week, spread over 3 separate days. Don't go for more than 2 days in a row without exercise. For example, 30 minutes Monday, Wednesday, Friday, Saturday and Sunday = 150 minutes total. Gradually increase the time of your activity sessions up to 60 minutes or more. Also, try to increase the intensity or challenge of your activities. More challenging activities could be hiking, sports, jogging or swimming laps.
5. **Continue to do regular resistance exercise.** Continue using weight machines, free weights, resistance bands or your own body weight. You can perform 8 to 10 different exercises to work most of the muscles in your body, perform 8 to 10 repetitions each at a moderate to hard intensity. Repeat this routine 2 to 3 times per week.

For more information on physical activity and exercise, go to **http://www.diabetes.ca/physicalactivityvideo**

diabetes.ca | 1-800-BANTING (226-8464)

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The aim of a physical activity prescription is to provide structured support to integrate physical activity into the daily lives of at-risk population groups (Rooney et al., 2023). Physical activity on prescription has been introduced in many countries, with variations in its name, design, and implementation (Arsenijevic & Groot, 2017). Despite the widespread use

of the use of physical activity prescription by HCPs (Arsenijevic & Groot, 2017), a study by Wisse et al. (2010) disputed its use as an effective method to increase physical activity in people living with type 2 diabetes. In a 2-year RCT with a physical therapist, Wisse et al. (2010) reported no significant differences between the intervention (participants with type 2 diabetes) and control group for self-reported physical activity. Furthermore, there were no significant differences for body composition, glycaemic control, medication use, or risk factors for cardiovascular disease (Wisse et al., 2010). The authors concluded that individualised physical activity prescriptions were insufficient to facilitate change.

A common criticism of the use of physical activity prescriptions by HCPs has been that while the published guidelines for the management and treatment of type 2 diabetes commonly provide extensive detail on medication (e.g., dosage, mechanisms of action, regimens) and medical nutrition therapy, physical activity does not receive the same level of detail within the guidelines (O'Hagan et al., 2013). As such, this makes following the protocol for physical activity prescription (duration, intensity, frequency) challenging for HCPs.

It is reported in the literature that HCPs experience many barriers to physical activity prescription, such as a lack of knowledge, resources, and time (Woodhead et al., 2023). As such, physical activity prescriptions are under-utilised and under-prescribed by HCPs as a method to increase patients' physical activity (Persson et al., 2013; Woodhead et al., 2023; Tchirkov, 2023). A scoping review by O'Regan et al. (2021) identified individual (HCP and patient) and organisational-level barriers to physical activity prescription. These barriers included HCPs' lack of time, a lack of validated tools, lack of training and education, patients' barriers to physical activity (e.g. physical fitness), patient readiness, and a lack of organisational or systems support (O'Regan et al., 2021). Taken together, these findings highlight numerous factors that hinder the effective implementation of physical activity prescriptions into HCPs' clinical practice.

1.4.1.2 Physical Activity Consultation/Counselling. A physical activity consultation is an intervention designed to provide guidance on physical activity, elicit behaviour change, and ultimately promote regular activity (Wattanaspisit et al., 2021). Physical activity consultations employ a semi-structured approach that empowers the patient to take responsibility for their behaviour change and make decisions on how to effect this change (O'Halloran et al., 2014). A physical activity consultation is typically based on the transtheoretical model ([TTM] Prochaska & DiClemente, 1986) and tailored to the individuals' stage of change: pre-contemplation (individuals lack awareness of the problem behaviour and do not intend to take action in the foreseeable future), contemplation (individuals intend to take action in the foreseeable future), preparation (people are ready to take action within the next 30 days), action (the individual has changed their behaviour and intends to keep progressing forwards) or maintenance (the individual has sustained the behaviour for more than six months and intend to sustain it). The consultations vary between individuals as they are dependent on the patient's stage of change, which is assessed by the HCP (Kirk et al., 2007). A physical activity consultation should also consider the patient's current activity status and discuss the recommended type, frequency and intensity of physical activity (Kirk et al., 2007). Research has demonstrated that physical activity consultations can lead to increases in physical activity and significantly improved metabolic outcomes for people with type 2 diabetes (e.g. Di Loreto et al., 2003; Kirk et al., 2004). It is important to note that these interventions were delivered by a researcher rather than a HCP; furthermore, these increases were only evident during the intervention stage (Alothman et al., 2017). Rendering the feasibility of implementing physical activity counselling in HCPs' routine clinical practice and its potential for sustained behaviour change for patients with type 2 diabetes unclear.

1.4.1.3 Brief Advice. Brief advice differs from physical activity consultation/counselling. While both strategies aim to elicit physical activity behaviour change, the latter usually offers a more detailed, supportive and personalised approach, whereas the former involves short, opportunistic guidance given by HCPs during routine consultations (Meriwether et al., 2008). An example of an approach to physical activity brief advice in healthcare settings is Moving Medicine, a UK-based initiative launched in 2018, that provides online consultation guidelines to HCPs for discussions on physical activity for patients with type 2 diabetes (Moving Medicine, 2024). The guides for HCPs offered in Moving Medicine consider how much time the HCP has to promote physical activity in appointments with patients with type 2 diabetes. They range from a 'one-minute conversation' guide, a 'five-minute conversation' guide, and a 'more minute' conversation guide. Tables 1.3, 1.4, and 1.5 present overviews of the contents of each guide.

An evaluation of Moving Medicine was conducted that aimed to assess the effectiveness of the initiative in supporting HCPs to integrate physical activity promotion into their routine clinical practice (Lowe et al., 2022). The evaluation data demonstrated that HCPs viewed the Moving Medicine resources positively, with increases in their knowledge, skills, and confidence to engage in physical activity conversations with patients. For example, 94% of those surveyed (n = 79) reported that the consultation guides increased their skills to promote physical activity, whilst 96% reported increased confidence. It was reported that 60% of those surveyed 'nearly always' promote physical activity to their patients. This suggests that the initiative may attract HCPs who are already regularly promoting physical activity rather than HCPs who promote it less. Barriers to using the Moving Medicine resources reported by HCPs included lack of time, patients' attitudes, and patient's lack of access to exercise equipment. A lack of awareness amongst HCPs about the resources was identified as a barrier to embedding this approach into routine clinical practice, and to achieve

this, broader outreach is needed, yet there were concerns about the long-term sustainability of the initiative as there was a decline in user engagement on the website. Of note, the evaluation of the Moving Medicine initiative did not explore HCPs' use of the resources with different sub-groups of patients; as such, its utility for promoting physical activity for patients with type 2 diabetes is unclear (Lowe et al., 2022).

Table 1.3

The 1-minute Conversation for Patients with Type 2 Diabetes

Component	**Description**
Ask	Ask for permission to discuss physical activity
Explain	Explain that many patients with type 2 diabetes find that being more physically helps them manage their condition and symptoms and improve their overall wellbeing
Invite	Ask if the patient would be willing to discuss this in more detail at another appointment

Table 1.4

The 5-minute Conversation for Patients with Type 2 Diabetes

Component	Description
Open the conversation	Ask the patient if they would be willing to have a 4–5-minute conversation about something that might help them improve their health and well-being
Assess the impact of the condition	Find out how type 2 diabetes has impacted their physical activity
Find out what they already know	Assess what they already know about the benefits of physical activity for type 2 diabetes
Share the benefits	Explain what things other patients have found beneficial
Encourage reflection	Check the patient's understanding of what has been shared with them
Make it personal	Ask the patient what their top 2-3 reasons for being more physically active
Summarise without adding anything	Summarise what the patient has said
Ask the key question	Ask if they plan to be more physically active
Agree a plan	Share ways other people have found useful when developing a plan
Arrange follow-up	Ask the patient if they would like to come back to build on the thoughts that they shared
Sign-post support organisations	Advise on free resources and support they could use

Table 1.5

The More Minute Conversation for Patients with Type 2 Diabetes

Component	Description
Open the conversation	Ask the patient if they would be happy to spend a few minutes talking about something that might help them improve their health and well-being
Assess the impact of the condition	Find out how type 2 diabetes has impacted their physical activity
Explore current activity	Assess how much physical activity they currently achieve each day
Find out what they already know	Assess what they already know about the benefits of physical activity for type 2 diabetes
Share the benefits	Explain what things other patients have found beneficial
Encourage reflection	Check the patient's understanding of what has been shared with them
Explore how they think activity might help	Explore the patients' understanding of how physical activity could help them
Respond to concerns	Address concerns the patient may have about being more physically active
Make it personal	Ask the patient what their top 2-3 reasons for being more physically active could be
Look forwards	Ask the patient to think of what changes they might see in six months if they did become more physically active
Help them build confidence	Asses their reasons for becoming more physically active
Summarise without adding anything	Summarise what the patient has said.
Ask the key question	What will the patient do?
Explore opportunities in daily life	How will they start to be more physically active?

Agree a plan	Share ways other people have found useful when developing a plan
Troubleshoot	Ask what barriers they might have to putting the plan into action
Arrange follow-up	Ask if it would be helpful to follow up on this conversation
Sign-post support to organisations	Advise on free resources and support they could use

The evidence for physical activity brief advice delivered by HCPs in non-diabetic populations demonstrates positive short-term outcomes when compared with usual care (Lamming et al., 2017). However, a systematic review of 47 RCTs reported that brief advice alone did not lead to significant improvements in HbA1c for people living with type 2 diabetes (Umpierre et al., 2011). Significant effects were only found when brief advice was provided alongside structured exercise training (aerobic, resistance, combined). The findings suggest that in isolation, brief advice for physical activity may not be sufficient to support behaviour change in people living with type 2 diabetes and that HCPs may need increased support to provide advice that addresses barriers to behaviour change in this population.

Another example of brief advice stemming from the United Kingdom is Making Every Contact Count (MECC), which was developed to encourage HCPs to support patient health behaviour change by providing brief or very brief interventions when the opportunity arises (Public Health England, 2016). Research examining HCPs awareness and engagement with MECC reported that only 31.4% were aware of MECC and even when HCPs perceived the need to offer behaviour change advice to patients, they felt unable to do so in 50% of the cases (Keyworth et al., 2018). In follow-up qualitative research to examine the barriers experienced by healthcare professionals in delivering physical activity advice to patients during routine clinical practice, Keyworth et al. (2019) concluded that barriers to MECC

included workload, the clinical environment, and HCPs perceptions of competence and their role.

1.5 The Gap Between Physical Activity Research and Its Promotion in Diabetes Care

Despite the recognised need for HCPs to promote physical activity to patients living with type 2 diabetes, there is a gap between these recommendations and HCPs routine clinical practice (Avery et al., 2012; Kime et al., 2020; Matthews et al., 2014). It can take several years, if at all, for research evidence to be incorporated into routine clinical practice or usual care (Bauer & Kirchner, 2020; Proctor et al., 2009). This is often referred to as the evidence-practice gap (e.g., Grol & Wensing, 2004). Prior research has noted challenges to the uptake of research into practice, including, but not limited to, the complexity and accessibility of the research (Smith & Johnson, 2023), HCPs education and training gaps (Kime et al., 2020; Netherway et al., 2021), and variability in practice settings, and regulatory or institutional barriers (Lau et al., 2016; Luoma et al., 2017). Pearson and Munn (2012) suggest that there are three influences on the evidence-to-practice gap:

1. The gap between the need for knowledge and the acquisition of that knowledge (needs for knowledge identified by patients, HCPs, and policymakers/governments)
2. The gap between acquiring new knowledge and its clinical application (from theoretical, epidemiological or bench-style research to clinical research)
3. The gap between the clinical application of new knowledge and the development of routine clinical actions or policy (translating research into practice)

Existing literature suggests that the evidence-practice gap is particularly prominent in primary healthcare (Lau et al., 2016). This is due to the unique characteristics of this setting, such as diverse practice settings, cultures, practices, and organisational structures (Lau et al.,

2016), which are substantially different to interventions delivered in ideal and controlled settings, such as RCTs (Titler, 2018). Yet, much of the evidence demonstrating the impact of physical activity for type 2 diabetes stems from large-scale RCTs that are conducted in controlled research settings, using standardised designs and protocols and are implemented by research staff or additional human resources (e.g., Matthews, 2014; Larsen et al., 2019; Luoma et al., 2017; Pi-Sunyer, 2014). These differences between research and practice mean that, despite the wealth of research demonstrating the positive impact physical activity can have on type 2 diabetes outcomes (e.g. Pan et al., 2018), translating this into HCPs clinical practice is not common practice and is fraught with challenges (Luoma et al., 2016).

For example, the Look AHEAD trial (Action for Health in Diabetes) was a longitudinal multicentre RCT delivered by a multidisciplinary team, examining the effectiveness of a lifestyle intervention (including physical activity) on type 2 diabetes outcomes (Wadden et al., 2006). Significant positive differences were found between the intervention and control group for physical activity levels, blood glucose and lipid control (Larsen et al., 2019; Pi-Sunyer, 2014). Furthermore, participants in the intervention group reported benefits in terms of weight loss, waist circumference, health-related quality of life, depression and higher rates of remission from type 2 diabetes (Larsen et al., 2019; Sunyer, 2014). However, despite the initial weight loss achieved, further maintenance was not sustained, demonstrating the challenge of sustained behaviour change for this population (Salvia, 2017). Nonetheless, these findings demonstrate that lifestyle changes that include increasing physical activity can improve overall health outcomes for people with type 2 diabetes (Wadden et al., 2006). Despite the positive findings reported from the Look AHEAD trial, concerns have been raised about the feasibility of translating these findings into HCPs real-world practice due to the substantial differences between research settings and clinical infrastructures (Bauer et al., 2015; Delahanty et al., 2018; Salvia, 2017). These may include

the availability of the necessary resources, funding and time, challenges following the complex protocol, and patients' willingness and adherence (Delahanty et al., 2018; Salvia, 2017). Bauer et al. (2015) further highlight that translation efforts can be hindered when resources for the research are separate to the clinical infrastructure (e.g. externally funded) or require a change to HCPs routine.

This evidence-practice gap is further evidenced in interventions delivered by HCPs in their clinical practice for adults with type 2 diabetes. Matthews (2014) conducted a 12-month pilot to explore the feasibility, implementation and effectiveness of physical activity consultation delivered to adults in a healthcare setting. An exercise health psychologist, who was present only during the research phase, delivered the intervention of seven 30-minute counselling sessions to interested patients within routine care. Significant increases in patients' physical activity levels were reported, along with lower BMI and self-reported weight loss, an increase in positive affect, and a decrease in depression scores (Matthews, 2014). Despite the positive patient outcomes, challenges noted to delivering the intervention beyond the pilot phase included a lack of administrative support, insufficient funding to integrate the service into routine care, lack of HCPs time to deliver the counselling sessions, and inadequate electronic health system updates making it difficult to accurately monitor patient progress (Matthews, 2014).

In another study, a 12-month cluster RCT, dieticians delivered physical activity consultations to patients with type 2 diabetes at baseline, four weeks and eight weeks (each 20-minute duration) and monthly WhatsApp messages such as *'start your new year with an aim to increase physical activity'* (Alghafri et al., 2018). Significant patient outcomes were reported for increased physical activity, reduced sitting time, systolic and diastolic blood pressure and triglycerides. In an evaluation study, all the HCPs delivering the intervention deemed the intervention to be either very or quite appropriate, and intervention components

were either perceived as suitable or very suitable (Alghafri et al., 2020). Yet, aspects of the intervention delivery were noted as challenging by HCPs; for example, the use of accelerometers, the patient questionnaire and the intervention delivery were too time consuming for HCPs to conduct. A lack of ongoing organisational support was also noted as a barrier to the long-term delivery of the intervention and the need for more training on physical activity for type 2 diabetes.

In line with the findings reported by Alghafri et al. (2020), other published evaluations of HCPs' experiences with delivering complex physical activity interventions in clinical settings have highlighted concerns about the interventions' sustainability during the post-research phase. Despite reporting significant patient outcomes, HCPs reported challenges to the long-term implementation of the physical activity interventions. These challenges included a lack of staff to deliver the intervention, competing demands and priorities, schedule conflicts, and a lack of organisational support (Wozniak et al., 2015). Other challenges included a lack of time, the increased administrative and training burden of the intervention (Dasgupta et al., 2017; van Sluijs et al., 2004; Verwey et al., 2015; Wozniak et al., 2016), low uptake of the intervention amongst less interested HCPs (Verwey et al., 2016), and a lack of role clarity in the intervention delivery (Wozniak et al., 2016).

The findings presented above (e.g. Alghafri et al., 2018, 2020) illustrate the challenges involved in translating physical activity evidence into real-world practice. Despite physical activity interventions demonstrating significant outcomes for patients, the conditions and components needed to replicate the intervention in real-world settings are not considered (Luszczynska et al., 2020). Grandes et al. (2008) suggest that research should be used to optimise clinical practice rather than demonstrate the efficacy of an intervention. Yet, in the area of focus for this PhD thesis, there is a wealth of literature focused on patient outcomes and a paucity that explores the challenges HCPs experience in promoting it. For the

successful translation of behaviour change interventions into real-world contexts, Brand and Silburn (2014) state that intervention end-users (e.g. HCPs, decision-makers) must be considered throughout their design and implementation. Furthermore, the practicalities of delivering the intervention in a real-world setting must also be explored (Curtis et al., 2016). There is a clear need for more research that focuses on HCPs perceptions of the barriers and facilitators to effective implementation of physical activity interventions and explores what they can feasibly deliver in their routine clinical practice. Doing so will support the development of a better understanding of what can be successfully implemented in real-world settings (Glasgow et al., 2004; Singal et al., 2014).

There have been calls for the more explicit use of theory in research to identify influences on behaviour change (i.e. facilitators of and barriers to change), to understand mechanisms of change, including how and in which contexts interventions are effective, and to inform intervention development, implementation and evaluation (Atkins et al., 2017; Michie et al., 2005). Despite the use of theory being advocated for (e.g. Craig et al., 2008) there is often an inconsistency in the use, effectiveness, and reporting of it in behavioural interventions (Hagger et al., 2020; Michie et al., 2005). This creates challenges for researchers, practitioners and decision-makers. Without clear reporting of the theory used in behaviour change interventions, it is difficult to identify why interventions are effective or ineffective and this can make replication, refinement and iteration challenging (Michie & Prestwich, 2010; Nilsen, 2015).

1.6 Implementation Science and Translation

1.6.1 Implementation Science and the Evidence-Practice Gap

Implementation science is defined as '*the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine*

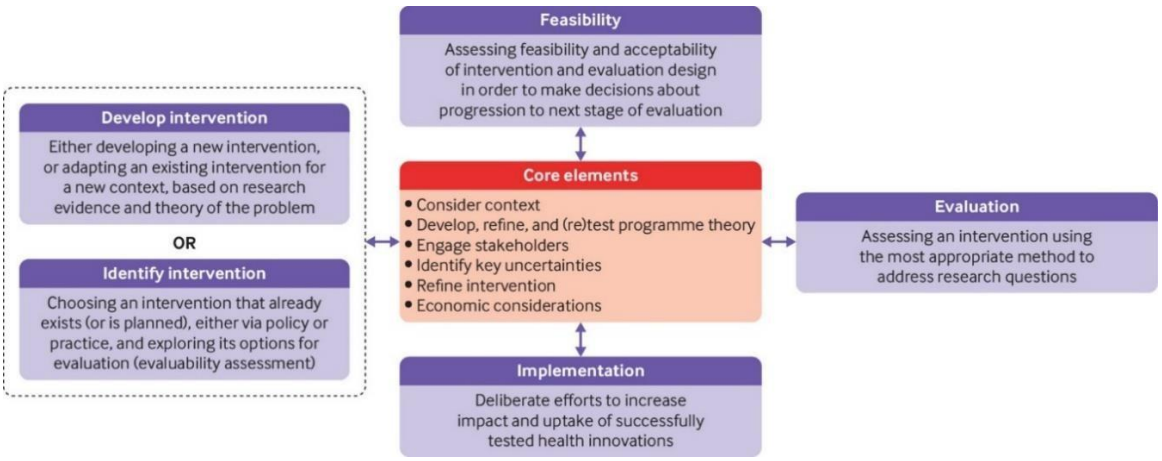
practice, and, hence, to improve the effectiveness of health services' (Eccles & Mittman, 2006, p.1). Presseau et al. (2021) advocate for the use of implementation science in health psychology research to explore the evidence to practice gaps that exist in healthcare. The authors propose that synergy between the two fields could provide novel insights to support and enhance the impact of behaviour change and translation beyond research settings. Implementation science recognises that to improve the quality of healthcare and implement new practices and/or change existing practices, evidence of the effectiveness of interventions alone is insufficient to change HCP practice (Lynch et al., 2018). Rather changes in individual and collective behaviour at multiple levels (e.g., individual, system, organisation, and policy) are required (Bauer et al., 2015) along with the development and use of implementation theories, and the accumulation and synthesis of research evidence (Luszczynska et al., 2020). This is pertinent to the area of research focused on in this programme of research. Despite the evidence demonstrating the positive impact of regular physical activity on type 2 diabetes outcomes (e.g. Hamasaki, 2016), it has proven a significant challenge to support HCPs to embed the findings from complex physical activity interventions into their routine clinical practice (Kime et al., 2020). Presseau et al. (2021) assert that despite the evidence of effectiveness from behaviour change interventions, the feasibility and acceptability of translating these into HCPs' routine clinical practices is unclear.

Implementation science also underscores the need to consider context to translate evidence to practice, and influence behaviour change; this means understanding what works for whom, where and why (Bauer et al., 2015; Nilsen & Bernhardsson, 2019). The importance of context is now reflected in the updated UK Medical Research Council (MRC) guidance for the development of complex interventions, whereby it has been added to the framework as a core component (Figure 1.3) (Skivington et al., 2021). The MRC guidance

provides a systematic and replicable framework for the development, feasibility, implementation and evaluation of complex healthcare interventions (Skivington et al., 2021). Defining features of complex interventions are that they have several interacting components or mechanisms of change, often have many different outcomes, target different groups or levels of organisations, and generate outcomes dependent on context or system-related factors (Craig et al., 2008; Skivington et al., 2021). The MRC guidance states that the outcomes of interventions can often be dependent on context, which is defined as '*any feature of the circumstances in which an intervention is conceived, developed, evaluated and implemented*' (Skivington et al., 2021, p. 4). The MRC framework notes that determinants of context can include factors related to physical, spatial, organisational, social, cultural, political, or economic aspects of healthcare, health systems, or public health contexts in which interventions are implemented (Skivington et al., 2021).

Figure 1.3

MRC Framework for Developing and Evaluating Complex Interventions (Skivington et al., 2021)



An umbrella review of 70 systematic reviews explored the causes of the evidence-practice gap in primary healthcare settings (Lau et al., 2016). Barriers to evidence-based practice identified in the review included unsupportive policies, legislation and restrictive regulatory frameworks, organisational factors such as culture, available resources, time, competing workloads, inadequate work processes and systems (Lau et al., 2016). In addition to a lack of investment by health authorities, stakeholder buy-in, and organisational support. Although the findings from this review (Lau et al., 2016) highlight the importance of the consideration of contextual factors when developing healthcare interventions, this is an often-overlooked component of intervention development (Rogers et al., 2021).

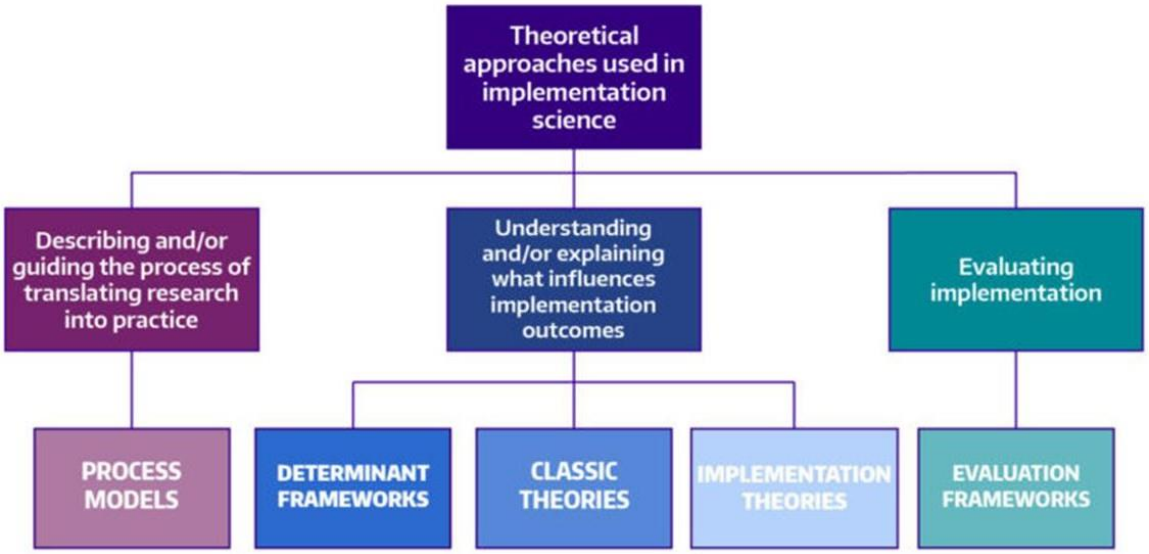
1.6.2 Implementation Frameworks

Implementation frameworks are used to understand the influences on behaviour (e.g., the adoption of evidence into clinical practice or policy) and the context in which they occur (Luszcynska et al., 2020). By understanding these factors, interventions can be developed and implemented to fit specific settings and populations' unique characteristics and needs, thereby enhancing health outcomes (Proctor et al., 2023). Whilst there are a number of frameworks, theories and models that can be used in the implementation process, Nilsen (2015) proposes that these can be categorised according to three overarching aims: to guide implementation processes, to guide process evaluations and to understand intervention outcomes, and finally, to explain implementation determinants (Figure 1.4).

Determinant frameworks outline general types (also known as classes or domains) of determinants hypothesised or shown to affect implementation outcomes (Nilsen, 2015). A scoping review of theories, models and frameworks used in implementation science reported that determinant frameworks were the most frequently used to identify barriers and facilitators (Wang et al., 2023). According to Luszczynska et al. (2020), there are two prominent implementation determinant frameworks used in the healthcare literature: the Consolidated Framework for Implementation Research (CFIR, Damschroder et al., 2009) and the Theoretical Domains Framework (TDF, Atkins et al., 2017; Cane et al., 2012). As the focus of this thesis is on understanding implementation determinants, only frameworks that explain these will be discussed, with the overarching aim of developing an understanding or explanation of influences (e.g., barriers and facilitators) on implementation outcomes

Figure 1.4

The Three Overarching Aims of Theoretical Approaches in Implementation Science and Five Categories of Theories, Models and Frameworks in Implementation Science (Nilsen, 2015)



1.6.2.1 The Consolidated Framework for Implementation Research.

The Consolidated Framework for Implementation Research (CFIR; Damschroder et al., 2009) is a meta-theoretical framework that was originally developed in response to the evidence-based practice implementation challenges within healthcare. The CFIR was developed through an analysis and synthesis of existing theories that can support the translation of research to practice, such as The Conceptual Model for Implementation Effectiveness (Klein et al., 2001) and the Ottawa Model of Research Use (Logan & Graham, 2004). The original CFIR (2009) comprised five major domains and selectable constructs that represent different aspects of the implementation process: 1) characteristics of the interventions, 2) outer setting, 3) inner setting, 4) individual-level moderators, and 5) determinants of implementation processes (Damschroder et al. 2009).

In 2022, the CFIR was updated based on user feedback, including the need to make it more applicable across differing innovations and settings, with the following revisions to these five inter-related domains and constructs made by Damschroder et al. (2022): 1) innovation domain, 2) outer setting domain, 3) inner setting domain, 4) individuals' domain, and 5) implementation processes domain. As described by these authors, the innovation domain represents the intervention's characteristics, which can include its source, evidence base, relative advantage, adaptability, trialability, complexity design and cost. The outer setting domain focuses on the external context within which the inner setting exists (e.g., the system or community). It includes critical incidents that may disrupt the implementation and/or delivery of the intervention, local attitudes, local conditions, partnerships and connections, policies and laws, financing, and external pressures. The inner setting domain is the setting in which the intervention will be implemented and includes structural characteristics (physical, information technology, and work), relational connections (e.g.,

formal and informal connections), communications, culture, and aspects related to the implementation and/or delivery process such as available resources and access to knowledge and information. The individuals domain represents the roles and characteristics of individuals involved in the implementation process, including their leadership levels, influence, roles as facilitators, leads, team members, and support and whether they are delivering or receiving the intervention. Finally, the implementation processes domain focuses on the strategies and actions taken to implement the innovation, including teaming, assessing needs and context, planning, tailoring strategies, engaging, doing, reflecting and evaluating, and adapting (Damschroder et al., 2022). Appendix A provides an overview of the updated CIFR for the five domains and the relevant construct name and construct definition for each.

The CFIR has been used to explore implementation determinants across a broad range of healthcare interventions including telehealth initiatives (Rangachari et al., 2022), the mental health services (Hadijstavropoulos et al., 2017), public health programs (Perez et al., 2015), evaluating patient-centred care (Safaeinili et al., 2020), patient and HCP education programs (Guyatt et al., 2021; Kegler et al., 2018), weight management programmes (Damschroder et al., 2013) patient screening procedures (Cole et al., 2015) and guideline implementation (Breimaier et al., 2015). Research using the CFIR states that the framework provides a comprehensive and systematic approach that can be used to develop an understanding of barriers and facilitators to implementation effectiveness, inform implementation strategies, and enable engagement with key stakeholders (Kirk et al., 2015; Means et al., 2020). However, it is also suggested that the CFIR can be challenging to use without adaptation due to its complexity, making it time-consuming to use (Means et al., 2020; Labbe et al., 2024).

1.6.2.2 The Theoretical Domains Framework. The Theoretical Domains Framework (TDF) was initially designed to identify the influences on HCPs' implementation of evidence-based recommendations and facilitate the development of implementation strategies for effective change (Cane et al., 2012; Michie et al., 2005). Practitioners and researchers involved in developing and implementing behaviour change interventions in healthcare settings frequently cite the TDF as one of the most frequently used implementation frameworks, underscoring its relevance in the area of research in this thesis (Luszczyzynska et al., 2020). Prior to the development of the TDF, it was recognised that there were several limitations to the application of theory in understanding and changing behaviour, particularly in healthcare (Michie et al., 2005). Key limitations included the complexity and overlap of a large number of existing theories, the lack of an integrated theoretical framework that combined relevant constructs from various theories to facilitate a comprehensive and coherent understanding of behaviour, the idiosyncratic selection of constructs in research, lack of accessibility for non-psychologists, and their limited practical utility (Michie et al., 2005). The TDF was developed to address these limitations by providing a structured, systematic way to simplify and integrate theories and constructs of behaviour and behaviour change into one framework.

The TDF was developed through an expert group consensus process, and 33 psychological theories and 128 theoretical constructs related to behaviour change were identified (Michie et al., 2005). These were then synthesised into a single, 12-domain framework (Table 1.6) to explain implementation and behavioural challenges to support intervention design. Each domain represents a range of related constructs that may mediate behaviour change at the level of the cognitive (e.g. decision-making processes), affective (e.g. optimism), social (e.g. social norms), and environmental (e.g. organisational culture) influences on behaviour (Cane et al., 2012). Any given determinant of behaviour may act as a

barrier or facilitator to those engaging in a specific behaviour (e.g. HCPs physical activity promotion); these can be mapped onto any of the domains of the TDF. Doing so allows for a comprehensive and systematic identification of the determinants of behaviour (e.g. individuals, organisational, environmental) prior to intervention development (Atkins et al., 2017; Cane et al., 2012).

Through a comprehensive validation process the original 12-domain TDF (v1) was further refined to include 14 domains (v2, table 1.7) (Cane et al., 2012). To do this a three-step method was used 1) identify the optimal number of domains, 2) define the content of each domain by identifying the most appropriate constructs to include in reach of the domains 3) finalise domain labels by selecting the most suitable labels for new domains, whilst retaining the labels that matched the original ones. The consensus process involved an open and closed sort task with 112 experts sorted domain component constructs into the domains belonging to v1 of the TDF, which was further analysed by Discriminant Content Validation (Pollard et al., 2006) and Fuzzy Cluster analysis (Kaufman & Rousseeuw, 1990) methods.

This consensus process resulted in a separation and clarification of the following Beliefs about Capabilities, Beliefs about Consequences, and Motivation and Goals into six new clusters. Motivation and Goals (v1) were separated into two domains: Intentions and Goals (v2). The domain name Beliefs about Consequences (v1) was retained, and a second domain was added termed Reinforcement (v2). The Beliefs about Capabilities (v1) domain also retained its original name and a second domain was added, termed Optimism (v2) (Cane et al., 2012). The domain Nature of the Behaviours was removed as there was no cluster representing this domain in the open sort task, and it was not assigned to the domain during the closed sort task (Cane et al., 2012). With the remaining eight domains being similar to the original TDF (Knowledge, Skills, Social/Professional Role and Identity, Memory, Attention

and Decision Processes, Environmental Context and Resources, Social Influences, Emotion, and Behavioural Regulation), resulting in a refined TDF that contains 14 domains and 84 component constructs (Table 1.7).

Table 1.6

Definitions of the 12 domains of the TDF (v1) and Component Constructs

Domain	**Constructs**
Knowledge	Knowledge Knowledge about the condition/scientific rationale Schemas +mindsets +illness representations
Skills	Skills Competence/ability/skill assessment Practice/skills development Interpersonal skills Coping strategies
Social/Professional Role and Identity.	Identity Professional identity/boundaries/role Group/social identity Social/group norms Alienation/organisational commitment
Beliefs about Capabilities	Self-efficacy Control – of behaviour and material and social environment Perceived competence Self-confidence/professional confidence Empowerment Self-esteem Perceived behavioural control Optimism/pessimism
Beliefs about Consequences	Outcome expectancies Anticipated regret Appraisal/evaluation/review Consequents Attitudes Contingencies Reinforcement/punishment/consequences Incentives/rewards Beliefs Unrealistic optimism Salient events/sensitisation/critical incidents Characteristics of outcome expectancies – physical, social, emotional; sanctions/rewards, proximal/distal, valued/not value, probable/improbable, salient/not salient, perceived risk/threat

Motivation and Goals	Intention: stability of intention/certainty of intention Goals (autonomous, controlled) Goal target/setting Goal priority Intrinsic motivation Commitment Distal and proximal goals Transtheoretical model and stages of change
Memory, Attention and Decision Processes	Memory Attention Attention control Decision-making
Environmental Context and Resources	Resources/material resources (availability and management) Environmental stressors Person x environment interaction Knowledge of task environment
Social Influences	Social support Social/group norms Organisational development Leadership Team working Group conformity Organisational climate/culture Social pressure Power/hierarchy Professional boundaries/roles Management commitment Supervision Inter-group conflict Champions Social comparisons Identity: group/social identity Organisational commitment/alienation Feedback Conflict – competing demands, conflicting roles Change management Crew resource management Negotiation Social support: personal/professional/organisational, intra/interpersonal, society/community Social group norms: subjective, descriptive, injunctive norms Learning and modelling

Emotion	Affect Stress Anticipated regret Fear Burn-out Cognitive overload/tiredness Threat Positive/negative affect Anxiety/depression
Behavioural Regulation	Goal/target setting Implementation intention Action planning Self-monitoring Goal priority Generating alternatives Feedback Moderators of intention-behaviour gap Project management Barriers and facilitators
Nature of the Behaviours	Routine/automatic/habit Breaking habit Direct experience/past behaviour Representation of tasks Stages of change model

Table 1.7

Definition of the 14 Domains of the TDF (v2) and Component Constructs

Domain	Definition	Component Constructs
Knowledge	An awareness of the existence of something	Knowledge (including knowledge of condition/scientific rationale) Procedural knowledge Knowledge of task environment
Skills	An ability of proficiency acquired through practice	Skills Skills development Competence Ability Interpersonal skills Practice Skills assessment
Social/Professional Role Identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting	Professional identity Professional role Social identity Identity Professional boundaries Professional confidence Group identity Leadership Organisational commitment
Beliefs about Capabilities	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use	Self-confidence Perceived competence Self-efficacy Perceived behavioural control Beliefs Self-esteem Empowerment Professional confidence
Optimism	The confidence that things will happen for the best or that the desired goal will be attained	Optimism Pessimism Unrealistic optimism Identity
Beliefs about Consequences	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation	Beliefs Outcome expectancies Characteristics of outcome expectancies Anticipated regret Consequents
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and given stimulus	Rewards (proximal/distal, valued/not valued, probable/improbable) Incentives Punishment Consequents Reinforcement Contingencies Sanctions

Intentions	A conscious decision to perform a behaviour or a resolve to act in a certain way	Stability of intentions Stages of change model Transtheoretical model and stages of change
Goals	Mental representations of outcomes or end states that an individual wants to achieve	Goals (distal/proximal) Goal priority Goal/target setting Goals (autonomous/controlled) Action planning Implementation intention
Memory, Attention and Decision Processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives	Memory Attention Attention control Decision making Cognitive overload/tiredness
Environmental Context and Resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour	Environmental stressors Resources/material resources Organisational culture/climate Salient events/critical incidents Person x environment interaction Barriers and facilitators
Social Influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviour	Social pressure Social norms Group conformity Social comparisons Group norms Social support Power Intergroup conflict Alienation Group identity Modelling
Emotion	A complex reaction pattern involving experiential, behavioural, and physiological elements by which the individual attempts to deal with a personally significant matter or event	Fear Anxiety Affect Stress Depression Positive/negative affect Burn-out
Behavioural Regulation	Anything aimed at managing or changing objectively observed or measured actions	Self-monitoring Breaking habit Action planning

1.6.2.3 The TDF and HCP Behaviour Change. Cane et al. (2012) stated that the advantages of the revised TDF are that it comprehensively covers potential influences on behaviour. There is clarity about each kind of influence due to each domain being specified

by component constructs, and the framework makes links between theories of behaviour change and techniques of behaviour change to address implementation problems (Cane et al., 2012). Furthermore, as advocated by implementation science, the TDF explicitly makes links to contextual influences on behaviour in two domains: Social Influences and Environmental Context and Resources (Presseau et al., 2021). In an examination of research using the TDF, Francis et al. (2012) state that the framework has two primary strengths: its theoretical coverage and its capacity to elicit a comprehensive set of beliefs that could potentially be mediators of behaviour change. However, is a theoretical framework rather than a theory, meaning that it does not propose causal links between the elements (Francis et al., 2012). Rather, the TDF provides a robust and extensive theoretical lens through which to examine the influences on behaviour that facilitates a comprehensive understanding of behavioural determinants (Atkins et al., 2017). The theoretical breadth of the TDF makes it particularly valuable in areas where behaviour is influenced by complex and often interrelated factors, such as healthcare (Mather et al., 2022).

Lipworth et al. (2013) conducted a thematic synthesis of 50 qualitative studies exploring HCPS perceptions of implementing healthcare quality care interventions and mapped these findings to the TDF. The aim of this study was to determine the extent to which the TDF can account for barriers and facilitators to HCPs behaviour change in the context of quality care interventions, whether there were TDF domains that were not relevant to the context being studied and if there were barriers and facilitators reported by HCPs that the TDF could not account for. Lipworth et al. (2013) reported that, in the context being studied, the TDF was able to account, to a considerable extent, for the barriers and facilitators of HCP behaviour change as there were no findings from the included studies that could not be mapped to at least one domain of the TDF. The authors concluded that all 14 domains of the TDF were relevant to HCPs' behaviour change within clinical settings and that the framework

can provide a comprehensive overview of the barriers and facilitators to the adoption of clinical quality interventions (Lipworth et al., 2013). These findings further highlight the complexity and difficulty of implementing healthcare interventions to change HCPs' clinical practice behaviours. Given that barriers were found across all 14 domains; even if only one of those barriers to behaviour change is present, it may be enough to create resistance to uptake of the intervention by HCPs (Lipworth et al., 2013). This complexity highlights the need to develop a thorough understanding of the influences on HCPs' clinical practice behaviour and their salience prior to the development and implementation of interventions aimed at changing their behaviour.

The TDF has been extensively used to explore barriers and facilitators to a variety of HCPs professional practice behaviours including the use of evidence-based recommendations for back pain in clinical practice (Hall et al., 2019), to understand influences on HCPs prescribing practices (Cullinan et al., 2015; Duncan et al., 2012), to explore diagnostic processes (Hallsworth et al., 2020; McDonagh et al., 2018), the use of electronic medication management systems (Debono et al., 2017), dementia diagnosis and management (Barry et al., 2020; Murphy et al., (2014), the clinical management of chronic diseases (Ramakrishnan et al., 2022), advanced care planning after hospital discharge (Peck et al., 2018), and the practice of evidence-based medicine and health promotion (Issac et al., 2020). The evidence from these studies provides a robust, comprehensive and systematic approach to identify and categorise influences on HCPs' behaviour (Atkins et al., 2017).

An example of the utility of the TDF as an implementation framework stems from a study by McLellan et al. (2019). These authors identified a gap between midwives' health promotion practice behaviours (e.g. smoking cessation) with pregnant and postpartum patients and the recommendations in the clinical practice guidelines (McLellan et al., 2019). This qualitative study used face-to-face one-on-one interviews (n = 11) with the interview

guided by the TDF (Michie et al., 2005; Cane et al., 2012) and an online questionnaire with open-ended questions (n = 505) to explore barriers and facilitators to midwives' health promotion practice behaviours. The study found that despite the midwives being motivated to engage in health promotion with patients and recognising the positive impact of this, there were barriers in practice. Barriers in the Environmental Context and Resources domain included increasing workloads, competing demands of the role, changes in healthcare service provision that disrupted continuity of care and a lack of training. The lack of training also impeded their confidence in addressing health promotion topics (Beliefs about Capabilities). The midwives also reported that they were overwhelmed by the increasing scope of their role, and its complexities (Social/Professional Role and Identity), and challenges to remember and prioritise health promotion practices in their routine clinical practice (Memory, Attention and Decision Processes).

The findings from this study (McLellan et al., 2019) were used to develop a theoretically informed health promotion practice behaviours toolkit to address the midwives' barriers to health promotion. For example, in the Memory, Attention and Decision Processes domain midwives noted that a barrier to health promotion was a reliance on maternity notes to remember carry out health promotion. To address this, the toolkit included visual prompts and cues and structured action planning tools. In a prospective examination of the toolkit with 108 midwives, 72% reported that it would be a useful tool to use to support health promotion, 69% reported that it was straightforward to use, 66% said they would use it, 52% felt that it would not interfere with their other priorities, and 45% did not see its use as a burden (McLellan, 2019).

As well as primary research exploring HCPs clinical behaviour, evidence from systematic reviews and umbrella reviews have demonstrated the utility of the TDF to identify influences on HCPs behaviour and to support intervention design (Michie et al., 2005; Cane

et al., 2012; Atkins et al., 2020; Dyson & Cowdell, 2021; Huij et al., 2014; Mather et al., 2022). For example, Dyson and Cowdell (2021) explored how the TDF, Behaviour Change Wheel (BCW) and COM-B model (Michie et al., 2014) were applied to designing interventions to support HCP behaviour change for evidence-based practice. Sixty studies were included in the review: 32 reported intervention design and 28 reported intervention design and testing. Of the 60 papers identified, 25 used the TDF v1 (Michie et al., 2005), and 12 used the TDF v2 (Cane et al., 2012). These studies targeted a range of HCP behaviours within varied settings and roles such as primary care practitioners' management of lower back pain (Eilayyan et al., 2020; French et al., 2012), emergency department and stroke clinicians/triage (Craig et al., 2016) and health providers delivery of smoking cessation counselling to pregnant women (Gould et al., 2017). A key finding from the systematic review by Dyson and Cowdell (2021) is the lack of studies using the framework in non-Western settings. Out of the 60 studies included in the review, only one was in a non-Western setting (Uganda) (Cummings et al., 2017) and used the BCW and COM-B model (Michie et al., 2014) rather than the TDF. Dyson and Cowdell (2021) conclude that the lack of research using the TDF outside of Western settings limits the generalisability of the findings and highlights a gap in the literature.

Atkins et al. (2020) reported findings from a systematic review focused on identifying barriers and facilitators to preventing catheter-associated urinary tract infections (CAUTI) and examining the strategic use of behavioural interventions. The authors identified 25 papers reporting barriers or facilitators to CAUTI-related behaviours performed by HCPs (Atkins et al., 2020). As with the systematic review described above (Dyson & Cowdell, 2021), most of the included studies stemmed from Western contexts, with the exception of one study from Thailand (Apisarnthanarak et al., 2017) and one from Taiwan (Hu et al., 2015). To determine the TDF domains that most influenced HCPs’ behaviour, the importance of each domain as

either a barrier or facilitator was ranked in line with the criteria from Lawrenson et al. (2018) of domain frequency (number of studies in each domain), elaboration (number of themes and subthemes), and evidence of conflicting beliefs within the studies. The domains that were identified as being the most influential on HCPs CAUTI-related behaviour were Environmental Context and Resources, Knowledge, Beliefs about Consequences, Social Influences, Memory, Attention and Decision Processes, and Social/ Professional Role and Identity (Atkins et al., 2020). Based on the findings of the review, Atkins et al. (2020) make recommendations for intervention design and refinement to target influences on HCPs CAUTI-related behaviour by using behaviour change techniques (BCTs) which are the active ingredients in behaviour change interventions (Michie et al., 2014) and can be mapped to the appropriate TDF domains. For example, barriers were identified related to limited and inconsistent documentation and records were identified in the Environmental Context and Resources domain, and Atkins et al. (2020) suggested the use of the BCT prompts and cues in the computer system to be used to target this barrier.

The use of the TDF in the findings discussed above demonstrates that HCP barriers extend beyond the individual level. Yet interventions to support HCPs behaviour change often focus on individual-level solutions such as guidelines, audits and feedback, education and incentivisation, which rarely lead to sustained behaviour change (Dombrowski et al., 2016; Johnson & May, 2015). Whilst these individual-level strategies to support HCPs are needed, it is clear from the research using the TDF to identify and address barriers at the system level is also required (Chater & Lowesnstein, 2023).

1.6.2.4 The TDF, HCP Promotion of Physical Activity. The TDF has been used to examine physical activity promotion by HCPs across a range of roles, such as

physiotherapists (Redthorn et al., 2022), midwives (McParlin et al., 2017), GPs and pharmacists (Sissons et al., 2020), nurses and physicians (Smith et al., 2021; Turner, 2021; van Dijk-Huisman, 2022), and healthcare assistants (Bondaronek et al., 2021). Findings from these studies identified key barriers and facilitators that influenced HCPs physical activity promotion. McParlin et al. (2017) examined the influences on midwives' use of the physical activity guidelines for obese pregnant women. It was reported that, despite midwives claiming they had knowledge about the importance of providing physical activity advice (Knowledge) and felt it was part of their role (Social/Professional Role and Identity), they lacked the skills (Skills), and resources (Environmental Context and Resources) to do so. As such, they did not plan or prioritise physical activity in their appointments (Memory, Attention and Decision Processes).

Turner et al. (2021) examined influences on HCPs' physical activity promotion within prostate cancer care and subsequently used the findings to develop a targeted training package for HCPs based on the findings. Ten TDF domains were identified as influencing HCPs promotion of physical activity and referral to exercise schemes; these included Knowledge, Behavioural Regulation, Memory, Attention and Decision Processes, Skills, Beliefs about Capabilities, Beliefs about Consequences, Social/Professional Role and Identity, Emotion, Environmental Context and Resources, and Social Influences (Turner et al., 2021). Examples of barriers reported by participants include lack of ability to assess whether patients could be active safely (Beliefs about Capabilities), lack of a referral pathway (Environmental Context and Resources), and a lack of belief in the National Institute for Health and Care Excellence (NICE) guidelines (Beliefs about Consequences). Facilitators included identifying key roles within the referral pathway (Social/Professional Role and Identity) and integrating feedback loops between exercise professionals, HCPs and commissioners into the prostate cancer care pathway to monitor outcomes of physical activity (Behavioural Regulation).

The findings from this study were mapped to 22 BCTs (Michie et al., 2014) that were used to inform the development of a half-day training package for HCPs; this was then evaluated and refined based on HCP feedback and piloted with two prostate cancer clinical care teams. While it was reported that the training supported HCPs to discuss barriers to exercise with patients and make referrals (Turner et al., 2021), the effectiveness of the training and scaling up of it is yet to be established.

1.6.2.5 The TDF, HCPs and Type 2 Diabetes. Within the type 2 diabetes literature, the TDF has been used in systematic reviews exploring HCPs barriers and facilitators to delivering care for adults with severe mental illness (Dorey et al., 2023) and psychological care (Chapman et al., 2016). In addition to qualitative research exploring HCPs' perspectives of influences to their assessment and treatment of knee osteoarthritis (King et al., 2022), diabetes care and management (Rushforth et al., 2016), and diet (Mayr et al., 2022). A systematic review from Boocock et al. (2021) explored primary care HCPs' perceived barriers and facilitators to dietary management of adults with type 2 diabetes. Fourteen qualitative studies were included in the review. The findings demonstrated that although the HCPs reported feeling confident about providing dietary advice (Beliefs about Capabilities), prominent barriers were a lack of knowledge and time for training (Knowledge and Environmental Context and Resources) and HCPs perception of a lack of patient engagement and adherence to dietary recommendations (Beliefs about Consequences). The authors suggest that the findings identified in this systematic review (Boocock et al., 2021) provide a basis to develop targeted interventions to support HCPs in this area of care. A limitation of this review was that only qualitative research was explored, indicating the possibility that not all barriers and facilitators were captured.

The findings within the TDF literature discussed in this chapter provide support for the use of it as an overarching framework to explore HCP behaviour and develop theory

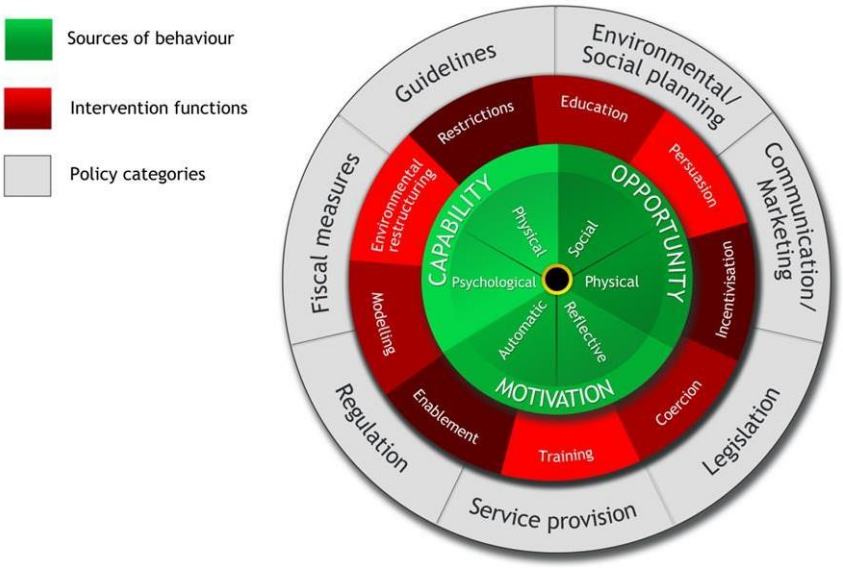
informed behaviour change interventions. Despite this, physical activity promotion by HCPs for people with type 2 diabetes has not been examined using the TDF (Cane et al., 2012). Given the challenges of translating the research evidence into practice identified in the literature (Grol et al., 2007) it is imperative to develop a thorough understanding of HCPs barriers and facilitators to physical activity promotion within diabetes care. Using the TDF to explore determinants of HCPs' physical activity promotion within diabetes care will enable the identification of organisational, emotional, cognitive, behavioural, and social factors that influence this part of their professional practice (Rhodes & Nigg, 2011) and the development of theoretically driven strategies to address barriers and facilitators and promote evidence- based practice (Atkins et al., 2017).

1.6.3 The TDF and COM-B Model

The 14 domains of the TDF can be further mapped to the COM-B model, which suggests that human behaviour results from their capability, opportunity and motivation (Michie et al., 2014). The COM-B model lies at the centre of the BCW as seen in Figure 1.5. The BCW is a synthesis of 19 behaviour change frameworks which provides a step-by-step method to design behaviour change interventions, including the selection of intervention strategies and BCTs that are likely to be effective for addressing barriers and facilitators to behaviour change (Carey et al., 2019; Michie et al., 2011).

Figure 1.5

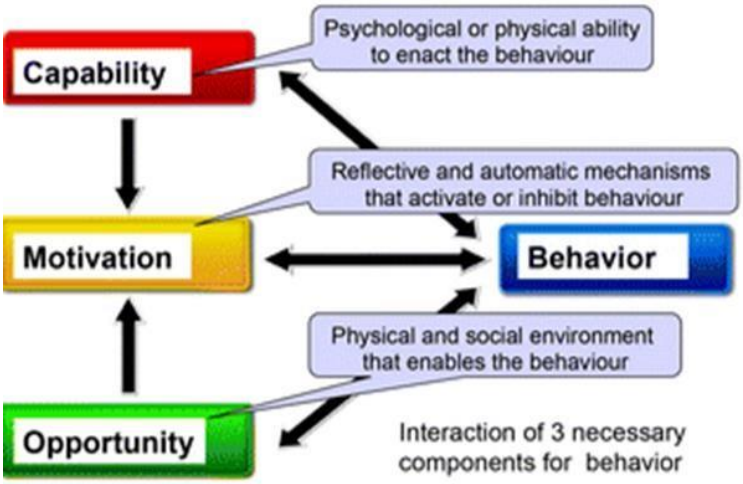
The BCW with COM-B Model Components (Michie et al., 2014)



Each component of the COM-B model is divided into two types. Capability can be psychological (e.g., knowledge) or physical (e.g. skills, stamina, or ability to engage in the required behaviour). Opportunity is comprised of physical (e.g. resources, time, or location) and social (e.g. social and cultural norms). Finally, motivation can be reflective (e.g. conscious thought processes and evaluations), or automatic (e.g. beliefs, emotional reactions, desires, wants or needs) (Michie et al., 2011). Figure 1.6 provides an overview of the COM-B model components and their corresponding constructs; the arrows between the components demonstrate the potential influence each has on the other. The COM-B model has been used extensively within health psychology research to understand, explain and change HCP behaviour (Dyson & Cowdell; 2021; Mather et al., 2022).

Figure 1.6

The COM-B Model and Components (Michie et al., 2011)



Although the TDF (Cane et al., 2012) and the COM-B model (Michie et al., 2011) are distinct, they are also complementary (Fahim et al., 2020). Together, these two approaches offer a comprehensive behavioural analysis and intervention design method and have been used in a number of studies exploring HCP clinical behaviour (Chater et al., 2019; Courtenay et al., 2019; De Leo et al., 2021; Rosario et al., 2021). Table 1.8 presents an overview of the COM-B model and the TDF domains related to each component.

Table 1.8

The COM-B Model and Components (Michie et al., 2014) Mapped to the TDF (Cane et al., 2012)

COM-B Model and Components		**Linked TDF Domain**
Capability	Psychological	Knowledge Skills Memory, Attention and Decision Processes Behavioural Regulation
	Physical	Skills
Opportunity	Social	Social Influences
	Physical	Environmental Context and Resources
Motivation	Reflective	Social/Professional Role and Identity Beliefs about Capabilities Optimism Beliefs about Consequences Intentions Goals
	Automatic	Reinforcement Motivation

Using the BCW framework, Keyworth et al. (2019) explored HCP barriers and facilitators to providing opportunistic behaviour change interventions for patients in routine clinical appointments. The COM-B model was used to guide the interview schedule and the findings were then mapped to the TDF (Cane et al., 2012). Four prominent TDF domains were identified as barriers and facilitators by HCPs; Environmental Context and Resources, Beliefs about Consequences, Beliefs about Capabilities, and Social/Professional Role and Identity. Examples of barriers identified in the Environmental Context and Resources domain

included time and workload pressures and lack of prioritisation; facilitators included the perceived need for signposting/resources and the importance of the physical environment in facilitating the delivery of behaviour change interventions (Keyworth et al., 2019). In the Beliefs about Consequences domain no facilitators were identified, barriers included, HCPs perceived lack of engagement from patients and the negative impact of the HCPs' health behaviours. Barriers in the Social/Professional Role and Identity domain included HCPs' inconsistent perception of responsibility, and delivering behaviour change was not part of the organisations' culture. Facilitators in this domain included the importance of building the relationship between HCP and patient and the importance of being a healthy advocate. Finally, in the Beliefs about Capabilities domain, no facilitators were identified; barriers included HCPs' perceived lack of confidence and scepticism about their capabilities to support patients' behaviour change (Keyworth et al., 2019).

The barriers and facilitators in all four TDF domains identified above were then mapped to intervention functions, and BCTs (Michie et al., 2014) were then suggested to overcome the challenges reported by HCPs. For example, in relation to the environment being conducive to deliver behaviour change interventions, and the need for signposting and resources, the intervention functions of training, restriction, environmental restructuring and enablement were suggested and linked to the BCTs restructuring the physical environment, discriminative (learned) cue, prompts/cues, restructuring the social environment and avoidance/changing exposure to cues for the behaviour. The study from Keyworth et al. (2019) study demonstrates that the combined use of the TDF and COM-B model can support the identification of barriers and facilitators to HCPs clinical behaviour change and enable the development of evidence-based recommendations and strategies to facilitate change.

1.7 Chapter Summary and Aims of this Thesis

The chapter has highlighted the rapidly escalating rates of type 2 diabetes, globally and in Oman, and the burden of this at multiple levels (IDF, 2021). Despite the well-documented benefits of regular physical activity for improved health outcomes for people with type 2 diabetes (e.g., Pan et al., 2018), research has demonstrated that people with type 2 diabetes are less physically active than the general population (Kennerly & Kirk, 2018). As a result, it has been suggested that HCPs play a central role in promoting physical activity to their patients living with type 2 diabetes (e.g., IDF, 2017). Although many HCPs try to encourage physical activity in their patients, they commonly report that this is fraught with challenges, such as lack of education and training related to physical activity, a lack of awareness or understanding of the physical activity guidelines, and a lack of resources and time, all leading to the well- documented evidence-practice gap (Kime et al., 2020). This not only highlights the missed opportunities in patient care but also the complexities inherent in changing the health behaviours of patients and HCPs within clinical settings. Despite the proposed role of HCPs in physical activity promotion, there is still a well-established gap between the available evidence and HCPs' uptake of it into their routine clinical practice (e.g., Bauer & Kirchner, 2020; Kime et al., 2020). To facilitate the translation of evidence to practice and support HCPs in this area of their professional practice, it is imperative to develop an in-depth understanding of the determinants of HCPs physical activity promotion for people with type 2 diabetes.

The use of implementation science frameworks, such as the TDF (Atkins et al., 2017), can support this development of this understanding and provide an evidence-based approach to understanding the influences on HCPs physical activity promotion at multiple levels (e.g., individual, organisation, system). Using this approach in this programme of research will add to the literature regarding the translation of research to practice. It will also be utilised for the

first time to explore the influences on HCPs' promotion of physical activity for people with type 2 diabetes, both globally and within Oman. By developing an in-depth, context-specific understanding of influences on HCPs' physical activity promotion for people with type 2 diabetes, targeted interventions grounded in evidence can be developed, implemented and evaluated to ensure that resources are put in the right place for maximum impact. This will make an original contribution to research and knowledge in this area and enable new evidence-based recommendations to be made.

Considering all of the above, the aims of this programme of research are to:

1. Synthesise, assess and develop an in-depth understanding of HCPs' barriers and facilitators to physical activity promotion for adults with type 2 diabetes.
2. Explore HCPs barriers and facilitators to physical activity promotion for adults with type 2 diabetes in Oman.
3. Explore healthcare policymakers' perspectives on physical activity promotion by HCPs in primary healthcare for people with type 2 diabetes in Oman.
4. Develop evidence-based recommendations to support HCPs in this area of professional practice and the integration of physical activity into the healthcare system.

Chapter Two: Methodology

2.1 Philosophical Asumptions

Lyons (1999) suggests that differences in research approaches exist as a result of the underlying nature of the beliefs of the researchers and guide the research process; this is described by Kuhn (1970) as a paradigm or ideological position. Components that underpin research paradigms relate to ontology, '*the nature of our beliefs about reality*' (Richards, 2003, p. 33), and the second epistemology, '*the branch of philosophy that studies the nature of knowledge and the process by which knowledge is acquired and validated*' (Gall et al., 2003, p. 13).

Within ontology and epistemology there are two primary paradigms, positivism and interpretivism (Alderson, 2021). Positivism corresponds with the traditional scientific method of research and asserts that there is a single reality and that this can be measured and known. Most frequently, this paradigm is associated with quantitative research methods (Guba & Lincoln, 1994). In contrast, interpretivists believe there is no single reality; rather, reality is shaped by influences and contexts that are local, individual and specific; this paradigm focuses on subjective interpretations and is associated with qualitative methods (Creswell, 2007).

Critical realism, which has grown from the works of Bhaskar (1998, 2013), is a philosophical branch of knowledge that positions itself between positivism and interpretivism and does not attempt to reconcile them. Rather, it acknowledges an *'objective reality as one that exists independently of individual perception but also recognises the role that individual subjective interpretation plays in defining reality'* (Taylor, 2018, p. 217), with its primary function being to determine '*what is objectively real and what is subjectively accepted as truth*' (Edwards et al., 2014, p. 9). Critical realism, therefore, combines and reconciles ontological realism and epistemological interpretivism (Alderson, 2021), which is argued to be an approach that can capture the reality of the world as it is (Gorski, 2013).

Sturgiss and Clark (2019) state that critical realism is particularly useful for developing an understanding of the complexities in healthcare, how and why things occur, and also to explore the influence of context on outcomes. Sturgiss and Clark (2019) further highlight the utility of critical realism in primary healthcare, where the influence of patients, the setting, healthcare professionals (HCPs), and the system are all interconnected and create a social reality. This level of understanding is a gap in this field of study: HCPs promotion of physical activity for people with type 2 diabetes. Much of the research in the area of study in this thesis focuses on the effectiveness of interventions and neglects the crucial role that context and individual beliefs and behaviour can have on implementation (e.g. Alghafri et al., 2018). Taking these complexities into account, it is necessary to examine the person and the environment in which they operate rather than focus solely on outcomes and intervention processes. This would enable the development, application, and evaluation of interventions that are not only grounded in the empirical literature, but also in real-world conditions in partnership with people who will be affected by the research and its findings. Given the challenges in this area of research regarding the translation of findings from research to practice and that critical realism is gaining recognition as a particularly suitable philosophy for health and illness research (Alderson, 2021), it was deemed as the best fit for this programme of research.

2.2. Design

Three separate studies were conducted to address the research aims. The first aim of the programme of research was to develop a broad and nuanced understanding of the research topic followed by a focused exploration of the experiences and perspectives of the research area for policy and practice in Oman. To achieve this, a mixed methods systematic review (MMSR) was conducted, which included both quantitative and qualitative findings.

This type of review was chosen to enable a comprehensive understanding and synthesis of the topic as it can bring together quantitative and qualitative findings (Stern et al., 2020). Furthermore, conducting an MMSR can identify and fill gaps in research areas and is advocated for to provide a richer evidence base for policy and practice, all of which are key requirements for the area being studied in this programme of research (Aromataris et al., 2022). The second and third studies adopted qualitative approaches to explore the perspectives of HCPs and policymakers regarding physical activity promotion for people with type 2 diabetes.

2.3 Study One

2.3.1 Systematic Reviews

The aim of a systematic review is to gather the available evidence on a research topic using a systematic, comprehensive, transparent and replicable methodology and presentation to provide an unbiased answer to a well-defined research question (Veginadu et al., 2022). Systematic reviews typically contain either quantitative or qualitative data, and each will address different types of research questions (Sataloff et al., 2021). At the broadest level, a quantitative systematic review gathers and analyses numerical data from primary studies. In contrast, a qualitative systematic review gathers and synthesises textual or narrative data from primary studies (Sataloff et al., 2021). Both qualitative and quantitative systematic reviews contribute to our understanding of the best available evidence on a topic. However, stakeholders using systematic reviews to inform their decision-making have advocated for more comprehensive evidence syntheses than what is offered by single-methods reviews (Stern et al., 2020). In recognition of this, the MMSR, which combines quantitative and

qualitative data, has emerged as a significant advancement in evidence-based healthcare (Stern et al., 2020).

MMSRs can maximise findings and provide a more comprehensive, nuanced understanding of healthcare issues, which can support decision-making in policy and practice (Pearson et al., 2015). The MMSR design was considered appropriate for this programme of research as the nature of the existing evidence is exploratory and encompasses both qualitative, quantitative and mixed-methods research. Furthermore, this approach ensures a well-rounded, inclusive synthesis of all relevant studies to address the research question.

2.3.2 The Joanna Briggs Methodological Approach for MMSRs

The Joanna Briggs Institute (JBI) has developed a comprehensive and rigorous approach to MMSRs (Lizarondo et al., 2020; Stern et al., 2020). Pertinent to the area of study in this programme of research, JBI reviews are based on a model of evidence-based healthcare rather than an exclusive focus on effectiveness (Santos et al., 2018). JBI reviews acknowledge that HCPs and decision makers require substantive and unbiased evidence to determine the feasibility, effectiveness and appropriateness of clinical practice interventions (e.g. physical activity promotion) (Santos et al., 2018).

Original JBI guidance for MMSRs stemmed from the work of Sandelowski et al. (2006), who proposed three designs for conducting this type of systematic review: contingent, segregated and integrated. In brief, the contingent design is the sequential synthesis of quantitative and qualitative data based on results from the previous synthesis. The segregated design uses a method referred to as configuration. This involves separate and simultaneous synthesis of the quantitative data and qualitative data into a complementary line of evidence to provide a comprehensive understanding of the topic. With a segregated design, the quantitative

and qualitative data findings can either support, refute, or complement each other (Lizarondo et al., 2020). Finally, the integrated design enables the assimilation of qualitative and quantitative data into a single synthesis (Stern et al., 2020). A necessity of this design is that the qualitative and quantitative data are considered similar enough that this process can be conducted and that both designs can answer the same research question (Lizarondo et al., 2020).

Building on the seminal work of Sandelowski et al. (2006), Hong et al. (2017) further explored methods to synthesise or integrate quantitative and qualitative data and identified two dominant frameworks in MMSRs: convergent (synthesis occurs simultaneously) and sequential designs (synthesis occurs consecutively). The JBI methodology for MMSR is underpinned by the work of both Hong et al. (2017) and Sandelowski et al. (2006). Stern et al. (2020) note that within MMSRs, the convergent design accounts for 95% of reviews. As such, it is the recommended methodology for JBI MMSRs and asserts that this can be further broken down into convergent integrated and convergent segregated. Table 2.1 presents a comparison of frameworks identified by Hong et al. (2017) and Sandelowski et al. (2006).

Table 2.1

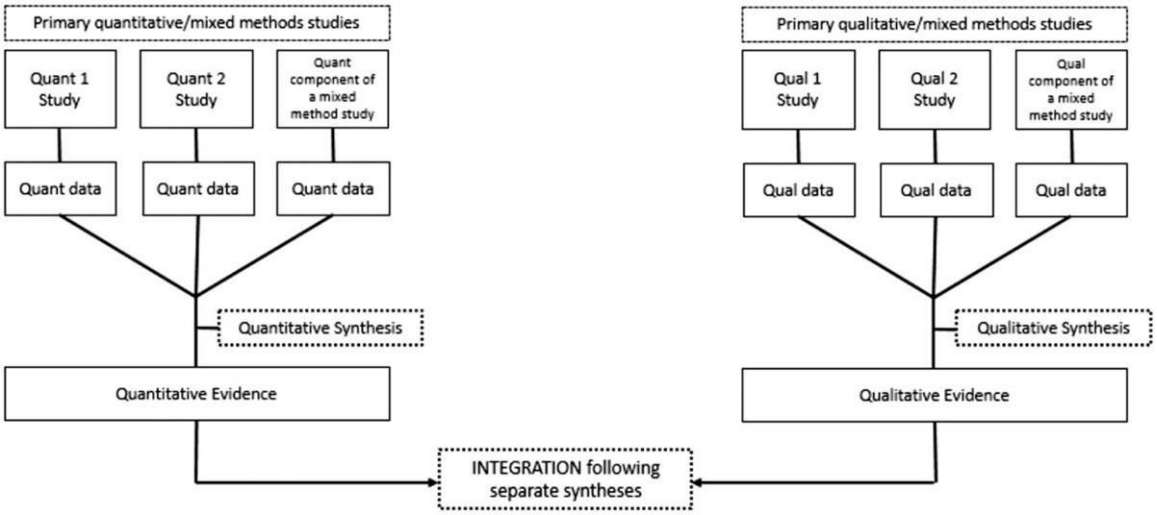
A comparison of Frameworks for MMSR Identified by Hong et al. (2017) and Sandelowski et al. (2006)

Hong et al. (2017)	**What is involved**	**Sandelowski et al. (2006)**
Convergent data-based	• Typically involves a broad review question that can be addressed by both quantitative studies and qualitative studies • Requires data transformation • Involves integration of transformed data	Integrated
Convergent results-based: Results are presented in the results section of the systematic review Convergent parallel results: results are presented in the discussion section of the systematic review	• Typically involves an overall review question with sub-questions (some that can only be addressed by quantitative studies and others that can only be addressed by qualitative studies) • Separate and simultaneous synthesis of quantitative data and qualitative data • Involves integration of quantitative evidence and qualitative evidence • No data transformation	Segregated
Sequential	• Synthesis of quantitative data and qualitative data are conducted sequentially based on results from the previous synthesis	Contingent

The convergent segregated approach entails separate quantitative and qualitative synthesis. Qualitative data are then pooled through meta-aggregation or narrative summary, whilst quantitative data are synthesised using meta-analysis or narrative summary. Upon completion, the quantitative and qualitative data findings are compared and subsequently organised into a cohesive line of reasoning and integrated analysis. This process is illustrated in Figure 2.1.

Figure 2.1

The Process of a JBI Convergent Segregated MMSR (*Stern et al., 2020)*

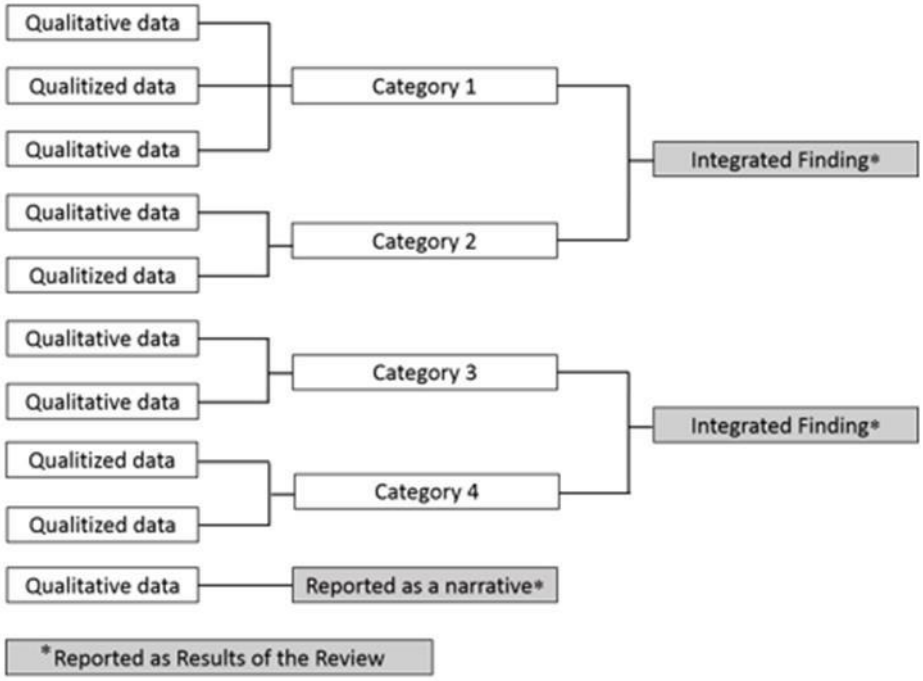


Conversely, the convergent integrated approach requires the combination of extracted quantitative, qualitative, and mixed-method data and data transformation. The latter can be done by transforming qualitative data into quantitative data, referred to as quantitizing, or by converting quantitative data into qualitative data, referred to as qualitizing. Qualitzing involves converting quantitative data, including those from mixed-methods studies, into textual descriptions or narrative interpretations. On the other hand, quantitizing is the process

of assigning numerical values to extracted qualitative data (Stern et al., 2020). Doing this ensures that the data is transformed into a compatible format that can be assembled and categorised/pooled based on similarity in meaning to produce a set of integrated findings (Stern et al., 2020). Subsequently, a detailed exploration of this pooled data is conducted to identify categories based on likeness in meaning. This process is illustrated in Figure 2.2.

Figure 2.2

The processes of a JBI Convergent Integrated MMSR (Stern et al., 2020)



For data transformation, JBI recommends that quantitative data be qualitized, as this is less likely to cause errors than assigning numerical values to qualitative data (Stern et al., 2020). As such, along with the convergent integrated approach, this method of transformation was used in the MMSR for this programme of research. However, currently, there is no guidance available that details the process of qualitizing quantitative data. After discussion with JBI, their recommendations to qualitize the quantitative data were that '*while transforming the data via qualitization will need to involve*

some level of interpretation, I would try and stick to the verbatim data as much as possible' and to '*include the statistics (where needed) to be as comprehensive as possible'* (C.Stern, personal communication, July 7th 2021). This recommended approach to qualitizing was followed for all quantitative data that required transformation for the MMSR in this programme of research.

2.3.3 Synthesis Methods in Systematic Reviews

Two synthesis methods were used in this study: framework synthesis (Brunton et al., 2020) and thematic synthesis (Thomas & Harden, 2008). The rationale for the use of both stems from the 'best fit' framework synthesis approach (Booth & Carroll, 2015) as well as guidance on the use of the Theoretical Domains Framework (TDF; Atkins et al., 2017). Both are discussed in more detail in the sections below; however, in brief, both advocate for the use of deductive and inductive approaches to ensure that all data relevant to the research question are captured.

2.3.3.1 Framework Synthesis. Framework synthesis originates from framework analysis, which has primarily been used in the context of analysing primary qualitative primary research data to address organisational and policy research questions (Ritchie & Spencer, 1994). Framework analysis is a structured method for managing and analysing qualitative data (Gale, 2013), and it involves five distinct yet interconnected stages: 1) familiarisation, 2) identifying a thematic framework, 3) indexing, 4) charting, and 5) mapping and interpretation (Ritchie & Spencer, 1994). Within the context of synthesising the findings of primary data in a systematic review, it is described as framework synthesis (Brunton et al., 2020).

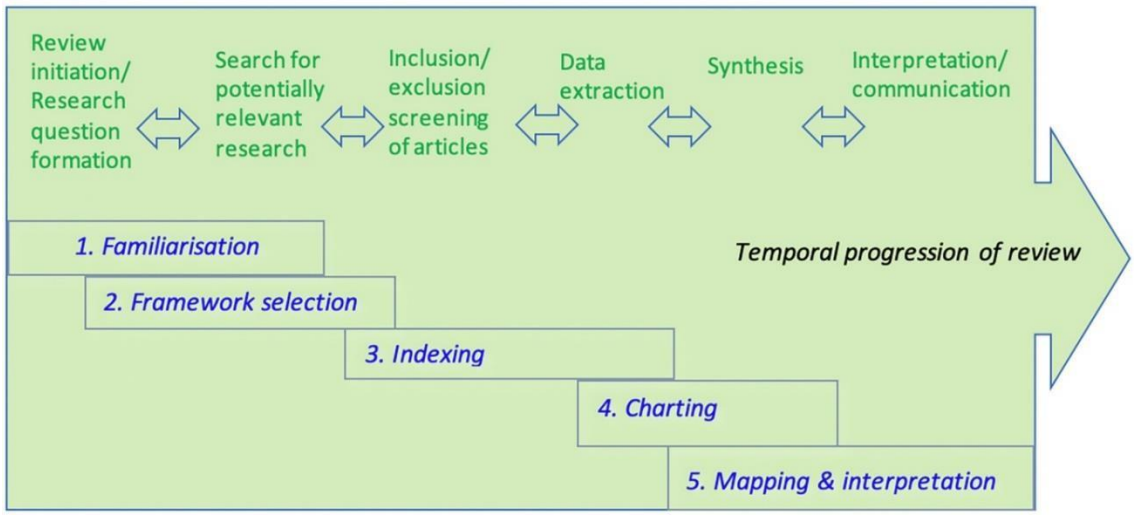
Framework synthesis is a flexible yet highly structured approach used to organise, synthesise, and tabulate primary research findings within systematic reviews, the goal of which is to capture a new understanding of the data (Brunton, 2017; Petticrew et al., 2013). The five stages of framework synthesis are the same as those described above for framework analysis (Ritchie & Spencer, 1994). Figure 2.3 provides an overview of the systematic review process in accordance with Gough et al. (2012) and the framework synthesis process (Ritchie et al., 2014).

A critical component of framework synthesis is the use of an a priori framework to guide data extraction and organisation (Carroll et al., 2011; Carroll et al., 2013). There are different approaches to the selection of the a priori framework, each dependent on the research aims, the characteristics of the data, and the extent to which the framework captures the components of the research focus. Whilst some studies will use pre-existing theories or frameworks (Demain et al., 2015; Kane et al., 2017; Krockow et al., 2019; Kruijsem-Terstra et al., 2014), others use the data found in the familiarisation stage of framework synthesis along with the researchers' previous experiences and understanding of the literature to develop the framework (e.g. Oliver et al., 2008).

Framework synthesis has been adopted for use in systematic reviews of qualitative research (e.g. Bearman & Dawson, 2013), mixed-methods systematic reviews (e.g. Chen et al., 2022), EPPI-centre systematic reviews (Brunton, 2017), as well as systematic reviews using the TDF as an a priori framework (Atkins et al., 2020; Graham-Rowe et al., 2018; Shaw et al., 2016). Furthermore, framework synthesis is underpinned by a critical realist approach (Alderson, 2021), which accepts the existence of a real world while also acknowledging that our understanding of this is mediated by our perceptions, beliefs and context (Barnett-Page & Thomas, 2009; Mercier et al., 2023). The five stages of framework synthesis will now be described, and their application in this MMSR will be detailed.

Figure 2.3

Framework Synthesis Stages Corresponding to the Systematic Review Process (reproduced from Brunton, 2019; Gough et al., 2012; Ritchie et al., 2014)



Stage 1: Familiarisation

At this stage of framework synthesis, it is imperative to develop an in-depth understanding of the topic under study and the review question is developed. Studies were identified from the electronic searches using the search strategy developed for the review, and those that met the eligibility criteria were read several times to ensure that the researcher was immersed in the data.

Stage 2: Framework Selection

At this stage, and as described above, either an a priori framework is selected from the literature or developed based on evidence and theory (Brunton et al., 2017; Petticrew et al.,

2013). For the purpose of the study, the TDF (Atkins et al., 2017) was used as the a priori framework. It was deemed an appropriate choice after familiarisation with the literature. A detailed overview of the TDF is presented in Chapter One. In brief, the TDF has been reported to be useful in examining and addressing implementation problems, can identify influences (e.g. barriers and facilitators) of behaviour and behaviour change, was developed to examine HCP behaviour, and has been used to guide clinical quality improvement interventions, all of which are relevant to this study and overall PhD thesis (Atkins et al., 2017).

Stage 3: Indexing

Indexing refers to '*the systematic application of codes from the agreed analytical framework [the TDF] to the whole dataset*' (Gale et al., 2013, p. 2). In the first instance, the contextual details of the included studies were captured using an extraction form developed for the purpose of this review that included the author(s) and the date the study was published, country and setting, the research aims study characteristics including design, data collection and sampling method, analytical technique used, and participant characteristics (Appendix B). Data were first coded deductively; the raw data from each study was extracted to a Microsoft Excel spreadsheet and coded as either barriers or facilitators. Barriers were defined as '*any factors that obstruct the HCP's promotion of physical activity with adults with type 2 diabetes.*' Facilitators were defined as '*any factors that enable HCP promotion of physical activity promotion for adults with type 2 diabetes*.' If there was ambiguity, barriers and facilitators were either coded based on how the papers included in the MMSR categorised them or through discussion with another review author.

Data were extracted from both qualitative and quantitative studies at two levels. For qualitative studies, the data units were extracted at the first level, i.e., direct participant quotes, and at the second level, i.e., author descriptions or summaries. Similarly, for quantitative studies, data units were extracted at the first level, e.g., statistics, and at the second level, e.g., author descriptions or summaries of the results. Where necessary, numerical data was qualitized (transformed from numerical to textual description or narrative interpretations) (Stern et al., 2020). For example, a study reported that diabetes educators' confidence in their patients to manage regular physical activity was low (below the midpoint of the scale, i.e. 50%) with a mean and standard deviation of 37.6±17.8 (measured on a scale of 0-100) (Dillman et al., 2010). The data units were described as high, moderate, or low based on how the authors quantified them in their published findings. When transforming this qualitative data to qualitative via the process of qualitizing, this would be reported as '*overall diabetes educators' confidence was low (37.65) in their patient's ability to manage regular physical activity and exercise*' (Dillman et al., 2010). Subsequently, the extracted data, including those that were qualitized, were imported to Atlas.ti, an online qualitative analysis tool and mapped onto the TDF domain they best represented.

Stage Four: Charting

Literature related to the TDF (Atkins et al., 2017) and framework synthesis (Booth & Carroll, 2015) suggest that the selected a priori framework may not sufficiently capture all the extracted data and, as such, there is a risk of missing important influencing factors not considered by the selected framework. To mitigate this, as is recommended in the literature (e.g. Atkins et al., 2017), an inductive analysis was conducted after the deductive analysis to mitigate this limitation. At this fourth stage, the findings from stage three (indexing) were analysed using inductive thematic synthesis (Thomas & Harden, 2008).

Thematic synthesis advances principles and techniques from Grounded Theory (Strauss & Corbin, 1998) and Meta-Ethnography (Noblit & Hare, 1998) and builds upon methods for thematic analysis of primary qualitative research (Barnett-Page & Thomas, 2009; Kavanagh et al., 2011). There are three steps to thematic synthesis: 1) line-by-line coding of the data (which was achieved in stage three described above), 2) generating descriptive themes that stay close to the data, and 3) generating analytical themes that go beyond the data and involves the reviewer's interpretation of the descriptive themes while considering the review question. In line with steps two and three during this stage of the review, the extracted, coded and mapped data during stage three (indexing) were synthesised, and themes and subthemes were then developed.

Whilst published guidance on framework synthesis does not specify a method for qualitative evidence synthesis (Carroll et al., 2011), thematic synthesis was chosen for the proposed systematic review for several reasons. It is an approach to qualitative evidence synthesis recommended by Cochrane (Flemming & Noye, 2021). It offers a flexible yet thorough approach to inductive coding and analysis using a set of established methods and techniques to identify important recurring themes and patterns in qualitative data (Thomas & Harden, 2008). Furthermore, it can be used within other synthesis methods, such as framework synthesis; it has demonstrated rigour and transparency and is considered to make practical outcomes more accessible (Thomas & Harden, 2008; Flemming et al., 2019).

Stage Five: Mapping and interpretation

At this step, the review findings were considered against the original research question and aims and written up in narrative form. In addition, the TDF domains were also judged for importance based on three established importance criteria: 1) domain frequency (number of studies in each domain), 2) elaboration (number of themes and subthemes), and 3) evidence

of conflicting beliefs within the studies (Atkins et al., 2020; Dorey et al., 2023; Lawrenson et al., 2018). The aim of this was to be able to provide actionable insights for policy and practice, such as being able to optimise resource allocation, prioritise the most influential determinants of behaviour to address within interventions, tailor interventions to specific contexts and enhance the theoretical underpinnings of interventions. To explore the data in this way, a deductive content analysis, which is often used alongside qualitative analysis and is often used in health research, was used (Elo & Kyngas, 2008). Content analysis is a reliable, transparent and comprehensive method that may increase the rigour of data analysis, allow the comparison of the findings of different studies, and yield practical results (Assaroudi et al., 2018; Krippendorff, 2018).

2.4 Qualitative and Quantitative Research

Qualitative and quantitative research are not opposed to one another; they differ according to their underlying objectives (Renjith et al., 2021). Qualitative research aims to explore and understand phenomena, whereas quantitative research is used to test and confirm hypotheses (Renjith et al., 2021). Qualitative methods, such as interviews, can provide rich, detailed descriptions of participants' views and experiences and the meanings and interpretations that are attached to them (Creswell & Creswell, 2017). This depth of insight is essential to understanding the complexities of human behaviour and social phenomena, as well as the context in which these occur (Braun & Clarke, 2013). Furthermore, qualitative research can capture nuances and consider context (Willig & Stainton-Rogers 2010) In contrast, quantitative research is unable to do this due to its reductionist approach, whereby complex phenomena are broken down into simpler, quantifiable parts and general patterns across populations, which do not show the complexities of people's experiences (Braun & Clarke, 2013; Renjith et al., 2021). Furthermore, qualitative methods are recommended for areas of

research that are not well understood and, as such, is exploratory in nature, unlike quantitative methods, which are used to test specific hypotheses (Creswell & Creswell, 2017; Renjith et al., 2021).

In the field of implementation science, the Qualitative Research in Implementation Science (QualRIS) group acknowledge that qualitative and quantitative methods and mixed methods are all useful to understand and influence the development, implementation, adoption and sustainment of interventions to support evidence-based practices. However, they highlight that qualitative research methods are integral to the field of implementation science (Sales et al., 2019). This is because qualitative methods can be used to elicit multiple stakeholder perspectives, inform the design and implementation of interventions, understand context across a variety of settings, encourage reflection on implementation processes, gain insight into the effectiveness of implementation, support the understanding of mechanisms of change, and contribute to theoretical development (Hamilton & Finley, 2019; Sales et al., 2019). Hamilton and Finley (2019) highlight that a focus of implementation science is to identify barriers and facilitators to best practices in clinical care, and that qualitative methods add value to this by supporting the development of an understanding of what is happening and why within real-world contexts. Given the important role of qualitative methods in implementation science, a qualitative methodology was selected as the most appropriate for this programme of research.

2.5 Data Collection and Analysis Methods

2.5.1 Qualitative Data Collection Methods

In both of the qualitative studies in this programme of research (studies two and three), semi-structured online interviews were employed as the data collection method. Research

interviews are a versatile form of qualitative data collection and are often used to explore a less well-understood research area (Sutton & Austin, 2015). Interviews provide a method to enable participants to describe how they interpret and understand the world around them and can support a researcher to gather information on people's experiences, beliefs, attitudes and perceptions of a specific topic (Knott et al., 2022). Whilst they are primarily conducted face-to-face, in recent years, particularly since the COVID-19 pandemic, digital technologies, such as online video or voice calling, have contributed to the evolution of this data collection method (Keen et al., 2022).

Interviews, unlike conversations, have a clear purpose and structure and support dialogue between a researcher and participant (Adams, 2010). Interviews in qualitative research can take differing forms; they can be structured, unstructured or semi-structured. A structured interview follows a rigid format and is conducted with a fixed set of pre-determined questions; whereas an unstructured interview is flexible and has no pre-determined questions (Knott et al., 2022). Semi-structured interviews strike a balance between the two; there are some pre-determined questions, but they allow for flexibility and follow-up questions, prompts or probes (Stuckey, 2013). Knott et al. (2022) state that the most common form of interview in the social sciences is the one-to-one interview with a semi-structured interview schedule. The main advantages of a semi-structured interview are the deep, rich data that can be collected; given its flexibility, the researcher can further explore complex answers, clarify uncertainties and probe nuances (Willig & Stainton-Rogers, 2010). A semi- structured interview guide forms the basis of the discussion between the researcher and participant (DeJonckheere & Vaughn, 2018). In general, it is comprised of 3-5 broad topic areas (Knott et al., 2022), and each of these areas includes a set of open-ended questions that form the basis for the interview (Knott et al., 2022). Whilst there are many strengths to semi-structured interviews, there are also limitations, including interviewer-participant

dynamics (e.g. difficulties building rapport), inconsistent data quality, they can be resource and time-consuming, and the open-ended questions can make data analysis complex (DeJonckheere & Vaughn, 2018). However, these were mitigated in this programme of research by developing and using an interview guide with clear and focused questions to support consistency across interviews, using data coding software, and regular supervision meetings to cross-check coding and interpretation of the data (e.g. Willig & Stainton-Rogers, 2010).

Another method of qualitative data collection is focus groups, which Willig and Stainton-Rogers (2010) describe as a group interview. In a focus group, the researcher adopts the role of facilitator or moderator with small groups of people from a similar background, typically 6-10 (Cyr, 2019). There are three primary advantages of focus groups: they are social in form, data are generated through an emic process, and data is generated at the individual, group and interactive levels (Cyr, 2019). The role of the researchers is to introduce the topic, guide the discussion using a focus group schedule, gently steer the discussion and set limits to the discussion (Willig & Stainton-Rogers, 2010). The focus group topic guide serves as a roadmap for the discussion, with questions and probes related to the research question to elicit participants' feelings, perceptions, beliefs and experiences of the selected topic (Cyr, 2019). Despite the advantages of focus groups from a group dynamic perspective, there are also disadvantages, including dominant participants, peer pressure, conformity or social desirability bias, and hierarchies (Cyr, 2019). Furthermore, some participants may not feel comfortable disclosing their perspectives and experiences in front of others (Willig & Stainton-Rogers, 2010). Given the potential disadvantage of group dynamics, such as power hierarchies amongst participants, one-to-one interviews were used to explore HCPs' and policymakers' experiences and perspectives in studies two and three in this programme of research.

2.5.2 Qualitative Data Analysis

A reflexive thematic analysis was employed to code and analyse the data in studies two and three. This is a theoretically flexible method used to identify and interpret patterns of meaning, referred to as themes in qualitative data (Braun & Clarke, 2022). This method enables a fluid yet systematic process that can provide a rich, detailed account of the data to answer a variety of research questions and is suitable to the aims of this study (Braun & Clarke, 2019). Furthermore, reflexive thematic analysis has been identified as being a useful method when exploring '*an under-researched area, or when working with participants whose views on the topic are not known'* (Braun & Clarke, 2006, p.83), as is the case with studies two and three in this programme of research. An additional strength of reflexive thematic analysis is that it can produce clear and comprehensive findings that make complex data accessible to a range of stakeholders (academics, practitioners, policymakers) (Braun & Clarke, 2021; Wiltshire & Ronkainen, 2021), which is a vital focus of this programme of research.

Reflexive thematic analysis was selected over other qualitative analytic techniques, such as interpretative phenomenological analysis (IPA; Smith & Nizza, 2022), grounded theory (Glaser & Strauss, 2017) or discourse analysis (Lyons & Coyle, 2007), as it was better suited to meet the aims of this programme of research. While there are similarities between these qualitative approaches, for instance, they are all pattern-based analytical applications, Braun and Clarke (2020) provide a rationale for the use of reflexive thematic analysis that aligns with the aims and methods of this research programme. IPA was designed to explore and understand participants' lived experiences in detail (Smith & Nizza, 2022), grounded theory supports the development of a theory from data (Glaser & Strauss, 2017), and discourse analysis focuses on patterns in language use and social practice (Coyle, 2007). These methods are not as suitable as reflexive thematic analysis for exploring the

perspectives and experiences of HCPs and policymakers as they may not capture the broader structural, systemic or contextual issues inherent within healthcare settings. Furthermore, the themes generated with reflexive thematic analysis, in comparison to these other analytical approaches, can highlight key challenges and opportunities experienced by participants (Braun & Clarke, 2019). This makes the analysis developed better suited to the development of actionable outcomes that can have implications for practice (Sandelowski & Leeman, 2012), which is an aim of this programme of research.

In addition, IPA (Smith & Nizza, 2022), grounded theory (Glaser & Straus, 2017) and discourse analysis (Coyle et al., 2007) are described as theoretically informed, as methodologies and structured approaches that clearly define the boundaries of a research project (Braun & Clarke, 2020). In comparison, reflexive thematic analysis is referred to as a *family of methods* (Braun & Clarke, 2020, p. 39), whereby there can be divergence in the analytical procedure. For example, a core component of studies one and two of this thesis is the inductive and deductive approach to coding, using the TDF (Cane et al., 2012) as an a priori framework. This approach to coding stems from a top-down approach whereby the researchers begin with pre-defined codes or themes based on existing theory (e.g. The TDF). IPA, grounded theory and discourse analysis are fundamentally inductive approaches focusing on generating insights from the data itself (Braun & Clarke, 2021). The design of studies two and three in this programme of research necessitated a more flexible approach to coding and analysis that was more suited to reflexive thematic analysis than these other analytical approaches.

Braun and Clarke (2022, p.8) define themes as '*patterns anchored by a shared idea, meaning or concept*'. Themes are derived from the process of coding, whereby the researcher identifies and organises patterns of meaning from a data set. A core component of this process in reflexive thematic analysis is researcher subjectivity and their active role in the production

of knowledge (Braun & Clarke, 2019). It is this component of reflexive thematic analysis that differentiates it from other forms of thematic analysis, such as coding reliability approaches (e.g. Joffe, 2011) and codebook approaches (e.g. King & Brooks, 2017). The codes and themes derived from the data set are understood to reflect the researchers' interpretations of and engagement with the data set (Byrne, 2022). The six-phase process for reflexive thematic analysis from Braun and Clarke (2006, 2022) is:

Phase 1: Familiarising yourself with the data. This involves the researcher becoming immersed in the data whereby the entire data set is transcribed and read and re-read, and initial analytical ideas and insights are noted. This phase supports the identification of information that could be relevant to the research question.

Phase 2: Coding. This involves the researcher systematically working through the dataset in a fine-grained manner to identify potentially interesting, relevant or meaningful data that may be informative in developing themes and answering the research question. Code labels are assigned to data; these should be brief but offer a specific and meaningful description of the coded data. Code labels can be semantic (explicit or surface level) or latent (implicit or conceptual).

Phase 3: Generating initial themes. In this phase, the researcher's focus moves from the interpretation of the individual data to the interpretation of the shared patterns of meaning across the dataset. Clusters of codes are combined in accordance with their shared meaning and the research question. This is an active process whereby the researcher constructs the

themes, multiple codes that share a similar underlying concept or feature may be collapsed into one single code, and potential or candidate themes are identified.

Phase 4: Developing and reviewing themes. Here, the researcher conducts a review of the candidate themes in relation to the entire dataset and all of the coded data to ensure that they make sense. Braun and Clarke (2022, p. 35) suggest the researchers reflect on the following questions: *Does each theme tell a convincing and compelling story about an important pattern or shared meaning related to the dataset? Collectively, do the themes highlight the most important patterns across the dataset in relation to the research question?* At this phase, revision may be necessary; some candidate themes may be retained, split into new themes, combined, or discarded if the candidate themes do not contribute to the overall narrative or make a logical argument.

Phase 5: Refining, defining and naming themes. In this phase the researcher develops a detailed analysis of each theme. Each theme and corresponding subtheme(s) should be clearly demarcated yet also come together to tell a convincing story of the dataset and answer the research question. Theme and subtheme names should also be clearly named and briefly described.

Phase 6: Writing up. Reflexive thematic analysis is not a linear process, and the writing up can often begin informally in phase 3, generating initial themes. In this phase, the writing process is refined and completed, and the order of the themes may be refined to produce a final cogent report that combines analytic narrative and data extracts.

2.6 Studies Two and Three

2.6.1 Study Two

Study two was designed to address the second aim of this programme of research to explore HCPs barriers and facilitators to the promotion of physical activity for people with type 2 diabetes in Oman. It was a qualitative study that employed online one-to-one interviews with HCPs working in primary healthcare in Oman. Participants were recruited via purposive sampling, which involves identifying and selecting individuals or groups of individuals on the basis of their knowledge about or experience of the phenomena of interest (Creswell, 2015). The study used a semi-structured interview schedule guided by the 14 domains of the TDF (Cane et al., 2012). One-to-one interviews were conducted online via MS Teams. Interviews were selected instead of focus groups as they can offer a nuanced understanding of individual perspectives and experiences and enable an in-depth exploration of individual perspectives and experiences in a private and confidential space (Willig & Stainton-Rogers, 2010).

In study two, the data were first coded deductively using content analysis (Krippendorff, 2018) as barriers or facilitators using NVivo 12©. The coded data were then mapped to the TDF (Cane et al., 2012) and subsequently the COM-B model (Michie et al., 2014). Data were then coded inductively using reflexive thematic analysis in accordance with the 6-phase process described above (Braun & Clarke, 2022). This approach for analysis is recommended in the literature by coding the data deductively and inductively to ensure that any data that does not fit into the TDF is not missed (Atkins et al., 2017).

2.6.2 Study Three

The third study was designed to address the third aim of this programme of research to explore policymakers' perspectives on physical activity promotion in Oman healthcare. Study three employed methods similar to those described above for study two. One-to-one online semi-structured interviews via MS Teams were employed with policymakers who were directly responsible for developing policies or decisions that influence the practice of HCPs working in primary health care with adults with type 2 diabetes. The participants were a purposive sample, and the data were analysed using the same 6-phase process of reflexive thematic analysis described above (Braun & Clarke, 2022).

2.7 Quality in Qualitative Research

Similar to the purpose of validity (the extent to which you can be sure that you are measuring what is intended) and reliability (the degree to which the measure does not change over time or successive measurements) in quantitative research, in qualitative research, rigour and trustworthiness are essential for best practice methods within study design (Braun & Clarke, 2022; Heale & Twycross, 2015; Lincoln & Guba, 1985; Yardley, 2000). Yardley (2000; 2016) suggests that for qualitative research, there are four key dimensions for enhancing and demonstrating quality that can be applied to qualitative research: sensitivity to context, commitment and rigour, transparency and coherence, and impact and importance. Table 2.2 provides an overview of these four dimensions of good quality qualitative research (in bold) and the form these may take (in italics). Although Yardley (2000, p.248) notes that these four criteria can be used flexibly, they can be interpreted and demonstrated in different ways, and as the author notes, '*it is not necessary or even possible for any single study to exhibit all these qualities*'.

Table 2.2

An Overview of the Four Dimensions of Good Quality Qualitative Research (Yardley, 2000)

Dimension	**Description of the dimension**
Sensitivity to context	Theoretical, relevant literature, empirical data, sociocultural setting, participants' perspectives, ethical issues
Commitment and rigour	In-depth engagement with topic, methodological competence/skill, thorough data collection, depth/breadth of analysis
Transparency and coherence	Clarity/power of description or argument, transparent methods and data presentation, fit between theory and method, reflexivity
Impact and importance	Theoretical (enriching understanding), socio-cultural, and practical (for policymakers and health workers)

In line with this criterion from Yardley (2000), in studies two and three of this programme of research, sensitivity to context was demonstrated by thoroughly engaging with the literature relevant to the phenomenon being studied to understand the key aspects of the phenomena and the context they occur in. Demographics and background details were requested from participants so that they were placed within the context of the study. These details were then considered in the analysis to examine how demographic and background details may influence the views of participants and their discussions.

Commitment and rigour were demonstrated by providing evidence of prolonged engagement with the research topic. In accordance with the recommendations from Yardley (2000) as well as those of Braun and Clarke (2019, 2022), sufficient time was spent collecting and analysing the data to ensure that the findings accurately reflect the way in

which the participants construct meaning. The researcher engaged in an intensive study of all the phases of reflexive thematic analysis to ensure a rigorous process of reading, coding, analysing, and interpretation occurs.

Transparency and coherence were demonstrated by ensuring that every aspect of the data collection and analysis was detailed to a sufficient level and disclosing all aspects of the research process within this programme of research to assure the reader that the translation of the findings is accurate. Lastly, in relation to impact and importance, by engaging directly with key stakeholders in this domain and developing an in-depth understanding of their experiences, actionable insight and recommendations can be made. The aim of this research is to enhance practice and policy and to have real-world relevance. Furthermore, the use of the TDF (Cane et al., 2012) to collect, organise and report the findings from studies one and two provides a comprehensive understanding of the issues and, importantly, provides an evidence-based framework to develop capacity-building strategies. Furthermore, this will also add to the theoretical developments in the growing body of literature related to the use of the TDF and its utility in understanding healthcare challenges in non-Western. In addition to the criteria set out above from Yardley (2000), Braun and Clarke's (2022) fifteen-point checklist for quality control (Table 2.3) was used to ensure the reflexive thematic analysis process described above was closely adhered to.

Table 2.3

Fifteen-Point Checklist for Reflexive Thematic Analysis (Braun & Clarke, 2022)

No.	Process	Criterion
1	Transcription	The data have been transcribed to an appropriate level of detail, and the transcripts have been checked against the recordings for 'accuracy'
2	Coding and theme development	Each data item has been given thorough and repeated attention in the coding process
3		The coding process has been thorough, inclusive and comprehensive; themes have not been developed from a few vivid examples (an anecdotal approach)
4		All relevant extracts for each theme have been collated
5		Candidate themes have been checked against coded data and back to the original dataset
6		Themes are internally coherent, consistent, and distinctive' each theme contains a well-defined central organising concept; any subthemes share the central organising concept of the theme
7	Analysis and interpretation - in the written report	Data have been *analysed* - interpreted, made sense of- rather than just summarised, described or paraphrased
8		Analysis and data match each other - the extracts evidence the analytical claims
9		Analysis tells a convincing and well-organised story about the data and topic; analysis addresses the research question
10		An appropriate balance between analytic narrative and data extracts is provided
11	Overall	Enough time has been allocated to complete all phases of the analysis adequately without rushing a phase or giving it a once-over-lightly (including returning to earlier phases or redoing the analysis if need be)

12	Written report	The specific approach to thematic analysis and the particulars of the approach, including theoretical positions and assumptions, are clearly explicated
13		There is a good fit between what was claimed and what was done – i.e. the described method and reported analysis are consistent
14		The language and concepts used in the report are consistent with the ontological and epistemological position of the analysis
15		The researcher is positioned as *active* in the research process; themes do not just 'emerge'

2.8 Ethics

Studies two and three received ethical approval from Birmingham City University ethics committee (BCU, Business, Law and Social Sciences, approval numbers Gibson /3322 /R(C) /2019 /Oct /BLSS FAEC and Gibson /#10682 /sub2 /R(C) /2022 /Sep /BLSS FAEC) and the ethics committee of The Ministry of Health, Oman (approval numbers MoH/CSR/20/9847 and MoH/CSR/22/26336), respectively (Appendix C and D). In addition, the British Psychological Society's (BPS) Ethical Principles (2021), Ethics Guidelines for Internet-Mediated Research (BPS, 2021) and the Code of Human Research Ethics (2021) and the General Data Protection Regulations (2018) were adhered to. The principles of these guidelines will now be summarised, and subsequently, how these were complied with in this programme of research will be summarised.

The four ethical principles laid out in the code of ethics and conduct (BPS, 2021) serves as a foundation for ethical practice. The first principle is respect; this encompasses respecting the dignity and rights of all individuals, this includes privacy and confidentiality, fairness and equality, and informed consent. The second principle competence relates to ensuring that the researcher maintains high standards of competence in their professional work, engages in ongoing professional development and acknowledges the limits of their

expertise. The third principle is responsibility, ensures professional accountability, ethical decision making and the recognition of a duty of care to participants. The fourth principle is integrity, this ensures that the researcher is honest, fair, unbiased and transparent, avoids conflicts of interest and exploitation and maintains professional boundaries (BPS, 2021).

The Code of Human Research and Ethics (BPS, 2021) also has four key principles. These principles are 1) respect for the autonomy, privacy, and dignity of individuals, groups and communities; 2) scientific integrity; 3) social responsibility; 4) maximising benefit and minimising harm. The first principle ensures that researchers demonstrate a clear duty of care to participants; this includes obtaining voluntary informed consent, ensuring a participant's privacy and confidentiality and non-discrimination. The second principle, scientific integrity, emphasises the need to ensure that research is designed and conducted with scientific rigour and quality, honesty and transparency. The third principle, social responsibility, encompasses the need to ensure the ethical use of research, be aware of the predicted and unintended outcomes of the research, and work in partnership with other stakeholders. The fourth principle maximising benefit and minimizing harm refers to the need for researchers to carefully assess and minimis risks, provide participants with appropriate support and debriefing, and continuously monitor the research process whilst safeguarding participants (BPS, 2021).

The Ethics Guidelines for Internet-Mediated Research are closely aligned with those described above in the Code of Human Research Ethics and encompass the same four principles (BPS, 2021). However, the Guidelines for Internet-Mediated Research highlight that special considerations are required in the context of research conducted on the Internet and the unique challenges associated with this such as such as data storage, transmission, digital privacy, that participants have adequately engaged with consent procedures, and that these along with confidentiality and anonymity and are robust and traceable and that participants are aware of their right to withdraw (BPS, 2021).

Finally, the General Data Protection Regulations (BPS, 2018) set out six principles for how personal data is handled: 1) processed lawfully, fairly and transparently; 2) only collected and used for particular lawful purposes; 3) is adequate, relevant and not used excessively for that purpose, 4) accurate and up to date; 5) stored no longer than necessary, and 6) is kept secure, and its integrity and confidentiality are protected.

Throughout this programme of research, all the aforementioned codes of conduct and principles were adhered to by obtaining ethical approval from Birmingham City University and the Ministry of Health Oman for studies two and three (e.g. the BPS code of social responsibility). To demonstrate adherence to the principles studies of respect, autonomy, maximising benefit and minimising harm and lawfulness, fairness, and transparency (BPS, 2018; BPS, 2021) robust measures were implemented in studies two and three to protect participants' privacy and anonymity. Informed consent was explicitly obtained from participants prior to the online interview (Appendix K and N). Participants were fully informed about the aims, nature, purpose and potential consequences of the research by providing a detailed information sheet about the studies (Appendix L and O). Further, it was explained that their participation in the interviews was voluntary and that they could withdraw without penalty. Participants in both studies were provided with 24 hours to two weeks to consider this information. If participants were interested in taking part in the study they were given opportunities to ask the researcher questions about the study. Additionally, prior to the interviews, participants in both studies completed a demographic details form (Appendix K and N) to ensure they met the eligibility criteria for each study; it was explained that if participants did not meet this criterion, they would not be eligible to participate in the study. Although in the Ethics Guidelines for Internet-Mediated Research (2021) level of control is cited as potential issue in research conducted online, however, in accordance with

the guidelines the data in both studies two and three were conducted in real-time, which the guidelines state is the most robust data collection method for online research (BPS, 2021).

The handling of the data was clearly explained to participants. For example, all audio and video files would be stored on a protected computer or BCU One Drive only accessible to the research team and it would be held for seven years and for the length of the viva, exam board, and publication. It was explicitly stated to participants that all data collected would be stored under pseudonyms to ensure confidentiality and anonymity. Additionally, in compliance with GDPR (2018) data were collected only for the specified purpose of studies two and three and was not used beyond the stated purposes.

Competence and scientific integrity were upheld by using robust and appropriate research methods, and the researcher maintained a high standard of work and was aware of the limits of one's expertise. This was demonstrated in this programme of research by ensuring that the researcher had sufficient training and experience. This was achieved by the researcher engaging in extensive reading on the methods being used in this programme of research. For example, the researcher attended a 10-week training programme for conducting a systematic review.

The BPS codes of responsibility, and maximising harm and minimising risk involve avoiding harm and taking care of the wellbeing of participants. This was demonstrated in this programme of research by gaining ethical approval for both studies one and two from Birmingham City University and the Ministry of Health in Oman. The ethical applications contained thorough risk assessments to identify and mitigate potential risk to participants and the researcher. For example, in the unlikely circumstance that a participant loses capacity during the interviews they would be offered to have any data they have provided up until that

point withdrawn and deleted. In addition, participants in each study were emailed a written debrief which explained the nature of the study again, confirmed their right to withdraw, and the length of time they had for this. Furthermore, the debrief sheet signposted them to contact details of independent parties to whom confidential concerns or complaints about the researcher could be addressed.

Competence and integrity were assured for each study by using robust and appropriate research methods and being transparent about the research purpose, aims and methods. For example, participants were advised before their agreement to participate in each study that the online interview would be video and/or audio-recorded. Before the recording of each interview began in MS Teams participants were reminded of this and asked for their consent again. In addition, all of the findings in this programme of research have been reported honestly, and the limitations of the research and potential biases were acknowledged. For example, in both studies, it was acknowledged that participants self-selected and, as such, may have a personal interest in the topic being investigated. The methods used in this programme of research have been described in detail above, this ensures the methodological rigour of the studies, transparency of the approach used and allows for replication of the research. Finally, demonstrating the Code of Social Responsibility the findings have been disseminated at conferences and will continue to be through further publications, workshops and conferences.

2.9 Chapter Summary

The methodological approach detailed above was used to achieve the aims of this programme of research. A MMSR was used to explore the evidence base relating to HCPs reported barriers and facilitators to physical activity for adult patients with type 2 diabetes. Mapping the data to the TDF domains (Atkins et al., 2017) and the COM-B model (Michie et al., 2014)

enabled a synthesis of the multilevel barriers that exist for this phenomenon as well as an understanding of the importance of these influences on HCPs physical activity promotion. A qualitative research method was used to explore HCPs' experiences of physical activity promotion to adult patients with type 2 diabetes in Oman. This research method was also used to explore policymakers' perspectives of the challenges faced by HCPs, as well as the feasibility of implementing strategies to support HCPs in this area and the integration of evidence-based findings into policy and practice.

Chapter Three: Barriers and Facilitators to the Delivery of Physical Activity Promotion by Healthcare Professional in Adults with Type 2 Diabetes: A Mixed Methods Systematic Review using the Theoretical Domains Framework

3.1 Introduction

Type 2 diabetes is a complex and chronic disease that has reached epidemic proportions globally (Sathish, 2019). Although factors such as genetics, age, ethnicity, race, and social determinants are known risk factors for the onset of type 2 diabetes lifestyle factors such as diet, physical activity, and smoking can increase an individual's susceptibility to the disease (Ismail et al., 2021). Excessive bodyweight and obesity are significant risk factors for type 2 diabetes (Schnurr et al., 2020), and research has demonstrated that reducing body weight by 5% to 7% can help manage or prevent type 2 diabetes (Kucera et al., 2021; Lau et al., 2013; Unick et al., 2011), whilst at least a 10% reduction in body weight can, in some cases, reverse the disease (Hallberg et al., 2019).

3.1.1 The Role of Physical Activity in Type 2 Diabetes Management

As discussed in more detail in Chapter One of this thesis, there is substantial evidence that regular physical activity of at least 150 minutes of moderate-intensity physical activity or 75-minutes of vigorous-intensity activity, combined with regular resistance training, is positively associated with improved health outcomes for individuals with type 2 diabetes (Colberg et al., 2016). For example, weight loss, reduced risk of cardiovascular disease, improved glycaemic control, and lipid levels (Colberg et al., 2016; Hamasaki, 2016; Umpierre et al., 2011; Wahid et al., 2016). However, despite the known benefits of physical activity many people with type 2 diabetes do not meet the recommended physical activity levels to achieve these improved outcomes (Morrato et al., 2007; Kennerly & Kirk, 2018; Zhao et al., 2008). There are a number of studies demonstrating this with ranges of physical inactivity for participants with type 2 diabetes between 51% to 97% (Al-Kaabi et al., 2009; Alghafri et al., 2017; Martin et al., 2021; Moratto et al., 2007, Rodríguez & Puchulu, 2015). Frequent barriers to physical activity reported by people with type 2 diabetes include low physical

ability, a lack of motivation, low confidence and a lack of time (Martin et al., 2021; Vilafranca-Cartagena et al., 2021).

3.1.2 HCPs and Physical Activity Promotion in Type 2 Diabetes Care

To support patients with type 2 diabetes to increase their physical activity levels and attain the associated health benefits described above (e.g. Colberg et al., 2016), clinical practice guidelines globally (e.g. IDF, 2017) recommend that healthcare professionals (HCPs) should promote physical activity to these patients. Yet HCPs frequently report that they find physical activity promotion challenging, and as a result their advice to patients is often brief, non-specific, inconsistent, or missed (Barnes & Schoenborn, 2012; Brannan et al., 2019; McPhail & Schippers, 2012; Vuori et al., 2013; Lion et al., 2019). A significant issue contributing to the challenges to physical activity promotion experienced by HCPs is that much of the evidence for the effectiveness of physical activity for type 2 diabetes stems from large-scale interventions that are conducted in controlled settings (e.g., Wadden et al., 2006), which differs substantially from HCPs routine clinical practice (Luoma et al., 2017).

3.1.3 The Evidence-to-Practice Gap

The evidence-practice gap has long been noted as a significant challenge for HCPs (Grol & Wensing, 2004; Coombes et al., 2021) and was explored in detail in Chapter One of this thesis. In brief, while the studies presented in Chapter One demonstrated improvements in patients' clinical outcomes, such as glycaemic control and insulin resistance (e.g., Matthews, 2014), none included any measurable HCP outcomes, such as changes to their consultation behaviour or their knowledge or confidence to promote physical activity. Furthermore, evaluations of physical activity interventions delivered by HCPs have reported that HCPs

express concerns about the feasibility of integrating the interventions into their routine clinical practice once support from the research phase, such as additional funding and personnel, is withdrawn (e.g. Alghafri et al., 2020; Dasgupta et al., 2017; Wozniak et al., 2016). This is a problem for both science and systems, often physical activity interventions are developed with the idea that if effective, they can be translated into practice (Estabrooks & Glasgow, 2006). However, they are often too complex and challenging to implement within existing health systems and organisational structures (Abu-Odah et al., 2022). As such before the development and implementation of complex interventions in healthcare settings it is important to develop an in-depth understanding of the context in which they will be delivered (Skivington et al., 2021).

Michie et al. (2014, p. 58) state that *'behaviour change interventions may fail because the wrong assumptions have been made about what needs to change',* and because of this, it is recommended that a crucial first step in developing interventions is to understand the influences on behaviour and the context they occur in (Nilsen, 2015; Skivington et al., 2021). To facilitate the development of interventions that can effectively support HCPs to promote physical activity in their routine clinical practice, it is imperative to develop a comprehensive understanding of the challenges they face. To do this, it is recommended that behaviour change theories and frameworks are used as they can offer valuable insight into the individual, contextual, societal and environmental factors that may influence behaviour and behaviour change (Atkins et al., 2017; Craig et al., 2008).

3.1.4 The Theoretical Domains Framework and COM-B Model

There is substantive evidence that interventions that are explicitly based on theory are more effective in real-world settings compared with those that are not (Hagger & Weed, 2019; Michie & Prestwich, 2010). As such, the use of behaviour change theories and frameworks

to develop interventions is recommended as they can offer valuable insight into the individual, contextual, societal and environmental factors that may influence behaviour and behaviour change (Craig et al., 2008). One such framework, which was originally developed to identify influences on HCPs implementation of evidence-based recommendations in their clinical practice, is the Theoretical Domains Framework (TDF, Atkins et al., 2017; Cane et al., 2012), which has been discussed in more detail in Chapter One. In brief the TDF is a synthesis of 33 theories of behaviour and behaviour change clustered into 14 domains. The TDF is recommended for implementation research to explore determinants of HCPs clinical practice behaviours (such as physical activity promotion) as it provides a comprehensive and systematic approach to understand the barriers and facilitators to behaviour and behaviour change (Nilsen, 2015; Atkins et al., 2017).

The TDF can be linked to the COM-B model, also discussed in Chapter One (Michie et al., 2014). These two frameworks are complimentary, and frequently used together to identify influences on HCPs clinical practice behaviour (e.g., Buchanan et al., 2021; De Leo et al., 2021; Hallsworth et al., 2020; Mather et al., 2022). The COM-B model proposes that for behaviour change to occur, a person must have the capability (psychological or physical), the opportunity (social or physical) and the motivation (automatic or reflective). The COM-B model provides a higher level-summary of data whilst the TDF enables a more detailed, and granular level of analysis (Atkins et al., 2020). Using both the TDF and COM-B model facilitates a comprehensive and replicable approach that can identify key influences on HCPs clinical practice behaviours and provides an evidence-based approach to intervention development (Richardson et al., 2019). The COM-B model sits within the Behaviour Change Wheel (BCW, Michie et al., 2014) approach to designing interventions, as such its use facilitates the mapping of determinants of HCPs clinical practice to behaviour change techniques (BCTs), which are the *active ingredients* within interventions, and intervention

functions (e.g. enablement, environmental restructuring) that can support the development of targeted and evidence-based interventions (Keyworth et al., 2019; Michie et al., 2014).

A recent umbrella review exploring barriers and facilitators to HCPs clinical practice behaviour change, across a range of clinical behaviours was conducted (Mather et al., 2022). Nineteen systematic reviews involving over 72,000 primary care physicians and the findings from these were retrospectively mapped to the domains of the TDF by Mather et al. (2022). The most commonly reported barriers were identified in the Environmental Context and Resources, Knowledge, and Social Influences TDF domains. The two themes identified as the most influential barriers in the umbrella review were knowledge, awareness and uncertainty (Knowledge) and time, workload and general resources (Environmental Context and Resources) across varied primary healthcare contexts. It was reported that all 19 systematic reviews included identified barriers in the Environmental Context and Resources domain.

The findings from this umbrella review (Mather et al., 2022) provide a detailed exploration and theoretically informed review of HCPs barriers and facilitators to behaviour change, and the large sample size provides greater reliability of the findings (Moller & Myles, 2016). Mather et al. (2022) conclude that the TDF, and the wider BCW framework it sits within provide a robust and systematic method of identifying important barriers and facilitators and strategies to address them. However, these same authors reported that among the 19 reviews included in their study, only one used the TDF (Ogeil et al., 2020) and one other used the COM-B model (McDonagh et al., 2018) to examine the data. Consequently, Mather et al. (2022) make recommendations for future systematic reviews to use theoretical frameworks such as the TDF to support the development of a systematic and rigorous understanding of HCPs barriers and facilitators to professional practice behaviours. Mather et al. (2022) further suggest that doing so can positively influence intervention outcomes and

support the development of the use of shared terminology and understanding. None of the systematic reviews included in this umbrella review related to diabetes care in general or HCPs promotion of physical activity which highlights a gap in the literature on this area of HCPs professional practice.

It is also recommended in the literature that a critical consideration when exploring HCPs clinical practice behaviour change is to develop an understanding of which TDF domains and COM-B model components may be the most influential on the target behaviour (Atkins et al., 2017; Patey et al., 2012). By doing this, it is possible to identify and then prioritise in an intervention the domains most likely to lead to the desired behaviour. As discussed in Chapter One, a systematic review by Atkins et al. (2020) explored barriers and facilitators of catheter-associated urinary tract infection (CAUTI) related behaviours by HCPs. By using the established importance criteria (Atkins et al., 2017; Lawrenson et al. (2018) , it was determined that the most influential domains on HCPs CAUTI-related behaviours were Environmental Context and Resources, Knowledge, Beliefs about Consequences, Social Influences, and Memory, Attention and Decision Processes (Atkins et al., 2020). The authors further sought to establish the extent to which the barriers identified in these most influential TDF domains were targeted in nationally adopted interventions (Atkins et al. 2020). An important finding in this review was that most interventions focused on addressing knowledge rather than other key influences, such as environmental and social (Atkins et al., 2020). The authors postulate that by not developing interventions that target the most influential domains on HCPs behaviour (e.g. Environmental Context and Resources) opportunities to deliver more effective interventions to change HCP behaviour may be missed (Atkins et al., 2020). This study highlights the critical importance of developing an in-depth understanding of the TDF domains on HCP behaviour prior to intervention development and implementation (Atkins et al., 2020).

Currently, there is a paucity of research examining the barriers and facilitators experienced by HCPs when promoting physical activity with adults with type 2 diabetes, and of the available research, they have not been understood in the context of implementation science, discussed in Chapter One. Greater insight into these influences, using implementation frameworks such as the TDF, would enable the development of more tailored interventions and provide targeted support for HCPs. To achieve this, a mixed-methods systematic review (MMSR) was conducted to examine qualitative, quantitative, and mixed-methods studies exploring HCPs promotion of physical activity to patients living with type 2 diabetes.

3.1.5 Study Aims and Objectives

The aim of this MMSR is to synthesise and assess the available data to develop an understanding of HCPs barriers and facilitators to physical activity promotion for adults with type 2 diabetes; this study addresses aim one of this programme of research (Chapter One, page 76). To do this, the study has the following objectives:

1. To identify and synthesise the barriers and facilitators experienced by HCPs to physical activity promotion for patients with type 2 diabetes.
2. To map the identified barriers and facilitators to the TDF (Cane et al., 2012) and the COM-B model (Michie et al., 2011).
3. To rank the importance of each TDF domain in influencing HCPs physical activity promotion for patients with type 2 diabetes.

3.2 Method

This systematic review followed the Joanna Briggs Institute (JBI) methodological guidance for MMSRs (Stern et al., 2020), discussed in detail in Chapter Two, and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines (Page et al., 2021). The protocol was registered on PROSPERO (CRD42020162844).

3.2.1 Inclusion Criteria

Population

This review considered studies that included HCPs (aged 18+ years) working in any healthcare setting caring for adult patients with type 2 diabetes. For the purpose of this review, a HCP is defined as any professional whose role includes lifestyle advice to people with type 2 diabetes, including, but not limited to general practitioners (GPs), health trainers, diabetes specialist nurses, endocrinologists, health visitors, practice nurses, physiotherapists, dieticians, community healthcare providers, and allied HCPs.

Phenomena of Interest

Self-reported barriers or facilitators experienced by HCPs to deliver physical activity promotion with patients with type 2 diabetes.

Context

Studies in all healthcare settings were included, with no restrictions based on location.

Types of Studies

This review considered quantitative, qualitative, or mixed-method studies, with participants in any healthcare setting and any HCP providing direct care for adults with type 2 diabetes. Studies reporting the perspectives of physical activity promotion from multiple people, e.g.,

patients and HCPs were included if it was clear which group the data came from thereby allowing it to be separated for analysis in this review. Similarly, studies that focused on more than one component of type 2 diabetes management were included if physical activity was included and it was possible to separate the data for analysis in this review. Studies only reporting on the effectiveness of physical activity interventions were excluded, along with studies not reporting HCP perspectives on the experience of physical activity promotion with adults with type 2 diabetes or only reporting patient perspectives. Studies not including a physical activity element, not written in English, or protocols and conference reports were also excluded.

3.2.2 Search Strategy

A comprehensive search strategy was developed to identify published and unpublished studies. The first stage involved consulting the Cochrane evidence-based guidelines for a systematic review. This process involved mapping the research question onto relevant elements using 'PIO' (Population/problem/patient; intervention/issue; outcome), which were based on three key concepts, HCPs responsible for the care of patients with type 2 diabetes, physical activity and intervention. Next, an iterative process was used to enter the PIO terms, sourced from Cochrane, into the NCBI resources MeSH (Medical Subject Heading) database to find the MeSH terms and all other terms within the tree hierarchy. Then, an analysis of keywords used to describe each article was conducted, synonyms and acronyms of each word were identified e.g., type 2 diabetes, diabetes mellitus, T2DM. Table 3.1 shows the MeSH headings, and Boolean search operators used for each component of PIO. In the first instance, barrier and facilitator terms were included in the search strategy however, a preliminary test of these terms resulted in increased sensitivity and reduced precision, either retrieving non-relevant articles or missing relevant ones, therefore they were subsequently removed from the

search strategy. For each database, the structure of the search strategy remained the same. However, the search terms required adaptions between the databases as they used different controlled vocabularies to index the articles; for example, MEDLINE uses MeSH, whereas PsycINFO uses Thesaurus of Psychological Index Terms, resulting in different terms and structures. As such, for a comprehensive search of the literature, it is imperative to consider the nuances of each database. For example, for this review the MeSH headings when searching for HCP-related terms were health personnel and health occupations, whereas the thesaurus terms in PsycINFO were health personnel and medical personnel. The full search strategies and adaptions of the terms for each database are presented in Appendix E.

Table 3.1

Search Terms Based on the PIO Framework for the MEDLINE and PubMed Searches

PIO criteria	Search term
Patient/population/ problem	Health personnel* OR Health occupations* AND Diabetes mellitus OR Type 2 OR type 2 diabetes* or type 2 diabetes mellitus* OR t2dm*
Intervention/issue	Exercise* OR Sports*OR Sedentary behavio#r* OR Exercise therapy* OR Physical fitness* OR Lifestyle*
Outcome	Intervention* OR early medical intervention* OR internet based intervention* OR health promotion* OR patient care management* OR counsel#ing* or counsel* OR program evaluation* OR health education* OR delivery of health care*

3.2.3 Information Sources

Online searches were conducted in MEDLINE, PubMed, CINAHL, PsycINFO, and Web of Science, and grey literature sites Ethos, Open Grey, and Google Scholar using the terms identified from the PIO criteria in Table 3.1. After screening and selection, the reference lists of included studies were also screened for additional studies that met the eligibility criteria.

All searches were limited to the English language only, human studies, and to ensure the scope and relevance of the findings to the review question, the search was conducted without any restrictions on the date range, covering the period from 1951 to 2020 (MacFarlane et al., 2022).

3.2.4 Study Selection

Two additional reviewers independently screened titles and abstracts and full texts for eligibility to ensure methodological rigour and transparency, as is the gold standard for systematic reviews (Higgins & Thomas, 2023; Stoll et al., 2019). The process followed was as follows. After searching for eligible studies, all identified citations were imported to EndNote X7, and all duplicates were identified and removed. The study selection began with screening the titles and abstracts of all papers retrieved from the searches. All eligible papers were then imported to Covidence, an online data screening and extraction tool and were independently screened by a second reviewer against the inclusion criteria. The full manuscripts of studies that met the inclusion criteria were retrieved and imported into Covidence. The full manuscripts were examined against the inclusion criteria and independently screened by a third reviewer. Full-text studies that did not meet the inclusion criteria were excluded, and the reason for exclusion was documented (Figure 3.1). If consensus was not reached, any disagreements were discussed and resolved by consensus or discussed with another reviewer (as required). If additional information was needed or if only protocols were available, the study authors were contacted by email to request relevant information in order to determine the paper's eligibility.

3.2.5 Assessment of Methodological Quality

The assessment of the quality of all full-text studies included in the review was conducted by the author of this thesis. Quantitative studies, quantitative components of mixed-method studies, qualitative studies, and qualitative components of mixed-method studies were appraised using the standardised JBI critical appraisal tools (Lockwood et al., 2017). For quantitative studies, the checklist for analytical cross-sectional studies was used. For qualitative studies, the checklist for qualitative research was used. The JBI checklist for qualitative research comprises 10 criteria encompassing various dimensions such as the research question, design, recruitment approach, data collection methods, researcher-participant dynamics, ethical considerations, data analysis, findings, findings' applicability, and research impact (Appendix F). The JBI checklist for analytical cross-sectional studies is comprised of eight questions that assess participant inclusion criteria, study design, measurement of exposure and outcome variables, strategies to address confounding factors, and the approach to statistical analysis and reporting of the results (Appendix G). Responses to each question can be categorized as yes, no, unclear, or not applicable for each critical appraisal checklist. All empirical articles meeting the eligibility criteria were included in the systematic review regardless of the quality or robustness of the methodological approach.

When assessing the quality of the included studies each study was reviewed and scored based on the relevant JBI criteria. Studies were given a score of one when the JBI criterion was met or 0 if it was not met or unclear; for qualitative studies, the total score is 10, and for quantitative studies, the total possible score is eight. For each study, a summary quality score was computed based on the percentage of checklist criteria that were fulfilled. Studies were classified as low, moderate or high quality based on the ranges of summary scores being 0-39%, 40 – 69%, and≥70%, respectively (Zhang et al., 2021). A second review author independently assessed 100% of all studies. Minor differences in scoring regarding study

quality were resolved with discussion.

3.2.6 Data Extraction and Analysis Plan

As discussed in more detail in Chapter Two of this thesis, data were first extracted deductively using framework synthesis (Brunton et al., 2020; Dixon-Woods, 2011) and content analysis (Krippendorf, 2018), with the TDF as the a priori framework (Atkins et al., 2017). This approach provides a systematic method to integrate established frameworks into the research process, which enables a focused, yet comprehensive examination of a topic (Brunton et al., 2020). The framework synthesis approach utilises a five-stage deductive and inductive approach to code and analyse extracted data, which consists of 1) familiarisation, 2) identification of the thematic framework, 3) indexing, 4) charting, and 5) mapping and interpretation. The approach taken at each step in discussed in detail in Chapter Two of this thesis and described in brief below.

Stage One: Familiarisation

This was an iterative process that involved reading and re-reading the included studies to ensure a comprehensive understanding of the content and that all barriers and facilitators were identified.

Stage Two: Framework Selection

The TDF (Atkins et al., 2017) was used as an a priori framework to extract data from included studies, whereby for coding purposes the 14 domains of the TDF represented the parent node and the barriers or facilitators the child nodes. As discussed in Chapter Two of

this thesis the TDF was also selected as it offers a systematic and comprehensive opportunity to integrate theory into the understanding of HCPs barriers and facilitators to physical activity promotion.

Stage Three: Indexing

Firstly, the contextual details of the included studies were captured using an extraction form developed for the purpose of this review (Appendix B). Data were extracted from both qualitative and quantitative studies and where necessary, in accordance with the JBI convergent integrated approach to MMSRs (discussed in detail in Chapter Two of this thesis); numerical data was qualitized (transformed from numerical to textual description or narrative interpretations) (Stern et al., 2020). The extracted data, including those that were qualitized, were imported to Atlas.ti and mapped to the TDF domain they were judged best to represent. At this point, all three reviewers met to verify and discuss 20% of the coded data to ensure agreement with the coding process.

Stage Four: Charting

At this stage an inductive analysis was conducted using thematic synthesis (Thomas & Harden, 2008). Similar data within TDF domains were synthesised and themes and subthemes were developed, in accordance with the guidance from Thomas and Harden (2008). The rationale for the use of thematic synthesis and the steps it entails have been discussed in detail in Chapter Two. However, in brief, thematic synthesis was selected as it is a recommended method for undertaking the type of evidence synthesis conducted in this systematic review (Flemming & Noyes, 2021). Furthermore, it offers a flexible yet thorough approach to inductive coding and analysis using a set of established methods and techniques to identify key recurring themes and patterns in qualitative data (Thomas & Harden, 2008).

There are three key components to thematic synthesis; the first stage, line-by-line coding of the data, was completed at stage three of the framework synthesis described above. Component two of thematic synthesis, generating descriptive themes that stay close to the data and component three, generating analytical themes that involve the reviewer's interpretation of the descriptive themes considering the review question, were conducted at this charting stage of the framework synthesis.

Stage Five: Mapping and Interpretation

At this final step, the derived analytical themes were written up and presented in narrative form. In addition, the TDF domains were also judged for importance based on three established importance criteria: 1) domain frequency (number of studies in each domain), 2) elaboration (number of themes and subthemes), and 3) evidence of conflicting beliefs within the studies (Atkins et al., 2020). This enabled not only a comprehensive understanding of the barriers and facilitators to physical activity promotion in accordance with the TDF domains, but also insight into the domains that most influenced HCPs physical activity promotion.

3.3 Results

3.3.1 Search Results

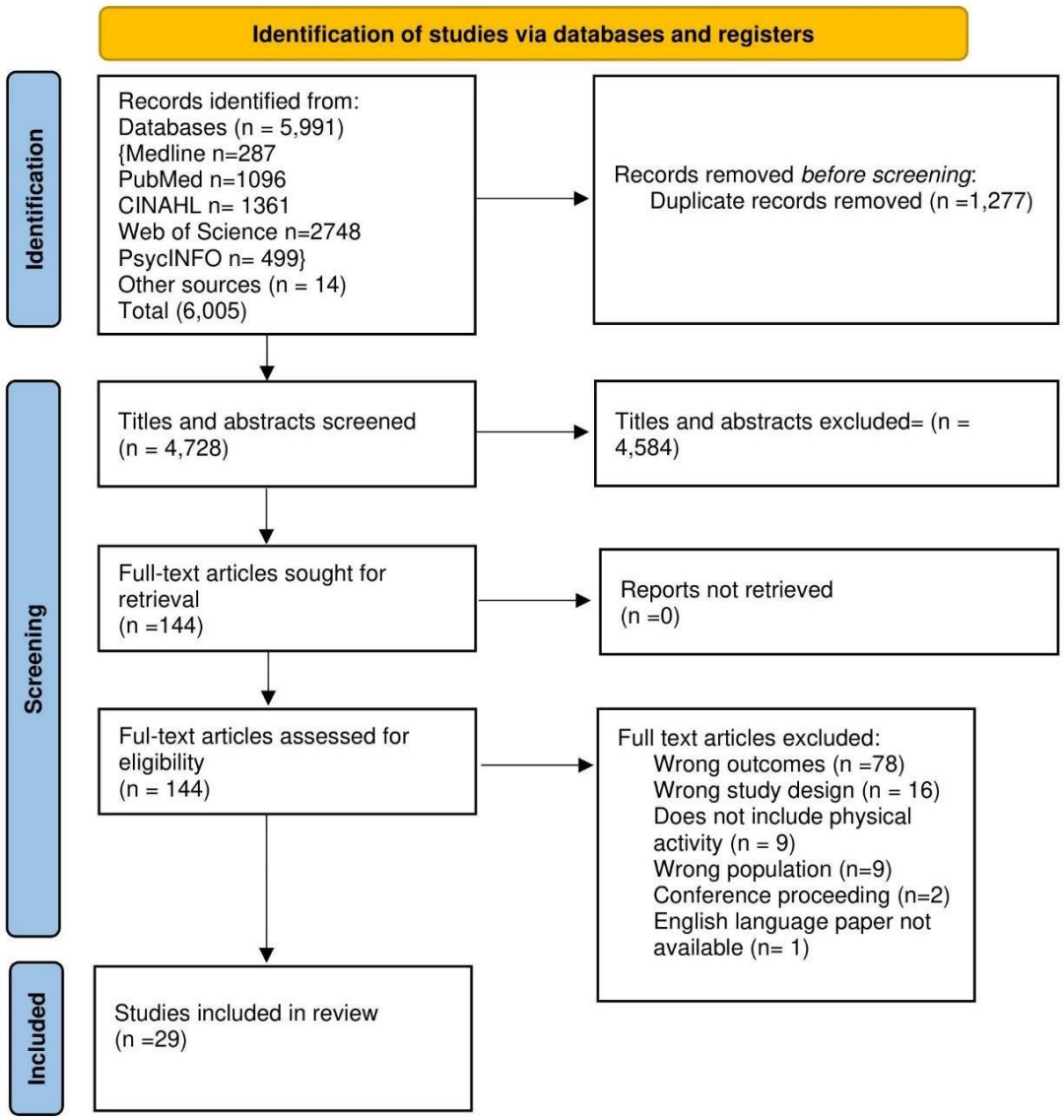
A total of 6,005 citations were retrieved from the database searches. After removing 1277 duplicates, the titles and abstracts of 4,728 studies were screened, and 144 full-text articles were retrieved and reviewed. One-hundred and fifteen articles were excluded, and 29 articles published between 1993 and 2019 fulfilled the inclusion criteria and were included in the review (Figure 3.1).

The inter-rater agreement scores were automatically calculated by the Covidence

software tool at both the title and abstract review stage and the full-text review stage. Inter-rater reliability is calculated by Covidence using statistical methods, such as Cohens Kappa Coefficient, which measures agreement beyond change with values ranging from -1 (complete disagreement) to 1 (perfect agreement) and considers the number of reviewers, the number of categories being rated and the level of agreement between the reviewers (Fothergill, 2024). At the title and abstract review stage for this MMSR, the inter-rater agreement score was calculated by Covidence as fair (Cohens $k = 0.29$), and moderate at the full-text review stage (Cohens $k = 0.50$). Inter-rater reliability within systematic reviews pertains to the reproducibility or measurement of the consistency of decisions made between two reviewers, and it is a crucial component in ensuring validity and consistency within the review process (Cook & Beckman, 2006). A high inter-rater reliability (≥ 0.61) suggests that the review raters are consistent in their judgments and agreements. In contrast, a lower inter-rater reliability score, referred to as fair or none to slight (≤ 0.40) indicates that the reviewers have varying interpretations or subjective judgements when evaluating the same phenomenon (Belur et al., 2021). The disagreements were either resolved by consensus or discussed with a third reviewer.

Figure 3.1

PRISMA Flow Diagram Showing the Process of Identifying Eligible Studies



Of the 29 articles included in the review, 15 were qualitative studies (Abouammoh et al., 2016; Alghafri et al., 2017; Avery, 2014; Berry et al., 2012; Carbone et al., 2007; Jones et al., 2014; Matthews et al., 2014; Miller & Beech, 2009; Mogre et al., 2019; Paiva et al., 2019; Raaijmakers et al., 2013; Stuij, 2018; Svenningsson et al., 2011; Torres et al., 2010; Zimmermann et al., 2018), and 13 were quantitative studies (Armstrong-Shultz et al., 2001; Dillman et al., 2010; Doehring et al., 2016; Dranebois et al., 2019; George et al., 2006; Gross

et al., 2007; Hixenbaugh & Winkley, 2001; Hnatiutk et al., 2012; Karduck & Chapman-Novakofski, 2018; Khairnar et al., 2018; Lanhers et al., 2015; Powell et al., 2016; Ruby et al., 1993), and one was a mixed-methods study (Larme & Pugh, 1998). Table 3.2 provides an overview of the characteristics of the included studies, the characteristics in this table have been presented in line with how they were reported in each study.

Table 3.2

Characteristics of the Included Studies

Author, date	Country/Setting	Research aim	Study characteristics	Participant characteristics	Findings
Abouammoh et al. (2016)	Saudi Arabia Hospital and primary healthcare	To explore the experiences of GP international medical graduates (IMG) providing lifestyle advice to people with type 2 diabetes and to raise awareness about cross-cultural interaction	Qualitative Focus groups and one-to-one interviews Purposive sampling The analytic technique used was not stated	Total *n* = 47 IMGs from the hospital setting *n* = 21 GP IMG graduates working in primary care *n* = 15 IMG that took part in follow up interviews *n* = 11	HCPs were aware of local cultural norms and believed they were providing culturally appropriate advice to patients. Yet, they were aware that patients felt that their advice was not always culturally relevant, and this affected their confidence in HCPs' ability to provide guidance in this area of care
Alghafri et al. (2017)	Oman Primary health care	To determine the perceptions of HCPs on physical activity promotion for adults with type 2 diabetes within a local clinical primary care setting in Oman	Qualitative Focus groups Purposive sampling Thematic analysis	Total *n* = 29 Family physicians *n* = 17 Nurses *n* = 5 Health educators *n* = 3 Dieticians *n* = 4	Key barriers identified were related to the healthcare system (e.g., lack of physical activity guidelines), individual factors (e.g., social norms that discourage activity), and environmental limitations (e.g., insufficient facilities). Recommendations included assigning the role of physical activity promotion to dietitians and using technology (e.g. pedometers) to support patients
Armstrong-Shultz et al. (2001)	USA Not specified	To compare and contrast patient and practitioner barriers to following meal or exercise plans and identify patient characteristics related to their perceived barriers	Quantitative Cross-sectional survey, questionnaire – developed by the researchers Purposive sampling Descriptive statistics, ordinal logistic regression, principal components factor analysis.	Total *n* = 143 Diabetes educators *n* = 143	HCPs' perceptions of patient barriers that would stop them from promoting physical activity (% of HCPs): A lack of time (52%), physical limitations (49%), physical pain (48%), balancing exercise with food intake (44%), low priority given to exercise (41%), dependence on weather conditions (37%), lack of exercise space (35%), physical discomfort (34%), inconvenient location for exercise (32%), lack of necessary equipment (28%), a dislike of sweating (20%), concerns about being overweight (13), concerns about low blood sugar (11%).

Avery (2014)	UK Primary care	To explore the experiences of HCPs in promoting physical activity and understand their training needs	Qualitative Semi-structured interviews Convenience sampling Content analysis	Total *n* = 5 GP *n* = 3 Specialists in diabetes/practice lead for diabetes *n* = 2	Barriers included difficulties communicating complex medical information to patients, low patient engagement and reluctance to take responsibility for managing their condition, a lack of training, a lack of tools to assess patients and that prescribing mediation was more straightforward than physical activity promotion
Berry et al. (2012)	Canada Unclear	To examine diabetes educators' understanding of how clients understand and use knowledge regarding nutrition and physical activity, the barriers diabetes educators face when translating lifestyle guidelines, and what factors the educators believe influence the uptake of guidelines by those with type 2 diabetes	Qualitative Semi-structured interviews Typical case sampling Cross case analyses at the individual educator level	Total *n* = 13 Registered nurses *n* = 2 Registered dietitians *n* = 7 Manager in charge of developing and reviewing educational materials *n* =1 Role not specified *n* = 3	Influences on HCPs physical activity promotion included the complexity of psychological, cultural, and social influences on patients' abilities to adopt new behaviours, limited resources, and a lack of support from exercise specialists and other HCPs
Carbone et al. (2007)	USA Health centre	To examine HCPs perceptions of patient barriers and facilitators to adopting self- management strategies and experiences supporting patients' self-management strategies	Qualitative Focus groups Purposive sampling Content analysis/topical analysis	Total *n* = 8 Medical paraprofessionals nurses, educators, outreach workers, physicians, physician assistants, and nurse practitioners.	Barriers reported by HCPs included patients attitudes towards physical activity, limited safe spaces for physical activity, limited access to exercise facilities integrating exercise into the patients' daily routines, and difficulty in effectively communicating the benefits of regular physical activity
Dillman et al. (2010)	Canada Unclear	To examine diabetes educators' perceptions of their abilities, attitudes, and difficulties related to physical activity and exercise counselling. To explore diabetes educators' perceptions of their patients' abilities and attitudes related to physical activity and exercise in managing their diabetes. Finally, examine the self-reported barriers diabetes educators face concerning physical activity and exercise counselling	Quantitative A cross-sectional survey, questionnaire developed by the researchers Purposive sampling Descriptive, frequency analysis, and MANOVA	Total *n* = 119 Diabetes educators *n* = 119	Barriers reported as % (n), mean frequency (1-4 scale), mean impact on counselling (1-4 scale) Lack of time to counsel 65 (77), 3.22, 2.70 Lack of interest by patient 34 (40), 3.00, 2.92 Lack of resources - 30 (36), 3.45, 3.05 HCP lack of ability/knowledge - 29 (34) =, 3.05, 2.69 Low counselling and referral efficacy (Wilk's lambda=0.84, p=0.003).

Doehring et al. (2016)	Canada Primary, secondary, tertiary and community care	To examine the knowledge, attitudes, and practices of physiotherapists in preventing and managing diabetes	Quantitative A cross-sectional survey, questionnaire Convenience sampling Descriptive statistics using Microsoft Excel and percentages calculated	Total *n* =401 Physiotherapists *n* = 401	Fewer than half (46.6%) of the respondents knew the recommended amount of weekly aerobic activity (150 min). 16.7% of physiotherapists were aware of the Canadian Diabetes Association Clinical Practice Guidelines 76.3% of participants reported that their education had not adequately prepared them to effectively manage people with diabetes.
Dranebois et al. (2019)	French Guiana Primary care	To evaluate the barriers, facilitators and practices of GPs regarding the prescription of physical activity for patients with type 2 diabetes	Quantitative A cross-sectional survey, questionnaire Purposive sampling Descriptive statistics, Chi-squared independence tests and Fisher's exact test	Total *n* = 73 Physicians *n* = 73	Barriers identified by participants included lack of structure (91.8%), lack of training and knowledge (80.8%), unsuitable support (75.3%), lack of support (74%), refusal of the patient' (71.2%), lack of time (69.9%), language barrier' (58.9%), no dedicated pricing' (54.8%), and not a reason for consultation' (53.4%)
George et al. (2006)	USA Inpatient and outpatient settings	To determine if differences existed between non-certified diabetes educator registered dietitians (non-CDE-RDs) and CDE-RDs certified diabetes educator registered dietitians (CDE-RDs)	Quantitative A cross-sectional survey, questionnaire Purposive sampling Descriptive statistics, frequencies, independent samples t-test and two-way ANOVA and post hoc tests on significant findings	Total *n* =167 Non-CDE RDs *n* = 73 CDE RDs *n* = 94	Knowledge scores: CDE-RDs 11.8 vs non-CDE-RDs 11.1 Design scores: CDE-RDs 33.5 vs. non-CDE-RDs 29.2 Content scores: CDE-RDs 26.9 vs non-CDE-RDs 22.4 Total exercise teaching scores: CDE-RDs 60.4 vs non-CDE-RDs 51.6
Gross et al. (2007)	Israel Community-based primary care	To examine primary care physicians' self- efficacy in counselling diabetic patients on lifestyle behaviours and the association between self-efficacy and self-reported counselling practices for these patients	Quantitative A cross-sectional survey, questionnaire Purposive sampling Chi-squared tests and logistic regression	Total *n* = 743 GP *n* = 238 Family physician *n* = 342 Internist/other *n* = 163	Self-efficacy on exercise counselling: 27% of physicians felt they could very effectively influence their patients to exercise Self-efficacy impact on exercise counselling: Physicians with high self-efficacy discussed exercise with almost all their patients 85.4% of the time, compared to 72.4% for those with low self-efficacy

Hixenbaugh and Winkley (2001)	UK Not specified	To compare patient and HCPs perceptions of the aspects of diabetes self-management most frequently omitted by patients	Quantitative A cross-sectional survey, questionnaire Purposive sampling Between-group analyses X^2- test.	Total *n* = 36	91.4% of HCPs believed that patients were likely to omit regular exercise from diabetes management. 85.7% of HCPs considered patients' emotional stress as a barrier. 74.3% of HCPs reported lifestyle interference as a barrier to physical activity, resulting in pessimism from them about promoting physical activity. 48.6% identified patients' lack of time as a barrier.
Hnatiuk et al. (2012)	Canada Primary care	To examine perceptions of physical activity support provided by physicians, nurses and other HCPs to adults with type 2 diabetes and compare these perceptions with those of the patients	Quantitative The researchers developed a cross-sectional survey questionnaire the physical activity support questionnaire Purposive sampling Kruskal -Wallis	Total n = 48 Nurses *n* = 18 Physician *n* = 15 Other HCPs *n* = 15	17% of healthcare providers (HCPs) could identify the Canadian Diabetes Association (CDA) guidelines for physical activity without prompting. 12% of HCPs identified Canada's Physical Activity Guide (CPAG) unprompted.
Jones et al. (2014)	Australia Not specified	To identify barriers and facilitators to effective type 2 diabetes self-management in rural settings with patients and HCPs	Qualitative Semi-structured telephone interviews Purposive sampling Inductive thematic analysis	Total *n* = 18 Diabetes educators *n* = 10 Podiatrists *n* = 2 Nurses *n* = 3 Dieticians *n* = 3	Barriers include patients' time management, motivation, denial of illness, access to resources, community attitudes and patient and HCPs education gaps. Supportive relationships were reported as facilitators.
Karduck and Chapman-Novkofski (2018)	USA Not specified	To develop and administer a questionnaire examining factors associated with health app use, recommendations, and effectiveness	Quantitative The researchers developed a cross-sectional survey questionnaire -The Clinician Apps Survey Purposive sampling Descriptive statistics, Chi-square test of independence	Total *n* = 719 Clinicians *n* =719	Fifty-eight per cent of clinicians recommended apps to track physical activity Sixty-two per cent of clinicians used apps for assessing physical activity among their patients Fifty-eight per cent believed apps were superior to traditional methods for tracking physical activity

Khairnar et al. (2018)	USA Primary care	To examine HCPs perspectives on barriers and facilitators to type 2 diabetes self-management	Quantitative A cross-sectional survey, questionnaire – developed by the researchers Purposive sampling Descriptive statistics, frequencies and percentages	Total *n* = 24 Physicians *n* = 21 Physician assistant *n* = 1 Transition of-care liaison *n* = 1 Nurse practitioner *n* = 1	95.2% of HCPs considered regular moderate exercise extremely important for diabetes self-management 85.71% of HCPs perceived regular moderate exercise as at least difficult for their patients 76.19% of HCPs believed that less than 50% of their patients were adherent to regular moderate exercise
Lanhers et al. (2015)	France Not stated	To examine if there was a link between physical activity in type 2 diabetic patients and GPs' attitudes to physical activity promotion	Quantitative A cross-sectional survey, questionnaire Cluster sampling Descriptive statistics, frequencies, percentages, Fischer's exact test, Spearman's correlation coefficient test, Wilcoxon test, one-way Kruskal- Wallis ANOVA, random effect models	Total *n* = 48 GPs *n* = 48	A significant correlation where higher barrier scores among GPs are associated with higher barrier scores among their type 2 diabetes patients ($p = 0.03$) A high intra-class correlation of 34% indicated a significant influence of GPs' attitudes towards prescribing physical activity on their patients' activity levels
Larme and Pugh (1998)	USA Primary care	To examine attitudes of primary care providers towards diabetes care	Mixed-methods A cross-sectional survey, questionnaire One to one semi-structured interviews Purposive sampling Non-parametric quantile test Content analysis	Total *n* = 31 Physicians *n* = 24 Mid-level providers (family nurse practitioners and physician assistants) *n* = 7	Diabetes was considered significantly more challenging to treat compared to hypertension, with 24 out of 30 respondents rating it above 5.5 ($p < 0.001$), and angina, with 20 out of 30 rating it above 5.5 ($p = 0.03$). Additionally, the majority rated hyperlipidemia (18 out of 30) and arthritis (18 out of 30) as easier to manage than diabetes. The participants reported a lack of training to support patients in changing their physical activity behaviour, which was exacerbated by patients ingrained habits and the complexities of treatment
Matthews et al. (2014)	UK Primary and secondary care	To explore the views of HCPs on physical activity promotion in routine diabetes care	Qualitative Semi-structured interviews and online survey Purposive sampling Interpretative phenomenological analysis	Total *n* = 16 for the online survey (open-ended questions) Two management *n* = 2 Three consultant physicians *n* = 3 Six diabetes nurse/practice nurses *n* = 6 GPs *n* = 4 Anonymous *n* = 1 Total *n* = 7 for interviews Participants were from primary care, secondary care, and health service management.	Key findings included a lack of structure for physical activity promotion, insufficient resources, lack of role clarity, inadequate behaviour change training, lack of awareness of a pilot referral programme and difficulties prioritising physical activity in routine appointments

Miller and Beech (2009)	USA Rural community centres	To evaluate rural HCPs physical activity counselling experiences and their perceptions of motivational interviewing (prior to training)	Qualitative Focus groups Purposive sampling Content-based analysis and thematic coding	Total *n* = 33 Nurses Dieticians Certified diabetes educators Physician	Participants reported low comfort with physical activity counseling due to lack of knowledge or feeling hypocritical about their own inactivity. Those who were regularly active and had counseling experience felt more comfortable. While motivational interviewing was seen as promising, time constraints and limited provider input were noted as barriers
Mogre et al. (2019)	Ghana Tertiary care	To explore HCPs and patient perspectives on barriers to self-management for type 2 diabetes	Qualitative Semi-structured interviews Purposive sampling and snowballing techniques Constant comparative method	Total *n* = 14 Nurses *n* = 8 Physician assistants or prescribers *n* = 2 Nutrition officers *n* = 2 Dieticians *n* = 2	HCPs' perceptions of patients were barriers to physical activity promotion, including patients' lack of motivation or willingness to exercise, beliefs that diabetes is caused by spiritual forces, inadequate family support, social stigma, low-income levels, limited access to exercise facilities, busy work schedules, and long distances to hospitals
Paiva et al. (2019)	Portugal Primary and tertiary care	To explore patient and provider perceptions of barriers and facilitators to patient-centred communication for type 2 diabetes	Qualitative Focus groups Purposive sample Grounded theory	Total *n* = 33 Primary care physicians, nurses, nutritionists, pharmacists, ophthalmologists, vascular surgeons, psychologists, nephrologists, endocrinologists	Patients complications were barriers to HCPs providing physical activity advice. Increasing patients access to resources to support behaviour change were facilitators
Powell et al. (2016)	USA Primary care, secondary care, and tertiary care	To examine factors influencing physical activity counselling by diabetes educators delivering diabetes self-management/support	Quantitative Cross-sectional survey study, questionnaire Purposive sampling Descriptive statistics, Kruskal-Wallis H test, Mann-Whitney U test, post hoc analysis	Total *n* = 119 Nurses *n* = 72 Nutritionist *n* = 34 Pharmacist *n* = 7 Health educators *n* = 3 Physician *n* = 2 Exercise physiologist *n* = 1	Diabetes educators spent approximately 14.5 minutes on physical activity, less than on diet and medication management Seventy-four per cent know the moderate-intensity aerobic activity guideline, 20.5% for vigorous intensity, and 62.8% for resistance training 54.7% of educators are very confident in their physical activity counselling Key challenges include patient engagement and limited time during sessions

Raaijmakers et al. (2013)	The Netherlands Primary care Secondary care	To explore HCPs perceived barriers to diabetes care	Qualitative One to one semi-structured interviews Random sampling Method of analysis not stated	Total *n* = 18 Family physicians *n* = 3 Practice nurses *n* = 3 Diabetes nurses *n* = 2 Dieticians *n* = 3 Physical therapists *n* = 2 Internal medicine *n* = 3 Pharmacists *n* = 2	Lack of role clarity, lack of knowledge and awareness of local community resources and lifestyle programmes and collaborative opportunities with physical activity experts were reported as barriers. Compiling list of local physical activity resources for patients was a facilitator
Ruby et al. (1993)	USA Inpatient and outpatient	To examine registered nurses, diabetes educators exercise teaching programs for elderly patients with non-insulin-dependent diabetes mellitus (NIDDM)	Quantitative A cross-sectional survey, questionnaire Random sampling Descriptive statistics, student t-tests, Mann Whitney U tests, Spearman's Rho and Pearson's r	Total *n* = 197	46% of educators cited lack of resources as a primary barrier. 30% noted a lack of specific knowledge on exercise prescription. 29% mentioned negative stereotypes, like ageism, affecting exercise teaching for elderly clients Facilitators included experience and education. RN, CDEs with over 30 weekly work hours and regular continuing education had more comprehensive programs
Stuij, (2018)	The Netherlands Primary and secondary care	To provide in-depth insight into the experiences of Dutch HCPs delivering physical activity counselling to type 2 diabetic adults	Qualitative One to one interviews Purposive sampling Narrative approach	Total *n* = 24 Physiotherapists *n* = 8 Practice nurses *n* = 5 Diabetes nurses *n* = 3 GPs *n* = 2 Internist *n* = 1 Diabetes specialist nurse *n* = 1 Dietician *n* = 1 Exercise coach *n* = 1 Exercise expert *n* = 1 Health specialist *n* = 1	Barriers included difficulty understanding patients perspectives, socioeconomic and cultural differences, patients lack of motivation, role clarity, lack of time, knowledge and training gaps. Facilitators included goal setting, personal experience with physical activity, motivational interviewing and initiating walking programmes.
Svenningsson et al. (2011)	Sweden Primary health care and county medical care settings	To gain a deeper understanding of HCPs main issues in consultations with diabetic and obese patients and how these issues could be overcome	Qualitative Group and individual interviews Open sampling and theoretical sampling Grounded theory	Total *n* = 20 Nurses *n* = 13 Physicians *n* = 4 Dieticians *n* = 2 Physiotherapist *n* = 1	Barriers included time constraints, knowledge gaps a focus on medical goals, resistance from patients and emotional burden. Facilitators included coaching and supportive approaches, individualised care strategies and collaboration with patients

Torres et al. (2010)	Brazil Primary care	To explore the perception of HCPs on their role in patient education for people with type 2 diabetes	Qualitative – Case study Focus groups Purposive sampling Thematic analysis	Total *n* = 23	Barriers included perceptions of patients lack of time to adhere to healthy life habits, lack of money, absence of appropriate places for physical activity, and individual passivity towards treatment
Zimmermann et al. (2018)	Australia Not stated	To explore the consultation practices of accredited exercise physiologists with people with type 2 diabetes and the recommendations they provide to promote long-term adherence to physical activity	Qualitative Focus groups and semi-structured interviews Purposive sampling Thematic analysis	Total *n* = 21	Barriers included a focus on medical information, a lack of psychosocial assessment tools, limited experience with behaviour change techniques, time constraints and client resistance. Facilitators included experience and rapport building, the use of motivational interviewing, adopting a person-centred approach and group exercise sessions

3.3.2 Quality Appraisal of Included Studies

Tables 3.3 and 3.4 below present the details of the quality assessment for the quantitative studies and the qualitative and mixed-method studies, respectively, for each of the checklist criteria (Appendix F and G). Fourteen qualitative studies were appraised to be of high quality, and one was appraised to be of moderate quality (Miller & Beech, 2009); the qualitative component of the mixed-methods study was also appraised as moderate quality (Larme & Pugh, 1998) according to the JBI critical appraisal tool for qualitative studies (JBI, 2020). All the included qualitative studies demonstrated congruity between the research methodology and the data collection methods, and the interpretation of the results. Furthermore, the conclusions drawn in all qualitative studies flowed from the analysis or interpretation of the data. All but one study (Abouammoh et al., 2016) clearly demonstrated congruity between either the research methodology and the research question or objectives. With the exception of two studies (Larme & Pugh, 1998; Miller & Beech, 2009), all others met the criteria of congruity between the research methodology and the analysis. All qualitative studies met the criteria regarding the representation of participants being adequately represented and demonstrating ethical approval of an appropriate body except Larme and Pugh (1998). The influence of the researcher was addressed in seven studies (Abouammoh et al., 2016; Alghafri et al., 2017; Carbone et al., 2007; Mogre et al., 2019; Paiva et al., 2019; Stuij, 2018; Svenningsson et al., 2011). For all the included qualitative studies, however, it was unclear if there was congruity between the philosophical perspective and the research methodology and no studies located the researcher culturally or theoretically.

According to the JBI critical appraisal tool for analytical cross-sectional studies (JBI, 2020) three of the quantitative studies were appraised as high-quality (Armstrong-Shultz et al., 2001; George et al., 2006; Gross et al., 2007), 10 were moderate quality (Dillman et al., 2010; Doehring et al., 2016; Dranebois et al., 2019; Hixenbaugh & Winkley, 2001; Hnatiuk

et al., 2012; Karduck & Chapman-Novkofski, 2018; Khairnar et al., 2018; Lanhers et al., 2015; Powell et al., 2016; Ruby et al., 1993), and the quantitative component of the mixed-methods study was appraised as low quality (Larme & Pugh, 1998). All studies used an appropriate statistical analysis. The inclusion criteria were clearly defined in most studies except for Dillman et al. (2010), Doehring et al. (2016), Khairnar et al. (2018) and Larme and Pugh (1998). Except for Lanhers et al. (2015), all studies described the setting and subjects in detail. Seven studies demonstrated use of objective, standard criteria for measuring the condition (physical activity promotion for patients with type 2 diabetes) (Armstrong-Shultz et al., 2001; Dillman et al., 2010; Doehring et al., 2016; Dranebois et al., 2019; George et al., 2006; Gross et al., 2007; Hixenbaugh & Winkley, 2001). Confounding factors were identified in two studies (Doehring et al., 2016; Gross et al., 2007); however, strategies to deal with these were not identified. Outcomes were measured in a valid and reliable way in four studies (Armstrong-Shultz et al., 2001; George et al., 2006; Hixenbaugh & Winkley, 2001; Khairnar et al., 2018), but were unclear in the remaining studies. No studies were excluded on the grounds of quality.

Table 3.3

Quality Assessment of the Qualitative and Mixed-Methods Studies

	Qualitative Studies										Score	%	Quality
Study	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**			
Abouammoh et al. (2016)	U	U	Y	Y	Y	N	Y	Y	Y	Y	7/10	70	High
Alghafri et al. 2017)	U	Y	Y	Y	Y	N	Y	Y	Y	Y	8/10	80	High
Avery (2014)	U	Y	Y	Y	Y	N	N	Y	Y	Y	7/10	70	High
Berry et al. (2012)	U	Y	Y	Y	Y	N	N	Y	Y	Y	7/10	70	High
Carbone et al. (2007)	U	Y	Y	Y	Y	N	Y	Y	Y	Y	8/10	80	High
Jones et al. (2014)	U	Y	Y	Y	Y	N	N	Y	Y	Y	7/10	70	High
Larme and Pugh (1998)	U	Y	Y	N	Y	N	N	N	N	Y	4/10	40	Moderate
Matthews et al. (2014)	U	Y	Y	Y	Y	N	N	Y	Y	Y	7/10	70	High
Miller and Beech (2009)	U	Y	Y	N	Y	N	N	Y	Y	Y	6/10	60	Moderate
Mogre et al. (2019)	U	Y	Y	Y	Y	N	Y	Y	Y	Y	8/10	80	High
Paiva et al. (2019)	U	Y	Y	Y	Y	N	Y	Y	Y	Y	8/10	80	High
Raaijmakers et al. (2013)	U	Y	Y	Y	Y	N	N	Y	Y	Y	7/10	70	High

Stuij (2018)	U	Y	Y	Y	Y	N	Y	Y	Y	Y	8/10	80 High
Svenningsson et al. (2011)	U	Y	Y	Y	Y	N	Y	Y	Y	Y	8/10	80 High
Torres et al. (2010)	U	Y	Y	Y	Y	N	N	Y	Y	Y	7/10	70 High
Zimmermann et al. (2018)	U	Y	Y	Y	Y	N	N	Y	Y	Y	7/10	70 High

Table 3.4

Quality Assessment of the Quantitative and Mixed Methods Studies

Cross-Sectional Studies (Quantitative Studies)								Score	%	Quality
Study	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**			
Armstrong-Schultz et al. (2001)	Y	Y	Y	Y	N	N	Y	Y	6/8	75	High
Dillman et al. (2010)	U	Y	U	Y	N	N	U	Y	3/8	38	Moderate
Doehring et al. (2016)	N	Y	U	Y	Y	N	U	Y	4/8	50	Moderate
Dranenois et al. (2019)	Y	Y	U	Y	N	N	U	Y	4/8	50	Moderate
George et al. (2006)	Y	Y	N/A	Y	N	N	Y	Y	5/7	71	High
Gross et al. (2007)	Y	Y	N	Y	Y	Y	U	Y	6/8	75	High
Hixenbaugh and Winkley (2001)	Y	Y	U	Y	N	N	Y	Y	5/8	63	Moderate
Hnatiuk et al. (2012)	Y	Y	U	U	N	N	U	Y	3/8	38	Moderate
Karduck and Chapman-Novokofski (2018)	Y	Y	U	U	N	N	U	Y	3/8	38	Moderate
Khairnar et al. (2018)	N	Y	Y	Y	N	N	Y	Y	5/8	63	Moderate
Lanhers et al. (2015)	Y	N	Y	U	N	N	U	Y	3/8	38	Moderate

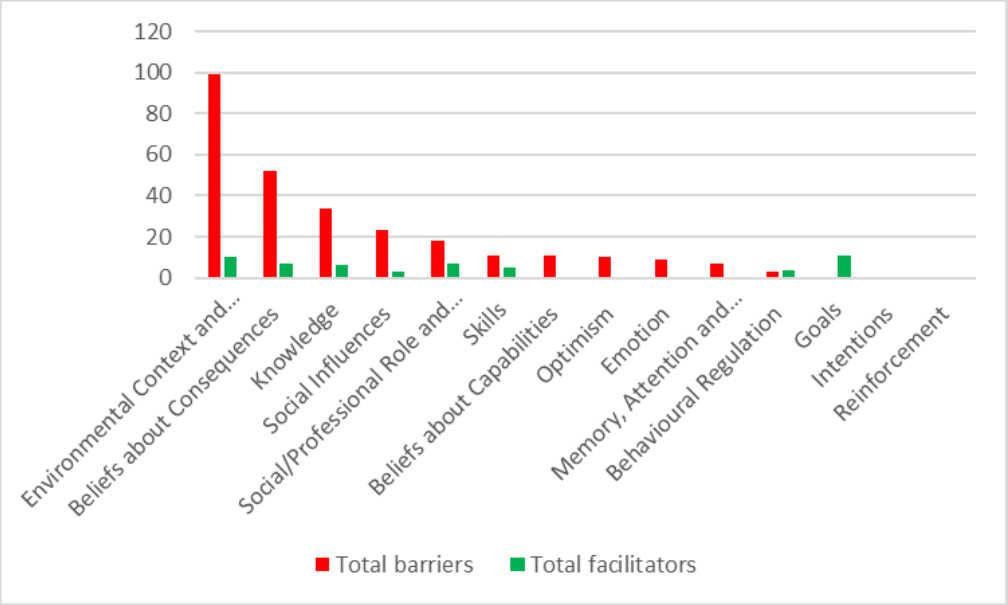
Larme and Pugh (1998)	N	Y	U	U	N	N	U	Y	2/8	25	Low
Powell et al. (2016)	Y	Y	U	U	N	N	U	Y	3/8	38	Moderate
Ruby et al. (1993)	Y	Y	Y	Y	N	N	U	Y	5/8	63	Moderate

3.3.3 Deductive Analysis

In total, 378 units of data were extracted; this comprised 240 qualitative units and 138 quantitative units. Ninety-eight of the quantitative units were qualitized, using the process described in Chapter Two. It was not necessary to qualitize all the quantitative data as extraction occurred at two levels: the statistical data (1st level) and the authors summary of the data (2nd level); only first-level data warranted qualitizing, as the authors summaries (2nd level data) were already in narrative form. In total, of these units of data, 261 barriers were coded, and 122 facilitators were coded. Of the 122 extracts coded as facilitators, 46 were suggestions made by HCPs about their beliefs about what they felt would support them with physical activity promotion. As a result, only 76 extracts (facilitators to physical activity promotion that HCPs had direct experience with) were included in the analysis section of this review. Those which were suggestions are further discussed at the end of the results section of this chapter. Barriers were identified in 11 TDF domains, Knowledge, Skills, Social/Professional Role and Identity, Beliefs about Capabilities, Optimism, Beliefs about Consequences, Memory, Attention and Decision Processes, Environmental Context and Resources, Social Influences, Emotion, and Behavioural Regulation. There were no barriers identified in the Goals, Intentions and Reinforcement domains. Facilitators were identified in eight TDF domains, Knowledge, Skills, Social/Professional Role and Identity, Beliefs about Consequences, Goals, Environmental Context and Resources, Social Influences, and Behavioural Regulation. There were no facilitators identified in the Beliefs about Capabilities, Optimism, Reinforcement, Intentions, Memory, Attention and Decision Processes, and Emotion domains (Figure 3.2).

Figure 3.2

Number of Barriers and Facilitators for each TDF Domain



3.3.4 The Ranked Importance of the Theoretical Domains Framework and COM-B Model

The importance of the influence of the TDF domains on HCPs' physical activity promotion (referred to as rank order) was determined by using three established importance criteria: domain frequency (number of studies identified in each domain), level of elaboration (number of themes/subthemes in each domain based on the inductive analysis) and conflicting beliefs (evidence of barriers and/or facilitators within domains) (Atkins et al, 2017; Patey et al., 2012). Table 3.5 presents the barriers and facilitators together; this demonstrates the evidence of conflicting beliefs (e.g., there are barriers and facilitators in a domain). This approach allows for importance to not only be based on frequency or perceived importance by HCPs but also on the disparities between HCPs' beliefs, which can guide intervention development (Atkins et al., 2020; Lawrenson et al., 2018). To provide insight into the differences between barriers and facilitators, Tables 3.6 and 3.7 present the ranking of the importance of the TDF domains for barriers and facilitators, respectively.

Table 3.5

Ranking of the TDF domains (with COM-B Model Component) According to Frequency, Elaboration and Conflicting Beliefs for Barriers and Facilitators

Ranking	TDF domain (COM-B component)	Frequency (no. of studies identified in max n = 29)	Elaboration (number of themes/ subthemes)	Evidence of conflicting beliefs (Yes/No)
1st	Environmental Context and Resources (physical opportunity)	20	8	Yes
Joint 2nd	Beliefs about Consequences (reflective motivation)	15	5	Yes
Joint 2nd	Knowledge (psychological capability)	15	5	Yes
Joint 3rd	Social/Professional Role and Identity (reflective motivation)	9	2	Yes
Joint 3rd	Skills (physical capability)	9	2	Yes
4th	Beliefs about Capabilities (reflective motivation)	9	1	No
5th	Social Influences (social opportunity)	8	2	Yes
6th	Goals (reflective motivation)	7	1	No
7th	Emotion (automatic motivation)	5	1	No
Joint 8th	Memory, Attention and Decision processes (psychological capability)	4	1	No
Joint 8th	Optimism (reflective motivation)	4	1	No
9th	Behavioural Regulation (psychological capability)	2	1	Yes
No ranking	Intentions (reflective motivation)	0	0	-
No ranking	Reinforcement (automatic motivation)	0	0	-

Table 3.6

Ranking of the TDF domains (with COM-B Model Component) According to Frequency, Elaboration and Conflicting Beliefs for Barriers

Ranking	TDF domain (COM-B component)	Frequency (no. of studies identified in max n = 29)	Elaboration (number of themes/ subthemes)	Evidence of conflicting beliefs (Yes/No)
1st	Environmental Context and Resources (physical opportunity)	19	8	Yes
2nd	Beliefs about Consequences (reflective motivation)	15	4	Yes
3rd	Knowledge (psychological capability)	14	4	Yes
Joint 4th	Skills (physical capability)	8	2	Yes
Joint 4th	Social Influences (social opportunity)	8	2	Yes
5tn	Beliefs about Capabilities (reflective motivation)	8	2	No
6th	Social/Professional Role and Identity (reflective motivation) opportunity)	6	2	Yes
7th	Emotion (automatic motivation)	5	1	No
Joint 8th	Memory, Attention and Decision Processes (psychological capability)	4	1	No
Joint 8th	Optimism (reflective motivation)	4	1	No
9th	Behavioural Regulation (psychological capability)	2	1	Yes
No ranking	Reinforcement (automatic motivation)	0	0	-
No ranking	Intentions (reflective motivation)	0	0	-
No ranking	Goals (reflective motivation)	0	0	-

Table 3.7

Ranking of the TDF domains (with COM-B Model Component) According to Frequency, Elaboration and Conflicting Beliefs for Facilitators

Ranking	TDF domain (COM-B component)	Frequency (no. of studies identified in max n = 29)	Elaboration (number of themes/ subthemes)	Evidence of conflicting beliefs (Yes/No)
1st	Goals (reflective motivation)	7	1	No
2nd	Environmental Context and Resources (physical opportunity)	6	2	Yes
3rd	Social/Professional Role and Identity (reflective motivation)	5	1	Yes
4th	Knowledge (psychological capability)	4	2	Yes
5th	Beliefs about Consequences (reflective motivation)	3	1	Yes
Joint 6th	Social Influences (social opportunity)	2	1	Yes
Joint 6th	Skills (physical capability)	2	1	Yes
7th	Behavioural Regulation (psychological capability)	1	1	Yes
No ranking	Optimism (reflective motivation)	0	0	-
No ranking	Intentions (reflective motivation)	0	0	-
No ranking	Beliefs about Capabilities (reflective motivation)	0	0	-
No ranking	Memory, Attention and Decision Processes (psychological capability)	0	0	-
No ranking	Emotion (reflective motivation)	0	0	-
No ranking	Reinforcement (automatic motivation)	0	0	-

3.3.5 Thematic Synthesis

The following section presents the results of the inductive thematic synthesis. Themes and subthemes are presented in each domain that represent either barriers or facilitators to HCPs physical activity promotion for patients with type 2 diabetes. Table 3.8 provides an overview of each TDF domain and COM-B model component, with frequencies and example quotes representing each theme/subtheme. Appendices H1 to H12 provide further examples of quotes to support the themes. All themes or subthemes relate to HCPs unless otherwise specified.

Table 3.8

Themes and Subthemes (with number of studies) Identified as Barriers or Facilitators in TDF Domains

TDF domain (COM-B)	Theme (Number of studies)	Subtheme (Number of studies)	Barrier/facilitator /both
Knowledge (psychological capability)	Knowledge about physical activity (13 studies)	General knowledge about physical activity (13 studies)	Both
		Lack of knowledge to support patients with comorbidities or complications (5 studies)	Barrier
	Knowledge of the social and environmental context (2 studies)	None	Facilitator
	The impact of inadequate training and education on knowledge (5 studies)	None	Barrier

Skills (physical capability)	Behaviour change skills required to promote physical activity (7 studies)	None	Barrier
	Communication skills (3 studies)	None	Both
Social/Professional Role and Identity (reflective motivation)	HCPs' perception of their roles and responsibilities for physical activity promotion (6 studies)	None	Barrier
	HCP's physical activity behaviour (5 studies)	None	Facilitator
Beliefs about Capabilities (reflective motivation)	HCPs' beliefs about their ability and confidence to promote physical activity (9 studies)	None	Barrier
Optimism (reflective motivation)	Pessimistic beliefs about the impact of physical activity advice on patient behaviour (4 studies)	None	Barrier
Beliefs about Consequences (reflective motivation)	Beliefs about patients (15 studies)	Patients interest and motivation for physical activity (12 studies)	Barrier
		Patients' adherence to physical activity advice (5 studies)	Barrier

		Patient comorbidities and complications (8 studies)	Barrier
	Belief in the impact of physical activity advice on patient outcomes (3 studies)	None	Facilitator
Goals (reflective motivation)	Goal setting (7 studies)	None	Facilitator
Memory, Attention and Decision Processes (psychological capability)	Competing demands and prioritisation of physical activity (4 studies)	None	Barrier
Environmental Context and Resources (physical opportunity)	Lack of time (17 studies)	HCPs time (12 studies)	Barrier
		Perceptions of patients lack of time (6 studies)	Barrier
	Access to resources (18 studies)	HCPs access to resources (17 studies)	Both

	Perceptions of patients access to resources (7 studies)		Both
	Financial challenges (8 studies)	None	Barrier
	Organisational support and priorities (7 studies)	None	Barrier
Social Influences (social opportunity)	Social and cultural norms (8 studies)	None	Both
	Awareness and understanding of social and cultural differences (2 studies)	None	Barrier
Emotion (automatic motivation)	Feeling negative about physical activity promotion (5 studies)	None	Barrier
Behavioural regulation (psychological capability)	Tracking, monitoring and evaluation (2 studies)	None	Both

Knowledge (psychological capability)

The TDF domain Knowledge involves '*an awareness of the existence of something*' (Atkins et al., 2017, p.4). Three themes were identified in this domain. The first theme was knowledge about physical activity and encompassed two subthemes: general knowledge about physical activity and lack of knowledge about physical activity to support patients with comorbidities or complications. The second theme was knowledge of the social and environmental context, and the third theme was the impact of inadequate training and education on knowledge.

3.3.5.1 Knowledge About Physical Activity (barriers, thirteen studies; facilitators, two studies).

3.3.5.1 a General knowledge about physical activity (barriers, thirteen studies; facilitators, two studies). A lack of general knowledge about physical activity was viewed as a barrier to its promotion by HCPs in thirteen studies (Alghafri et al., 2017; Avery, 2014; Berry et al., 2012; Dillman et al., 2010; Doehring et al., 2016; Dranebois et al., 2019; George et al., 2006; Hnatiuk et al., 2012; Karduck & Chapman-Novkofski, 2018; Matthews et al., 2014; Miller & Beech, 2009; Powell et al., 2016; Ruby et al., 1993). In general, HCPs reported a lack of knowledge of basic information about physical activity and type 2 diabetes, such as what safe blood glucose levels are during exercise (Doehring et al., 2016), what physical activity (type, duration, and frequency) to recommend to people with type 2 diabetes (Avery, 2014), and how physical activity affects diabetes control (Powell et al., 2016).

HCPs also reported limited knowledge, understanding and awareness of the published physical activity guidelines and policies as a barrier to physical activity promotion in eight studies

(Alghafri et al., 2017; Berry et al., 2012; Doehring et al., 2016; Dranebois et al., 2019; George et al., 2006; Hnatiuk et al., 2012; Matthews et al., 2014; Powell et al., 2016).

> *Health Canada says, 'participate in moderate aerobic-intensity-level activity three times a week and do resistance exercise three times per week'...I basically look at them at that point and say, 'Okay, does that make sense to you? Because it doesn't make sense to me either, right, because when you read that thing, you're like, Whaaatt? Like it's not clear as to what you do.* (Berry et al., 2012, participant quote)

However, whilst some HCPs in studies from Ruby et al. (1993) and George et al. (2006) acknowledged the gaps in their knowledge that made promoting physical activity more challenging, a facilitator of physical activity promotion was noted in which HCPs with greater diabetes management experience and education felt that they had more knowledge and understanding of the fundamentals of physical activity for people with type 2 diabetes than those with more limited experience and education in this area.

> *The majority of the registered nurse certified diabetes educators [RN, CDEs] in this sample demonstrated a sound understanding of fundamental concepts of exercise and its effects on elderly clients with NIDDM, this mastery of knowledge may be related to the extent of experience and advanced educational levels of the RN, CDEs in this sample.* (Ruby et al., 1993, qualitized statistical data and author summary)

3.3.5.1.b Lack of Knowledge to Support Patients with Comorbidities or Complications (barrier, five studies). HCPs' lack of knowledge about physical activity was also a barrier to its promotion to patients with comorbidities or complications of type 2 diabetes, such as obesity, cardiovascular disease, and osteoarthritis (Alghafri et al., 2017; Berry et al., 2012; Matthews et al., 2014; Powell et al., 2016; Ruby et al., 1993). Specific challenges identified by HCPs included a limited understanding of physical activity for more complicated cases (Alghafri et al., 2017) and a lack of knowledge on how to develop appropriate physical activity plans for patients with complications or comorbidities (Matthews et al., 2014; Powell et al., 2016; Ruby et al., 1993).

> *I mean, a lot of them can be in wheelchairs or on walking sticks, and physical activity would not be possible or a priority with them, so that would probably be the main reason [why physical activity is not discussed].* (Matthews et al., 2014, participant quote)

3.3.5.2 Knowledge of the Social and Environmental Context (facilitator, two studies). HCPs in studies conducted in Oman (Alghafri et al., 2017) and Saudi Arabia (Abouammoh et al., 2016) noted that knowledge of their patients' social and environmental context facilitated physical activity promotion. Despite facing challenges such as hot climates, inadequate infrastructure, rapid urbanisation, and gender norms, which can all hinder patients uptake of physical activity, HCPs in these studies discussed strategies they used that facilitate physical activity promotion, such as encouraging male patients to walk to more distant mosques for prayer and finding ways for females to be physically active at home (Abouammoh et al., 2016) and the development of a community mapping initiative (Alghafri et al., 2017). The latter

involved creating maps of exercise facilities in different areas, allowing HCPs to provide specific recommendations on where and how patients could engage in physical activity.

> *Community mapping for physical activity facilities [places and volunteering buddies] to inform healthcare providers is a good idea to improve PA referrals*. (Alghafri et al., 2017; author summary and healthcare professional quote)

3.3.5.3 The Impact of Inadequate Training and Education on Knowledge (barrier, five studies). Five studies reported that inadequate training on physical activity had a detrimental impact on HCPs knowledge and was a barrier to effectively promoting it to patients with type 2 diabetes (Alghafri et al., 2017; Dillman et al., 2010; Dranebois et al., 2019; Larme & Pugh, 1998; Matthews et al., 2014). For example, in the study from Dillman et al. (2010), diabetes educators reported that despite attempting to address physical activity in sessions with patients, they lacked the knowledge to do so sufficiently. This was attributed to a lack of training; 40% of the participants in this study had received no formal training, an additional 40% had received only one form of training (e.g., a workshop or conference presentation), and 20% had received more than two forms of training. In two other studies, HCPs reported that their education and training in medical schools or residencies were insufficient to equip them with the knowledge to promote physical activity effectively (Doehring et al., 2016; Larme & Pugh, 1998).

> *A lack of physical activity and exercise training for diabetes management was observed: 40% had received no formal training, while another 40% had only received one form of training*. (Dillman et al., 2010, qualitized statistical data and author summary)

Skills (physical capability)

Atkins et al. (2017) define the Skills domain as '*an ability or proficiency acquired through practice*' (p. 4). Two themes presented below were identified in this domain; behaviour change skills required to promote physical activity, and communication skills.

3.3.5.4 Behaviour Change Skills Required to Promote Physical Activity (barrier, seven studies). HCPs belief that they lacked skills to promote physical activity was recognised as a barrier to its promotion in seven studies (Abouammoh et al., 2016; Alghafri et al., 2017; Berry et al., 2012; Dranebois et al., 2019; George et al., 2006; Matthews et al., 2014; Zimmermann et al., 2018). Specific barriers identified by participants included the ability to prescribe physical activity (Dranebois et al., 2019), design and implement exercise teaching programs (George et al., 2006), provide physical activity counselling, and use behaviour change skills and strategies in consultations, particularly with patients who have comorbidities (Alghafri et al., 2017; Berry et al., 2012; Matthews et al., 2014; Zimmermann et al., 2018).

> *I'm not sure about my knowledge and skills to support physical activity in patients with diabetes who may have multiple comorbidities and require structured physical activity advice, not just a general statement.* (Alghafri et al., 2017; participant quote)

Zimmermann et al. (2018) also reported that HCPs experienced challenges in translating behaviour change skills into practice. Participants reported that they tried to incorporate strategies, such as motivational interviewing, into their patients' appointments to promote

physical activity. However, they noted that while these approaches were considered valuable in theory, implementing them in practice proved more challenging.

In one study expatriate doctors in Saudi Arabia recognised the limitations of their skills and experience to provide culturally competent advice that was acceptable to patients, particularly females. HCPs reported challenges in applying their knowledge about the culture to real-world situations in order to agree on physical activity plans and suggest suitable alternatives when patients reported barriers (Abouammoh et al., 2016).

3.3.5.5 Communication Skills (barrier, one study; facilitators, two studies). GPs expressed that it was challenging to communicate complex information about physical activity and type 2 diabetes to their patients despite feeling knowledgeable about the underlying physiological mechanisms of it (Avery, 2014). They felt this barrier hindered patients' uptake of their physical activity advice, prompting the GPs to recognise the need for more training to effectively communicate information to patients and to be able to tailor this to their patient's needs and abilities (Avery, 2014). Conversely, two studies highlighted skills that facilitated more effective communication when promoting physical activity, including building rapport, developing trust between the HCP and the patient, a focus on patient-centred care rather than instructive advice-giving, and asking open-ended questions (Stuij, 2018; Zimmermann et al., 2018). The HCPs felt that these approaches resulted in more adherence from their patients to the physical activity advice they were providing.

> *I guess it is all about building a relationship with that person and getting them to like you; it's like that whole no like - no trust sort of thing. If they like you, then you form a*

> *relationship with them, then they are more likely to trust what you've got to say, so that's a big part of it.* (Zimmermann et al., 2018, participant quote)

Social/Professional Role and Identity (reflective motivation)

According to Atkins et al. (2017), the Social/Professional Role and Identity domain is defined as '*a coherent set of behaviours and displayed personal qualities of an individual in a social or work setting*' (p.4). Two themes were identified in this domain: HCPs' perceptions of their roles and responsibilities for physical activity promotion and HCPs' physical activity behaviour.

3.3.5.6 HCPs Perceptions of Their Roles and Responsibilities for Physical Activity Promotion (barrier, six studies). There were varied views from HCPs within the studies on their roles and responsibilities for physical activity promotion (Alghafri et al., 2017; Larme & Pugh, 1998; Matthews et al., 2014; Raaijmakers et al., 2013; Stuij, 2018; Zimmermann et al., 2018). Participants shared that there was a lack of consensus on who should be responsible for physical activity promotion, as well as uncertainties about the practicalities of this role (Alghafri et al., 2017; Matthews et al., 2014; Raaijmakers et al., 2013; Zimmermann et al., 2018). In one study it was reported that because of this lack of clarity HCPs focused more on metabolic outcomes or diet, assuming that another HCP had already discussed physical activity with the patients (Matthews et al., 2014). The study from Stuij (2018) highlighted tensions that existed between HCPs in different roles; whilst some were proactive about physical activity promotion, others felt this was a patient or public healthcare responsibility.

> *Getting people to be active is a public healthcare responsibility. My responsibility is to offer these people, when they have developed diabetes, their care as good as possible … not to change their [patients] behaviour. Even if you do your absolute best, it won't happen.* (Stuij, 2018, participant quote)

HCPs also identified the complexity of diabetes treatment within their roles as a barrier, expressing the challenges they faced, such as the need to address multiple areas with patients, like medications, glucose monitoring, screening and prevention of complications, managing comorbidities and complications and lifestyle education, as well as coordinating with other team members and specialists (Larme & Pugh, 1998).

3.3.5.7 HCP's Physical Activity Behaviour (facilitator, five studies). HCPs who were more physically active compared with those who were not promoted physical activity more to their patients with type 2 diabetes, felt that their advice had more impact on patient behaviour (Dranebois et al., 2019; Matthews et al., 2014), and reported feeling more confident promoting physical activity than HCPs who were not physically active (Miller & Beech, 2009; Powell et al., 2016). Additionally, some HCPs reported that personal experience of challenges with being physically active was a facilitator to its promotion as it enabled them to understand their patients' struggles more and allowed them to recognise the need for providing enhanced guidance to their patients (Stuij, 2018).

> *Diabetes educators engaging in regular physical activity [at least over the past 6-months] perceived themselves as more confident counselling on physical activity*

> *compared with those who reported not engaging in physical activity over the past 6 months.* (Powell et al., 2016, authors summary)

Beliefs about Capabilities (reflective motivation)

The TDF domain Beliefs about Capabilities involve an '*acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use'* (Atkins et al., 2017, p.4). The theme, representing barriers for this domain, is HCPs' beliefs about their ability and confidence to promote physical activity. No facilitators were coded to this domain.

3.3.5.8 HCPs' Beliefs About Their Ability and Confidence to Promote Physical Activity (barrier, nine studies).

Participants in nine studies perceived that a lack of confidence and ability was a barrier to physical activity promotion (Alghafri et al., 2017; Doehring et al., 2016; Dillman et al., 2010; Dranebois et al., 2019; Gross et al., 2007; Larme & Pugh, 1998; Matthews et al., 2014; Powell et al., 2016; Zimmerman et al., 2018). HCPs reported a perceived lack of capability to engage patients in physical activity and influence their patient's behaviour (Gross et al., 2007; Powell et al., 2016; Zimmermann et al., 2018). GPs in the study from Dranebois et al. (2019) shared that they did not feel comfortable advising their patients about the physical activity recommendations and, as a result, did not do so. Lower physical activity counselling efficacy was reported by diabetes educators who included physical activity counselling in ≤ 25% of their consultations, whereas those who included it in ≥ 50% of their consultations reported higher perceived counselling efficacy (Dillman et al., 2010). Finally, due to HCPs' unsuccessful attempts in the past to influence patients' physical activity behaviour, they

reported that prescribing medication was considered more accessible and more effective than advising patients about lifestyle behaviour change for diabetes management.

> *In general, HCPs reported lacking in confidence when tackling lifestyle issues [physical activity] with their patients, primarily due to frustration resulting from numerous unsuccessful attempts in the past.* (Avery, 2014, authors summary)

Optimism (reflective motivation)

The Optimism domain is defined as '*the confidence that things will happen for the best or that desired goals will be attained'* (Atkins et al., 2017, p.4). One theme was developed in this domain; pessimistic beliefs about the impact of physical activity advice on patient behaviour, described below. No facilitators were coded to this domain.

3.3.5.9 Pessimistic Beliefs About the Impact of Physical Activity Advice on Patient Behaviour (barrier, four studies). HCPs in four studies reported they had pessimistic beliefs about their patients' motivation to be physically active, their compliance with the physical activity advice the HCPs were providing and that patients were more adherent to the pharmacological management of type 2 diabetes (Carbone et al., 2007; Dranebois et al., 2019; Khairnar et al., 2018; Stuij, 2018). Consequently, these HCPs found supporting patients to be physically active challenging and, as a result, were less likely to promote it during appointments.

> *I am always in this area, pessimistic, because as I told you, most of them are not following this, and if you go to my clinic, my report may be around 80 to 90% they are not going to exercise, not engaged in exercise, they are not walking, so actually, this is very poor.* (Stuij, 2018, participant quote)

Beliefs about Consequences (reflective motivation)

According to Atkins et al. (2017), the Beliefs about Consequences domain involves '*acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation*' (p. 4). In this domain, two themes were conceptualised. The first theme, HCPs' beliefs about patients, reflects how HCPs' perceptions of their patients can be a barrier to promoting physical activity to patients. Within this theme, three subthemes were identified: patients' interest and motivation for physical activity, patients' adherence to physical activity advice, and patients' comorbidities and complications. The second theme was beliefs about the impact of physical activity on patient outcomes.

3.3.5.10 HCPs beliefs about patients (barrier, 15 studies).

3.3.5.10.a Patients' interest and motivation for physical activity (barrier, 12 studies). In 12 studies, it was perceived that some patients were not interested or receptive to physical activity advice, that physical activity was not a priority for them, or they lacked the willingness or motivation to change their behaviour (Alghafri et al., 2017; Armstrong-Shultz et al., 2001; Avery, 2014; Berry et al., 2012; Dillman et al., 2010; Dranebois et al., 2019; Lanhers et al., 2015; Matthews et al., 2014; Mogre et al., 2019; Raaijmakers et al., 2013; Stuij, 2018; Zimmermann et al., 2018).

> *Of all the diseases out there, diabetes is the one they are going to do kicking and screaming into making lifestyle changes…*W*hen I say exercise or even activity, the walls are up. (Berry et al., 2012, participant quote)*

3.3.5.10.b Patients Adherence to Physical Activity Advice (barrier, five studies). It was also noted in five studies that patient non-compliance with physical activity recommendations or unwillingness to change their behaviour prevented HCPs from intensifying physical activity treatment and improving their health outcomes (Avery, 2014; Dillman et al., 2010; Khairnar et al., 2018; Ruby et al., 1993; Svenningsson et al., 2011). Avery (2014) reported that HCPs often observed patients adopting a passive role during consultations and were reluctant to change their physical activity behaviour, which HCPs believed to be evidence of them not wanting to take responsibility for their disease.

> *GPs expressed dissatisfaction that many of their patients do not act upon the advice they provide about increasing their PA/exercise levels* (Avery, 2014, author summary)

3.3.5.10.c Patients' Comorbidities and Complications (barrier 8 studies). HCPs in eight studies indicated that their concerns about the negative consequences of physical activity for their patients, particularly those with comorbidities or low physical fitness or ability, would stop them from promoting it to patients (Armstrong-Shultz et al., 2001; Berry et al., 2012; Dillman et al., 2010; Lanhers et al., 2015; Matthews et al., 2014; Mogre et al., 2019; Ruby et al., 1993; Stuij, 2018). For example, these were risks of complications such as hyperglycaemia

(Lanhers et al., 2015), the patient's age (Mogre et al., 2019; Ruby et al., 1993), or patients with obesity or osteoarthritis (Armstrong-Shultz et al., 2001; Berry et al., 2012; Dillman et al., 2010; Lanhers et al., 2015; Matthews et al., 2014; Mogre et al., 2019; Ruby et al., 1993; Stuij, 2018).

> *Eighty-eight per cent of diabetes educators perceived that their patient with type 2 diabetes was too overweight to exercise.* (Armstrong-Shultz et al., 2001, qualitized statistical data)

3.3.5.11 Belief in the Impact of Physical Activity on Patient Outcomes (facilitator, three studies). In three studies, HCPs who felt that their physical activity advice had a positive impact on their patients' behaviour or health outcomes were more likely to promote it (Dranebois et al., 2019; Matthews et al., 2014; Ruby et al., 1993). For example, in the study from Ruby et al. (1993), seeing improvements in patients' pulmonary fitness, metabolic control, and cardiovascular disease risk factors was a reason why they would include physical activity in patient education programmes.

> *Fifty-five per cent of registered nurse-certified diabetes educators stated that metabolic improvements [blood glucose, insulin sensitivity, weight control, medication use] was a reason why they would include it in their education programs.* (qualitized statistical data)

Goals (reflective motivation)

According to Atkins et al. (2017), the Goals domain involves *'mental representations of outcomes or end states that an individual wants to achieve'* (p.4). One theme was developed in this TDF domain: goal setting. No barriers were coded in this domain.

3.3.5.12 Goal Setting (facilitator, seven studies). In seven studies HCPs viewed goal setting with patients as an effective strategy to motivate them to be physically active (Avery, 2014; Carbone et al., 2007; Matthews et al., 2014; Mogre et al., 2019; Stuij, 2018; Svenningsson et al., 2011; Zimmermann et al., 2018). Specific strategies used by HCPs included setting specific, measurable, achievable, realistic and timely (SMART) goals (Matthews et al., 2014; Mogre et al., 2019; Stuij, 2018; Zimmermann et al., 2018), setting goals linked to tangible outcomes such as HbA1c levels (Carbone et al., 2007; Matthews et al., 2014), creating action plans at each appointment (Avery, 2014) and integrating physical activity goals into patients' daily life, e.g., biking to the supermarket instead of walking (Stuij, 2018).

> *I think with exercise… give them a very specific timetable for what I expect them to have done by the next appointment. Because… if you just say, 'I'd like you to start exercising, do some swimming' [No good]. You need to say, 'How about you do three sessions of swimming.* (Avery, 2014, participant quote)

Memory, Attention and Decision Processes (psychological capability)

The Memory, Attention and Decision Processes domain is defined as '*the ability to retain information, focus selectively on aspects of the environment and choose between two or more*

alternatives' (Atkins et al., 2017, p.4). One theme was identified in the data for this domain: competing demands and prioritisation of physical activity. No facilitators were identified to this domain.

3.3.5.13 Competing Demands and Prioritisation of Physical Activity (barrier, four studies). In two studies (Khairnar et al., 2018; Larme & Pugh, 1998) HCPs' reported difficulties prioritisng physical activity promotion in their appointments with patients due to the complexities of diabetes treatment and the multiple aspects of care HCPs are responsible for. HCPs in the study from Khairnar et al. (2018) noted that their patients were left to address this component of diabetes management themselves.

> *The patients often have other chronic illnesses that require their attention during the office visits. Consequently, the PCPs [primary care physicians] have to let patients work on their exercise regimen without being able to provide much care in that regard. (Khairnar et al., 2018, author summary)*

In another study diabetes educators ranked physical activity promotion as less important than focusing on educating patients about healthy eating and taking medications (Powell et al., 2016). Whilst in another study, diabetes educators reported that their patient education was dominated by '*survival skills',* with their patients being either too ill or too overwhelmed for them to focus on physical activity promotion (Ruby et al., 1993).

Environmental Context and Resources (physical opportunity)

The Environmental Context and Resources domain is defined as '*any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour*' (Atkins et al., 2017, p. 5). Lack of time represents the first theme in this domain, with two subthemes: HCPs' lack of time and their perceptions of patients' lack of time. The second theme in this domain is access to resources, with two subthemes: HCPs' access to resources and their perceptions of patients' access to resources. The third and fourth themes are financial challenges and organisational support and priorities, respectively.

3.3.5.14 Lack of Time (barrier, 17 studies).

3.3.5.14.a HCPs Time (barrier, 12 studies). A lack of time to promote physical activity was identified as a barrier to its promotion by HCPs in twelve studies (Algahfri et al., 2017; Avery, 2014; Dillman et al., 2010; Dranebois et al., 2019; Khairnar et al., 2018; Lanhers et al., 2015; Matthews et al., 2014; Powell et al., 2016; Raaijmakers et al., 2013; Ruby et al., 1993; Stuij, 2018; Zimmermann et al., 2018). Specific issues identified due to a lack of time included short hours of diabetes clinics (Alghafri et al., 2017), insufficient time to cover all aspects of diabetes treatment, including physical activity in the time available (Dillman et al., 2010; Dranebois et al., 2019; Khairnar et al., 2018; Matthews et al., 2014; Powell et al., 2016; Ruby et al., 1993; Stuij, 2018; Zimmermann et al., 2018), low frequency of appointments (Stuij, 2018), HCPs work schedules (Lanhers et al., 2015), the large amount of data they have to collect during

patients' appointments (Matthews et al., 2014; Zimmermann et al., 2018), and the need to focus on patients diabetes-related complications or other chronic illnesses (Khairnar et al., 2018).

> *We are time pressured in our interactions with patients, so we can't really cover all aspects of diabetes care with them in one visit, never mind the aspects of wider care [physical activity].* (Matthews et al., 2014, participant quote)

> *Time allotted for diabetes self-management education support visits was reported as the greatest barrier to physical activity counselling.* (Powell et al., 2016, author summary)

Additional barriers related to limited time for HCPs was a lack of time to engage in training on physical activity (Avery, 2014). Although training was identified in the Knowledge domain essential to supporting HCPs to promote physical activity, participants in this study reported that a lack of time to engage in training impacted their opportunity to increase their knowledge and skills, and facilitate physical activity promotion:

> *Although a specific amount of time for training was not reported, GPs described time available for trainings as "limited" and only when they could acquire a locum to cover their clinics.* (Avery, 2014, author summary)

3.3.5.14.b Perceptions of Patients Lack of Time (barrier, six studies). As well as their time limitations, HCPs also perceived that their patients' lack of time for physical activity was a barrier to its promotion for them. It was noted that for some patients, physical activity was not a

priority because of their schedule or competing demands, such as social or work commitments, which resulted in HCPs finding it more challenging to promote if patients were less receptive to their advice (Alghafri et al., 2017; Armstrong-Shultz et al., 2001; Berry et al., 2012; Jones et al., 2014; Mogre et al., 2019; Torres et al., 2010).

> *Our main problem is with the females, whom, they don't have the time, they don't have the place to do it, and they have many social commitments* (Alghafri et al., 2017; participant quote)

3.3.5.15 Access to Resources (barrier, 18 studies; facilitator, five studies).

3.3.5.15.a HCPs Access to Resources (17 studies). Issues related to a lack of access to resources were considered barriers to physical activity promotion in 17 studies (Alghafri et al., 2017; Armstrong-Shultz et al., 2001; Avery, 2014; Berry et al., 2012; Dillman et al., 2010; Dranebois et al., 2019; George et al., 2006; Hnatiuk et al., 2012; Jones et al., 2014; Karduck & Chapman-Novkofski, 2018; Lanhers et al., 2015; Matthews et al., 2014; Powell et al., 2016; Raaijmakers et al., 2013; Stuij, 2018; Ruby et al., 1993; Torres et al., 2010). Specific barriers reported were inadequate staffing and support, along with the unavailability of exercise specialists (Alghafri et al., 2017; Matthews et al., 2014; Ruby et al., 1993), inadequate physical activity guidelines (Alghafri et al., 2017; Berry et al., 2010; Dranebois et al., 2019; George et al., 2006; Hnatiuk et al., 2012; Matthews et al., 2014; Powell et al., 2016), limited educational materials for patients and HCPs (Alghafri et al., 2017; Berry et al., 2012; Matthews et al., 2014), inadequate physical activity referral pathways (Alghafri et al., 2017; Dranebois et al., 2019;

Matthews et al., 2014; Raaijmakers et al., 2013; Stuij, 2018), and lack of space for physical activity consultations within healthcare facilities (Alghafri et al., 2017).

> *Forty-six per cent of RN, CDEs [registered nurse, certified diabetes educators] indicated that lack of resources (time, money, facilities, equipment, personnel, and physician and institutional support) was the most important reason why implementing a comprehensive exercise teaching program specifically for elderly clients with NIDDM [non-insulin dependent diabetes mellitus] was difficult* (Ruby et al., 1993, author summary)

Facilitators to overcome barriers related to access to resources experienced by HCPs included the development of a more conducive-built environment to support patients to be more physically active, such as building more walking trails (Paiva et al., 2019), along with initiatives such as compiling lists of local physical activity initiatives, opportunities and resources to recommend to patients (Alghafri et al., 2017; Raaijmakers et al., 2013) and creating walking groups (Stuij, 2018). In one study a pilot physical activity referral scheme was viewed as a facilitator of physical activity promotion; however, it was also shared that general awareness amongst HCPs of this scheme was low and was identified as a key training priority (Matthews et al., 2014).

> *Another respondent reported that their care group had drawn up a list of local initiatives [lifestyle programs and prevention initiatives that they could refer their diabetes patients to].* Raaijmakers et al., 2013 author summary)

3.3.5.15.b Perception of Patients Access to Resources (barrier seven studies, facilitator six studies). Patients' limited access to physical activity resources was also viewed as a barrier to physical activity promotion. HCPs reported that this not only hinders patients' opportunities to engage with the advice provided but also makes it challenging for them to offer realistic guidance and support (Alghafri et al., 2017; Armstrong-Shultz et al., 2001; Jones et al., 2014; Torres et al., 2010) and develop and implement effective exercise teaching programs (Ruby et al., 1993). Specific barriers discussed included facilities being too far away or closed, an unsupportive-built environment such as a lack of accessible and safe areas to walk (Alghafri et al., 2017), the patients' rural location (Jones et al., 2014), and a lack of access to appropriate materials or equipment (Armstrong-Shultz et al., 2001).

> *Some health professionals indicated that exercise options are limited for rural dweller and that a lack of diversity in options for exercise contributed to difficult in managing type 2 diabetes 'we didn't have a swimming pool dedicated to rehab and aqua type of sports, where people, you know with joint problems, or really overweight or obese people could perhaps get in the water and do some kind of exercise'.* (Jones et al., 2014; author summary and participant quote)

Research stemming from France, Oman, and the United States of America also reported that adverse weather conditions, such as extremely hot temperatures, often made being physically active outside for patients unachievable and as a result the HCPs did not focus on physical activity promotion in appointments (Alghafri et al., 2017; Armstrong-Shultz et al., 2001; Lanhers et al., 2015).

Technological support was reported as a facilitator that could overcome some barriers to resources for patients. For instance, digital services such as fitness trackers and watches, or smart games, such as the Nintendo Wii consoles and digital personal trainers, were perceived as facilitators of physical activity as they increased patient engagement and interest and HCPs could monitor and follow-up patients' behaviour (Alghafri et al., 2017; Karduck & Chapman-Novkofski, 2018).

> *Most clinicians believed that apps were effective for assessing physical activity. Furthermore, many clinicians recommended that their patients track physical activity via smartphone apps compared with traditional methods*. (Karduck & Chapman-Novkofski, 2018, author summary)

3.3.5.16 Financial Challenges (barrier, eight studies). Financial challenges created barriers to physical activity promotion for HCPs in eight studies (Alghafri et al., 2017; Dranenois et al., 2019; Karduck & Chapman-Novkofski, 2018; Matthews et al., 2014; Powell et al., 2016; Ruby et al., 1993; Stuij, 2018; Torres et al., 2010). Specific barriers included lack of financial reimbursement to HCPs for physical activity counselling or prescription (Dranebois et al., 2019; Powell et al., 2016), short duration of insurance coverage for physiotherapy appointments for patients (Stuij, 2018) and limited funding provided to develop adequate physical activity services or programs to support HCPs in promoting activity to patients with type 2 diabetes (Matthews et al., 2014; Ruby et al., 1993).

> *Our physical activity budget, we get within the Health Board, is about 3/4million [GBP], so we put about GBP 750 000 into the physical activity, the core budget ... So that's less than a pound per person spending on physical activity within the [Health] Board. The majority of that funding will go to our exercise referral scheme for the salaries of our [physical activity] advisors.* (Matthews et al., 2014, participant quote)

The cost of physical activity for patients was also identified as a barrier to its promotion by HCPs. For example, some patients were unable to access resources that were seen as facilitators of physical activity promotion by HCPs such as gyms or fitness trackers as these were unaffordable. HCPs felt that this limited the advice and support related to physical activity they were able to provide to patients (Alghafri et al., 2017; Karduck & Chapman-Novkofski, 2018; Stuij, 2018; Torres et al., 2010).

3.3.3.17 Organisational Support and Priorities (barrier, seven studies). A lack of organisational support was reported by HCPs as a barrier to physical activity promotion in seven studies (Alghafri et al., 2017; Avery, 2014; Dranebois et al., 2019; Powell et al., 2016; Matthews et al., 2014; Raaijmakers et al., 2013; Ruby et al., 1993). Specific organisational barriers reported were lack of training opportunities on physical activity promotion (Alghafri et al., 2017; Avery, 2014), inadequate multidisciplinary collaboration (Raaijmakers et al., 2013), physical activity not being set as a quality indicator or an agreed healthcare delivery priority within the health system (Alghafri et al., 2017; Matthews et al., 2014) and insufficient support from other sectors or stakeholders (Alghafri et al., 2017; Matthews et al., 2014).

> *We do try and get it [physical activity] in planning frameworks so that there is a responsibility for the areas [Health Boards] to do something about physical activity. But it's patchy [across the Health Boards].* (Matthews et al., 2014, participant quote)

Social Influences (social opportunity)

The Social Influences domain involves '*interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviour*' (Atkins et al., 2017; p.5). Two themes were identified in this domain, social and cultural norms, and awareness and understanding of social and cultural differences.

3.3.5.18 Social and Cultural Norms (barrier, eight studies; facilitator, two studies).

Evident from the studies in this theme was that several factors related to cultural beliefs and priorities, and gender and cultural expectations were barriers to physical activity promotion for HCPs (Abouammoh et al., 2016; Alghafri et al., 2017; Berry et al., 2012; Carbone et al., 2007; Jones et al., 2014; Khairnar et al., 2018; Mogre et al., 2019; Stuij, 2018). For instance, a study from Ghana reported that physical activity is considered something for wealthy people or is part of Western culture, not their own (Mogre et al., 2019). In Oman, rapid urbanisation, sedentary jobs and domestic helpers were perceived as barriers to creating a physically active culture (Alghafri et al., 2017). In rural areas in South Australia, HCPs postulated that social stigma and feeling embarrassed to exercise in public places were barriers to physical activity promotion (Jones et al., 2014). Additional barriers reported in these studies were religion and gender norms, which were compounded by a lack of family support (Berry et al., 2012; Carbone et al., 2007; Khairnar et al., 2018; Mogre et al., 2019).

> *You have a woman who needs to get out to get some exercise to be healthy, but it's against Muslim...they can't go out on their own, they don't necessarily have family support, so there's... so there's cultural issues.* (Berry et al., 2012, participant quote)

However, cultivating a physical activity culture was reported as a facilitator to physical activity promotion, with practical approaches being the creation of walking groups (Stuij, 2018), and creating a physical activity culture within health centres (e.g., physical activity discussions with colleagues and active meetings) (Alghafri et al., 2017).

3.3.5.19 Awareness and Understanding of Social and Cultural Differences (barrier, two studies). This theme reflects the impact of HCPs familiarity of their patients social and cultural norms can be either a barrier or facilitator to physical activity promotion. In one study, despite expatriate HCPs reporting some familiarity with the customs and culture of patients, they lacked direct experience of living it (Abouammoh et al., 2016). It was also suggested that this may affect the patient's attitude towards the physician, with them not always trusting the advice they are receiving (Abouammoh et al., 2016).

Cultural differences, socioeconomic status, and patients' lived experiences were also highlighted as barriers to physical activity promotion. Some HCPs found it challenging to see the barriers their patients faced from their perspective, which led to conflicts with some patients.

> *Some professionals referred to socioeconomic or cultural differences between them and many of their patients, like a lower socioeconomic status, living in a deprived*

> *neighbourhood or having a non-Western background, especially for women. These patients were thought to have more difficulties in understanding the messages, to set certain 'priorities' and to implement PA in daily life...it also made it difficult for the professionals to really understand the difficulties, on the other hand, because they were not familiar with these circumstances.* (Stuij, 2018, author summary)

Emotion (automatic motivation)

The Emotion domain involves '*a complex reaction pattern involving experiential, behavioural, and psychological elements by which the individual attempts to deal with a personally significant matter or event*' (Atkins et al., 2017; p.5). One theme was conceptualised in this domain: feeling negative about physical activity promotion. No facilitators were coded to this domain.

3.3.5.20 Feeling Negative About Physical Activity Promotion (barrier, five studies).

HCPs described several negative emotions regarding physical activity promotion (Avery, 2014; Dranebois et al., 2019; Matthews et al., 2014; Stuij, 2018; Svenningsson et al.,2011). In some studies, participants reported feeling frustrated and irritated that their patients did not act on the physical activity advice they were given, making it difficult for them to retain the motivation to promote it (Stuij, 2018). Feelings of guilt were also reported, resulting from unsuccessful attempts to change their patient's physical activity behaviour, which resulted in them focusing more on pharmacological management than lifestyle change (Svenningsson et al., 2011). HCPs in French Guiana reported feeling isolated in physical activity promotion, as they were working in remote areas serving isolated villages (Dranebois et al., 2019) and dissatisfaction that their patients were unresponsive to their advice (Avery, 2014). HCPs also reported feeling frustrated and overwhelmed by *'the numerous and overlapping physical activity*

strategies that have been published,' making it difficult to know which one to follow (Matthews et al., 2014).

Behavioural Regulation (psychological capability)

According to Atkins et al. (2017), the Behavioural Regulation domain involves '*anything aimed at managing or changing objectively observed or measured actions*' (p.5). One theme was developed in this domain: tracking, monitoring and evaluation.

3.3.5.21 Tracking, Monitoring and Evaluation (barrier, two studies; facilitator, one study). In one study, it was reported that physical activity was not included in the electronic health system, which was seen as a barrier to physical activity promotion as it made it more challenging for HCPs to follow up, monitor or evaluate their patients' physical activity levels (Alghafri et al., 2017). In another study, HCPs reported that smartphone health applications could facilitate patients' tracking, monitoring and accountability of physical activity, and as such, recommended their use (Karduck & Chapman-Novkofski, 2018). However, it was noted that a barrier to their use was that they could record inaccurate data, such as '*adding calories back for exercise*' (Karduck & Chapman-Novkofski, 2018).

3.3.6 Suggested Facilitators of HCPs Physical Activity Promotion for Patients with Type 2 Diabetes.

Within some of the papers included in this review, the authors included questions to HCPs on what they felt would support them more with physical activity promotion (Alghafri et al., 2017;

Avery, 2014; Berry et al., 2012; Dranebois et al., 2019; Matthews et al., 2014). These data extracts were not included in the main analysis as they are suggestions rather than evidence-based facilitators of physical activity promotion, and their generalisability is limited to the context that the HCPs work. Nonetheless, they do provide insight into the needs of HCPs and their views on how they could be further supported. HCPs suggested that capacity-building efforts targeted to the domains of Knowledge, Skills, Social/Professional Role and Identity, Reinforcement, and Environmental Context and Resources could facilitate physical activity promotion (Appendix I). The most suggestions for facilitators stemmed from the Environmental Context and Resources domain.

3.4 Discussion

This MMSR has explored and synthesised HCPs' barriers and facilitators to physical activity promotion for adults with type 2 diabetes using the TDF (Cane et al., 2012) as an a priori framework. The review identified 29 papers for inclusion that stemmed from quantitative, qualitative and mixed-methods studies within the published and grey literature. The objectives of this study were to identify barriers and facilitators experienced by HCPs in the promotion of physical activity for patients with type 2 diabetes, to map these findings to the TDF and the COM-B model (Michie et al., 2014) and assess the importance of the domains influencing HCP's behaviour (e.g. Atkins et al., 2017; Lawrenson et al., 2018).

Barriers were found in all TDF domains except Goals, Intentions and Reinforcement. Based on the importance criteria of frequency, elaboration and conflicting beliefs (e.g. Atkins et al., 2020), the Environmental Context and Resources domain was the highest-ranked domain for barriers influencing HCPs' physical activity promotion. This was followed by Beliefs about

Consequences, Knowledge, Skills, Social Influences, Beliefs about Capabilities, Social/Professional Role and Identity, Emotion, Memory, Attention and Decision Processes, Optimism and Behavioural Regulation, respectively. The top six ranking domains represented 85% of barriers coded, which suggests that these are key domains to be targeted in interventions to support HCP physical activity promotion for people with type 2 diabetes. Facilitators were found in eight domains, with Goals ranked highest, followed by Environmental Context and Resources, Social/Professional Role and Identity, Knowledge, Beliefs about Consequences, Social Influences, Skills, and Behavioural Regulation.

Despite the wealth of evidence demonstrating that physical activity at the recommended levels can improve outcomes for people with type 2 diabetes (e.g., Hamasaki et al., 2016) and the suggestions that HCPs are well placed to promote it (e.g., IDF, 2017), the HCPs in the studies included in this MMSR expressed many barriers to this in their clinical practice. In line with prior research, barriers to HCPs physical activity promotion identified in this MMSR included organisation and system-level barriers, including lack of time in appointments, increasing workloads, and competing demands (Albert et al., 2021; Huij et al., 2015; Kime et al., 2020), lack of referral pathways (Din et al., 2015; Morgan et al., 2021), and insufficient staffing or funding (e.g., Mather et al., 2022). In this MMSR, and in alignment with the literature (e.g. Huij et al., 2015), HCPs also identified the complexities of their roles and a lack of clarity on their responsibilities for physical activity promotion as barriers. The findings from the current study highlight that HCPs' barriers to physical activity promotion are often related to the wider socio-political contexts of existing systems and organisational structures, such as limited funding, resources and staff, and increased workloads. The allocation of resources in healthcare can

involve complex decision-making by governments and policymakers (Seixas et al., 2021). As such, Bird et al. (2022) suggest that there is a need for meaningful engagement from multiple stakeholders to identify opportunities to embed physical activity promotion into routine care.

In the Beliefs about Consequences domain, it was found that HCPs' beliefs about their patients can result in them either placing less priority on physical activity in appointments or not promoting it at all. This demonstrates the interplay between HCPs and their perceptions of their patients' barriers. Prior research has found that individuals with type 2 diabetes report significantly more barriers to physical activity than the general population, for example, lack of time (Advika et al., 2017), perceived difficulty of physical activity (Thomas et al., 2004), physical discomfort (Egan et al., 2013), and lack of willpower or habit (Vilafranca Cartagena et al., 2021). Yet, as demonstrated from the findings in this MMSR, HCPs either do not feel equipped with the knowledge and skills to support patients to address these barriers or they choose to focus on other areas of diabetes management in the short time available.

In this MMSR, and also consistent with existing research (Albert et al., 2021; Kime et al., 2020; Vishnubala & Pringle, 2021), HCPs reported a lack of knowledge and skills to promote physical activity effectively and for many, this was exacerbated by a lack of training and inadequate guidelines. Both of these barriers are a common finding within the literature. For example, in the umbrella review conducted by Mather et al. (2022), a lack of guidelines was a prominent barrier in five systematic reviews examining influences on clinical behaviour change for HCPs. In line with the findings from Mather et al. (2022), the HCPs in this MMSR reported that the current physical activity guidelines lacked more detailed information on physical activity for type 2 diabetes and did not take into account multiple comorbidities and complications experienced by a significant number of patients making physical activity promotion more

challenging. This suggests that further exploration of the content of physical activity guidelines as well as the strategies used to disseminate them is a crucial step in closing the evidence-practice gap.

The training and education barriers identified in this review are also consistent with the literature exploring influences on HCPs' physical activity promotion (Crisford et al., 2018; Huij et al., 2015; Glowacki et al., 2019). Given this, the need to embed physical activity education and training within healthcare systems has been identified as a priority (Netherway et al., 2021). Yet despite these recommendations, much of the available training for HCPs remains primarily underpinned by a pharmacological approach (Netherway et al., 2021). While this type of knowledge is important for HCPs, it is clear from the evidence from this review and the existing research (Netherway, et al., 2021; Kime et al., 2020; Smith et al., 2004) that there is a need to increase the availability and comprehensiveness of physical activity training for HCPs. To effectively promote physical activity to patients with type 2 diabetes HCPs need more in-depth knowledge along with the skills (e.g., behaviour change skills, communication skills) and confidence to translate this knowledge into practice. Whilst the findings in this MMSR clearly demonstrate the need for increased training and education for HCPs to support them to promote physical activity, it is also critical that this is not done in isolation. Capacity-building efforts must also address the organisation and structural-level barriers identified in this MMSR, such as lack of time, funding and workforce, as individual-level approaches only are unlikely to have a significant impact (Chater & Loewenstein, 2023).

This MMSR also found that some HCPs felt pessimistic about the impact of the advice on patient behaviour (e.g. Stuij, 2018), which in some cases resulted in feelings of frustration, disappointment, guilt and isolation (e.g. Dranebois et al., 2019). In a model of the development

of physician burnout, referred to as the simplified 5-stage model for the development of burnout, it is suggested that emotions, such as frustration and apathy can lead to burnout, with one in three HCPs experiencing this phenomenon at any given time (de Hert, 2020). HCPs burnout affects not only their own wellbeing, but also the quality of care they deliver to patients (de Hert, 2020). It is recommended by de Hert et al. (2020) that interventions at the individual level, such as counselling are required to support HCPs with burnout. However, research also suggests that drivers of HCP burnout are primarily rooted in healthcare organisations and systems, such as increased workloads, inefficient work processes, administrative burdens, and organisation or leadership culture (West et al., 2018). Given that HCP burnout is an international issue, a multi-faceted approach from all stakeholders is needed that will align with the key drivers of HCP burnout, such as a systems approach that addresses structure, organisation and cultures within healthcare (National Academies of Sciences, Engineering, and Medicine; 2019).

Despite the dominance of barriers compared to facilitators found in this review, some HCPs reported strategies or resources that facilitated physical activity promotion for them. The majority of facilitators were coded in the Goals, Social/Professional Role and Identity and Environmental Context and Resources domains, and these findings are consistent with prior research. For example, in seven studies included in this review, goal setting was reported by HCPs as a valuable approach to support patients in increasing their physical activity. This is a widely used and effective strategy to increase physical activity levels in people living with type 2 diabetes, with research suggesting that this approach can lead to reductions in HbA1c (Fredrix et al., 2018). This suggests that efforts to upskill HCPs on behaviour change strategies, such as goal setting, could support them to promote physical activity and improve patient outcomes. Finally, studies in the present review, as commonly seen in the literature, reported that HCP's physical

activity behaviour was a driver of its promotion, with physically active HCPs more likely to promote it (Bakhshi et al., 2015; Silva et al., 2022; Selvaraj & Abdullah, 2022). This finding highlights the influence that HCPs beliefs and behaviours can have on physical activity promotion (Godin et al., 2008).

Also, in line with prior research other facilitators identified in this MMSR to support HCPs physical activity promotion were physical activity referral schemes (Williams et al., 2007), improving the built environment (Omura et al., 2020) and the use of technology (Laranjo et al., 2021). These findings suggest that although it is important to address HCP factors that can influence physical activity promotion, it is also critical to understand how wider determinants, such as system and policy level factors, can impact this.

There is rapidly growing evidence demonstrating the utility of the TDF in exploring and understanding influences on HCPs' professional practice in Western contexts (e.g., Keyworth et al., 2019; Presseau et al., 2018). Yet, this approach has not been adopted in Oman, or in any other non-Western settings, to explore HCPs' professional practice (Dyson & Cowdell, 2021). This is likely because the TDF is relatively new and was developed in a Western setting to explore HCPs' professional practice in this context (Atkins et al., 2017; Cane et al., 2012). However, the barriers and facilitators to HCPs' clinical practice may be different between Western and non-Western settings; for example, there may be social, cultural, economic and healthcare system differences (Borg, 2014). As such Dyson and Cowdell (2021) have highlighted that the scope of application of the TDF in non-Western settings may be limited and identified the need to explore this further as a research priority.

Out of the 29 papers in this review, seven were from non-Western settings (Abouammoh et al., 2016; Alghafri et al., 2017; Dranebois et al., 2019; Gross et al., 2007; Mogre et al., 2019;

Paiva et al., 2019; Torres et al., 2010). Given there were no barriers or facilitators identified within these studies that the TDF was not able to account for suggests that it may be a useful framework to explore HCPs' clinical practice in both Western and non-Western settings. However, caution should be noted as none of the studies included in this review were underpinned by the TDF (Atkins et al., 2017) or the COM-B model (Michie et al., 2014). As demonstrated in this study, the retrospective mapping of primary data enables a systematic and rigorous synthesis of the available data that can identify the influences on HCPs' physical activity promotion at multiple levels. Nonetheless, it will also be important to use the TDF to guide and analyse primary research in this area to enable a targeted, comprehensive, theory-driven, and replicable exploration of HCPs' promotion of physical activity that considers the nuances of each context. In line with the aims of this study and the findings of the MMSR, exploring barriers and facilitators to HCPs' promotion of physical activity to patients with type 2 diabetes in Oman using the TDF is required to enable a more comprehensive understanding of the problem and the development of targeted evidence-based capacity-building strategies.

3.4.1 Strengths and Limitations

To the best of the researcher's knowledge, this is the first systematic review and synthesis of barriers and facilitators experienced by HCPs in promoting physical activity for adult patients with type 2 diabetes. There are several strengths to this review. It is recommended in the MRC guidelines that following a theory-based approach to research can enhance its rigour, coherence and applicability (Craig et al., 2008; Skivington et al., 2021). The MRC guidelines further recognise that no single theory may adequately address all aspects of complex interventions. In line with this guidance to use theories that consider different levels (e.g., macro, meso, and

micro) and domains (e.g., behavioural, organisational, social), the use of the TDF (Atkins et al., 2017) and the COM-B model (Michie et al., 2014) offers a more comprehensive and theory-informed assessment of the influences on HCP physical activity promotion (French et al., 2012). There were no barriers or facilitators that could not be mapped to one or more of the TDF domains, which suggests that the TDF appears to provide a comprehensive account of the barriers and facilitators to physical activity promotion experienced by HCPs. In addition, determining the importance of the TDF domains allows for insight into the most significant barriers and facilitators to HCP's physical activity promotion, which can guide implementation and evaluation design (e.g., Atkins et al., 2020). Mapping the findings to the COM-B model provides a robust, theory-informed methodology to then select BCTs and intervention functions to target the most influential barriers and facilitators to HCP professional behaviour change (Presseau et al., 2021).

Adopting the JBI approach to MMSRs was also a strength of this review; it enabled the synthesis of findings from quantitative, qualitative, and mixed methods designs. In addition, this review included both published and grey literature. This approach can ensure that all the available evidence is included in the MMSR, thus facilitating a comprehensive understanding of the research question. Furthermore, the JBI approach to MMSRs is standardised, thereby enhancing the reproducibility and transparency of the review (Stern et al., 2020). A limitation of the JBI approach was the lack of published guidance on the process of qualitizing the quantitative data which made the process of data transformation challenging. Nonetheless, this was mitigated by consulting directly with JBI to determine the best approach to this component of the MMSR.

Despite the strengths of this MMSR there were also limitations. The TDF (Cane et al., 2012) is a theoretical framework that identifies and describes influences on behaviour; it is not a theory and, as such, does not propose testable relationships between elements (Atkins et al., 2017). According to Lipworth et al. (2013), this can make it challenging to determine the cause of a facilitator or a barrier. As such, prior to the development of interventions to address HCPs' physical activity promotion, qualitative research that uses the TDF as a framework is recommended to probe and further clarify the influences of their behaviours (Atkins et al., 2017; Lipworth et al., 2013; McGowan et al., 2020).

As discussed above, none of the original studies included in this MMSR used the TDF to assess HCPs' professional practice. As a result, firstly, there is the possibility of interpretation bias, although to minimise this, a second reviewer independently reviewed (20%) of the coded data. Secondly, it is possible that some of the TDF domains were not identified as frequently as others because the primary studies did not ask questions that tapped into the domains and their component constructs. For example, studies have reported that HCPs experience clinical inertia (e.g., Isajev et al., 2022). This would relate to the Emotion domain; however, this was not identified as an important domain. In addition, the questions asked in the studies may also have led to biases in the findings; for example, a number of papers focused on knowledge (e.g., Doehring et al., 2016) or resources (e.g., Alghafri et al., 2017). As such, there may be additional barriers or facilitators in less-represented TDF domains. A TDF-based questionnaire or interview schedule may facilitate a broader understanding of barriers and facilitators.

Furthermore, is important to note that the paucity of facilitators found in this systematic review may not be representative of HCPs' actual experience, as not all the papers included within this study were designed to explore barriers and facilitators explicitly. Nonetheless, the

finding regarding the lack of facilitators identified in this MMSR highlights a critical challenge some HCPs face when promoting physical activity. Global guidelines such as the IDF (2017) state that HCPs should advise, encourage, support, and counsel diabetic patients on physical activity as part of ongoing diabetes education and self-management. Yet, as demonstrated in this review and the wider literature, they often report multiple barriers and fewer facilitators to this in practice (e.g., Albert et al., 2021; Kime et al., 2020).

Another limitation of this review is that many of the studies included did not solely examine physical activity promotion. For example, out of the 29 papers included in the review, 16 focused on multiple areas of diabetes management, such as self-management (Carbone et al., 2007; Doehring et al., 2016; Hixenbaugh & Winkley, 2001; Jones et al., 2018; Khairnar et al., 2018); delivery of physical activity or dietary guidelines (Berry et al., 2012; Larme & Pugh, 1998); lifestyle behaviour (Abouammoah et al., 2016; Gross et al., 2007); diabetes care (Raaijmakers et al., 2013); patient education (Torres et al., 2010); obesity management (Svenningsson et al., 2011); self-care (Mogre et al., 2019); health apps (Karduck & Chapman-Novkofski, 2018); patient communication (Paiva et al., 2019); and diet and exercise (Armstrong-Shultz et al., 2001). Not only may this have limited the findings presented on physical activity, but each area of diabetes self-management for patients will have different behavioural drivers (Peng et al., 2022), meaning that HCP barriers and facilitators for each behaviour may be different.

Finally, it has been noted in a previous systematic review (Lipworth et al., 2013) that it can be challenging to distinguish between the HCP's voice and the study authors interpretations of these perspectives. To mitigate this, the current review categorised the extracted data as first-level (HCP quote or statistical data) and second-level (researcher/author summary). The aim of

this approach was to minimise bias, improve rigour, ensure clarity and source distinction and support a comprehensive data synthesis.

3.5 Conclusions

This systematic review adopted a systematic and theoretically informed approach to identify key themes and subthemes to provide greater insight into the barriers and facilitators experienced by HCPs. The results of this review demonstrate the complexity of physical activity promotion for HCPs for people with type 2 diabetes, evidenced by the many intersecting barriers reported and the paucity of evidenced facilitators to support them with this. Despite the growing evidence of the utility of the TDF in primary research from Western contexts, the utility and applicability of this approach on HCPs' clinical practice in non-Western settings is not currently known (Dyson & Cowdell, 2021). Given that this gap in the application of the TDF has been identified, and the pivotal role of context and culture was identified in several domains in this review, the next chapter aims to use the TDF to explore HCPs' physical activity promotion for patients with type 2 diabetes in Oman. This approach will allow for a detailed exploration of HCPs physical activity promotion and the context it occurs in.

Chapter Four: A Qualitative Study Exploring the Barriers and Facilitators of the Delivery of Physical Activity Promotion by Healthcare Professionals for Adults with Type 2 Diabetes Working in Primary Healthcare Facilities in Muscat, Oman

4.1 Introduction

As discussed in previous chapters, type 2 diabetes is a chronic health condition that has become a major public health problem (Sathish, 2019). It is estimated that 462 million of the world's population are living with type 2 diabetes (International Diabetes Federation [IDF], 2021). It has been predicted to rise to 700 million by 2045 (IDF, 2019). The Middle Eastern and North African (MENA) region has the highest adult age-adjusted regional prevalence of diabetes in the world (16.3%), and this is predicted to rise to 19.3% (136 million) by 2045 (IDF, 2021). In 2021 it was reported that 73 million adults (aged 20-79) in the MENA region are living with diabetes, with at least 90% of these cases being type 2 diabetes (IDF, 2021). Furthermore, the MENA region has reported the highest number of diabetes-related deaths in people of working age (24.5%) and an expenditure of 33 billion USD on healthcare for individuals with diabetes (IDF, 2021).

Within the 21 countries and territories in the MENA region, the Sultanate of Oman currently ranks 12th for the highest cases of diabetes, with an age-adjusted prevalence of 13.8% (IDF; 2021), which, in the absence of effective interventions, is predicted to rise to 43% by 2050 (Al-Lawati et al., 2015) placing an increasing burden on the healthcare system (Al-Riyami, 2010). For example, approximately 50% of patients on renal dialysis and amputation surgeries are due to complications of diabetes (The Ministry of Health [MoH], 2015). The magnitude of type 2 diabetes in Oman has, in part, been attributed to the significant social development, economic growth and urbanisation that has occurred throughout the country since the 1970s, resulting in detrimental lifestyle changes such as reduced physical activity and an increase in the intake of saturated fats and sugar (Alhyas et al., 2011). This has placed a substantial burden on Omans's healthcare sector and resulted in a growing incidence of non-communicable diseases (NCDs), including type 2 diabetes, with the cost of managing type 2 diabetes estimated to be

845.2 USD per person each year (IDF, 2021), with estimates of this increasing to as much as 1,986.80 USD per person by 2050 (Awad et al., 2020). Yet, despite this, the healthcare sector in Oman continues to focus on the treatment of type 2 diabetes rather than preventative care, with less priority placed on lifestyle modification (Alghafri, 2020).

4.1.1 The Health System and the Management of Type 2 Diabetes in Oman

Chapter One provides a more in-depth overview of the health system and management of type 2 diabetes in Oman. In brief, health care is predominantly financed and run by the government, with the MoH as the leading provider. All Omani citizens and residents working in the public sector have healthcare services provided and financed by the government. There are three levels of healthcare provided: primary, secondary, and tertiary. All three levels of care provide services for diabetes management. Within primary healthcare in Muscat, Oman, which is the focus of this PhD thesis, there are 26 healthcare centres (Alghafri et al., 2018). It is recommended that these primary healthcare centres should offer a multi-disciplinary approach to diabetes management (MoH, 2015). Although this approach to type 2 diabetes management can lead to improved patient outcomes, such as reductions in HbA1c levels and improvement in blood pressure and lipid levels (Levengood et al., 2020), research in Oman reports that that this approach is challenging due to resource constraints (Al-Alawi, 2019).

4.1.2 Summary of the Findings from Type 2 Diabetes Research and Physical Activity in Oman

There is a paucity of research in Oman exploring HCPs views on diabetes care, with the evidence base more focused on prevalence and epidemiology (e.g., Al Mandhari et al., 2009), diabetes care in general (Alyaarubi, 2011); patient perspectives of diabetes self-management

(e.g., Al-Rhabi et al., 2014), or patients quality of life (e.g., Al-Maskari et al., 2011). Of the limited studies exploring primary healthcare HCPs' experiences of providing care for patients with type 2 diabetes, a number of challenges were identified. These included high workloads (Abdulhadi et al., 2013), inadequate manpower and underutilisation of dieticians and nurses (Al-Alawai et al., 2019; Alghafri et al., 2017), poor infrastructure within the health centre (Al-Alawi et al., 2019; Alghafri et al., 2017), lack of technical support, e.g., inadequate IT systems (Al-Alawai et al., 2019), lack of knowledge and skills for diabetes care (Al-Alawi et al., 2019; Alghafri et al., 2017), inaccessible or insufficient diabetes guidelines (Abdulhadi et al., 2006; Al-Alawai et al., 2019; Alghafri et al., 2017), the unavailability of diabetes medication (Al-Alawi et al., 2019), suboptimal relationships or communication between patients and HCPs (Abdulhadi et al., 2006; Abdulhadi et al., 2013) and cultural norms (Alghafri et al., 2017).

Alghafri et al. (2018) developed and implemented a physical activity intervention for patients with type 2 diabetes delivered by dieticians in four primary healthcare centres in Oman. The intervention reported significant differences in patient outcomes related to their physical activity levels, triglycerides, and diastolic and systolic blood pressure between the intervention and control group (Alghafri et al., 2018). Whilst no HCP-related outcomes were measured during the intervention, the evaluation of the intervention revealed that despite the 66% of the dieticians delivering it deemed it acceptable, challenges were raised about delivering it in their routine clinical practice once the research phase ended. These challenges included space limitations in the health centres, the delivery of the intervention would be too time-consuming in their typical workday, and that more training is needed on the use of behaviour change techniques and physical activity measurement tools to be able to use them effectively with patients. The findings from Alghafri et al. (2018) demonstrate that behaviour change interventions delivered in primary

health care can increase patients' physical activity levels and improve their health outcomes in Oman. However, what is not clear from these findings is how physical activity interventions can be delivered by HCPs in their routine clinical practice that are sustainable outside of a research setting.

4.1.3 Implementation Frameworks and HCPs

To support the translation of evidence into practice, the Medical Research Council (MRC) guidance for the development of complex interventions underscores the importance of identifying and developing theory (Craig et al., 2008; Skivington et al., 2021). The utility of the TDF (Cane et al., 2012) in exploring determinants of HCPs' clinical practice behaviours was presented in Chapter One of this thesis. Yet, despite this rapidly growing evidence base, Dyson and Cowdell (2021) identified that there is a paucity of studies outside of Western settings that have used the TDF to understand HCPs clinical practice behaviours or support the implementation of evidence-based practice. None of the 60 studies included in the review by Dyson and Cowdell (2021) were based in non-Western settings. One study based in Uganda (Cummings et al., 2017) adopted the use of the Behaviour Change Wheel (BCW) approach and COM-B model (Michie et al., 2014), but not the TDF, to support the development of an intervention to increase the use of a triage tool at four tertiary care facilities. This highlights a gap in the literature; Dyson and Cowdell (2021) recommend that in-depth insight into the determinants and nuances of HCP's clinical practice using the TDF in non-Western cultures is needed but currently remains largely unknown.

A key rationale for the development and implementation of complex interventions is that they will bring about the desired change. As such, it is important to develop a theoretical

understanding of the process of behaviour change using existing evidence and theory (Davis et al., 2015). In earlier research, Kirk et al. (2016) stated that it is imperative that researchers understand how behaviour change models and frameworks, such as the TDF, make sense in different cultural contexts before the development of behaviour change interventions or implementation strategies. Given that there may be significant differences in healthcare systems and social or cultural norms between Western and non-Western settings, in line with the MRC guidance (Skivington et al., 2021), it is imperative to develop context-specific understandings of behaviour before the development of interventions and implementation strategies rather than adopting a '*copy and paste approach'* (Dyson & Cowdell, 2021, p.11).

Given the importance of context, stakeholder engagement and identifying and developing theory in complex intervention development (Craig et al., 2008; Skivington et al., 2021), along with the identified gap in the literature (Dyson & Cowdell, 2021), the aim of this chapter is to extend the previous work (e.g. Alghafri et al., 2018) by exploring HCPs barriers and facilitators to physical activity promotion for patients with type 2 diabetes in Oman using the TDF (Cane et al., 2012) as the theoretical framework.

4.1.4 Study Aim and Objectives

The aim of this study is to explore the barriers and facilitators experienced by HCPs working in primary care in Muscat, Oman when promoting physical activity to adult patients with type 2 diabetes; this study addresses aim two of this programme of research (Chapter One, page 76). To achieve this aim, the current study has the following objectives:

1. To identify barriers and facilitators experienced by HCPs in promoting physical activity to patients with type 2 diabetes.

2. To map barriers and facilitators experienced by HCPs in promoting physical activity to patients with type 2 diabetes to the TDF and COM-B model.

3. To develop overarching themes and subthemes from the mapped data to provide a conceptual framework for the data.

4.2. Method

4.2.1 Design

A qualitative study was conducted using one-to-one semi-structured online (MS Teams) interviews with HCPs caring for adults with type 2 diabetes working in primary healthcare in Muscat, Oman.

4.2.2 Materials

The TDF was used to guide the development of the interview schedule (Atkins et al., 2017). In doing so, this enabled a broad and systematic understanding of the HCPs' barriers and facilitators to physical activity promotion and ensured that the interview schedule (Appendix J) was guided by the TDF (Cane et al., 2012) an evidence-based implementation determinant framework (Chapter One). It is recommended by Atkins et al. (2017) that the domains of the TDF can be used to develop and guide the interview schedule; as such, this approach was used for this study. In line with these recommendations, the interview schedule for the present study included 20 questions, each one linked to a TDF domain. Examples of the questions in the interview schedule

include: *To what extent do you feel providing physical activity advice to patients is part of your role?* (Social/Professional Role and Identity), *how confident do you feel about providing physical activity advice to patients?* (Beliefs about Capabilities), *and do you feel you have the necessary skills to help patients increase their physical activity?* (Skills). After the development of the interview schedule, a pilot interview was conducted with the semi-structured interview schedule to highlight any practical issues with the online interviews, test the appropriateness of the questions and identify any limitations. No revisions were made to the interview schedule after the pilot interview, and the data from this study was included in the overall findings of this study.

4.2.3 Participants

As recommended, to generate insight and in-depth understanding in qualitative research a purposive sampling strategy was used (Braun & Clarke, 2013) as described in Chapter Two. Purposive sampling involves identifying and selecting individuals or groups of individuals on the basis of their knowledge about or experience of the phenomena of interest (Creswell & Guetterman, 2018). For this study, HCPs were selected based on their knowledge and experience of promoting physical activity within primary care for type 2 diabetes patients. The following inclusion and exclusion criteria were applied:

- Participants must be 18 years of age or over.
- Participants must be employees of the Ministry of Health and work within or on behalf of primary healthcare facilities in Muscat, Oman.
- Participants must be directly responsible for the care of adults with type 2 diabetes.
- Participants must be able to read and speak English fluently.

To ensure the participants met these criteria, a demographics form (Appendix K) was completed prior to the interview, which required them to confirm their eligibility to participate in the study explicitly. Participants were excluded if they did not meet all of the inclusion criteria outlined above. Participants working in primary care were invited to participate in the study via email, which included the participant information sheet (Appendix L) by the Director General of the MoH in Oman and were given at least a minimum of 24 hours to consider this information. Interested participants were then asked to provide their contact details, which were sent via the aforementioned Director General to the researcher so that a convenient date and time could be arranged to conduct the one-to-one interview. All participants were given the opportunity to ask questions prior to scheduling the interview. In total, 23 HCPs (male $n = 6$, female $n = 17$) working in primary care in Muscat, Oman, with type 2 diabetic patient-facing roles participated in the study. Table 4.1 provides an overview of the participant characteristics. HCPs working in various roles were invited to ensure a range of views could be explored. All of the interviews were conducted in English, and in accordance with the inclusion criteria, all participants were fluent in English; however, English was not their first language. A debrief sheet was emailed to each participant immediately after each interview (Appendix M)

Table 4.1

Characteristics of the Participants

Healthcare professional role	Number of participants	Number of years in the role (range)
Physician/Administration	1	13
Family physician	9	5-19
Clinician	1	7
Endocrinologist	4	6-25
Diabetologist	1	30
Dietician	2	12-14
Dietician/administration	1	12
Diabetes educator	2	8-20
General practitioner	1	10
Senior specialist family physician	1	10

4.2.4 Procedure

Ethical approval for the study was obtained from the Birmingham City University ethics committee (ref: Gibson /3322 /R(C) /2019 /Oct /BLSS FAEC) and the Oman Ministry of Health ethics committee (MoH/CSR/20/9487) (Appendix C). Twenty-three interviews were conducted, lasting between 30 to 70 minutes. Data were collected during December 2021 until data saturation occurred; that is, no new findings, themes, codes, or concepts are evident in the data (Glaser & Strauss, 2017; Saunders et al., 2018). The interviews were transcribed verbatim and uploaded to NVivo 12© for coding and analysis.

4.2.5 Data Analysis

Atkins et al. (2017) sets out a method for the analysis of qualitative data using the TDF as an a-priori framework which was followed for this study. In the first instance, deductive coding was

applied using content analysis (Krippendorff, 2018). Each transcript was read and re-read several times, and the relevant data were coded as a barrier or facilitator to the promotion of physical activity by HCPs. Then, each barrier or facilitator was coded to the relevant TDF domains and, subsequently, the COM-B model component (Michie et al., 2014). After that, an inductive reflexive thematic analysis was applied to the data that followed Braun and Clarke's (2019; 2022) six-phase process, described in detail in Chapter Two, to identify themes and subthemes relating to the barriers and facilitators identified within TDF domains. This approach for analysis is recommended in the literature, coding the data deductively and inductively ensures that any data that does not fit into the TDF is not missed (Atkins et al., 2017).

4.3. Results

All 14 domains of the TDF were found to influence HCP behaviour as either barriers and/or facilitators. Barriers were found in all domains except Goals, and facilitators were found in all domains except Beliefs about Consequences. Figure 4.1 and Table 4.2 present the number of barriers and facilitators coded to each domain of the TDF. Three themes and ten subthemes were identified that represent barriers and facilitators reported at different levels: the individual, organisation and system, and environment and community (Table 4.3).

Figure 4.1

Number of Barriers and Facilitators for each TDF Domain

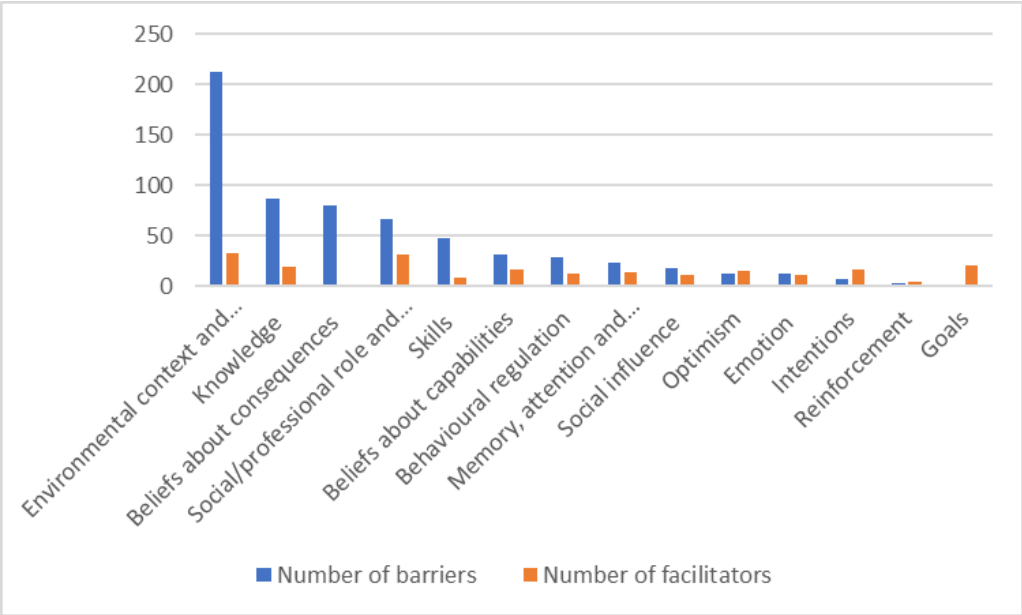


Table 4.2

Number of Barriers and Facilitators in each TDF Domain

TDF Domain	Number of Barriers	Number of Facilitators
Knowledge	87	19
Skills	48	9
Social/Professional Role and Identity	67	32
Beliefs about Capabilities	31	16
Optimism	13	15
Beliefs about Consequences	80	0
Reinforcement	3	5
Intentions	7	16
Goals	0	21
Memory, Attention and Decision Processes	24	14
Environmental Context and Resources	213	33
Social Influences	18	11
Emotion	13	11
Behavioural Regulation	29	13

Table 4.3

An overview of the Themes and Subthemes

Theme	Subtheme	TDF domains (COM-B model component)
Theme One - Individual-level Influences	HCPs' knowledge and skills	Knowledge (psychological capability) Skills (psychological capability) Beliefs about Capabilities (reflective motivation) Beliefs about Consequences (reflective motivation) Environmental Context and Resources (physical opportunity)
	HCPs' attitudes and beliefs about physical activity	Social/Professional Role and Identity (reflective motivation) Beliefs about Consequences (reflective motivation) Optimism (reflective motivation) Intentions (reflective motivation) Memory, Attention and Decision Processes (psychological capability)
	HCPs' beliefs about patients' physical activity behaviour and motivation	Beliefs about Consequences (reflective motivation) Intentions (reflective motivation) Optimism (reflective motivation) Goals (reflective motivation) Emotions (automatic motivation) Environmental Context and Resources (physical opportunity)
Theme Two - Organisation and System-Level Influences	Time, workload and competing clinical goals	Environmental Context and Resources (physical opportunity) Memory, Attention and Decision Processes (psychological capability) Social/Professional Role and Identity (reflective motivation)

	Availability and accessibility of resources	Knowledge (psychological capability Environmental Context and Resources (physical opportunity) Social/Professional Role and Identity (reflective motivation) Behavioural Regulation (psychological capability) Memory, Attention and Decision Processes (psychological capability)
	HCPs roles and responsibilities	Social/Professional Role and Identity (reflective motivation) Environmental Context and Resources (physical opportunity) Knowledge (psychological capability)
	Training opportunities and incentives	Knowledge (psychological capability) Beliefs about Capabilities (reflective motivation) Environmental Context and Resources (physical opportunity) Reinforcement (automatic motivation)
Theme Three- The Environmental Infrastructure, Norms and the Wider Community	Urban planning and the physical environment	Environmental Context and Resources (physical opportunity)
	Norms and culture	Social Influences (social opportunity) Environmental Context and Resources (physical opportunity)
	Community Engagement	Environmental Context and Resources (physical opportunity) Social Influences (social opportunity)

4.3.1 Theme One: Individual Level Influences

This theme explores the individual-level influences on HCPs' physical activity promotion with three subthemes: HCPs' knowledge and skills, HCPs' attitudes and beliefs about physical activity, and HCPs' beliefs about patients' physical activity behaviour and motivation.

4.3.1.1 HCPs' Knowledge and Skill

TDF domains (*COM-B component)*: Knowledge, Skills *(psychological capability)*, Beliefs about Consequences, Beliefs about Capabilities *(reflective motivation*), Environmental Context and Resources *(physical opportunity)*

This subtheme encompasses HCPs' perceptions that their lack of knowledge and skills about physical activity were barriers to its promotion. Lack of training and lack of adequate inclusion of physical activity in the medical curriculum contributed to gaps in HCPs' knowledge and skills in this area of diabetes care. No facilitators were coded to this subtheme.

Although most HCPs recognised the strong evidence base for physical activity and its importance as a component of type 2 diabetes management, they reported that a lack of knowledge and understanding about physical activity meant they were unable to provide detailed advice or guidance to patients.

> *We describe that [physical activity], but it's a very short discussion, very brief discussions not even that much deep because none of us have the knowledge to go to a deep discussion and offer a solution for the problem.* (Participant 16)

Specific gaps in knowledge that were discussed by HCPs included the basics of physical activity for type 2 diabetes, the appropriate type, intensity and duration of physical activity to recommend to patients, uncertainties about how to safely increase patients' physical activity, and a lack of knowledge to tailor physical activity advice to patients' individual needs. This was identified as a significant challenge when attempting to promote physical activity to patients with complications or comorbidities such as obesity, arthritis or pain.

> *There are some patients you don't know how to modify their exercise. Many patients with type 2 diabetes say they have knee problems, you know, they have osteoarthritis; they can't walk... I think those patients really need to have some other way of doing physical activity, but how to do it… I am sure that many doctors won't know how to answer… and I think if you have a patient who's in a wheelchair, how can you know [how] to promote them to do exercise? What types of exercise can they do since they cannot walk?* (Participant 6)

Because of these gaps in knowledge and the complexities of the disease, many HCPs were reluctant to discuss physical activity with patients. Instead, they focused more on the medical management of type 2 diabetes.

> *I don't see that we have enough knowledge, especially with challenging cases ... we want to deal with the issue the same way we deal with pharmaceuticals. It's easy to write a prescription just take paracetamol three times a day, but you can't do this with this*

> *physical activity if you want to consider it as a medication…we would rather spend more time explaining the drug or any medicine rather than explaining physical activity...* (Participant 1)

HCPs also felt that they lacked the skills to integrate physical activity promotion into their routine clinical practice. Specific gaps in skills discussed included formal assessment of patients' physical activity levels and abilities, prescribing physical activity, quantifying physical activity into tangible goals and outcomes for the patients, counselling skills and using behaviour change strategies with patients. Although HCPs were aware of the benefits of having these specific skills, they lacked the understanding and ability to translate them into practice.

> *We need more skills… [we need to know] the type of exercise they can do with their age, with the sex either male or female that I think it's important especially in our community.* (Participant 7)

> *I mean, they're [patients] okay with taking medication, but with changing their habits, it's a bit difficult, and it's very challenging, and health professionals just don't have the skills.* (Participant 16)

The lack of inclusion of physical activity and how to promote it in the medical curriculum and CPD training opportunities also contributed to HCPs' knowledge and skills gaps. This was attributed to a lack of funding directed to this area of their professional practice, with much of the training available to HCPs being funded by pharmaceutical companies and the scant

coverage of physical activity within the medical curriculum. These approaches emphasise the pharmacological management of type 2 diabetes rather than equipping HCPs with the knowledge and skills needed to include physical activity promotion as a core component of type 2 diabetes management.

> *Because see most of the medications are supported by pharmaceuticals, so there will be a lot of training [from the] pharmaceutical [companies], and pharmacy, will ensure that physicians understand about the drugs... there will be constant kinds of capacity-building activities on the medicines but poor physical activity [training] as there is not any company who could that support that…we lack that kind of trainings for healthcare providers.* (Participant 1)

> *I think it is a lack of knowledge as well...because actually, even in medical school… you will always find a chapter talking about prevention or lifestyle, but it is a small tiny one, you know… it's all about the physiology of diabetes… medications, and naming of the side effects...you always find that lifestyle is the last page… they say that lifestyle is the first line [of treatment] before starting medication, but… I think the way of teaching medical students and these guides makes them focus more on pharmacological than non-pharmacological aspects.* (Participant 6)

4.3.1.2 HCPs' Attitudes and Beliefs about Physical Activity

TDF domains *(COM-B component)*: Social/Professional role and identity, Beliefs about Consequences, Optimism, Intentions *(reflective motivation),* Knowledge, Memory, Attention and Decision Processes *(psychological capability)*

This subtheme reflects how HCPs' beliefs about physical activity could be a barrier or a facilitator to its promotion. Beliefs regarding the prioritisation of medication or dietary changes in diabetes management were barriers to physical activity promotion. Conversely, positive beliefs about physical activity for type 2 diabetes and patients' outcomes facilitated its promotion. HCPs' physical activity behaviour also influenced their decision to promote it.

Some HCPs discussed how they prioritised diet or medication management with their patients. This often stemmed from their own personal beliefs and level of knowledge and comfort in these areas of diabetes care, with the acknowledgement that this was a result of pursuing their interests, not necessarily because it is a better option. This demonstrates that HCPs' personal interests and motivation for physical activity can shape the comprehensiveness of care and advice provided to patients.

> *So, my view is always diet is more important than physical exercise when it comes toobesity or weight management...I don't focus on physical exercise much…I always focus on diet; then I say, yeah, exercise, keep it up… if I compare it to giving medication, if I am going to promote medicine and insulin, I would be motivated, but with physical*

exercise, I won't be that motivated as prescribing... I would just say do exercise and keep it up, you know, that sort of thing, diet, yes, because the diet is my interest personally. (Participant 6)

Some doctors are really not interested in this thing; they're just treating the patient, and next and next, the doctors themselves are not aware of the importance of physical activity and behaviour change for the patient, so that might act as a barrier for the physical activity thing. (Participant 4)

Conversely, for some HCPs, observations of changes to their patient's health, such as reductions in weight or glycated haemoglobin (HbA1c) levels, reinforced their belief in the value of physical activity for controlling diabetes and motivated them to promote it as a core component of diabetes management.

We had to decrease their insulin doses because they are actually doing physical activity; they don't need that many doses, so that reflects beautifully how physical activity actually improves their health. (Participant 11)

The result we get motivates me to discuss that [physical activity] with the patient because I feel so happy if the patient comes and tell me I control my blood sugar, I start losing the weight; the result itself will motivate me to do more discussions with the patients. (Participant 15)

HCPs' physical activity behaviour also influenced their decision to promote it. HCPs who were physically active felt more knowledgeable about physical activity and were able to understand their patients' challenges more because of their own experiences. As a result, they felt better equipped to provide advice to patients compared with HCPs who were not physically active.

> *This is challenging because the doctors themselves don't do physical activity. If you don't do it, how will you know the way to advise the patient? It will not come from a person who is experienced in this topic; it will only be theoretical and something that we just tell.* (Participant 11)

> *Once you, as a doctor or health professional start exercising, you know what the patient will go through; you'd have a personal experience to talk about… maybe you'll face the same challenges as the patient, so you will have bigger experience and give them the right advice.* (Participant 16)

4.3.1.3 HCPs Beliefs about Patients' Physical Activity Behaviour and Motivation

TDF Domains (*COM-B component)*: Beliefs about Consequences, Intentions, Goals, Optimism *(reflective motivation)*, Emotions *(automatic motivation)*, Environmental Context and Resources *(physical opportunity)*

This subtheme demonstrates how HCPs' beliefs about their patient's interests and motivation for physical activity were barriers to promoting physical activity for them.

> *Because the hardest part [of physical activity promotion] is the patient themselves… they don't try to improve or they believe that they can't find the time for physical activity…this is the most challenging part to convince them.* (Participant 11)

HCPs expressed the view that patients were often resistant to their physical activity advice, resulting in discussions about physical activity either being very brief or missed altogether.

> *The most challenge is the intention and the patient tension...if the patient is not willing whatever you do you cannot change what is in their minds about exercise; maybe they don't believe that exercise can help with controlling your diabetes... we have to work case by case to help them, and at the end, you will give suggestions but... he is the one who will decide...* (Participant 9)

> *Some of the patients, they just they are not, you know, willing to get engaged into this part of treatment, so it just stops at this; I reinforce, I bring it up in a very brief way because I know they will not follow so yeah, it just stays like this*. (Participant 17)

These issues were compounded by patients' expectations of a pharmacological approach to their care. This was attributed to patients' dominant beliefs about the speed and effectiveness of medication to manage type 2 diabetes and a broader societal issue of cultural attitudes and

lack of acceptance of physical activity in Oman. HCPs noted that it was challenging to change these ingrained beliefs and integrate physical activity into treatment plans.

> *Sometimes you know a patient who doesn't believe at all [in physical activity], sometimes the patients only believe in medicine… it's really very challenging to convince people about it if they have that belief, you know, an opposite belief about something… it's the most challenging, the acceptance that it's one of the therapies [for type 2 diabetes]… most of the people think it's a complementary therapy, it's not essential, so this is challenging to reach people that this is as important as your drug.* (Participant 5)

> *Yes, the majority, yes, they believe that medication will help them, will control the sugar in a quick way, in a fast way, so this one… again, it's the culture. We don't have the culture of lifestyle.* (Participant 2)

Given these barriers, some HCPs reported that, despite efforts to engage patients with physical activity promotion, the uptake of their advice was low. This led to them feeling sad and frustrated about their ability to influence patient engagement and behaviour.

> *I mean sometimes the frustration… when I have spent last time giving a lot of my time, and we have sat, and we have talked about it [physical activity], and when the patient comes in 6 months [later]… I really feel sorry for like why didn't he take my advice…I as the physician, I am limited… I feel sad; I feel upset. It's like, I want to help them… but*

what to say? There's nothing much I can do. (Participant 10)

I am always in this area pessimistic because, as I told you, most of them are not following this, and if you go to my clinic and my report may be around 80 to 90%, they are not going to exercise, they are not engaged in exercise, they are not walking, so actually this is very poor. (Participant 18)

Other HCPs anticipated low patient compliance with their physical activity promotion, suggesting past experiences of this. As a protective measure, they kept their expectations low to avoid personal disappointment or upset.

I do not believe in full compliance; my expectation is always not very high, so I will not be upset. (Participant 22)

HCPs identified the heterogeneity of patients with type 2 diabetes, such as their age, comorbid conditions, medication regime, and level of education, as increasing the complexity of physical activity promotion. This diversity makes tailoring their advice to meet individual patients' needs more challenging and can increase patients' resistance to HCPs' physical activity recommendations because it is not personalised to their individual needs.

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You get all sorts of spectrums of cases of patients. Some of them they are educated, some of them they are not, some of them they are willing to learn to educate themselves, some of them they are not, and you also get multiple comorbidities, you know, some of them they are you know, they are on wheelchair some of them they had surgery some of them

> *heart implication. So, it is quite a bit challenging to adapt [physical activity promotion] to each and every person again... you need to individualise to what they can do but it's not easy.* (Participant 17)

Despite these challenges, some HCPs have noted that planning and goal setting with patients has facilitated the promotion of physical activity. Goals that were measurable and achievable or linked to tangible health outcomes (e.g., differences in blood glucose levels or reducing insulin medication) or were personally relevant were found to be helpful when engaging patients in discussions about physical activity.

> *I tell them that you will notice by yourself that the amount of insulin you need is less. So that makes them actually happy and encourages them to do more physical activity because that's something that they can notice within a few days.* (Participant 11)

> *It [physical activity promotion] needs to be linked to outcomes like how frequently you want to do this, and it is linked to the glycated haemoglobin readings so that when you discuss it with a patient, you are convincing the patient more and more on the positivity of doing, so this is what you have been doing for the last three months and these are the positive outcomes of your physical activity behaviour*. (Participant 1)

4.3.2 Theme Two: Organisation and System-Level Influences

This theme encompasses HCPs' perceptions about how organisational and system-level factors influenced their physical activity promotion for patients with type 2 diabetes. The subthemes

identified here were time, workload and competing clinical goals; availability and accessibility of resources; HCPs roles and responsibilities; and training opportunities and incentives.

4.3.2.1 Time, Workload and Competing Clinical Goals

TDF domains (*COM-B component)*: Environmental Context and Resources (*physical opportunity*), Memory, Attention and Decision Processes (*psychological capability*), Social/Professional Role and Identity (*reflective motivation*)

In this subtheme, it was reported that several characteristics of the clinical and organisational context impacted HCPs promotion of physical activity with patients with type 2 diabetes. These included high patient numbers, acute cases, and only seeing patients with diabetes one day per week. HCPs frequently reported that these barriers often undermined their capacity to fully address physical activity in appointments or make it a priority, resulting in them only giving superficial or brief advice or none at all. They commented that capacity-building efforts to embed physical activity into primary care must not only address their gaps in knowledge but also barriers resulting from the organisation and structure of the health system.

> *I think it's the time factor in the clinic...it's all about the system, I blame the system a lot. If the system is keeping one doctor to see 20 patients in 6 or 5 hours and allocating each patient 15 minutes… you don't have time to give physical activity advice; your aim is to finish this one up, and let's see the other one, the second patient; it's down to pressure in the clinic going on… I think this is the main issue that needs to be solved... even if you*

> *are educating doctors about physical activity promotion while you're not providing the setting that allows him to do it, there's no point.* (Participant 6)

> *It's really difficult, as you know, counselling [for physical activity] requires lots of techniques and time. As a GP, waiting for 20 or 30 patients on the list, it's almost impossible to give that proper counselling.* (Participant 2)

HCPs reported barriers related to the volume of patients and insufficient health centre capacity to meet the needs of the large diabetic population in Oman. This, together with a reported shortage of HCPs with appropriate expertise, led to challenges in providing timely appointments, with waiting times of up to six months. It also had an impact on continuity of care, making it more challenging for HCPs to promote physical activity consistently.

> *We are only one centre for more than 50,000 people, and we have too many diabetic patients; sometimes, you cannot give them an appointment in less than six months or four months, and this might affect the continuity of care of those patients because there are no slots available for the next four months, for the next five months, the next six months for some patients.* (Participant 21)

The limited time in appointments to promote physical activity was further compounded by the complexities of HCPs' roles and the competing demands associated with diabetes care. Consequently, they often had to prioritise their patients' most salient issues in appointments, resulting in a lack of time to promote physical activity.

> *Being a physician, you always focus on medical therapy…You want to focus on, you know, fixing the high blood sugar readings, and you can do it by fixing the insulin and medical therapy, so you don't have time to educate them [on physical activity]*. (Participant 6)

Some participants discussed ways that they had tried to overcome the challenges of time and workload barriers by increasing the amount of time allocated to patients and scheduling extra appointments for patients with their medical residents. However, this was not possible in all clinics due to a lack of resources.

> *In the system what we have done we actually increase the time of the patient appointment, so it used to be 15 minutes we changed it to 25 minutes... we also added one more day for diabetic clinic... to provide enough time for the patients and give them more time to discuss the non-pharmacological issues... This is what we should do in the system itself so increasing one day, increasing the duration of the Diabetic Care appointment. (Participant 11)*

4.3.2.2 Availability and Accessibility of Resources

TDF domains (*COM-B component*): Environmental Context and Resources (*physical opportunity*), Social/Professional Role and Identity (*reflective motivation*), Memory, Attention and Decision Processes, Knowledge, Skills, Behavioural Regulation (*psychological capability*)

4.3.2.2.a Workforce. Participants explained that staff shortages made physical activity promotion more. challenging, especially in health clinics impacted by time limitations and high patient numbers. This highlighted the increasing demands on HCPs due to the increasing prevalence of type 2 diabetes in Oman and the need for more HCPs within primary healthcare clinics.

> *We need more doctors… for diabetes per se, I might see up to 10 to 15 patients per day, that's a big number if you want to provide that very, to provide counselling, to provide deep conversations, so that's very difficult.* (Participant 2)

This was compounded by the uneven distribution of support staff across different health centres, such as health educators. For example, whilst health educators were considered essential to support physicians with numerous aspects of diabetes care, including physical activity promotion, they were not assigned to all clinics. This exacerbated the challenges discussed in the theme above regarding insufficient time and workload, leaving little to no time to promote physical activity and highlighting the inadequate and inconsistent distribution of human resources within the healthcare system.

> *In my previous health centre… I was lucky to have a health educator, but in this health centre, I don't have a health educator, so now I have to do it all; I don't have time for physical activity in detail.* (Participant 10)

Another barrier was the insufficient availability of HCPs with physical activity expertise who could offer patients more comprehensive and tailored physical activity support. Although there was a referral pathway to access an obesity clinic staffed with physiotherapists and health educators, this was only available in secondary or tertiary care. However, substantial waiting times and staff shortages meant they could only take a small number of the patients referred to them.

> *I mean, even physiotherapy, we don't have that much physiotherapy. We don't have the referral. If someone has a problem with their back or knees, we could at least refer them to physiotherapy, but we don't have that much physiotherapy manpower.* (Participant 16)

***4.3.2.2.b Resource Shortages*.** Participants explained that a lack of equipment and space in health centres also hindered physical activity promotion and increased patient attrition. Specific resource shortages that were discussed included access to technological assistance, private spaces, and promotional tools.

> *There are no resources whatsoever. I mean, frankly, there's nothing... We don't have the means to measure their body composition; only tertiary care has this... we need to have some videos or leaflets that explain the types of physical activity that they can do with exercises, the calories burned by the physical activity we don't have any of that it's just verbal messages [from HCPs].* (Participant 16)

Additional concerns related to inadequate resources and tools was the lack of a system to plan, follow up and monitor patients' physical activity. Without this, HCPs said that patients could lose interest or not understand the importance of physical activity within diabetes management. Some HCPs expressed concerns that the absence of these tools could lead to patient attrition due to a perceived lack of support from HCPs.

> *With time, if you don't keep on following this patient, he might lose interest, or he may develop pain; you know, these people are obese. Some of them may develop pain, calf pain, and pains in their bodies, and if you don't follow these patients and provide the necessary support, they may withdraw from your clinic and not come back to you.* (Participant 1)

> *Without a mechanism [to follow-up] after I teach them... they will go back to the same level... whatever effort I have put in*. (Participant 10)

HCPs commented that being able to monitor patients during and after treatment would support the standardisation of physical activity care, with some suggesting that this could improve the efficiency of the healthcare system and the quality of care for patients.

> *Benefits would be system-related benefits because if you have controlled [blood glucose] patients, they don't really need to come regularly. So, it will reflect back on your busy clinics; you'll have less patients and more time for others...The other thing I think you won't be prescribing more medication, so it's an economic benefit later on.* (Participant 1)

However, it was reported that current healthcare policies in Oman disproportionately emphasise medical treatment for type 2 diabetes rather than lifestyle management. In addition to new procedures (e.g., system changes to monitor patients), HCPs explained that new policies are also needed to support the prioritisation of physical activity in clinical practice.

> *We need higher authority instructions, saying that we need now instead of focusing on treatment; again, it's time to focus more on physical activity. We need more policies and more guidelines.* (Participant 2)

4.3.2.2.c Guidelines. The participants discussed how the inadequate inclusion of physical activity in the clinical practice guidelines is a barrier to physical activity promotion. Although physical activity guidelines developed by the MoH are available, many HCPs felt that they only provided basic information and did not equip them with the knowledge to recommend more than walking for 30 minutes each day to their patients.

> *Our MoH guidelines are a bit old, and they don't touch the physical activity the way they should.* (Participant 10)

As a result, many of the HCPs used guidelines from sources other than those from the MoH, such as those from the American Diabetes Association (ADA, 2016). However, it was recognised that these also lacked sufficient detail to tailor advice to patients. It was also explained that these guidelines do not consider the complexities of patients with type 2 diabetes

and lack the level of detail required to enable HCPs to provide consistent and clear recommendations to patients, such as how to manage insulin and blood glucose levels.

> *I've been repeating myself about individualising physical activities, but this has not been addressed much in the guidelines or international protocols… also how to adjust how to reduce insulin it is not actually guidelines… we need universal guidelines… for example, to give the patient instructions that if you are going for heavy exercises for a longer duration, then you have to adjust your insulin by increasing or decreasing etc.* (Participant 17)

HCPs discussed the challenges of translating the broad guidelines into meaningful, actionable, and practical advice for patients. They also noted that it is difficult to communicate the information in the guidelines to patients in a way that is easy for them to understand and implement in their daily lives. As a result, patients can find this area of diabetes management confusing, leading to disengagement or non-compliance. To mitigate this, HCPs often kept their advice to patients brief or generic and spent their time focusing on other areas.

> *But with no explanation of what these guidelines are or how to translate them into actual practice… most of the physicians in their routine clinics would just go for a general message rather than actually giving it time… How can you tell a person to exercise 150 minutes a week? That's difficult, and it's vague… the patient might really get confused… then you will lose your patients.* (Participant 1)

> *I don't believe that many patients will understand if you just throw this number onto them; you need to explain what they can do and how this can be reflected in their daily lives. So, the guidelines and the articles they're quite dull and boring; they are not individualised for patient care*. (Participant 17)

Another challenge for the HCPs in this study was that these guidelines (e.g., the ADA) are based on Western rather than Arab contexts and culture, which added to the difficulty of translating the guidance into their clinical practice and patient behaviour.

> *So, my understanding from ADA [physical activity guidelines] and some of the lectures online from there will be updated, and then I don't know how to translate it for my patient because what we see in my patient community is very different from sometimes what we see online, so you know how to convey that, how to translate that information into my community. That's the difficulty I see, you know*. (Participant 10)

> *You get different guidelines across the literature; quantifying physical activity is very difficult, and translating this quantification into different languages is also difficult*. (Participant 1)

Some HCPs, however, were not aware of specific physical activity recommendations for patients with type 2 diabetes and instead relied on guidance from the general population. This reliance on broad, well-known recommendations underscores a gap in HCPs' knowledge and

education, as well as their access to or the availability of information that considers the needs and nuances of people with type 2 diabetes.

> *I'm not sure if there's a specific recommendation that's different from the population, but what I know is that 150 minutes per week is the WHO recommendation, so it's around 30 minutes per day for five days, and that's what usually we instruct the patient's this is the minimum that they need to do.* (Participant 11)

4.3.2.2.d Supportive Resources. In this subtheme, HCPs discussed resources that facilitated the promotion of physical activity. In one health centre, HCPs developed a protocol to standardise consultations as they recognised that their differing approaches did not support continuity of care. They also conducted bi-annual audits of their patients' physical activity behaviour using a questionnaire to monitor them. However, it was noted that these initiatives were carried out independently by individual health centres rather than being standardised across the entire health system.

> *We have the template… we have standardised our care… all of us have different ways of doing consultations, but to bring common things… I have put [on the template] that they have to provide something for physical activity, and sometimes, we audit the patient also. For example, at the end of the six months, if some patients are sitting outside, I'll give them a questionnaire [about physical activity]…we have agreed that we will make a check [on physical activity].* (Participant 10)

Another resource that HCPs noted facilitated physical activity promotion was The Diabetes Conversation Map. This is an educational tool used between HCPs and groups of patients with diabetes that fosters conversations about self-management of diabetes, including the importance of physical activity, which HCPs feel facilitates its promotion. However, despite its utility, its use was discontinued during COVID-19 and has not yet been resumed.

> *So, with the diabetic map… they [patients] discuss different issues using this interactive map… they discuss their lifestyle… they talk about physical activity, that's why we have a health educator there, she talks about physical activity, and we have the dietitian who concentrates on the diet…* (Participant 3)

> *Actually, we started that [Diabetes Conversation Map], but we did not go on because of the [COVID-19] situation… so it was the kind of thing that I think started helping our patients to understand more [about diabetes self-management].* (Participant 4)

Other HCPs made suggestions about what resources they felt would support them to promote physical activity. For example, a standardised physical activity questionnaire, assessment tool or smartphone application tailored to the context of Oman and integrated into the electronic health system, or a structured physical activity programme or clinic for patients embedded within primary healthcare clinics. It was also explained that all patients have a type 2 diabetes booklet that they bring to each appointment to record indicators such as blood pressure and fasting blood glucose. HCPs suggested that a column could be added to this booklet for

physical activity, which would make at least asking the question about physical activity behaviour mandatory and prompt HCPs to initiate the discussion.

> *It's a reminder, and at the same time, the booklet will be back to the patient so the patient can monitor himself and can see in there all of his visits when he was doing the physical activity how was the blood pressure and the blood sugar… and if he is not doing in the last three months it will also reflect in his weight and his blood sugar and everything that make the patient see actually the impact of this physical activity in the booklet, you know, in something that he can touch and can see*. (Participant 11)

> *I think if we have a clinic, a specialised clinical for this physical activity, I think it will be suitable for that, for that advice and to follow up.* (Participant 8)

4.3.2.3 HCPs Roles and Responsibilities

TDF domains (*COM-B component*): Social/Professional Role and Identity (*reflective motivation*), Environmental Context and Resources (*physical opportunity*), Knowledge (*psychological capability*)

This subtheme identified that whilst most of the HCPs in this study could see the importance of physical activity promotion for patients with type 2 diabetes, there was a lack of clarity on who should be responsible for it. Physicians felt that it was beyond the scope of their role due to their time limitations, competing demands and the breadth of knowledge required to promote it.

I'd never say it's a big part [of the role] because I told you to be very frank with you, it is a part of it but I also need to talk about the symptoms, I need to talk about any new symptoms, I need discuss about medication side effects, I need to talk about hypoglycaemia, I need to talk about complications. (Participant 10)

If I take myself… I have general awareness, but then it's a very big field, very specialised, and to be honest, sometimes I ask myself, is it my job to do it? I'm a physician; do I need to do it...? (Participant 5)

The ambiguity surrounding the allocation of responsibilities for physical activity promotion was compared with the much clearer dietary advice and the dieticians who provided this advice. The well-defined scope of the dieticians' role means that other HCPs clearly understand their role in providing dietary advice to patients, and they reported a much clearer understanding of how their role interacts with the dieticians and, importantly, who is responsible for this aspect of patient care. The absence of a comparable role for physical activity promotion results in uncertainties about who is responsible for it, leaving HCPs unclear on the extent of their role in this area of diabetes care.

Diet is in a better position than the exercise… in our side [of the world] still it's developing the concept of exercise, prescribing exercise, it's still not that much developed… For the diet, we have a dietician, so basically, we give general diet advice, but the whole role is the dietitian, the nutrition specialist... So, we don't have problems with the diet; we give the whole role to them, and we don't do anything except the, you

> *know, the whatever, you know, general diet advice... The exercise role comes all on the physician basically, and we only know the basics of exercise prescription or advising* (Participant 5)

It was indicated that to promote physical activity effectively, a multidisciplinary approach was needed that included HCPs with more physical activity expertise. However, this was not deemed achievable within the current healthcare system.

> *Part of my role? Yes. As a brief conversation, yes... it's a combined role. It should start with the clinician as a brief intervention about physical activity lifestyle modification, then go to the person who's really skilled...* (Participant 2)

> *The diabetic clinic setting has to be a multidisciplinary setting... in which you have a dietician, a diabetic nurse, a psychiatrist, a physician, and maybe a health educator as well... It's not like this here... we don't have that flow.* (Participant 6)

No facilitators were identified in this subtheme; however, suggestions were made by the HCPs to overcome the barriers noted above. They felt that there needs to be a consensus on the role of the HCP in physical activity promotion, and from there, clear guidelines and policies should be developed on the HCPs' roles and responsibilities for physical activity promotion. Another suggestion was to create a pool of expertise with interested and knowledgeable HCPs with the hope that '*their knowledge and skills will trickle down through the health care centres*'. (Participant 1)

4.3.2.4 Training Opportunities and Incentives

TDF domains (*COM-B component*): Knowledge, Skills, Beliefs about Capabilities (*psychological capability*), Environmental Context and Resources (*physical opportunity*), Reinforcement (*automatic motivation*)

A barrier consistently discussed in all interviews was the impact of a lack of training and education on physical activity and its promotion for patients with type 2 diabetes. Due to inadequate training opportunities, HCPs' physical activity knowledge and skills remained low, resulting in most of them only feeling capable of providing basic advice and support to patients.

> *I think more training definitely will be needed for all doctors... we have some basic knowledge but how to deliver it in the best way and evidence based I think we need some more training on that*. (Participant 11)

Most of the HCPs were enthusiastic about more opportunities for training in physical activity. However, it was noted that, within the current system, there were no performance indicators for HCPs linked to physical activity, meaning that the current system primarily relied on HCPs' motivation and interest to develop their knowledge and skills. It was suggested that the CPD system could be amended, as it may be useful for incentivising engagement in physical activity training and that HCPs physical activity promotion should be monitored.

We don't have any system of appraising healthcare professionals based on their performance … even with a CPD the CPD points are not linked to any incentives tangible incentives because the CPD points needs to be linked to promotions whatever but if you just keep on calculating and collecting CPDs what does it mean? I think if CPD was linked to promotions or tangible well established system of appraisal for healthcare professionals that would help. (Participant 1)

Maybe have it as a report or a semi-annual report for the physical activity, like indicators [for the HCPs]. How many physical activity prescriptions have you given this month? And what's the outcome of this prescription? Did the patient follow up on the prescription? Was there any relapse, any constraints or difficulties for prescription? It needs a regular follow-up by the administrator or by the head of the health institution. (Participant 16)

HCPs further explained that key performance indicators were introduced in healthcare centres to encourage HCPs to screen for pre-diabetes and, where needed, provide lifestyle advice to patients. The introduction of key performance indicators resulted in improvements in pre-diabetes screening; the participant suggested that the same approach is needed for physical activity promotion.

… after we included it as an indicator... and said that it would be evaluated and measured every year, people are more into applying it and telling the patient about pre-diabetes; the same thing needs to be done for physical activity, an indicator that is monitored by the

administrative authority body. (Participant 16)

While some HCPs engaged in additional learning to support their physical activity promotion, this was done with their own time and resources. It was noted by some HCPs that, although they had the interest and motivation to learn more about this area of diabetes care, there were limited opportunities within the current system, and as a result, it was challenging to bridge this gap in their clinical practice.

> *It's just scattered training... just mostly lectures or presentations regarding physical activity or even about diabetes interventions as a whole, but no specific training is provided... [it's] really, really honestly not available.* (Participant 21)

Nonetheless, two suggestions were made for improving HCPs' knowledge and skills. Firstly, conducting audits to understand their current levels of knowledge and understanding so that training/education programmes can be targeted to address their gaps in knowledge appropriately. Secondly, consistent continuing medical education (CME) or CPD on physical activity prescription and behaviour change skills workshops with ongoing monitoring and evaluation of these skills to highlight areas of improvement.

> *[What is] the knowledge of the current physicians about it [physical activity], you need to know the baseline level, where are your people...and then from there you see where you can fill the gaps, probably first increase knowledge or awareness by workshops and then probably you can do some structured training.* (Participant 5)

I think conducting workshops and conducting CMEs... even like when you see role plays, would help in improving our skills and how to ask the patient about their physical activities and how to start guiding them. It's very important... and somebody who is an expert supervising us or giving this workshop is very important... and after having such workshop actually assess me... when I have a patient you come to my clinic and assess how I'm doing. (Participant 4)

4.3.3 Theme Three: The Environmental Infrastructure, Norms, and the Wider Community

This theme presents HCPs' views regarding the impact of urban planning, the physical environment and infrastructure as barriers to physical activity promotion. In addition to the impact of social and cultural norms, and insufficient relationships with community organisations on their capacity to promote physical activity.

4.3.3.1 Urban Planning and the Physical Environment

TDF domains (C*OM-B component*): Environmental Context and Resources (*physical opportunity*)

This subtheme explores how the hot weather and poor environmental infrastructure, such as the lack of safe outdoor spaces to be active and poorly maintained or missing pavements, make it more challenging for HCPs to promote physical activity to individuals with type 2 diabetes. They reported an incongruence between their advice and how patients could realistically put it into

practice. For example, during the summer months, temperatures can exceed 50°C with high humidity, making being physically active outside unrealistic. This often led to increased resistance from patients regarding HCPs' advice.

> *Also, our weather, I feel it is the most challenging thing, which is all the time when I ask the patient to go for exercise, they say I can't go outside, so it is very challenging for us, for me and for the patient also*. (Participant 14)

> *It makes it harder, and sometimes, for some patients, it doesn't make sense that I advise them to do the physical activity, and then they ask where should we go… there's no safe area to walk* (Participant 6)

While some HCPs suggested that their patients could join a gym or engage in other indoor activities to overcome the heat and poor infrastructure, this was considered expensive, resulting in inequalities in patients' access to physical activity resources.

> *There is always a gym, but how many people can afford it... if we had the walking places, you know, and you have parks… it would definitely help more.* (Participant 10)

4.3.3.2 Norms and Culture

TDF domain (*COM-B component*): Environmental Context and Resources (*physical opportunity*); Social Influences (*social opportunity*)

The environmental barriers discussed in the subtheme above were further exacerbated by cultural norms and religious practices, such as the emphasis on modesty and privacy for females. Not only may this make being active outside challenging, as these spaces are not designed to consider privacy, but there is also a scarcity of female-only exercise facilities, such as gyms.

> *Not only that, the geography and the environmental barriers are also good reasons for people not being adherent to physical activity. We don't have enough spaces or places especially for women to practice, so you, as a physician, if you ask somebody to start being active and sustain this kind of behaviour, you really need to be careful not just to send a general comment, but to help the patient to identify the barriers and to get some solutions.* (Participant 1)

HCPs' perception of patient beliefs about the appropriateness of physical activity for females and their cultural acceptance of physical activity as a treatment for type 2 diabetes were barriers to its promotion. HCPs reported that this stemmed from patients' lack of understanding of the health benefits of physical activity and its misalignment with the cultural norms and values of some patients.

> *Guidelines keep on insisting on physical activity... I think the problem is, again, I go back to how to do it in our culture and whether the guidelines are culturally accepted.* (Participant 1)

Some HCPs described that despite knowing their female patients would benefit from physical activity, navigating these societal and cultural challenges increased the barriers to physical activity promotion.

> *There are young people patients who will say, females who say no cycling is not an exercise for us in our culture you know I cannot go round cycling; my family doesn't allow me to go cycling, so then what's the alternative, well I cannot go to the gym... What choices should I give her, you know, so it can make it really challenging?* (Participant 10)

> W*ith the woman is still in some areas is still like if a woman goes out for walking, they'll be like, okay, you're not supposed to walk you are supposed to be at home.* (Participant 16)

4.3.3.3 Community Engagement

TDF domain (*COM-B component*): Environmental Context and Resources (*physical opportunity*) Social Influences *(social opportunity)*

HCPs perceived that poor communication and relationships between healthcare centres, the wider community, and organisations also impacted physical activity recommendations. HCPs explained that the absence of a referral system for patients to community facilities and resources made it challenging to offer actionable recommendations.

> *Unfortunately, no, we still don't have that very good and strong communication between the health centre and the community around it; we don't have that, you know, the community supporting the health centre; we are still lacking the referral system to the community facilities and resources we don't have, unfortunately.* (Participant 4)

HCPs discussed community engagement and partnership working as potential facilitators of physical activity promotion, but it was noted that a lack of communication between the MoH, HCPs and community organisations hindered this.

> *We need to communicate with the community around us, why are not communicating, why we are we working separately and independently without the help of the community, I'm not sure about that. I think we need to improve this part... it makes it more hard definitely [to promote physical activity].* (Participant 11).

However, before the COVID-19 pandemic, some HCPs described community events that were created to promote physical activity and that some healthcare centres had collaborated with the Ministry of Sports Affairs to achieve this. A low-cost membership to gyms in football stadiums in two different locations was briefly set up in Muscat for females with type 2 diabetes. However, this had not been re-established.

> *I did last year, two years back, I did one, and I went to these football stadiums, and I called all my [female] diabetic patients, and they came there may be 30 to 40 patients, and we did a lot of activity that day, and I saw people has the motivation, you know if*

you create some sort of activity, but it's like not one day, do this activity one you know in a while but what we need is something which is consistent. (Participant 10)

We started working with the Ministry of Sports Affairs and then we decided to give them space in the stadium for the overweight and obese women, but the project was stopped because of the pandemic. (Participant 16)

4.4 Discussion

The aim of this study was to explore HCPs barriers and facilitators to physical activity promotion for adults with type 2 diabetes in Oman, using the TDF. This analysis presents multi-level barriers and facilitators to physical activity promotion with individuals with type 2 diabetes experienced by HCPs working in primary care facilities in Oman. Overall, barriers were identified in all domains except Goals, and facilitators were mapped to all domains apart from Beliefs about Consequences. The highest number of barriers and facilitators were identified in the Environmental Context and Resources Domain. Examples of barriers identified included insufficient staffing resources, and culturally relevant guidelines (Environmental Context and Resources), a lack of knowledge to promote physical activity (Knowledge), and a lack of clarity on who is responsible for physical activity promotion (Social/Professional Role and Identity). Examples, of facilitators included HCPs developing their own resources, such as checklists and patient questionnaires (Environmental Context and Resources) and increasing their knowledge of community resources for patient referrals (Knowledge).

The barriers identified in this study highlight the challenges associated with the evidence-practice gap and the complex interactions that exist for HCPs when caring for people with type 2 diabetes. Despite the evidence demonstrating that physical activity has many benefits for type 2 diabetes (e.g., Hamasaki, 2016), and that HCPs can have an influential role in patients' adoption of healthy lifestyle behaviours (McPhail & Schippers, 2012), the accounts of the HCPs in this study, and the several interacting TDF domains demonstrate the complexities of doing this in practice.

4.4.1 Comparison of the Findings of this Study with the Literature

In line with prior research, the HCPs in this study reported gaps in their knowledge and skills related to physical activity and its promotion (Albert et al., 2021; Herbert et al., 2012; Lion et al., 2018). Barriers related to knowledge in this study, which are also commonly reported in the literature, included inadequate understanding of the foundational principles of physical activity and its promotion, lack of knowledge to intensify patients' physical activity and lack of knowledge to promote physical activity to patients with complications or comorbidities (e.g., Albert et al., 2021; Kime et al., 2020; King et al., 2022; Stuij, 2018). This latter barrier poses a significant issue for HCPs physical activity promotion, considering that out of 1,389,016 patients, Iglay et al. (2016) reported that 97.5% had one comorbid condition alongside type 2 diabetes, and 88.5% had at least two.

Specific gaps in skills to promote physical activity found in this study, and the wider literature include using behaviour change techniques and strategies with patients (Albert et al.,

2021; Chisholm et al., 2012; Huij et al., 2015), physical activity assessment and counselling (Cunningham & O'Sullivan, 2021; McPhail & Shippers, 2012), and prescribing physical activity (Thornton et al., 2016), all of which are exacerbated by limitations in time and resources (e.g. McPhail & Shippers, 2012). As with prior research, this was primarily attributed to a lack of training (Netherway et al., 2021; Rushforth et al., 2016) and inadequate guidelines (Kime et al., 2020; Vishnubala et al., 2022), both of which demonstrate the complex interplay between the individual level barriers, and organisation and system-level barriers.

The findings in this study demonstrate the impact of HCPs lack of knowledge and skills on their capability and confidence to promote physical activity to patients with type 2 diabetes. To effectively promote physical activity, it is vital that HCPs feel knowledgeable and skilled to do so. Whilst the majority of HCPs in this study wanted more training on physical activity and how to promote it, they reported a lack of access to training and CPD that could bridge this gap in their skills and knowledge. These findings are consistent with the literature. It is frequently reported that physical activity and how to promote it are not considered in the level of detail required in medical curriculums or included in CPD training (Vishnubala & Pringle, 2021; Weiler et al., 2013). These findings highlight an incongruence; HCPs do not have access to sufficient training or education to promote physical activity, yet it is recommended that they are well-placed to promote it (e.g., IDF, 2017). It is suggested that the lack of integration of physical activity within medical education and CPD training programmes may result in physical activity being considered less of a priority than other aspects of HCPs' roles and responsibilities (Netherway et al., 2021). In line with this HCPs in the present study were unclear about their roles and responsibilities for physical activity promotion. This was compounded by the pharmacological focus of type 2 diabetes treatment and management in their education and

training resulted in primarily biomedical model of care. Whilst the benefits of embedding physical activity promotion into healthcare are clear (e.g., Hamasaki, 2016), this will not be successful without addressing the lack of education and training provided to HCPs on it and the clarification of their role in promoting it.

Compounding knowledge and skills barriers, and consistent with prior evidence, HCPs in the present study reported that the lack of in-depth, good-quality clinical practice guidelines for type 2 diabetes and physical activity was a barrier to its promotion (Cuthill & Shaw, 2019; Haussman et al., 2018; Hou et al., 2020; Vishnubala et al., 2022), As a result, many HCPs in this study and in earlier research report a lack of confidence and low perceived ability to promote physical activity beyond basic and generic advice and as a result, again keeps the focus more on pharmacological management of type 2 diabetes (Herbet et al., 2012; Kime et al., 2020).

An additional challenge noted by the participants in the present study was that diabetes guidelines primarily originate from Western contexts; for example, many of the HCPs in this study reported using the ADA guidelines (e.g. Colberg et al., 2016). These published guidelines (e.g. ADA) do not consider the nuances of the Arabic culture, such as religious and cultural norms, or environmental factors, such as the extreme heat in summer. The lack of inadequate guidelines identified by HCPs in this study indicates that there is a clear need to develop physical activity guidelines that consider the diverse cultural and geographic factors to support HCPs to provide context-specific education and strategies. Additionally, social and cultural norms were identified as barriers to physical activity promotion, particularly with female patients. Given that earlier research stemming from Oman identified that females are more inactive than males

(Alghafri et al., 2017), it will be imperative that HCPs are provided with support to provide culturally competent physical activity promotion.

Most HCPs in the present study intended to promote physical activity in their consultations; however, several system-related barriers to doing this in practice were discussed. These included limited time in appointments (Albert et al., 2021; Kime et al., 2020; McPhail & Shippers, 2012), increasing workloads and patient numbers (e.g., Keyworth et al., 2019) and the competing demands of their role. There was also reported to be a lack of resources, including an insufficient workforce and physical activity expertise, inadequate referral pathways, lack of equipment and space in health centres, and an inadequate electronic health system to monitor and follow up with patients (e.g., Matthews et al., 2014). As well as inconsistent allocation of patients to HCPs, the infrequent availability of appointments, the lack of a multidisciplinary approach to diabetes care, and inadequate links to community resources (Al Alawi et al., 2019; Speake et al., 2021; Vuori et al., 2013). These barriers led to concerns over the quality and continuity of care given to patients, which is considered critical to a successful primary care system (Gulliford et al., 2006), and is associated with improved patient outcomes, fewer hospitalisations, and reduced healthcare costs (Chan et al., 2021). In line with findings from similar research, a lack of continuity of care noted in this study is not only a barrier to effective diabetes management (Kumar et al., 2022; Rushforth et al., 2016), but it is often linked to resource-constrained environments (Meiqari et al., 2019).

Promoting physical activity in some healthcare centres was facilitated by developing and implementing resources such as following protocols during appointments or distributing physical activity questionnaires to patients. Whilst the use of protocols has been identified as a facilitator to physical activity promotion with people with type 2 diabetes (e.g., Stuij, 2018), it is important

to note that it has also been suggested that they can lead to increased time pressures and work processes (Wolker-Manta et al., 2022). Given that HCPs in the present study shared that lack of time and resources, and increased workloads was a barrier to physical activity promotion it is imperative that, before wider dissemination of protocols, further exploration and evaluation of these resources in the context they are being used in is conducted.

HCPs can play a central role in physical activity promotion and can positively impact their patients' behaviour (e.g., Wheeler et al., 2017). Research has demonstrated that HCPs beliefs and attitudes about their patients can have a significant influence on the content of their consultation (Wollny et al., 2018). In this study, it was found that HCPs' beliefs about their patients were barriers to physical activity promotion, such as patients' motivation or stamina for physical activity, often resulting in them omitting it from their consultations. This supports the findings from prior literature (e.g., Lion et al., 2018; Nam et al., 2021; Mogre et al., 2019). For example, when HCPs have low belief in their patient's compliance with their recommendations, they are less likely to promote physical activity and focus more on controlling their patients' blood sugar levels with pharmacological treatments (Albert et al., 2021; Litchfield et al., 2019; Freeman & Loewe, 2000; Freene et al., 2019).

The present study has identified individual-level barriers that impede the translation of the evidence base into HCPs routine clinical practice, e.g., knowledge, skills and beliefs. However, HCPs in this study also identified barriers at the system and organisational level that impact their physical activity promotion to patients with type 2 diabetes, such as time and resource limitations. Interventions that focus on individual-level issues, which Presseau et al. (2021) refer to as a false dichotomy, without focusing on the system they operate in, have been '*disappointingly modest*' and are likely to insufficiently address complex problems such as those

being examined in this PhD thesis (Chater & Loewenstein, 2023, p. 1). These same authors suggest that when developing interventions to change behaviour, it is also necessary to consider systemic change, which focuses on public policy and is described as a system of rules, norms, and institutions (Chater & Loewenstein, 2023). This highlights the importance of a dual approach that can understand and address both individual and systematic barriers that impact HCPs' promotion of physical activity. To achieve this, research exploring the evidence-practice gap suggests that engaging with policymakers and decision-makers is an important part of this process to ensure that solutions are developed that are grounded in an understanding of the complex interplay between individual behaviours and systemic barriers (Abu-Odah et al., 2022).

4.4.2 Strengths and Limitations

A significant strength of this study is that it is the first qualitative study exploring barriers and facilitators experienced by HCPs when promoting physical activity to patients with type 2 diabetes globally and in Oman using the TDF (Atkins et al., 2017) and the COM-B model (Michie et al., 2014). Although earlier research in Oman has noted challenges to the provision of diabetes care, including physical activity promotion (Alghafri et al., 2017; Alyaarubi, 2011), prior to this programme of research, there has been minimal progress in this area of research. The findings from the current study not only add to the body of research but also extend current understandings in this area of HCPs' professional practice.

The use of the TDF and the COM-B model in this study aligns with recommendations in the literature regarding the development of interventions (Craig et al., 2008; Skivington et al., 2021). The TDF and COM-B model provides a systematic and detailed overview of HCPs' experiences that can establish a strong basis for the development of recommendations and

interventions to support HCPs. The updated MRC guidelines on developing and evaluating complex interventions underscore the critical influence of context (Skivington et al. 2021). The use of TDF in this study aligns with these recommendations and enables the identification of contextual factors that can influence HCPs' promotion of physical activity, such as social and cultural norms. Understanding the influence that these barriers can have on HCPs physical activity promotion is vital to facilitating the development of context-specific interventions (e.g., Presseau et al., 2018).

An additional strength of this study is that, as noted by Dyson and Cowdell (2021), the TDF has not been used to explore HCPs' professional practice behaviour outside of Western settings. The current study has contributed to minimising this gap in the literature and provided novel insight into the utility and appropriateness of the TDF and COM-B model to identify and categorise influences on HCPs' physical activity promotion within primary healthcare settings in Oman. This extends the current knowledge base regarding the scope of the TDF to explore and understand the complex determinants that influence HCPs' professional practice behaviours across culturally diverse contexts. However, to further add to the literature, it will be important to extend these findings to determine if the components of the BCW, such as behaviour change techniques and intervention functions (Michie et al., 2014), are effective when practically applied in non-Western settings to barriers identified by the TDF. While important, this is beyond the scope of the current study and should be addressed by future research. Nonetheless, this study has addressed a gap identified in the literature (Dyson & Cowdell, 2021) and has demonstrated the utility and applicability of the TDF to determine and identify barriers and facilitators to physical activity promotion outside of Western contexts.

Another strength of this study was the use of deductive and inductive coding in the analysis of the data. Data were initially coded deductively, using content analysis, to the TDF domains and COM-B model constructs. A common criticism of a purely deductive approach to coding is that important influences on behaviour that do not fit within the TDF may be missed (Martis et al., 2018; McGowan et al., 2020). As such, inductive coding, which employs a bottom-up approach to data analysis, was also applied to the data to check for emergent codes that TDF may not account for. Furthermore, the interview schedule was guided by the TDF, with questions developed for each domain as recommended in the literature (e.g. Atkins et al., 2017). McGowan et al. (2020) postulate that this may mean that barriers or facilitators not related to the TDF domains may be missed, as the interview schedule may be too restrictive and not allow for discussion beyond the domains. The use of inductive coding in the current study also addresses this potential limitation.

Participants were a purposive sample, with the recruitment of participants supported by the Director General of the MoH. Whilst this led to a sufficient sample size of a diverse range of HCPs, offering a wide range of perspectives and experiences, this may have led to biases, such as social desirability bias or some of the sample being more motivated towards physical activity promotion. It may be that a more random sample of HCPs would report additional barriers or facilitators beyond what was found in this study.

Another limitation of this study is that more physicians than dieticians and diabetes educators took part in this study, which may result in a lack of generalisability or biases in the findings. For instance, many of the physicians felt that dieticians or health educators may have more time to promote physical activity to patients with type 2 diabetes. However, it was also noted that dieticians and diabetes educators lacked sufficient knowledge and skills to promote

physical activity to these patients. If assigning the responsibility of physical activity promotion to dieticians and diabetes educators is a feasible option a more in-depth examination into the feasibility of this and their training needs will be required.

Finally, HCPs were only recruited in primary healthcare settings in the capital of Oman, Muscat, meaning that the generalisability of the findings may be limited across primary healthcare settings. Muscat is more developed compared with other regions in Oman; there is a higher standard of living, better infrastructure, and more opportunities for healthcare (Nebel & Richthofen, 2016). To determine if standardisation of physical activity promotion is feasible across Oman, additional interviews with HCPs in other regions of Oman will be needed as the influences on physical activity promotion may differ. Finally, although all participants spoke English fluently, this was their second language; as such, this may exclude important insights.

4.5. Conclusion

This qualitative study mapped interview data to the TDF (Cane et al., 2012) and COM-B model (Michie et al., 2014) to present a comprehensive examination of the barriers and facilitators experienced by a diverse range of HCPs in a primary healthcare setting in Oman. This study identified that HCPs experience a number of barriers, at multiple levels of the system, making it challenging to promote physical activity consistently and adequately to their patients with type 2 diabetes. The data presented in this study indicate that to address HCPs barriers to physical activity promotion a multi-component strategy, that targets key TDF domains at the individual, organisation and system level will be required. To further contribute to the understanding of how this can feasibly be achieved in Oman the next chapter of this PhD thesis examines healthcare policymakers perspectives of physical activity promotion in primary healthcare settings.

Chapter Five: A Qualitative Study Exploring Healthcare Policymakers Perspectives of Physical Activity Promotion in Type 2 Diabetes Care in Oman

5.1 Introduction

As discussed in previous chapters of this thesis, the prevalence of type 2 diabetes is increasing rapidly in Oman and globally and is becoming a significant burden on people with the disease, their families, the healthcare system and the national economy (International Diabetes Federation, [IDF], 2022). Physical activity is an integral component of type 2 diabetes management and can reduce complications of the disease, as well as prevent, delay, or even reverse the disease (e.g., Hallberg et al., 2019). Yet, in Oman, only 21.6% of adults with type 2 diabetes are physically active at the recommended levels, with females more inactive than males (Alghafri et al., 2017). Despite the recommendations that HCPs are well placed to promote physical activity to people with type 2 diabetes within their routine clinical practice (IDF, 2017; World Health Organisation [WHO], 2018), HCPs in Oman, as reported in Chapter Four of this thesis report many challenges to this, and as a result, their advice is brief, generic or not given at all. Despite Oman's clinical practice guidelines highlighting the need for HCPs to promote physical activity to their patients with type 2 diabetes, there are very few details on how to do this in practice, and a biomedical approach to managing the disease (e.g., medication, bariatric surgery, etc.) is the common healthcare approach to tackling the growing problem (Alghafri et al., 2018).

5.1.1 The Gap Between Research, Practice and Policy

It has been estimated that 85% of investment in health and biomedical research is wasted every year because of failure to understand the priorities and needs of key stakeholders, research methods that do not consider the complexities and nuances of the problem, and inadequate or unclear dissemination of the research findings (Chalmers & Glasziou, 2009, 2014; Macleod et

al., 2014). It is increasingly recognised that there is a growing need to bridge the gap between evidence-based research, practice and policy to improve healthcare systems, delivery and care outcomes (Subramaniam et al., 2022). Yet, change and improvement in healthcare are increasingly complex to achieve (Grol et al., 2007) and it is increasingly being recognised that there is a need to understand determinants of behaviour of stakeholders at all levels of a healthcare system (Presseau et al., 2021).

5.1.2 The Evidence to Practice Gap

Frequently, healthcare improvement interventions target factors related to HCPs or patients without considering that improvement and implementation might be hindered by a broader range of factors such as economic, administrative, or organisational factors (Grol et al., 2007). This can be seen in the intervention studies reviewed in Chapter One of this thesis. Despite many of the studies reporting that the delivery of a physical activity intervention by HCPs resulted in significant improvements to outcomes for patients with type 2 diabetes, there was no consideration of the intervention's integration into the broader healthcare context and system (e.g., Alghafri et al., 2018; Fowles et al., 2014). As a result, HCPs reported concerns about delivering the intervention once the research phase ended, citing challenges such as the intervention being too burdensome to deliver, inadequate resources and time constraints (e.g., Alghafri et al., 2020).

Whilst this focus on efficacy in interventions demonstrate the impact of regular physical activity on outcomes for people with type 2 diabetes (e.g., Alghafri et al., 2018), this approach will not aid the translation of research into practice or policy (Skivington et al., 2021). This is because potential key influences on intervention outcomes and sustainability are not always

considered such as whether the intervention aligns with policy goals or priorities, if it can be integrated into the existing system and processes, or whether there are sufficient resources for long-term support (Skivington et al., 2021). In acknowledgement of the need for this in-depth understanding, the updated UK Medical Research Council (MRC) guidance for developing and evaluating complex interventions emphasises the importance for researchers to focus not only on the design of the intervention but also on the context in which it will be delivered to maximise its impact and real-world implementation (Skivington et al., 2021).

5.1.3 The Need for Stakeholder Engagement

Another core component of the MRC framework is the importance of engaging with a range of stakeholders, including patients, practitioners and policymakers, early in the intervention development process and after that at each phase of the research (Skivington et al., 2021). The authors suggest that this approach to stakeholder engagement can support the development or identification of an intervention most likely to result in positive benefits to health whilst also improving the likelihood of changes to policy and practice (Skivington et al., 2021). Supporting the rationale for this approach, systematic reviews exploring the implementation of evidence and guidelines in healthcare settings have reported that interventions that addressed multiple factors at multiple levels, such as the individual (e.g., knowledge and attitude) and the system (e.g., organisational culture, capacity, service delivery, resources) had a greater likelihood of successful implementation compared to those that did not (Grol & Wensing, 2004; Li et al., 2018; Waddell et al., 2021).

Policymakers are key stakeholder groups to engage with, as they can provide critical insight into the practicalities of implementation in real-world settings that consider the broader

political, social and economic context (Skivington et al., 2021). In light of this, evidence-informed health policymaking is advocated within the literature as an approach to enhanced decision-making and improving the performance of health systems (Macintyre et al., 2001; Oliver et al., 2014). However, a well-documented gap exists between research, practice and policy that can result in health system inefficiencies and poorer outcomes (Boaz & Nutley, 2023; Nutbeam, 2004; Oliver & Cairney, 2019; Oliver et al., 2014). Research has reported several barriers to policymakers' engagement with and use of evidence in policymaking. These barriers include inadequate access to high-quality, policy-relevant and timely research (Cairney & Oliver, 2017; Newman et al., 2016; Nutley et al., 2007; Oliver et al., 2014), evidence utilisation and integration challenges (Oliver et al., 2014), insufficient political and institutional support and funding (Liverani et al., 2013; Scott et al., 2019), and policymakers gaps in knowledge and skills to access and implement research findings (Abu-Odah et al., 2022; Ellen et al., 2018). Furthermore, communication gaps (Uzochukwu et al., 2016), differing timelines (Head, 20; Oliver et al., 2014), and misaligned priorities and goals (Cairney & Oliver, 2020) between policymakers and researchers have also been noted as barriers.

An additional consideration when exploring the gap between research, policy and practice is that policymakers often approach healthcare from a macro-level perspective. Their focus is typically on healthcare delivery aspects, such as funding, regulatory compliance, and policy frameworks (Walshe & Smith, 2011). In contrast, HCPs place more of a focus on meso- and micro-level factors such as quality of patient care and accessibility of resources at the point of care (Greenhalgh et al., 2018). The divergence in viewpoints between HCPs and policymakers can result in misaligned strategies in healthcare delivery (Vogel et al., 2013). For example, policymakers might implement regulations or processes at a systemic level that they believe

would be effective but may actually be impractical or a burden for HCPs at the point of care. Likewise, HCPs may advocate for change that they perceive as beneficial at the individual level but are financially or logistically unfeasible from a policy perspective. As a result, before developing interventions or strategies to support HCPs in this area of diabetes care, it is essential to understand areas of convergence and divergence between key stakeholder groups that could impede or facilitate the implementation of research into practice (Grol & Wensing, 2004). Understanding the views of policymakers, as well as other stakeholders, is essential to developing a broad understanding of potential implementation challenges, identifying priority areas to address, and ensuring that resources are allocated for maximum impact (Abu-Odah et al., 2022; Green & Aarons, 2011; Grol & Wensing, 2004).

There have been numerous studies that have explored challenges to the translation of research evidence into clinical practice (e.g., Abu-Odah et al., 2022) and HCPs barriers and facilitators to physical activity promotion (e.g., Albert et al., 2021; Keyworth et al., 2019; Kime et al., 2020). Yet the perspectives of healthcare policymakers are scarce (Cairney et al., 2017; Frahsa et al., 2014; Lee et al., 2015; Oliver et al., 2014), despite them being involved in key decisions that shape the healthcare system and health delivery (Gonzales et al., 2012). The need for the inclusion of policymakers in the development and implementation of healthcare interventions is evidenced in the study by Alghafri et al. (2018) in Oman. Despite this physical activity intervention demonstrating significant improvements in health outcomes for patients with type 2 diabetes, once the research phase was over, it was not feasible to continue its delivery due to a lack of resources and funding (Alghafri et al. 2018; 2020). This highlights the importance of engaging with policymakers to identify challenges to implementation and to

ensure that interventions are not only effective but that their delivery can be sustained in the long term.

5.1.4 Evidence-Based Policy Making in Oman

The political context of Oman is described in more detail in Chapter One. In brief, there is a cabinet of 23 ministers representing different ministries, of which the Ministry of Health, is one (MoH, n.d). Higher-level policymakers include the Sultan, royal family members, the Council of Ministers and the Council of State (Majlis al-Dawla) (Katzman & Collins, 2021). Whilst lower-level policymakers are the Consultative Assembly (Majlis al-Shura), specialised advisory boards and committees, local government officials and municipal councils, and government agencies and departments (Al-Sabahi et al., 2023).

Although there is not a detailed standalone guideline or policy for physical activity and type 2 diabetes, physical activity was embedded within Oman's national non-communicable disease policy and plan of action (Al-Siyabi et al., 2021). However, an examination of this policy and plan reported that despite advancements being made, there were limitations, including no defined budget for the plan, no explicit evaluation plan was developed, and no surveillance system was set up to monitor physical activity trends. There were little details on how to operationalise initiatives to target vulnerable groups, and it does not specify how sub-groups of the population will be targeted such as people with type 2 diabetes (Al-Siyabi et al., 2021). The lack of an effective national strategy and adequate guidelines to support HCPs, as well as the findings from Chapter Four of this thesis, suggest HCPs are left to navigate this crucial aspect of

diabetes management without sufficient resources or guidance, potentially compromising patient outcomes and professional efficacy.

Given the utility of evidence-based policymaking in healthcare (e.g., Oliver et al., 2014), there have been calls in Oman to strengthen the relationships between health researchers and policymakers to support evidence-informed policy and decision-making (Al-Riyami, 2010; Al-Al-Sabahi et al., 2023). Yet, research in this area is very limited; only two published studies have explored healthcare policymakers' views in Oman (Al-Sabahi et al., 2023; El-Jardali et al., 2012). The study by El-Jardali and colleagues (2012) explored knowledge translation with representatives from 11 countries within the Eastern Mediterranean Region, including Oman. This study identified key barriers to evidence-based policymaking, including accessibility to research evidence, the need to make quick decisions, financial constraints, lack of strategic thinking by policymakers, and lack of local evidence (El-Jardali et al., 2012). A limitation of these findings is that all responses were collated, meaning it is not possible to determine which ones specifically relate to the challenges faced in Oman. Nonetheless, they do provide insight into key barriers reported by countries within the Eastern Mediterranean Region that need to be considered in relation to evidence-based policymaking.

The second published study in this area, conducted by Al-Sabahi et al. (2023), examined policymakers' perceptions of the challenges of evidence-informed policymaking in supporting the embedding of a knowledge translation department within the health system in Oman. The authors reported several challenges to evidence-based policymaking, including low interest in research, a lack of research skills and time for finding, synthesising and applying research evidence, as well as financial constraints and limited resources. Capacity-building efforts, such

as training and CPD for policymakers, were identified as important in supporting evidence-based policymaking (Al-Sabahi et al., 2023).

Despite healthcare policymakers having a significant and active role in determining healthcare services for patients with type 2 diabetes, to date, their views on physical activity promotion for this group of patients have not been explored. Despite the robust evidence base demonstrating the effectiveness of physical activity in improving type 2 diabetes outcomes (e.g., Hamasaki et al., 2016), the HCPs in Chapter Four of this thesis and earlier research (e.g., Kime et al., 2020) report numerous barriers to translating this evidence into their routine clinical practice. This highlights the difficulties of translating research findings into practice and policy (Milat & Li, 2017). As such, it is imperative to explore the views of healthcare policymakers prior to the development of interventions and strategies to support HCPs as they play a crucial role in shaping environments, for example, through funding and legislation that can facilitate or hinder physical activity promotion.

Given the pivotal role of policymakers, the final study for this programme of research will focus on examining their perspectives on physical activity promotion within primary healthcare settings in Oman. By gaining a deeper and more nuanced understanding of the processes, practices, and policies that can hinder or facilitate the implementation and translation process, including the views of healthcare policymakers will ensure that the recommendations stemming from this PhD thesis have been considered from both the end-user perspective and the policymaker's perspectives. This approach will allow for recommendations and strategies that can be both effective and sustainable (Skivington et al., 2021; Tricco et al., 2018).

5.1.5 Aim and Objectives

This study aims to explore the perceptions of healthcare policymakers employed by the MoH in Oman on the influences of promoting physical activity to patients living with type 2 diabetes in primary healthcare settings. This study addresses aim three of this programme of research (Chapter One, page 77). To achieve this, the study has the following objectives:

1. To explore healthcare policymakers understanding of the challenges experienced by HCPs promoting physical activity to adults with type 2 diabetes in Oman.

2. To explore the experience of implementing strategies to support HCPs in promoting physical activity to adults with type 2 diabetes.

3. To explore the experiences of healthcare policymakers on implementing evidence-based research findings regarding physical activity and type 2 diabetes.

5.2 Methods

A more detailed overview of the methodological underpinnings of this study is detailed in Chapter Two.

5.2.1 Design

This qualitative study was conducted using semi-structured online (MS Teams) one-to-one interviews with policymakers who met the inclusion criteria for this study.

5.2.2 Participants

Eight healthcare policymakers working within the MoH were recruited for this study using purposive sampling. The sample included six female and two male participants. The participants described themselves as policymakers (*n* = 2), policy advisors (*n* = 1) and senior management (*n*= 5) with a range of 4 – 17 years of experience. To meet the eligibility criteria for this study, the participants were:

- 18 years of age or over
- employees of the MoH
- directly responsible for developing policies or decisions that influence the practice of HCPs working in primary health care with adults with type 2 diabetes
- able to read and speak English fluently

To ensure all participants met the inclusion criteria, they completed a demographics form (Appendix N) before the interview that explicitly confirmed their eligibility to participate in the study. Participants who did not meet all of the inclusion criteria outlined above were excluded from participating in the study.

Participants were invited to participate in the study via email, which included the participant information sheet (Appendix O) from the Director General of Primary Healthcare in the Directorate of Health Services for the MoH in Oman. Participants were then given sufficient time (at least 24 hours) to consider the information in the information sheet before a date and time for the online interview was arranged and to ask any questions before taking part. Interested participants were then asked to provide their contact details, which were sent via the Director General to the researcher. At this point, the researchers sent the participants a demographic

details form and an informed consent document (Appendix N). Upon receipt of these forms eligible participants were contacted so that a convenient date and time could be arranged to conduct the online one-to-one interview. All participants who expressed interest in the study met the inclusion criteria. All participants were given the opportunity to ask questions prior to scheduling the interview. All interviews were conducted in English, in accordance with the inclusion criteria, while all participants were fluent in English; this was not their first language. All participants were emailed a debrief form immediately after the interview (Appendix P)

5.2.3 Materials

A semi-structured interview schedule (Appendix Q) was designed to explore policymakers' perceptions of physical activity promotion for adults with type 2 diabetes, the feasibility of implementing strategies to support HCPs in this area, and the integration of evidence-based findings into policy and practice. The interview schedule was informed by the findings in studies one and two of this programme of research, and prior literature (e.g., Abu-Odah et al., 2022). The interview schedule included 16 questions, with prompts designed to facilitate a deeper exploration of the topic and guide the conversation. The interview schedule covered the topic areas of policymakers' perspectives of HCPs challenges and barriers to physical activity promotion for patients with type 2 diabetes, the feasibility of developing increased support for HCPs, and their experience and views of evidence-based policymaking. Examples of the questions in the interview schedule included: *What support do you think is needed for physical activity to be embedded within the existing healthcare system to support/increase physical activity promotion*? *What more do you think could be done to support healthcare professionals to promote physical activity to people with type 2 diabetes*? *Do you feel you have adequate access to health research to support your decision-making*?

5.2.4 Procedure

Ethical approval for the study was obtained from the Birmingham City University ethics committee (Gibson /#10862/sub2/R (C)/2022/Sep/BLSS FAEC) and the Oman Ministry of Health ethics committee (MoH/CSR/22/26336) (Appendix D). Data collection took place between May and June 2023. The online interviews lasted between 30 and 70 minutes, with an average duration of 45 minutes, and were audio or video recorded using MS Teams and transcribed verbatim by the researcher for analysis. All participants were thanked and debriefed after the interview, provided with the opportunity to ask any questions they had regarding the study, and their right to withdraw period was also re-stated.

5.2.5 Data analysis

To ensure confidentiality and anonymity, all identifying information was removed and replaced with a number and their working title (e.g., policymaker, policy advisor, manager). Transcripts were analysed using inductive reflexive thematic analysis, a rigorous procedure that follows a 6-phase guide as recommended by Braun and Clarke (2019, 2022), discussed in more detail in Chapter Two. Phase 1) familiarising yourself with the data; phase 2) coding; phase 3) generating initial themes; phase 4) developing and reviewing themes; phase 5) refining, defining and naming themes; and phase 6) writing up (Braun & Clarke, 2019, 2022). For phase 1, the eight interviews were transcribed verbatim and read and re-read by the researcher several times, after which, for phase 2, the data were coded in NVivo 12© (QSR International), and code

labels were assigned. For phase 3 codes were clustered together in accordance with shared meaning and the research question. In phase 4, the initial candidate themes were reviewed and revised where necessary. In phase 5, a detailed analysis of the themes and subthemes was conducted. In phase 6, the themes and subthemes were written up into a final report that combined analytic narrative and data extracts. Regular supervision meetings were held throughout the coding and theme/subtheme development process to allow discussions to ensure quality control, the refinement of codes and themes, and validation of the analysis. As recommended by Breakwell et al. (2006), the analysis process stopped when the data was understood in detail. Finally, in accordance with phase 6 of thematic analysis, the themes and subthemes were then written up in full using direct quotes from participants to illustrate the themes and highlight the most relevant points participants made during the interview, fulfilling the research aims and providing answers to the research questions. As described in Chapter Two, to ensure rigour and trustworthiness of the data Yardley's (2000) four dimensions of good quality qualitative research were followed: sensitivity to context, commitment and rigour, transparency and coherence, and impact and importance. In addition, Braun and Clarke's (2022) revised 15-point checklist was also adhered to.

5.3 Results

A total of four themes with 12 subthemes were conceptualised from the data related to the research objectives. Table 5.1 provides an overview of the themes and subthemes.

Table 5.1

An Overview of the Themes and Subthemes

Theme	Subtheme
1. The Healthcare System	Access and availability of resources
	Insufficient workforce
	Education and training
	A public health approach
2. Physical Activity in Healthcare Policy and Strategic Planning	Competing healthcare priorities
	Shifting priorities and increasing awareness
	Bureaucratic challenges
3. Collaboration and Leadership	Challenges with collaboration efforts
	A shared understanding and leadership support
4. Accessibility and Availability of Research and Evaluation Data	The need for more local research
	Practical barriers to research
	The need for evaluation data

5.3.1 Theme One: The Healthcare System

This theme highlights how policymakers perceive that HCPs capacity and ability to promote physical activity to patients with type 2 diabetes can be influenced by organisational, system and policy level factors. Subthemes include Access and availability of resources, Insufficient workforce, Education and training, and A public health approach.

5.3.1.1 Access and Availability of Resources. In this subtheme all participants recognised that a lack of resources, such as equipment, tools, guidelines, checklists or protocols, and physical space within healthcare centres, negatively impacts HCPs ability to promote physical activity to patients with type 2 diabetes.

> *…at the primary healthcare level, which is the first access for these patients in diagnosis management and follow-up, there is a lack of resources [for HCPs] like equipment and educational tools... or a well-structured policy to guide the healthcare worker on how to promote physical activity...* (Participant 6)

Despite an awareness of these issues, some participants noted that it was challenging to address them in the current sociopolitical and resource-limited climate. The MoH's capacity to support HCPs physical activity promotion was impacted by top-down decisions that resulted in budget constraints and a lack of authority and jurisdiction to make changes at the healthcare and community levels, resulting in limited access to resources.

> *The barriers are the resources… we don't have the authority to make changes in the community, and we don't have enough resources to provide for our patients… we don't have a proper budget to initiate our own physical activity plans for our patients at the level of the health system or the level of the primary healthcare…* (Participant 4)

The importance of addressing physical activity resources at the patient and community level was also emphasised. Many participants shared that there are limited free resources, such as parks or safe walking paths, and that for many people, gym memberships were often too expensive. The need for more readily available and low-cost resources for HCPs to direct patients to was recognised as important but currently lacking to facilitate support for HCPs in this area of diabetes management.

> *Accessibility for the patients because you, because they [HCPs] could, for example, go and run a clinic and do all of these things, but if there is no facility or area for them to do physical activity, it's gonna really dampen the or hasten the process… that's one issue that's not really in our hands.* (Participant 1)

> *If you look at the community, there's not a lot of access to public or, you can say, outdoor physical activity areas. What I mean is like parks, there are no outdoor exercise parks… so that's something the municipality can do for the entire population's right to have accessible areas to promote physical activity...accessibility is a big problem* (Participant 2)

It was discussed that the implementation of a new initiative, 'Healthy Cities and Healthy Villages,' could address the lack of community physical activity resources by supporting communities to identify their needs and ask for resources from a variety of stakeholders to address them.

> *We are trying to create this culture and also create demand within the community, so they ask for things to be done. Instead of asking the Ministry of Health to build a new health centre, they ask the municipality to have walking pathways or parks, or they ask the Ministry of Sports for more programs.* (Participant 8)

5.3.1.2 Insufficient Workforce. In this subtheme participants frequently mentioned a shortage of HCPs within primary healthcare as a barrier to HCPs capacity to promote physical activity for patients living with type 2 diabetes. Despite the increasing population in Oman and the increased number of health centres and speciality clinics introduced into the healthcare system, the number of HCPs to support this demand has not increased, resulting in an overburdened primary healthcare system.

> *We went on from two and a half million [patients] a decade ago to four and a half, but the doctors' numbers have not increased…* (Participant 7)

> *The main issue here is the shortage of the healthcare worker… it is a big issue… we are dealing with an increasing number of programs [clinics and initiatives] every month,*

let's say not every year, every month or two, and you are having the same number of doctors. (Participant 5)

Workforce shortages exacerbated existing time and workload barriers for HCPs, which meant that physical activity promotion could not be consistently included in appointments with patients living with type 2 diabetes.

Shortage of staff… we need more staff, it's the main thing, to have time to organise this [physical activity] we need more staff. (Participant 6)

There is a time limit which does not allow the healthcare worker to sit and offer proper counselling or education [on physical activity] because there is crowdiness available of the primary healthcare, and there is time wise does not allow. (Participant 4)

This was seen as a challenge that impacted both the patients and HCPs caring for them. It was perceived as compromising the quality of care and accessibility to healthcare for patients and increased the risk of burnout and stress for HCPs.

… we are dealing with an increasing number of programs every month… for example, if you had ten doctors taking care of 5 programs, now we'll have eight doctors taking care of 15 programs or 20 programs. How will these people give the appropriate care or even

have the time to think about other ways or strategies [physical activity] to tackle this issue? (Participant 5)

Let's say that I'm a family physician in a health centre… I have a lot of obligations… It's really too much… today, he's in the diabetic clinic tomorrow, he's in the elderly clinic…and that puts a lot of burden on the doctor as well… at the end of the day, the doctor is exhausted… how will he also have time to provide counselling about physical activity? (Participant 6)

A broader systemic challenge that compounded workforce shortages and lack of time that impeded continuity of care was the structure of the healthcare system. Currently, no restrictions are placed on which healthcare centres patients can attend. This results in an uneven distribution of patients among providers and makes it challenging to match HCP allocation with patient demand. This systematic challenge makes forecasting needs and optimising resource distribution (such as the workforce) more challenging for policymakers.

Continuity of care is one of the options which we are trying to implement, but because our health care system is governmental, so it's free for all… we try to divide them [patients] into catchment areas… but and because it's free and there are no constraints, any patient can walk into any health centre, our population, they want health care wherever they want, not with the same doctor. our population, they want health care wherever they want (Participant 7)

Additional workforce challenges to promoting physical activity within diabetes care were employee attrition, competing priorities and the reallocation of staff that have been trained in physical activity promotion, all of which impacted continuity of care and the ability of HCPs to consistently promote physical activity.

> *We have many competing priorities, so what is happening is that you could be training a number of diabetes educators [on physical activity], and these are mainly nurses, and then they will be just asked to go cover other areas or other clinics… so then you start losing your workforce.* (Participant 3)

The reallocation of staff trained in physical activity promotion highlights the influence of administrative decisions on the implementation and sustainability of initiatives that could support physical activity promotion within primary healthcare. For example, nurses used to be responsible for collecting physical activity data, but this was stopped, which was seen to hinder the integration of physical activity promotion into the healthcare system.

> *We used to rely on nurses, for example, to extract data and collect data [about physical activity], but then, unfortunately, this conflicted with what the DG [Director General] nursing was saying, so that was stopped.* (Participant 3)

> *…also, with this high turnover, we find many facilities having these really good [physical activity] initiatives… but then when you start losing those healthcare*

> *providers, or they're being shifted around… it causes a lot of burnout and you end up losing those initiatives and those innovations that were really helping patients.* (Participant 3)

The incongruency between the increasing demand on the healthcare system and the inadequate distribution and allocation of newly qualified HCPs to primary added to an insufficient workforce and overburdened primary healthcare system.

> *We have a lot of doctors who are graduating every year... who are sitting at home waiting for jobs and not getting jobs. The same goes for nurses, pharmacists and other medical experts and medical specialities. I really don't know what the problem is… financial, problems, maybe, I really don't know.* (Participant 5)

Despite these workforce challenges being an action point on the government's agenda each year, the participants were not aware of any plans in place to address this issue.

> *Shortage of staff has been a challenge and a problem for years now. I really wish to get higher authorities to look into these issues and try to solve them somehow. I'm not that optimistic, really… they do know the issue… It's one of their agenda items every year, but they don't find any solution so far.* (Participant 5)

5.3.1.3 Education and Training. In this subtheme the participants acknowledged that within the healthcare system, the responsibility for physical activity promotion to patients with

type 2 diabetes was placed with HCPs. Yet they also recognised a disparity between what HCPs are expected to do and the lack of training and education provided to them to build their knowledge and ability in this area.

> *We continue to tell them [HCPs] to encourage your patients to change their lifestyle…but then we're not really providing them or the patients with the right tools to do so… We don't really have proper education or training in terms of physical activity. So the right instructions and the right counselling technique to provide [physical activity promotion] patients in not happening… So I'd say that's the challenge, lack of awareness and not enough training or even awareness from it in terms of training, we are not helping them build their capacity to provide counselling.* (Participant 3)

Participants highlighted the current limitations of HCPs education and training curriculums and how this contributes to the challenges they experience in this area of diabetes care. Most of the education and training for HCPs focuses on pharmacological rather than non-pharmacological approaches to managing type 2 diabetes. This was perceived by participants to reinforce the dominant medical paradigm in Oman and resulted in many HCPs predominantly focusing on a biomedical approach to the management of type 2 diabetes at the expense of physical activity.

> *But why do we have defects in [physical activity] counselling? Because whenever we focus on formal training or education, it's on guidelines or pharmacological management [of type 2 diabetes], but this area [physical activity] is not tackled very*

well. Why? I don't know… maybe there is a lack of awareness… so it's ignored or not very much visible. (Participant 4)

Although it was agreed that increasing HCPs training on physical activity could support their promotion of it, the lack of training centres and budget was perceived as limiting the availability and accessibility of training. To mitigate this, each governate (an administrative division of state that is headed by a governor) was responsible for physical activity training; however, inconsistencies within and across regions with this approach resulted in slow progress in this area.

There are barriers to training… we don't have enough training centres; what we do is we try and encourage the governorates themselves to ensure that they are continuously conducting this training, but we find that it could be a bit slow as well… we've seen these programs not really happening… (Participant 3)

It was further acknowledged that the lack of physical activity and behaviour change expertise in Oman exacerbates the challenges of developing and providing training to HCPs. It was felt that this could be addressed by partnering with international organisations to conduct this training in Oman or sending HCPs overseas. However, budgetary requirements and support from higher-level policymakers were seen as barriers to this.

We could send [to Saudi Arabia] some family physicians to get certified in lifestyle medicine… I think that would make a big difference…. The challenges to this [physical

activity] training would be getting the money and the support from stakeholders… we could use them to empower the others [HCPs], teach the others, and implement this. (Participant 7)

Disparities in the allocation of fellowships were highlighted, with the perception that the government prioritises other medical specialities over those in primary healthcare. This was partly attributed to lack of awareness of the importance of lifestyle medicine.

We need to send some family physicians to get certified in lifestyle medicine. I think that would make a big difference but getting the money and support would be challenging…we do have fellowships and scholarships… but not for lifestyle medicine… what's happening now is that they are trying to identify the areas of deficiency and send people for fellowships depending on that. They would go like, "Hmm, we need a neonatologist in this area of Oman." They would offer that this year. Next year they will need a cardiologist or a urologist, but family medicine is not usually one of the, it's the specialty with the least chances to go for a fellowship in Oman. (Participant 7)

Several participants, however, recognised that any efforts to improve HCPs training and education on physical activity would have less impact without the infrastructure (e.g., parks and pavements) to support patients to be physically active, highlighting the need for a multi-sectoral approach to address the issue.

So, education, you can do that… but you need to provide the setting first and then provide

> *the education, but to consider only the education, thinking that that will be enough is an error… Even if the healthcare professional does their job within the health centre, but the community is not prepared, and they're not ready, physical activity cannot be promoted… it has to go all together*. (Participant 8)

5.3.1.4 A Public Health Approach. In this subtheme, participants discussed the underutilisation and underdevelopment of the public health sector in Oman. Public health was described as a '*missing sector'* (Participant 7) between the MoH and the government. Participants discussed that the lack of a public health approach exacerbates HCPs' challenges in promoting physical activity. It was emphasised that more expertise in this area is needed, especially when considered alongside the lack of funding and resources and the need to reach target populations, which requires knowledge and skills that HCPs lack.

> *We do have public health, but it's not as well established…we do need more people in that area...they would be more aware of how to get money for campaigns and how to reach people. I think those are things that they [HCPs] are not taught, and they have to develop and search, and it's not easy.* (Participant 7)

However, in the political and healthcare climate in Oman, public health strategies are predominantly applied to communicable rather than non-communicable diseases (NCDs), such as type 2 diabetes. This indicates a disparity between the government's approach to disease management that prioritises immediate responses over long-term preventive measures and highlights the need for a shift in thinking about the treatment of NCDs along with the broader

application and integration of public health into the system.

> *Unfortunately, when you say about prevention, or about public health, they [the government] will think about communicable diseases only.* (Participant 8)

Exacerbating the lack of recognition by the government of the need for a public health approach to NCD management was the absence of training and education provided to HCPs in this area. Whilst a public health component used to be included in medical education, this has been discontinued. The curriculum places a heavy emphasis on the clinical management of chronic disease, which can result in a narrower focus on pharmacological treatment approaches for type 2 diabetes. It was emphasised by participants that curriculum reform is required to reintegrate public health training into residency programs.

> *We used to have in residency a block on community medicine, but not anymore.* (Participant 6)

> *When I graduated from the College of Medicine, I didn't know about public health actually… they are teaching us only the clinical part, so it should start from there, and it should be considered as one of the modalities of treatment*. (Participant 8)

Furthermore, it was explained that whilst there are a small number of trained public health specialists in Oman they are underutilised and are not allocated to roles that leverage their

training and expertise. The lack of a public health strategy underscores a systemic gap in the government's integration of preventative strategies into healthcare, which includes physical activity promotion.

> *We do have a couple of public health specialists, but I think they are more into the statistics part, not the community part. I'd say it's lacking, and it's not usually done here... We do need more people in that area so that we can integrate it together and have a better outcome.* (Participant 6)

> *Maybe it's the health system itself… I know people who studied health system management but are not working in that field. For some reason, they [the MoH] don't know how to make use of them... that's why it's not applied as it should be*. (Participant 7)

5.3.2 Theme Two: Physical Activity in Healthcare Policy and Strategic Planning

In this theme, participants identified that a lack of prioritisation of physical activity within government healthcare policies and strategic planning influences HCPs' promotion of it. Participants identified several factors they felt influenced this, some of which exacerbated the barriers of access and availability of resources, insufficient workforce and inadequate education and training reported in Theme One above. These factors are presented here as subthemes: competing healthcare priorities, shifting priorities and increasing awareness, and bureaucratic challenges.

5.3.2.4 Competing Healthcare Priorities. Participants reported that although higher-level policymakers consider diabetes a healthcare priority, physical activity is not seen as a core component of its care. The lack of focus on physical activity within healthcare policy and planning was partly attributed to the numerous pressing demands on the healthcare system and a lack of awareness of the benefits of physical activity for type 2 diabetes amongst higher-level policymakers.

> *I think the biggest barrier would again be competing priorities. We continue to say that, as a health sector, we need to focus on disease management rather than counselling for physical activity.* (Participant 3)

> *The biggest challenge is to actually raise that awareness with the health care officials here in the Ministry [of Health], but that is because there are other priorities, and this [physical activity] is not seen as something that is of importance, especially not within the health sector*. (Participant 6)

It was reported that healthcare decision-making was primarily influenced by the limited resources and funding available and the need to direct these to areas perceived to be more critical, such as treatment, medications, hospital admissions, and reducing waiting lists. However, this was done at the expense of non-pharmacological health promotion activities, such as physical activity, as this does not yield immediate results.

Policymakers have to choose, right? I mean, they have a certain amount of money and the budget and human resources, so they're gonna prioritise things that are more critical… people who need dialysis, people who need acute treatment, they're not going to focus their power or resources on something like physical activity… they don't see it as immediate payback. (Participant 1)

I don't think it is a priority; the main priority currently actually is providing health services, reducing the appointments, reducing the waiting time, and reducing the period between appointments. (Participant 2)

This appeared to keep HCPs more focused on the pharmacological management of the disease and keeping up with an overburdened healthcare system.

Doctors are busy… priority has not been initiated or activated for physical activity in diabetes; everybody talks about diabetes, and everybody talks about pharmacological interventions, but for physical activity, there are not many talking about this. (Participant 4)

Some participants suggested that a contributing factor to the lack of prioritisation of physical activity in healthcare resource planning was a lack of advocacy for its importance in

type 2 diabetes treatment and management by the MoH. It was recognised that this keeps the focus on expanding tangible resources, such as hospitals and medication, rather than focusing on approaches that could, in the long term, reduce the burden on the healthcare system, such as physical activity promotion.

> *Maybe we [the Ministry of Health] are not advocating for it [physical activity]. Well, perhaps the health system is not advocating for this. When they talk about diseases, they don't make this a priority; they always request more hospitals, and they always request more medications for range and for staff.* (Participant 8)

However, although other healthcare priorities and limited awareness influenced the lack of inclusion of physical activity in healthcare policy and planning, participants noted an incongruence between physical activity and dietary management of type 2 diabetes. It was felt that, compared with physical activity promotion, the rationale for and impact of dietary care in type 2 diabetes management was more apparent to policymakers and, as a result, had more resources directed to it.

> *We talk more about dietitians and their roles but not enough about physical activity…this [physical activity] is not seen as something that is of importance… so we're investing a lot in dietitians but not physical activity…* (Participant 6)

5.3.2.5 Shifting Priorities and Increasing Awareness. Without governmental prioritisation and integration of physical activity into healthcare policies, it was perceived that HCPs would continue to face barriers to promoting it. The importance of increasing awareness among high-level policymakers about the crucial role of physical activity and its promotion was emphasised to ensure opportunities are not missed and to allocate additional resources to support promotion efforts.

> *At the level of the policymaker, priority has to be clarified…we need to work on objectives and implementation strategies...and it needs a belief from the higher level, with financial support and human resources support.* (Participant 4)

Examples of this happening in other areas of healthcare, such as smoking, women's health and screening programmes, were discussed, demonstrating that when an area of healthcare is seen as a priority, it is possible to create structures or strategies to address this and allocate resources accordingly.

> *We talk more about tobacco, and now we have growing numbers of tobacco cessation services, but then not enough on physical activity…* (Participant 3)

> *It's not a priority [physical activity]; if it were, they would go out of their way to structure it into the routine of the healthcare centre.* (Participant 1)

An example of how this has been achieved for an asthma program at the primary care level was shared. The development of policies and procedures provided a structured and standardised framework for HCPs to work within that also supports role clarity. Comparisons were made for the potential of using this approach for physical activity promotion by HCPs, with the suggestion that it could be integrated into primary care policies to provide more structured and systemic support to HCPs.

> *I am a firm believer in policies because I feel it just gets very chaotic if you don't have the right policies and procedures in place… we've introduced them in the past for the asthma program… so we have standard operating procedures for running the asthma clinic. Then it just flows easily because everyone knows what to do and why they're doing it as well... you know, maybe not a standalone policy for physical activity, but it could be integrated within primary care policies...* (Participant 3)

5.3.2.6 Bureaucratic Challenges. Some participants noted that hierarchical and bureaucratic challenges were barriers to embedding physical activity promotion within health centres. For example, new ideas or innovations need to be approved by several committees, which highlights the complex and multistage processes that the MoH currently faces when trying

to implement new programs or initiatives to promote physical activity. This was seen to significantly delay progress in this area.

> *It needs to go to this committee and then go to the other committee, and then go through to this committee and think about it and get the answer from this committee again, due to the other committee. This is the logistic thing that makes things complicated… things in our part of the world take longer and longer each year. If you are having an idea, your expectation for that idea to be applicable or done, it'll take maybe ten years or more.* (Participant 5)

This was seen as particularly problematic when trying to allocate resources to support physical activity promotion, with procedural complexities and speed of implementation being significant barriers.

> *At the level of space, at the level of primary healthcare, at the level of resources, it has to go from this level to also another higher level in which they have their own constraints… things move very slow.* (Participant 4)

A recent example regarding the electronic healthcare system that was implemented in Oman highlighted this complexity. The recent addition of two questions to the electronic health

system to record patients' duration and frequency of physical activity and to prompt the provision of brief advice by HCPs was seen as a positive advancement. However, it was added the implementation process of integrating these two questions into the system took a significant amount of time to secure buy-in from the relevant decision-makers. Underscoring the slow process of institutional change to embed physical activity promotion into the healthcare system because of bureaucratic, procedural and stakeholder engagement challenges.

> *One of the things that we were struggling to do is to have something within the health care system for this to make it easy for the health care professionals. Thanks God that like a few months ago, we could insert the question of are you physically active or not?* (Participant 8)

> *Integrating the physical activity [two questions] within the health system was a very big challenge, we had to wait four years to convince people to get it.* (Participant 8)

Additional challenges to integrating the two questions into the electronic health system is that the system does not have the functionality to make the questions mandatory; as such, there is currently a reliance on HCP's motivation, engagement and compliance for effective implementation.

> *He [the patient]will be asked two questions to assess their level of physical activity, this will then alert the nurse, alert the physician so that they hope that counselling will be provided then… at this stage, it's not mandatory [to ask the questions] but we have raised this point that we need to monitor it and be able to extract that data… then we follow up and make sure that we do have accurate numbers and then we assess the facilities and make sure that this is actually happening…so they're taking baby steps…* (Participant 3)

5.3.3 Theme Three: Collaboration and Leadership

This theme encompasses participants' views on the lack of coordination between the MoH departments and other ministries, governorates and sectors in health promotion efforts. This is perceived to make promoting physical activity more challenging for HCPs and the need for more support for collaborative efforts. Subthemes include Challenges with collaboration efforts, Shared understanding and leadership support.

5.3.3.4 Challenges with Collaboration Efforts. In this subtheme participants discussed that siloed working within the MoH and other organisations and ministries in Oman hinders physical activity promotion. This results in a lack of collaboration and coordination of physical activity promotion efforts and impedes the scale and reach of initiatives.

> *Everyone is on their own; there isn't a committee that bonds all of these professionals in one place.* (Participant 1)

It's [physical activity promotion] individual efforts… we're yet to see it on a wider scale… not really enough is happening, unfortunately. (Participant 3)

It was emphasised that this often resulted in disjointed approaches to physical activity promotion or departments and sectors working in isolation. A key challenge exacerbating this is the perception from other sectors and ministries that physical activity promotion is often seen as the responsibility of the MoH.

I mean, they always say that this is not our work; this is the work of the Ministry of Health, but we are trying to put things on their shoulders. (Participant 8)

As part of a wider plan to promote population-level physical activity and improve cross-sector collaborations, a multi-sectoral plan of action was developed in line with the recommendations of the International Society for Physical Activity and Health (ISPAH) framework (Milton et al., 2021). The aim of this plan was to build on the ongoing efforts of each ministry collaboratively. Yet, to date, more than two-thirds of this action plan has not been adhered to or implemented effectively, demonstrating the need to improve long-term policy and action planning to facilitate physical activity promotion.

We developed a multi-sectoral plan of action [for physical activity] with the involvement of different sectors… but 70% of it is not implemented (Participant 8)

Barriers to cross-sectoral collaboration efforts to implement the ISPAH (Milton et al., 2021) plan included a lack of ownership and oversight amongst the different stakeholders and a perceived lack of political commitment, budget, and resources. Underscoring the need for an overarching governing body to ensure realistic planning, adequate resourcing, and regular monitoring and evaluation of implementation plans.

> *One of the challenges was that we didn't have a budget for this plan of action, but it was still signed by the minister and distributed to different sectors to work on…but who is monitoring what is happening? The Ministry of Health cannot monitor what the municipality is doing or what the Ministry of Sports is doing. It needs a structural organisation within the government that has the power and the budget to oversee all of these activities* (Participant 8)

Highlighting these collaboration challenges further, participants discussed the need to improve the infrastructure and urban planning in Oman. To achieve this, other ministries, such as urban planning, transport, and the municipality, need to be involved. However, participants indicated that working with these other governmental bodies was challenging. This was attributed to their fragmented roles and responsibilities and poor communication between each sector. It was emphasised that this makes aligning plans and goals difficult despite the recognised need for an integrated multi-sectoral approach.

But the transport system and urban planning are difficult sectors because they have their own plans [for physical activity promotion]. Their roles are also scattered among different sectors. The urban planning is distributed between transport and housing… it is difficult to reach them. (Participant 8)

The MoH had previously collaborated with the Ministry of Sports to promote community physical activity facilities for people with type 2 diabetes. However, this was stopped because of competing priorities within each ministry highlighting the difficulties in maintaining collaborative partnerships when there are differing priorities across sectors.

I know [name removed] was thinking that they had actually started working with the Ministry of Sports Affairs on having [physical activity] clinics within the stadiums, and then again, because of competing priorities, that was removed. (Participant 3)

This was also seen to have implications for HCPs, with some participants reflecting that this could result in them focusing less on promoting physical activity as their efforts seemed futile.

They [HCPs] reached that point where they feel like it's a useless point to convey [physical activity] because no one does anything about it or they can't do anything about it. (Participant 1)

5.3.3.5 A Shared Understanding and Leadership Support. Reflecting upon the challenges to collaborative efforts for physical activity promotion in the subtheme above, participants noted the need for a shared understanding of the challenges and strategies to promote more collaborative working between all stakeholders. It was also shared that to achieve change, there is a need to collaboratively determine what can be done whilst recognising the constraints of the available resources and existing infrastructure.

For something to kind of actually be effective, the first step is going to be to get all of those players that are going to be involved on board to know, can it actually be done, is this feasible or not… it will need to [be] high-level commitment… and high-level dialogue and to make sure that it is being cascaded in terms of collaborations of the health sector and non-health sectors at all levels as well. (Participant 6)

The importance of leadership support, such as the cabinet of ministers, to establish cross- sectoral collaborations and plans and advocate for the role of physical activity for people living with type 2 diabetes was underscored. Adequate budgets and resources would also be needed to support these efforts, and monitoring the allocation and use of these was noted to be essential.

But we need commitment and a strong leader who can integrate the system of the Ministry of Health with other health sectors because it is not only the role of the Ministry of Health; it is the role of many sectors involved in providing the proper healthcare and

physical activity for diabetes, so the commitment of the health of the leaders or policymaker is very, very important to initiate the change. (Participant 4)

Yes [budget] and also political commitment…and there needs to be close monitoring on what they are doing with the budget. (Participant 3)

The need for a more strategic approach to physical activity promotion was discussed. An advancement in the area of physical activity promotion was discussed. A high-level committee had recently been formed to address different areas related to lifestyle diseases, including physical activity. This is chaired by a member of the Oman Royal Family and includes other high-ranking officials; participants expressed the hope that this level of support would create more awareness and visibility of the importance of physical activity and its promotion and the need for strong collaborations. From here, additional committees and task forces were planned to support collaborative efforts to promote physical activity at the national level and embed it within healthcare.

We really need to make sure that we're taking advantage of this high-level commitment as well. So if it's shared by a royal family... that physical activity is important, we hope that will cascade down to all levels, be it health and non-health… and it's there within healthcare... (Participant 3)

We will be forming other committees. These will be the operational committees now within these committees that we different task forces to tackle different areas, for example, physical inactivity… we're hoping that you know, it won't just be different

campaigns, but it will be something integrated within the level of healthcare. (Participant 3)

However, not all participants were aware of the formation of this committee, highlighting the need for improved communications across ministries and sectors.

We need to improve our structural organisation within the government, whether a committee or a council or a foundation… it can be done because there are examples for other things, for other issues they have, for drug abuse… for COVID-19, we had one, it can be done… (Participant 8)

5.3.4 Theme Four: Accessibility and Availability of Research and Gaps in Evaluation Data

This theme identified participants' views that there is a lack of research and evaluation data being generated within Oman. This was a barrier to prioritising the physical activity agenda in Oman, as there is not enough knowledge and understanding of its benefits at the policymaker level. Additionally, this theme further highlights that physical activity campaigns are inconsistent and not monitored or evaluated, meaning that their impact on behaviour is unknown. Subthemes include The Need for More Local Research, Practical Barriers to Research and The Need for More Evaluation Data.

5.3.4.4 The Need for More Local Research. This subtheme highlights that a significant challenge for HCPs promotion of physical activity is the gap that currently exists in research, policy and practice. Participants emphasised the need to conduct more research to support evidence-based policymaking. However, it was acknowledged that this was not currently being addressed despite being a core component of the physical activity action plan.

> *In that [ISPAH] plan of action, actually, one of the domains is the research, or generating the research, but that is yet to be implemented.* (Participant 8)

> *We need to conduct more research; I think it's a very, I mean it's a field [physical activity] that we don't touch enough in research… the more valid research we get, the more reliable research and reliable findings that will help actually to make better decisions… we need to do more research definitely.* (Participant 2)

It was reported that because of the lack of research, higher-level policymakers lack knowledge of the benefits of physical activity for patients and the wider system, and this hinders the development of guidelines and policies or strategies to provide more support for HCPs.

> *I think this is very important. We should start generating this evidence and put it as case studies and policy briefs… numbers are always striking, especially when you compare the amount of money you are spending to treat these diseases compared to the amount of money you need to prevent these diseases, so these are very important*. (Participant 8)

> *If those recommendations [related to physical activity] came from proper research studies, maybe higher-level people or other sectors will use them [to guide decision-making] … because any policy or guideline has to be based on scientific results…* (Participant 4)

Some participants made critical observations that highlighted a challenge for evidence-based policymaking in Oman; much of the available evidence stems from international research that is often conducted in Western contexts. As such, it may fail to address the context and nuances of Oman and limit institutional and cultural generalisability. It was felt that local data would be more influential with higher-level policymakers.

> *As decision-makers, you don't want only to get some sort of research from other countries, especially when we talk about physical activity; our setting is different, the environment is different, and the people's attitudes are different, so relying on international studies… will not actually fit our situation…. we need local studies that are done with our community here… this will be more useful for them [the government] to make decisions… but I don't think are many.* (Participant 2)

It was further suggested that without this local research, developing policies and programs to support HCPs in promoting physical activity would be challenging, as the government and higher-level policymakers would not see it as an essential component of diabetes care. It was suggested that to address this, it is imperative to develop insights from

within Oman demonstrating the effectiveness and impact of physical activity for type 2 diabetes and the critical role that HCPs can have in promoting this.

> *Without proper communication, evaluation, refinement, improvement and data, how will this get through proper channels and policy? Why would they take notice? If those recommendations came from proper research study, maybe higher-level people or other sectors will depend on that research to strengthen or implement the need…because any policy or guideline it has to be based on scientific results.* (Participant 4)

5.3.4.5 Practical Barriers to Research. Despite recognising the need for more research in this area to inform decision-making, in this subtheme, participants described that there were barriers to conducting it. These barriers include inadequate expertise, insufficient resources and funding, permission and access to research participants, and a lack of research assistance to support the research process. The need for a collaborative approach between policymakers and researchers was considered to be crucial to support this.

> *We need more research to reach them [the government and policymakers], and we need to be enabled to do this research. We need the resources to do the research, we need the permission to reach people to do the research, we need the funding, the research assistance… I think it shouldn't be a burden in one sector or one part of the community; it has to be a collective effort*. (Participant 6)

Given the funding challenges that exist for researchers, participants explained that the government encourages researchers to explore additional funding strategies beyond the government or public sector, such as the private sector. This indicates a recognition of the limited funding available to support physical activity research and the need to leverage support from private investments.

> *In the ministries, in the government in general, they try to encourage the researchers not only to consider the funds from the government but also to seek part of the funds from the private sector or from those who are doing voluntary things for the community like charity, so they try to encourage the researchers to, to actually to, to seek help from those people.* (Participant 2)

5.3.4.6 The Need for Evaluation Data. The participants further discussed that there was a lack of evaluation data to contribute to understanding the reach, impact and effectiveness of prior physical activity interventions and campaigns. Some participants attributed this to a lack of knowledge about evaluation methods; however, without this type of data, the interventions were quickly forgotten and not seen as important or effective for policy planning and strategic development.

> *The main intention of those who actually organise those campaigns is to organise the campaign without considering the next step with regards to that campaign… and without considering actually how to evaluate and maybe because probably they are not like, they*

> *don't have the knowledge to do that to how to evaluate those outcomes in a scientific way in a meaningful way to get a resource that is accepted by everyone, I mean.* (Participant 2)

> *There are scattered [physical activity] initiatives…but there is no sustained in these initiatives and there is no evaluation in those initiatives to see the outcome.* (Participant 4)

As a result, it was felt that this hindered the development and implementation of effective physical activity promotion efforts. Instead, they kept '*repeating the same mistakes*' (Participant 2), as they did not know what worked and what did not and could not make refinements accordingly or allocate resources for maximum impact. Without this, using evidence to bring about policy or practice change was deemed challenging.

> *If it is not evaluated, how do we know if it is working? Do we need to change our strategy? Do we need to add more? Is there a defect, or do we need to strengthen the healthcare worker or the system? Or in the way we can work with the community, where do we have to mobilise our resources…* (Participant 4)

5.4 Discussion

The objectives of this study were to explore healthcare policymakers' understanding of the challenges experienced by HCPs promoting physical activity to adults with type 2 diabetes,

determine the feasibility of implementing strategies to support HCPs in this area of diabetes care, and to explore their experiences of implementing evidence-based findings regarding physical activity and type 2 diabetes. Four themes were conceptualised. Theme one, 'The Healthcare System,' identified policymakers' perspectives of system-level barriers that impeded HCPs promotion of physical activity. Theme two 'Physical Activity in Healthcare Policy and Strategic Planning' identified a lack of prioritisation of physical activity within healthcare planning and policy due to competing demands within the healthcare system. Theme three 'Collaboration and Leadership' explored the challenges the MoH experiences when collaborating with other sectors and ministries to promote physical activity and the need for increased leadership and support. Theme four 'Accessibility and Availability of Research and Gap in Evaluation Data' identified a lack of local research and monitoring and evaluation of prior physical activity campaigns. These findings build on previous research highlighting the complexities of physical activity promotion by HCPs for people with type 2 diabetes (e.g., Kime et al., 2020) and the challenges for policymaking related to this (Rigby et al., 2022). The findings also align with the literature that there is a need for organisational and system-level improvement that supports HCPs to deliver this component of diabetes care effectively (Rigby et al., 2020).

There was a consistent view among participants that barriers related to the healthcare system (e.g. infrastructure, human resources, policy, financing) adversely impacted HCPs' promotion of physical activity. These barriers included inadequate resources, insufficient workforce, HCPs' lack of time, increased workloads and a lack of education and training for HCPs on physical activity and how to promote it. These findings align with some of the barriers reported by HCPs in study two of this programme of research (Chapter Four) and are commonly identified within the literature as barriers to physical activity promotion (e.g., Kime et al., 2020;

Matthews et al., 2014; Stuij, 2018). The current study addresses a gap in the literature whereby behaviour change interventions often focus on the individual level without considering the context of the system in which individuals operate (Chater & Loewenstein, 2023). By exploring policymakers' perceptions of HCPs' barriers to physical activity promotion for people with type 2 diabetes, this study offers additional insight into the system influences contributing to or exacerbating these barriers.

Participants in the present study reported that the competing demands of the healthcare system, and often more pressing healthcare priorities, resulted in a lack of prioritisation of physical activity and its promotion in healthcare planning or policies for policymakers. Setting priorities and allocating resources within the constraints of limited funding, rising demands for services, and challenging bureaucratic processes is a common challenge within healthcare globally and in Oman (Daniels, 2016; Mitton & Donaldson, 2004). However, this approach results in a healthcare system that is reactive rather than proactive or preventative, focusing on clinical management and care (Vuori et al., 2013). As seen in the current study, this creates a challenge to health systems that must focus on the increased demands on hospital admissions or medications due to the rising occurrence of NCDs (Silva et al., 2023). Yet, in the long term, this reactive approach is counterintuitive.

The increasing burden of type 2 diabetes and associated comorbidities and complications is placing an ever-increasing burden on the healthcare system in Oman and globally that will lead to higher healthcare expenditures (IDF, 2021). For example, as discussed in Chapter One, the IDF (2021) estimated annual diabetes expenditure in Oman was 845.2 USD per person, and it is estimated that this will increase to 1,986.80 USD per person by 2050 (Awad et al., 2021). This will undoubtedly put an increased strain on an already resource-limited system and highlights the

growing need to transition towards a preventative approach to disease management and healthcare system resilience (Schiavone et al., 2021).

It is well evidenced that physical activity, at the recommended level of 150-minutes per week, is related to improved population health, the decline of physical inactivity-related diseases such as type 2 diabetes, and significant reductions in healthcare costs (Bird et al., 2022; Ding et al., 2016; Duijvestijn et al., 2023). However, as noted above, this needs to be prioritised within the Oman healthcare system. Consistent with challenges to translational research (Abu-Odah et al., 2022), modifying usual care and integrating health innovations, such as physical activity promotion, into a resource-limited healthcare system is challenging (Franco-Trigo et al., 2020). In the short term, physical activity interventions can be more time-intensive, increase resource demands, and be less cost-effective than pharmacological and surgical treatments (Duijvestijn et al., 2023). Nevertheless, in the long term, research has demonstrated that increases in patients' physical activity levels can lower healthcare costs and reduce the burden of chronic disease (Ding et al., 2017). Given these findings, it is imperative that funding and resources are diverted towards the preventative agenda to ensure the long-term sustainability of the healthcare system (Wise et al., 2016). Yet, participants in the current study noted that policymakers' lack of awareness and knowledge related to the role and impact of physical activity in type 2 diabetes care was a barrier to its prioritisation, highlighting the pressing need to address this.

To support the needed prioritisation of physical activity in healthcare policy and planning for type 2 diabetes management, it is essential to establish a robust evidence base using behavioural insights that highlight its reach, impact, and effectiveness (Rigby et al., 2020). Yet a significant finding of the current study is that in Oman, there is a paucity of local applied and implementation research on physical activity and type 2 diabetes, and much of the evidence in

this area stems from Western settings. This poses a significant barrier to evidence-based policymaking in Oman as there are fundamental cultural, socioeconomic, environmental, and healthcare system differences (Erissman et al., 2021). The lack of relevance of research findings, as noted in the present study, has been cited in the literature as a significant barrier to the uptake of evidence by policymakers (e.g., El Jardali et al., 2012; Oliver et al., 2014). In line with the core element of the MRC guidance of the need to consider context (Skivington et al., 2021), this information gap underscores the need to build a local picture of type 2 diabetes and physical activity with applied and implementation research that considers the local context that is useful to those responsible for making real-world health decisions. This demonstrates the importance of creating an eco-system whereby not only is support and funding allocated to conduct and disseminate research, a challenge noted in this study, but also in which policymakers are supported to develop knowledge translation competencies (Schwendinger et al., 2022).

The findings of the current study indicate that challenges with multistakeholder collaboration were a barrier to physical activity promotion and its integration into healthcare. The participants noted that fragmentation within the MoH and the wider system resulted in siloed working, a lack of information sharing, poor communication, and a lack of oversight or input regarding one another's physical activity initiatives and efforts in healthcare. These collaboration challenges were illustrated by the difficulties in implementing the ISPAH (Milton et al., 2021) plan. Whilst the government approved this plan, 70% of it was not implemented. A significant challenge to implementing this plan was a lack of funding, in addition to a lack of oversight and ownership between stakeholders and insufficient leadership support. The lack of implementation of this plan highlights the need to find new ways to implement initiatives and plans across sectors effectively.

The challenges and complexities of coordinating actions across different sectors are well documented in the literature. For example, a systematic review has noted similar challenges to cross-sector collaborations and physical activity promotion to those found in the current study. These include a lack of common goals, insufficient resources and funding, a lack of leadership, poor communication and coordination, competing sector identities and priorities, a lack of clear roles, responsibilities and ownership, limited capacity and willingness for co-production, and limited knowledge of how each sector works (Kolovou et al., 2023). Other influences have been reported in the literature and are important considerations for the context of this study when addressing barriers to cross-sector collaboration; these include inadequate support, an insufficient workforce, lack of time, and low trust among collaborating partners (van Dale et al., 2020). Given the significant challenges related to cross-sector collaboration and physical activity promotion identified in the current study, it will be vital to address these for impactful change. Addressing collaboration challenges will require a cross-sectoral approach that extends across ministries, government, the public sector, non-governmental organisations and any other relevant stakeholders (Kolovou et al., 2023). Danaher et al. (2011) reported that for successful cross-sectoral collaboration, a shared vision, strong relationships among partners, and leadership are critical. Van Dale and colleagues (2020) extended this with seven evidence-based recommendations to facilitate cross-sectoral collaboration for health promotion; these include 1) connecting collaboration goals with existing key policies while advocating for political support, 2) defining a shared vision of the problem to be solved aligned with organisational goals, 3) create an effective mix of partners with diverse backgrounds, 4) build bridges between sectors and disciplines through effective leadership, 5) keep collaboration partners in all sectors engaged, 6) use a planned/systematic approach suitable for all partners, and 7) ensure there are sufficient

resources to sustain the collaboration. Given that participants in this study noted that other sectors were dispersed and disconnected, a planned and systematic approach, as described above (van Dale et al., 2020), will be vital to ensure sustained success.

5.4.1 Strengths and Limitations

There are several strengths to the current study. Firstly, the inclusion of policymakers is a key strength of this study. A notable criticism in health research is that policymakers are often not included as key stakeholders prior to intervention development; traditionally, research in this domain has focused on the views of patients or healthcare professionals (Oliver et al., 2014; Rigby et al., 2020). Policymakers are uniquely positioned to offer insights into the broader health system and policy landscape. Involving them in this research has resulted in a detailed understanding of challenges at different levels of the healthcare and wider systems and creates actionable insights that may influence the feasibility, scalability and sustainability of a proposed intervention. Furthermore, it is the first study to explore policymakers' views regarding promoting physical activity by HCPs for people living with diabetes in Oman, and there is no published study in this area globally. The exploratory, qualitative nature of this study is also a strength, as it is a flexible approach that can provide depth and understanding to a complex or poorly understood phenomenon (Creswell & Creswell, 2017). This approach allowed for the exploration of wider contextual factors that may influence HCPs' physical activity promotion and healthcare policy and planning related to it (Maxwell, 2012).

Nonetheless, there are some limitations to this study. Firstly, a purposive sample was used, which may have attracted more policymakers interested in physical activity and type 2

diabetes who understands this area more than other policymakers. Nearly all participants had previously worked in primary healthcare. Although this may increase their expertise and knowledge in this area, it may not be representative of policymakers' views in general. Despite this, the participants' viewpoints appeared thoughtful, considered and balanced, with some differences between them. Furthermore, the participants only represented the MoH; whilst obtaining the views from these policymakers is vital, given the complexity of physical activity promotion, the views from policymakers representing other ministries, such as the Ministry of Urban Planning and the Ministry of Sport, are needed. However, this was not within the remit of this thesis. Finally, it was not possible to recruit high-level policymakers. As such, the findings may be missing some key perspectives and may not capture all the challenges to physical activity promotion, as the participants in this study noted the hierarchical and bureaucratic challenges of the decision-making and implementation process.

5.5 Conclusion

The findings of this qualitative study provide novel insights from policymakers in Oman regarding type 2 diabetes and physical activity promotion. Building on the findings from study two (Chapter Four), the participants in the current study were able to provide insight into the political and systemic influences on HCPs' promotion of physical activity to patients with type 2 diabetes. The data presented in this study highlight the challenges to translational research in this complex and under-resourced area and the need to address barriers at multiple levels of the system. This study also highlighted the need to engage stakeholders and leaders across multiple sectors to strengthen and align approaches for more impact. To effectively address the multi-level challenges that impact HCPs' physical activity promotion for people living with type 2 diabetes identified in this programme of research, a comprehensive strategy is needed that addresses the

barriers that exist at the micro, meso and macro levels. This will require meaningful engagement from leaders and policymakers and a realignment of their priorities that directs the allocation of funding and resources towards physical activity promotion in diabetes care. To support evidence-based policymaking, access to timely and relevant research will be needed, along with impactful and sustained cross-sectoral collaborations.

Chapter Six:Discussion

6.1 Discussion

The aims of this programme of research were to synthesise, assess, and develop an in-depth understanding of HCPs barriers and facilitators to physical activity promotion for adults with type 2 diabetes; explore HCP barriers and facilitators to physical activity promotion for adults with type 2 diabetes in Oman; explore healthcare policymakers' perspectives on physical activity promotion in primary healthcare in Oman; and develop evidence-based recommendations to support HCPs in this area of diabetes care. This final discussion chapter will draw upon the three studies reported in this thesis to summarise key findings, and to address aim four of this programme to develop evidence-based recommendations to support HCPs in this area of their professional practice and the integration of physical activity into the healthcare system. Finally, recommendations for practice and research will be made and the strengths and limitations of this programme of research will be discussed.

6.1.1 Synthesis of the Findings from this Programme of Research

In the first study in this programme of research, the mixed methods systematic review (MMSR), barriers were coded to 11 of the TDF domains (Cane et al., 2012), with the highest number of barriers coded to the Environmental Context and Resources domain. This was followed by Beliefs about Consequences, Knowledge, Skills, Social Influences, Beliefs about Capabilities, Social/Professional Role and Identity, Emotion, Memory, Attention and Decision Processes, Optimism and Behavioural Regulation, respectively. Facilitators were coded to eight domains, with Goals ranked highest, followed by Environmental Context and Resources, Social/Professional Role and Identity, Knowledge, Beliefs about Consequences, Social

Influences, Skills, and Behavioural Regulation.

Study two built on the findings from study one and also contributed to an identified gap in the literature: the lack of non-Western studies using the TDF (Cane et al., 2012) to explore determinants of HCPs professional practice (Dyson & Cowdell, 2021). Barriers were mapped to all TDF domains except Goals, and facilitators were mapped to all domains except Beliefs about Consequences. A content analysis (Krippendorff, 2018) of the data in this study identified that the highest number of barriers and facilitators were, in line with the findings of study one, also found in the Environmental Context and Resources domain, followed by Knowledge, Beliefs about Consequences, Social/Professional Role and Identity, Skills, Beliefs about Capabilities, Behavioural Regulation, Memory, Attention and Decision Processes, Social Influences, Optimism, Emotion, Intentions and Reinforcement. The highest number of facilitators were also found in the Environmental Context and Resources domain, followed by Social/Professional Role and Identity, Goals, Knowledge, Beliefs about Capabilities, Intentions, Optimism, Memory Attention and Decision Processes, Behavioural Regulation, Social Influences, Emotion, Skills, and Reinforcement, respectively.

Although reported less frequently than barriers, facilitators to HCP's physical activity promotion were identified in studies one and two. However, this often stemmed from anecdotal evidence, or suggestions made by HCPs as opposed to evidenced-based facilitators. One common facilitator reported in both studies as facilitating physical activity promotion was goal setting by HCPs to support patients in increasing their physical activity. Goal setting is defined by Locke and Latham (2002, p.705) in goal setting theory as '*the object or aim of an action*'. Collaborative goal setting is considered to be a fundamental component of patient-centred care and enables HCPs to identify meaningful goals and develop action plans with patients to meet

them (Crawford et al., 2012; McSharry et al., 2016). Goal setting is an established and theoretically informed effective behaviour change technique that can be used by HCPs to increase the confidence and motivation of people living with type 2 diabetes to be more physically active (Rossen et al., 2015). It has been reported that collaborative goal setting between HCPs and patients with type 2 diabetes can result in significant increases physical activity levels and clinically significant decreases to HbA1c levels for people living with type 2 diabetes (Fredrix et al., 2018; McSharry et al., 2016; Nguyen-Vaselaar, 2021). Furthermore, it is also suggested that it is a useful technique to use in time limited healthcare settings (Michie et al., 2008), such as those described in this programme of research. There is substantial evidence demonstrating the impact of goal setting on patient behaviour (Epton et al., 2017), underscoring the importance of its inclusion in the existing taxonomies of behaviour change (Hagger et al., 2014; Michie et al., 2011; Michie et al., 2013).

6.1.2 Understanding the Most Influential TDF Domains on HCPs' Physical Activity Promotion

Both studies one and two identified a dominance of barriers to HCPs' physical activity promotion compared to facilitators. This is an important finding and reflects the current lack of support for HCPs to promote physical activity, despite this being considered a component of their role in diabetes care (IDF, 2017). Further insight into the origins of the barriers and facilitators was derived by ranking the importance of the TDF domains, as recommended by Atkins et al. (2017).

In study one, the top six domains for barriers accounted for 85% of the barriers, and in study two, the top six barriers accounted for 83% of the barriers. A notable finding was that the

highest-ranking domains for barriers were the same in both studies one and two: Environmental Context and Resources, Knowledge and Beliefs about Consequences. In both studies, the Environmental Context and Resources domain had the highest number of barriers. This is an important finding and affirms the MRC guidance on the need to consider context in the development of complex healthcare interventions (Skivington et al., 20201). Similar findings have been reported in the literature regarding barriers to HCPs' clinical practice behaviours (Atkins et al., 2020; Mather et al., 2022). For example, the systematic review by Atkins et al. (2020), discussed earlier in this thesis, also reported that the top three TDF domains influencing HCPs catheter-associated urinary tract infection-related behaviours were Environmental Context and Resources, Knowledge and Beliefs about Consequences. Furthermore, the umbrella review from Mather et al. (2022) exploring barriers and facilitators to clinical practice behaviours, also identified the Environmental Context and Resources and Knowledge as the most influential domains.

When considering the findings from this programme of research alongside prior literature (e.g. Atkins et al., 2020; Mather et al., 2022), it is apparent that notable influences on HCPs' clinical practice stem from the broader socio-political context of existing systems and organisational structures. For example, the physical environment and cultural norms intersect to create perceptions and beliefs that result in the deprioritsation of the provision of resources and funding. The Environmental Context and Resources domain encompasses the physical, social and environmental influences on HCPs' clinical practice behaviours (Cane et al., 2012). The consistent identification of this TDF domain in this programme of research and prior research for the highest number of barriers (e.g. Mather et al., 2022) suggests that rather than individual-level factors, the most impactful barriers for HCPs are systemic in nature. This affirms the suggestion

from Chater and Loewenstein (2023) that there is a need to move beyond individual level-only solutions to also address complex problems from a systemic level that also considers a broader range of influences on behaviour, such as the characteristics of the complex system they operate in (DeCorby-Watson et al., 2018).

6.1.3 Training and Education

To effectively translate the physical activity evidence into practice, a knowledgeable and skilled workforce is a necessity (Silva et al., 2023). Yet in this programme of research and the prior literature (Atkins et al., 2020; Mather et al., 2022), the Knowledge domain of the TDF ranks amongst the top three domains for barriers to clinical practice. HCPs' lack of knowledge and skills to effectively promote physical activity were reported in all three studies, a finding that is consistent with the prior literature (e.g. Vishnubala & Pringle, 2021). Along with a general lack of knowledge and skills, HCPs in studies one and two determined that a lack of knowledge and skills exacerbates the challenges HCPs experience when trying to promote physical activity to patients with complications and comorbidities. Barnett et al. (2012) note that existing medical education does not consider multimorbidity in chronic healthcare conditions, and as such, HCPs feel unprepared to manage patients with comorbidities. Given that perceptions of competence and self-efficacy (i.e. person's beliefs about their capabilities to perform a behaviour to achieve the desired outcome; Bandura, 1988), are predictors of HCPs' physical activity promotion for patients with type 2 diabetes (e.g. Chatterjee et al., 2017; Kime et al., 2020), addressing this will be imperative.

The gaps in HCPs' skills and knowledge were exacerbated by a lack of CPD and the inadequate inclusion of physical activity and its promotion in the undergraduate medical education curriculum. This is a common finding in the literature (Netherway et al., 2021; Silva et al., 2023). This demonstrates that, despite the suggestion that HCPs should have a key role in physical activity promotion (e.g. IDF, 2017), this must be supported by efforts at the organisation and system level to increase the quality and provision of evidence-based physical activity training and medical education content for HCPs (Hart et al., 2023; Netherway et al., 2021).

An important and novel finding in study two, which also demonstrated the overlap between the Knowledge and Environmental Context and Resources TDF domains, was related to clinical practice guidelines. HCPs used guidelines that are primarily developed in and for Western contexts, e.g. the American Diabetes Association guidelines (2016). This can create an additional barrier for HCPs in Oman, as the guidelines need to consider the nuances of Arabic culture and context. This finding highlights the need for clinical practice guidelines that are tailored to fit the specific cultural, economic, and environmental contexts of non-Western populations. Rio and Saligan (2023) have also highlighted the lack of culturally tailored physical activity guidelines and the need to develop guidelines for HCPs that consider the unique cultural and social contexts of different communities that influence physical activity and its promotion. Rio and Saligan (2023) emphasise that this provides an opportunity to improve physical activity policies and interventions to engage people in culturally meaningful ways.

6.1.4 HCPs' Beliefs Influence Their Promotion of Physical Activity

The Beliefs about Consequences domain was ranked in the top three TDF domains for barriers in studies one and two. This finding highlights that HCPs' beliefs about their patients and the role of physical activity promotion can impact their promotion of it. Consistent with the literature (e.g., Godin et al., 2008), HCPs who perceived their patients to be less interested, motivated or adherent to their physical activity advice promoted it less, choosing instead to focus on other areas of diabetes management (Godin et al., 2008; Keyworth et al., 2019; Sassen et al., 2011; Selvaraj & Abdullah, 2022; Silva et al., 2023). HCPs who held positive beliefs about the impact of physical activity on type 2 diabetes outcomes were more likely to promote it than those who did not (Booth et al., 2013; Keyworth et al., 2019; Stuij, 2018). Finally, as also noted in the literature, HCPs' physical activity behaviour was a predictor of its promotion (Silva, 2023). Whereby HCPs who were more physically active were more likely to promote physical activity to patients with type 2 diabetes than those who were not. This is likely because HCPs who were physically active held more positive attitudes and beliefs about the impact and importance of physical activity.

HCPs' individual decisions can influence the adoption, or not, of clinical-related behaviours and it is important to understand the cognitive mechanisms that underly HCPs' clinical behaviours (Godin et al., 2008). The findings from studies one and two provide insights into how attitudes and perceived behavioural control can drive HCPs' decision to promote physical activity, or not. For example, due to HCPs' unsuccessful attempts in the past to influence patients' physical activity behaviour, studies one and two identified that prescribing medication was considered more accessible and more effective than advising patients about lifestyle behaviour change for diabetes management. Attitudes (e.g. positive or negative beliefs towards

the behaviour and its outcome; Ajzen, 1991) and perceived behavioural control (e.g. how much control a person believes they have over engaging in a specific behaviour, and barriers and facilitators experienced in past behaviours, Ajzen, 1991) can influence HCPs intention and behaviours to promote physical activity (Sassen et al., 2011).

6.1.5 Local Barriers and Facilitators to Change

The findings from this programme of research emphasise the importance of identifying local contextual determinants (barriers and facilitators). All three studies identified local barriers to change; these included the unsupportive environmental infrastructure, the perceived appropriateness of physical activity for females, gender norms and the wider cultural acceptance and beliefs about physical activity on HCPs' physical activity promotion. These are important findings that can be used to improve policies or programs that can engage people in physical activity in culturally meaningful ways (Rio & Saligan, 2023). For example, it is noted in the literature that females are less physically active than males (Alghafri et al., 2017; Sharara et al., 2018) and this was evidenced in all three studies in this thesis. Yet there is a paucity of culturally tailored interventions for Arabic females. Donnelly and Al-Thani (2018) recommend that it is imperative to create an environment that is conducive to physical activity for females. To do this it will be essential to consider the cultural and contextual drivers to physical activity (or inactivity) for females.

All three studies also highlighted how the context of the organisation and system influenced HCPs' physical activity promotion. For example, in alignment with prior research a lack of time to promote physical activity, increasing workloads, a lack of organisational support,

a lack of resources, and an insufficient workforce (e.g. Albert et al., 2021). The similarity of findings across the studies in this thesis and prior literature demonstrates the pervasive impact these influences can have on HCPs' professional practice (Rushforth et al., 2016). The convergence of views between HCPs in study two and policymakers in study three demonstrated that the policymakers had some insight and understanding of HCPs' challenges in this area of diabetes care. This is an important finding, as research has shown that a shared understanding of barriers can support the development of strategies and policies that are more aligned with real-world challenges (Aarons et al., 2011; Muellmann et al., 2017).

Despite these commonalities of the organisation and system-level influences on HCPs physical activity promotion, Skivington et al. (2021) note that it is crucial to consider the specific contexts in which these influences occur when developing interventions. The findings from study three highlight the importance of this. The policymakers were able to offer broader, contextual perspectives on the macro and meso-level influences that contributed to or exacerbated the barriers reported in studies one and two. For example, the policymakers in study three identified a challenge within the structure of the Oman healthcare system that impacted HCPs' physical activity promotion whereby patients are not restricted to healthcare centres within their catchment areas, which allows them to attend any healthcare centre they prefer. This level of understanding is required to ensure that implementation strategies to support HCPs to promote physical activity can be tailored to the local context and targeted to the area most likely to facilitate change (Coles et al., 2020; Rogers et al., 2021).

6.1.6 Evidence-Based Policymaking

Prior literature has highlighted the importance of evidence-based policymaking in healthcare planning and prioritisation (e.g. Baynes et al., 2022). A notable finding in study three was that policymakers in Oman lack access to contextually relevant research evidence on physical activity and its promotion to inform their decision-making. This exacerbated the lack of prioritisation of physical activity promotion in healthcare policy and planning as policymakers were not aware of its importance or impact on people living with type 2 diabetes, and as such, resources were not directed to this component of diabetes care. While evidence-based policymaking has been identified as essential to support the efficient use of resources and the translation of evidence into policy and practice (Tricco et al., 2022), a notable challenge for this in Oman is the lack of contextually relevant applied and implementation research.

A novel finding in this programme of research that can have a significant influence on evidence-based policymaking in Oman is that the vast majority of evidence for the effectiveness of physical activity for type 2 diabetes stems from Western contexts and, as such, does not consider the nuances of the Arabic context. To support evidence-based policymaking, Rigby et al. (2020) have stated that using local research evidence ensures that policies can be developed for the specific social, economic, cultural and environmental needs of the local context (Rigby et al., 2020). Lack of relevance in research findings has been reported as a significant barrier to the uptake of evidence-based policymaking in healthcare (e.g. El Jardali et al., 2012; Oliver et al., 2014). The findings in this programme of research affirm the need to engage with policymakers to understand their barriers and facilitators to evidence-based policymaking as a crucial component of intervention development (Oliver et al., 2014) and the need for contextually relevant research (Rigby et al., 2020).

6.1.7 The Value of a Theoretical Approach

A notable contribution of this thesis is that it is the first study to use the TDF (Cane et al., 2012) to explore HCPs' clinical practice behaviours in a non-Western setting, a gap in the literature identified by Dyson and Cowdell (2021). The findings in this research demonstrate the wider application and utility of the TDF and COM-B model (Michie et al., 2014) and that these theoretical frameworks can adequately identify the nuances and cultural determinants of non-Western settings that influence behaviour. There were no barriers or facilitators identified in studies one and two that could not be accounted for by the TDF and COM-B model. This finding is of significant importance and contributes to the existing literature demonstrating the utility of the TDF and COM-B model to explore HCPs' professional practice behaviours (e.g. Mather et al., 2022). Furthermore, it extends current understandings of the scope of the TDF beyond predominant Western applications and demonstrates the applicability, theoretical robustness and versatility of the framework to understand the complex determinants of HCPs' professional practice across culturally diverse settings. This finding further underscores the TDFs potential to be used across different healthcare contexts to understand influences on HCPs' behaviour and contribute to the broader fields of health psychology and implementation science and the potential to inform the development of culturally tailored interventions, strategic plans, and policies that have the potential to improve healthcare practices globally.

Hagger et al. (2020) highlight the importance of developing an understanding of the extent to which the theory is appropriate for the target population to support the translation of evidence into practice. Literature indicates that complex interventions underscored by theory are more likely to lead to change (Hagger & Weed, 2019; Michie & Prestwich, 2010) yet the reporting of this in published research is limited, inconsistent and inconsistent (Hagger et al.,

2020; Prestwich et al., 2014). Work to develop an evidence base that supports standardisation in health psychology is ongoing (e.g. Schenk et al., 2023). The detailed and transparent use of theory in this programme of research adds to this evidence base and demonstrates the importance of developing a comprehensive and transparent understanding of influences on HCPs' behaviour. The findings in this study not only support replicability and comparisons of findings from future studies in global and local health settings but also the development of evidence-based, theoretically informed interventions in attempts to close the evidence-to-practice gap.

6.2 Evidence-Based Recommendations

As previously discussed in Chapter One of this thesis, the BCW offers a structured and evidence-based framework to facilitate the development of behaviour change interventions (Michie et al., 2014). In brief, at the core of the BCW is the COM-B model, which, along with the TDF (Cane et al., 2012), can be used to explore target behaviours and identify what needs to change. These findings can then be mapped to nine intervention functions and policy categories, which were developed from a systematic analysis of nineteen behaviour intervention frameworks (Michie et al., 2011). The intervention functions serve as broad categories that can be tailored to address specific behaviours in particular contexts. Each function targets one or more determinants of behaviour, as defined by the TDF and COM-B model. The nine intervention functions included in the BCW are education, persuasion, incentivisation, coercion, training, environmental restructuring, modelling, enablement or restriction. Subsequently, these can be mapped to policy categories that can support or enable behaviour change interventions; the categories provide strategies at a higher level, often involving governance and regulations, to facilitate the implementation of behaviour change interventions (Michie et al., 2014). The BCW outlines

seven policy categories: communication/marketing, guidelines, fiscal measures, regulation, legislation, environmental/social planning, and service provision (Michie et al., 2014). Finally, following the identification of intervention functions and policy categories, behaviour change techniques (BCTs), defined as '*an active component of an intervention designed to change behaviour'* (Michie et al., 2013, p. 4), are selected. The taxonomy of 93 BCTs, organised into a structured list with 16 groupings, was developed to provide a standardised language for describing intervention content (Miche et al., 2014).

The fourth aim of this programme of research was to develop evidence-based recommendations to support HCPs in this area of their professional practice and the integration of physical activity into the healthcare system. To achieve this aim, using the BCW framework the key findings from all three studies were used to create summary themes; these were then mapped to BCTs using the BCT taxonomy v1 (Michie et al., 2013). Subsequently, these were mapped to intervention functions and policy categories, in line with the Behaviour Change Wheel (BCW, Michie et al., 2014), and summary recommendations for how these could be operationalised were made. See Table 6.1.

Table 6.1

Summary of Key Findings and Evidence-Based Recommendations to Support HCPs' Promotion of Physical Activity and Integrate Physical Activity into the Healthcare System

Summary Themes ***Study Themes***	**Recognised Barriers and Facilitators**	**TDF Domain (COM-B Construct)**	**BCTs According to Barriers/Facilitators**	**Intervention Function**	**Policy Category**	**Summary Recommendations**
HCP Knowledge and Skills Study One: *Knowledge, Skills, Beliefs about Capabilities and Emotion Domains* Study Two: *Individual-Level Influences and Organisation and System-Level Influences* Study Three: *The Healthcare System*	**Barrier**: • Lack of general knowledge and gaps in knowledge, especially for patients with complications and comorbidities • Lack of knowledge, understanding and awareness of guidelines • Skills gaps included behaviour change, counselling, physical activity prescription and effective communication. For some, this resulted in negative affect and low perceptions of confidence and competence • For some HCPs, a lack of knowledge and skills resulted in negative affect and low perceptions of confidence and competence	Knowledge (psychological capability) Skills (physical capability) Beliefs about Capabilities (reflective motivation) Emotion (automatic motivation)	1.1. Goal setting (behaviour) 1.2. Problem solving 1.3. 1.3 Goal setting (outcome) 4.1 Instruction on how to perform the behaviour 4.2 Information about antecedents 5.1 Information about health consequences 6.1 Demonstration of the behaviour 7.1 Prompts and cues 12.5 Adding objects to the environment	Education Training Modelling Environmental restructuring	Guidelines Service provision	• Education delivered through the provision of consistent CPD opportunities, workshops, and seminars • Education and training that supports the development of specific skills such as the use of BCTs, goal setting, and effective communication • The use role play and feedback to build competence and confidence • Signpost to relevant written and digital resources/online learning materials/modules • Engage with community organisations and facilities to compile lists of local and accessible physical activity resources and tools and distribute them to HCPs

	Facilitator: • Knowledge of patients' social and environmental context helps to make tangible recommendations • Building rapport, developing trust, and patient-centred care supported effective communication between HCPs and patients • Goal setting and planning supported physical activity promotion					
HCPs Training and Education Study One: *Knowledge, Skills, Reinforcement, Environmental Context and Resources Domains* Study Two: *Individual-level Influences and Organisation and System-Level Influences* Study three: *The Healthcare System*	**Barrier:** • Lack of training opportunities to develop knowledge and skills to support physical activity promotion • Lack of incentives for training • Insufficient training centres, experts and budget • Physical activity is not covered in enough detail in the undergraduate medical education curriculum	Knowledge, Skills (psychological capability) Social/Professional Role and Identity (reflective motivation) Reinforcement (automatic motivation) Social Influences (social opportunity) Environmental Context and Resources	3.1 Social support (practical) 4.1 Instruction on how to perform the behaviour 5.1 Information about health consequences 6.1 Demonstration of the behaviour 8.1 Behavioural practice/rehearsal 8.7 Graded tasks 9.1 Credible source 10.1 Material incentive (behaviour) 10.8 Incentive (outcome) 12.5 Adding objects to the environment	Education Training Modelling Environmental restructuring Incentivisation	Guidelines Service provision Environmental /social planning	• Develop behavioural science-informed training programs that are targeted to HCP's skills barriers and knowledge gaps that include role-play and feedback with ongoing monitoring and evaluation. • Ensure that education and training content considers the culture and context of Oman so that culturally competent recommendations can be provided by HCPs • Develop and disseminate case studies/videos of complex cases to provide examples to guide consultations • Link training opportunities to incentives and performance indicators, e.g. CPD points and annual reviews

		(physical opportunity)				• In the first instance, prioritise training for HCPs interested in physical activity so that they can act as role models/champions for other HCPs • Form public-private partnerships to mitigate resource barriers (e.g. space and funding), leverage existing spaces for training and/or develop online training material • Embed detailed physical activity modules in the medical education curriculum using a standardised/established framework. Incorporate physical activity into core subjects, develop specific modules on physical activity, use active teaching methods and incorporate technology/digital resources • Ensure that education and training content considers context
Time, Workload, Staffing Levels, Resources and Tools, and Physical Activity Guidelines Study One: *Knowledge, Skills, Environmental Context, Social/Professional*	**Barrier:** • An insufficient workforce, competing demands and the structure of the healthcare system exacerbated time and workload barriers • Staff attrition and reallocation of staff with physical activity training	Knowledge and Skills (psychological capability) Social/Professional Role and Identity (reflective motivation)	3.2 Social support (practical) 4.1 Instruction on how to perform the behaviour consequences 5.1 Information about health 6.1 Demonstration of the behaviour 7.1 Prompts and cues	Education Environmental restructuring Modelling Enablement	Guidelines Service provision Regulation Environmental /social planning	• Enable and foster multidisciplinary working • Map workforce needs across clinics • Clarification of roles and responsibilities for physical activity promotion and identify staff for further training • Strengthen workforce retention strategies and

Role and Identity, Environmental Context and Resources, Memory, Attention and Decision Processes, and Behavioural Regulation Domains Study Two: *Organisation and System-Level Influences and The Environmental Infrastructure, Norms and The Wider Community* Study Three: *The Healthcare System*	• Lack of clarity of role and responsibility for physical activity promotion • Insufficient HCP and patient resources and tools (e.g. equipment, checklists, space within healthcare centres, parks and safe walking places) • Insufficient referral opportunities to HCPs with physical activity expertise • Insufficient culturally tailored interventions/resources for Arabic females • Inadequate physical activity guidelines impact HCPs knowledge and skills barriers. The content of existing physical activity guidelines is too basic and does not account for the heterogeneity and complexity of patients • Current physical activity guidelines are based on Western rather than non-Western populations **Facilitator:** • Increasing appointment time	Environmental Context and Resources (physical opportunity) Social Influence (social opportunity)	12.1 Restructuring the physical environmental 12.2 Restructuring the social environment 12.5 Adding objects to the environment			signpost to/incentivise uptake of primary care positions • Develop standardised questionnaires, checklists and protocols to support planning, monitoring and follow-up and of patients' physical activity • Develop clear routes of referral to exercise specialists and encourage multidisciplinary collaborations across all levels of the healthcare system. • Compile lists of local physical activity resources and initiatives and clearly signpost referral pathways between MoH and community resources • Support HCP training and education through the recommendations above • Develop locally tailored clinical practice guidelines for physical activity promotion that consider patient complexities and the unique social and cultural context • Urban planning improvement to build a more conducive environment for patients to be physically active

	• Adding an additional diabetes clinic to their schedule • A protocol and patient questionnaire to standardise their approach to PA promotion • Developing or increasing knowledge of physical activity resources and tools for HCPs and patients •					
HCPs' Attitudes, Beliefs and the Impact of Social and Cultural Norms Study One: *Beliefs about Consequences, Optimism, and Social Influences Domains* Study Two: *Individual-Level Influences and The Environmental Infrastructure, Norms and The Wider Community*	**Barrier:** • Beliefs about patients' receptiveness to advice, physical ability, and expectations of a pharmacological approach • Perceptions of patient's beliefs about cultural appropriateness and norms and a lack of understanding of the importance of physical activity influenced its promotion **Barrier and Facilitator:** • HCPs beliefs about physical activity and their physical activity behaviour influenced its promotion	Knowledge and Skills (psychological capability) Beliefs about Consequences (reflective motivation) Intentions (reflective motivation) Social Influences (social opportunity) Emotion (automatic motivation)	3.2 Social support (practical) 5.1 Information about health consequences 9.1 Credible source	Education Training Modelling	Guidelines Service provision Environmental /social planning	• Support HCPs in identifying and addressing patients' barriers to engaging in physical activity through patient-centred and culturally competent approaches • Training for HCPs that includes information about and/or demonstrates the effectiveness of physical activity promotion that targets specific patient beliefs. • Utilise HCPs with positive beliefs and behaviours as physical activity champions/role models
Policymakers Information Needs,	**<u>Barrier:</u>** • A lack of knowledge and awareness about	Knowledge (psychological capability)	3.2 Social support (practical)	Education Training	Guidelines Service provision	• Conduct and disseminate local research to support

Organisational Leadership and Support and Multisector Collaboration Study one: *Environmental Context and Resources and Social Influences Domain* Study Two: *Organisation and System-Level Influences* Study Three: The *Healthcare System, Physical Activity in Healthcare Policy and Strategic Planning, Collaboration and Leadership and Accessibility and Availability of Research and Evaluation Data*	the role of physical activity in type 2 diabetes care influences decision-making and prioritisation of healthcare budget and resources to other areas of healthcare • A lack of local contextually relevant research and local evaluation data to increase awareness and support prioritisation of physical activity and its promotion in healthcare • A Lack of leadership support and governance structures for the role of physical activity and its promotion impacts funding and prioritisation and increases bureaucratic challenges • Inadequate collaborative efforts within and across sectors and ministries • A lack of ownership and oversight of physical activity initiatives • An inadequate public health sector	Environmental Context and Resources (physical opportunity) Social influences (social opportunity) Beliefs about Consequences (reflective motivation)	5.2 Information about health consequences 12.1 Restructuring the physical environment 12.2 Restructuring the social environment 12.5 Adding objects to the environment	Environmental restructuring Enablement	Environmental /social planning Regulation	evidence-based policymaking and translation • Support knowledge transfer between researchers and policymakers, e.g. workshops and conferences • Address practical barriers to research, e.g. expertise and research assistance to increase capabilities and capacity to conduct local research • Identify key senior leaders, such as ministers of the cabinet or high-level policymakers across ministries, to champion the physical activity agenda to create awareness and engagement, gain political support, and create ownership and accountability for physical activity plans and policies and other supporters to champion the physical activity agenda, drive initiatives • Explore funding streams and resource allocation for physical activity promotion in the healthcare system, e.g. healthcare budgets, government grants, and partnerships with the private sector • Develop a long-term, actionable strategy for physical activity promotion in healthcare that includes a strategic plan with internal

						and external stakeholders to build and integrate a public health component into the MoH structure • Map and strengthen multi-sector collaboration to develop a shared understanding of the issues and priorities and co-design initiatives • Develop an understanding of each stakeholder's barriers and facilitators to the implementation of proposed initiatives and plans (e.g. improvements to urban planning)

6.3 Recommendations for Practice

Enabling change in this complex healthcare system will be challenging and require an approach that can balance immediate needs that focus on treatment and the ongoing need to innovate and improve healthcare delivery (Gomez-Chaves et al., 2021; Omachonu et al., 2010). Modifying usual care and integrating health innovations into existing healthcare systems is complex (Skivington et al., 2021) but necessary to support the translation of research into practice. Without a collective and systemic drive at all the levels of influence identified in this thesis, strengthening and supporting HCPs' capability, opportunity and motivation for physical activity promotion will likely remain inconsistent and inadequate. Stemming from this programme of research and to support the summary recommendations made above in Table 6.1 and to also address aim four of this programme of research are detailed recommendations for practice for key findings.

HCPs in all three studies reported that HCPs' lack of knowledge and skills are barriers to physical activity promotion. This was linked to a lack of consistent CPD training for HCPs. Pearson et al. (2018) postulate that HCP professional practice is a series of complex behaviours, and as such, CPD should be considered as a behaviour change intervention that is underpinned by relevant theory, methods and techniques to aid the translation of research into practice (Steinmo et al., 2015). Building on this Hart et al. (2023) recommend that CPD for HCPs is grounded in behavioural science and highlight the utility of the COM-B model to support this. The authors propose that using the COM-B model moves CPD beyond traditional competency-based approaches to also consider HCPs' opportunities and motivation for professional practice behaviour change (Hart et al., 2023). When developing CPD for HCPs Hart et al. (2023) firstly

emphasise the importance of clearly defining the intended behavioural outcomes, which refers to who needs to do what, how, with whom, when and where. Next, the authors highlight the importance of identifying the influences (barriers and facilitators) on the intended behavioural outcomes (Hart et al., 2023). After this behavioural diagnostic, it is then recommended that evidence-based BCTs (Pearson et al. (2018) are embedded in training activities to address barriers or use facilitators to support HCPs' clinical behaviour change (Hart et al., 2023). Using this approach to CPD ensures that it is evidence-based, replicable, and that its impact can be measured and evaluated (Hart et al., 2023; Pearson et al., 2018).

It is recommended that physical activity CPD for HCPs in Oman is developed using the guidance outlined by Hart et al. (2023) and the barriers and facilitators identified in this programme of research. For example, studies one and two identified that an influence on HCPs' physical activity promotion for people with type 2 diabetes in clinical appointments (the intended behavioural outcome) was their lack of knowledge and skills to promote it to patients with complications or comorbidities (the barrier). A training activity to address this barrier could include presenting case studies of complex patients to HCPs and demonstrating how physical activity could be promoted to them (BCTs instruction on how to perform the behaviour and demonstration of the behaviour). HCPs could then engage in role-play (BCT behavioural practice/rehearsal) and be provided with feedback (BCT feedback on behaviour) on this to support the development of competencies and confidence to promote physical activity with more challenging patients.

In addition to the development of evidence-based CPD training using the approach described above (Hart et al., 2023), it will be important to create a culture within the healthcare

system whereby physical activity is seen as a core component of diabetes care. Along with increased training opportunities to support this, it will also be imperative that physical activity and how to promote it is embedded into the undergraduate medical education curriculum. (Netherway et al., 2021). In Oman there is a lack of an established framework of how and what to include in the medical education curriculum to support HCPs to promote physical activity. Gates and Ritchie (2018) propose that to successfully embed physical activity promotion into the curriculum; the following strategies are adopted: incorporate physical activity into core subjects, develop specific modules on physical activity, use active teaching methods and incorporate technology and digital resources. Furthermore, faculty members should be trained, and strategic partnerships should be developed. Finally, continuous evaluation and sharing of best practices will ensure the curriculum's effectiveness and adaptability to emerging needs (Gates & Ritchie, 2018).

Supporting physical activity promotion in healthcare requires sustained and purposeful multi-sectoral collaborations (Kolovu et al., 2023; Rigby et al., 2020). Whilst this has been identified as a challenge in this programme of research, there is a clear need to develop new ways of working that create an environment that facilitates collaborations (Kolovou et al., 2023). To support collaborative efforts, a shared vision and buy-in from people in leadership roles will be needed. The WHO (2019) also advocates for strong leadership and governance structures that can coordinate action across the system and mobilise resources to promote physical activity in primary healthcare, which has been shown to facilitate the development of policies and structures to support health promotion activities, including physical activity (Jones & Sundwall, 2016; Vuori et al., 2013; Woods et al., 2022).

In the first instance, it is recommended that a Stakeholder Analysis is conducted; this can lay the foundations for effective collaboration and decision-making in health innovations and address the needs and expectations of stakeholders (Franco-Trigo et al., 2020; Parnell & Gangwish, 2023). A stakeholder analysis is a systematic process that identifies all relevant stakeholders prior to the start of a project, groups them according to their levels of participation, interest and influence in the initiative, and determines the most effective methods to engage and communicate with each stakeholder throughout the initiative (Franco-Trigo et al., 2020). Conducting a stakeholder analysis will also ensure there is a shared understanding of the issues and priorities, unified visions and goals, clarity on roles and responsibilities, increased commitment, improved communication, and optimised resource use, which van Dale et al. (2020) have reported as facilitators to cross-sectoral collaboration.

To support the prioritisation of physical activity promotion and its integration into the healthcare system in Oman will require a local evidence base. Evidence-based policymaking has been identified as essential to support the efficient use of resources and the translation of evidence into policy and practice (Tricco et al., 2022). Yet, a notable challenge to this in Oman is that the vast majority of evidence for the effectiveness of physical activity for type 2 diabetes stems from Western contexts. As such a key priority for the physical activity agenda in Oman will be to conduct contextually relevant applied and implementation research to start to build a local picture to support the translation of evidence into practice and policy (Oliver et al. 2014). This will not only support the development of plans or policies to support physical activity promotion but also the development of contextually relevant resources, such as clinical practice guidelines. To support the development and implementation of local research and facilitate the translation of evidence into practice, it is suggested that partnerships and collaborations between

researchers and key stakeholders, such as HCPs and policymakers, should start early on in the intervention development process (Abu-Odah et al., 2021; Skivington et al., 2021). Doing so will ensure that the intervention is developed to address barriers in relation to practice and policy and utilise facilitators that are more likely to support change (Oliver et al., 2014).

Additional recommendations to facilitate evidence-based policymaking include building relationships between researchers, policymakers and other stakeholders and encouraging knowledge transfer between researchers and key stakeholders, e.g., through workshops, conferences, and policy briefs (Oliver et al., 2014). Given that barriers to conducting local research were reported in study three, such as lack of research expertise and availability of research assistants, an avenue to secure funding could be to partner with international academic institutions and explore funding opportunities such as grants.

The impact of resource constraints and lack of funding on physical activity promotion was evident in this thesis. While integrating physical activity into the healthcare system may, in the short term, increase resource demands, in the long term, it can support reductions in healthcare expenditure and the burden of chronic disease on the system (Ding et al., 2017). In light of this it will be important for healthcare policymaking in Oman to make the shift from a reactive model of healthcare to a proactive one and to ensure there is leadership support in place for this. To prioritise physical activity promotion, it will be important that any strategic plans or policies also consider funding and resource constraints. This will involve re-directing existing funding streams and the exploration of new funding streams to support the integration of physical activity promotion into the healthcare system, e.g. healthcare budgets, government grants, and partnerships with the private sector. Creating awareness of the impact of physical

activity from local evidence, as described above, may also support the reallocation of funding and resources to support the integration of it into the system (Rigby et al., 2020).

6.4 Recommendations for Future Research

The current programme of research has contributed to gaps identified in the literature (e.g. Dyson & Cowdell, 2021) and provided novel insight into the utility and appropriateness of the TDF (Cane et al., 2012) and the COM-B model (Michie et al., 2014) to explore this area of research.Nonetheless, an important next step will be to determine if these findings can be operationalised in practice to support the effective development and implementation of behaviour change interventions. For example, when considering the findings alongside the BCW (Michie et al., 2014), this thesis has completed the first stage of this approach, understanding the behaviour and what needs to change. However, the next steps will be to test if our understanding of the identified barriers and facilitators can meaningfully be translated into intervention design and implementation that supports HCPs' professional practice behaviour change in Oman using steps two and three from the BCW, identify intervention options, and identify content and implementation options (Michie et al., 2014). It is also recommended that the MRC guidance is adhered to determine feasibility and support implementation evaluation, thus ensuring a rigorous and systematic process is followed (Skivington et al., 2021).

The factors influencing physical activity promotion are likely to vary across HCP roles and settings, for example, access to resources (Algahfri et al., 2017), length of time in patient appointments (Stuij et al., 2018), the availability of training or CPD (Avery, 2014) or social and cultural norms (Abouammoah et al., 2016). Whilst it was not possible to examine the influence of role and setting in this programme of research, doing so would enable a more focused behavioural analysis of barriers and facilitators that are specific to disciplines of HCPs and

settings. As such, further research is needed to examine the influence of role and setting on physical activity promotion. This will allow for training programs or interventions to be tailored to the specific needs of HCPs rather than a one-size-fits-all approach.

An important finding in this thesis is that HCPs' beliefs about their patients can play a crucial role in the promotion of physical activity. Whilst the examination of the barriers and facilitators to physical activity experienced by people living with type 2 diabetes in Oman was outside the scope of this thesis, given the critical role of the patient in physical activity behaviour change (e.g. Kennerly & Kirk, 2018), it is recommended that future research conducts a comprehensive and systematic examination of determinants of physical activity within this population. It is recommended that this research adopts the same theoretically informed approach as this programme of research, using the TDF (Cane et al., 2012) and the COM-B model to allow for a detailed examination of patients' barriers and facilitators to physical activity. These behavioural insights would allow for a comparison with the findings of studies one and two pertaining to HCPs' beliefs about their patients Furthermore, this would add to the literature base and provide evidence-based guidance for researchers, intervention developers, practitioners and policymakers to guide the development of implementation interventions.

6.5 Strengths and Limitations of this Programme of Research

Study one (the MMSR) was, to the best of the researcher's knowledge, the first systematic review and synthesis of HCPs barriers and facilitators to HCPs physical activity promotion for patients with type 2 diabetes. The adoption of the Joanna Briggs Institute (JBI) methodology (Stern et al., 2020) was a strength of this programme of research. This is a novel approach to the topic of research in this thesis and enabled the synthesis of findings from quantitative, qualitative, and

mixed methods designs, thus ensuring that all the available evidence was included. The JBI approach provides a rigorous and transparent methodology, therefore enhancing the credibility and trustworthiness of the review findings (Santos et al., 2018). Furthermore, the JBI methodology enables a detailed understanding of complex phenomena and is designed to produce valuable insights that are relevant and applicable to evidence-based clinical practice and healthcare policymaking and decision-making (Stern et al., 2020).

Mapping the findings from the TDF to the COM-B model (Michie et al., 2014) in studies one and two was another strength of this programme of research. Whilst it is acknowledged that there are numerous health psychology theories (e.g. the Theory of Planned Behaviour; Ajzen, 1991), the use of the TDF (Cane et al., 2012) and COM-B model (Michie et al., 2014) was intentional. Using these two approaches enabled a thorough and theoretically informed exploration of barriers and facilitators to HCP's physical activity promotion. Furthermore, this approach can more fully capture the complexities of HCPs' professional practice behaviour change compared with the limitations of using a single health psychology theory which may exclude important drivers of behaviours (reflecting the need for standardised theoretical frameworks) in the area being studied in this thesis.

Furthermore, the use of the TDF (Cane et al., 2012) and the COM-B model (Michie et al., 2014) for data collection and analysis in studies one and two offered a robust and systematic framework for understanding, developing and implementing behaviour change interventions (Michie et al., 2014). This is an approach to research that is advocated for in the literature to advance health psychology theory and methods (Presseau et al., 2021). Furthermore, synthesising research in this way effectively creates specific recommendations that can be implemented in various local systems in ways that build up the evidence of what works, for

whom, and under which circumstances (Public Health England, 2019). Furthermore, mapping the findings from the TDF to the COM-B model provides a theoretical basis for the development of evidence-based interventions to support HCPs' physical activity promotion using behaviour change techniques and intervention strategies (Keyworth et al., 2019; Michie et al., 2014). There were no barriers or facilitators in studies one and two that could not be mapped to the TDF. This demonstrates the reliability of this framework in identifying influences on HCP's physical activity promotion for people with type 2 diabetes across differing settings and contexts (Phillips et al., 2015). A limitation of this is the potential for researcher bias or subjectivity, which was mitigated by having a second coder, which was another strength of this research. Furthermore, the use of the TDF in study two addressed the gap identified in the literature by Dyson and Cowdell (2021) and provided evidence for the applicability of the TDF to explore determinants of HCPs' professional practice in non-Western settings.

The findings from studies two and three highlight the importance of engaging with different stakeholders to develop a comprehensive understanding of the barriers and facilitators to HCPs' physical activity promotion at multiple levels of the system. To successfully translate behaviour change interventions into practice, the end-users and the context must be considered throughout the design and implementation (Brand & Silburn, 2014; Curtis et al., 2016). The inclusion of policymakers in study three is a significant strength of this programme of research. A notable criticism in health research is that despite the recognition of the importance of engaging with policymakers in the development of complex healthcare interventions (e.g. O'Cathain et al., 2019), their perspectives in published health research are scarce (e.g. Frahsa et al., 2014). Traditionally, research in this domain has focused on the views of patients or HCPs (Oliver et al., 2014; Rigby et al., 2020). Yet, as demonstrated in this research, policymakers are

uniquely positioned to offer insights into the broader health system and policy landscape that can influence the feasibility, scalability and sustainability of an intervention. Engaging with policymakers in study three facilitated a comprehensive understanding of the features and characteristics of the healthcare system in Oman, the broader influences of other ministries and sectors, and how these interact. This depth of understanding has been noted as important prior to developing and implementing complex interventions (Plack et al., 2019). This level of insight also enables a better understanding of how and where to intervene within the healthcare system to support the integration of physical activity and to provide more support to HCPs to promote it (Brannan et al., 2019) and ensures that resources are allocated for maximum impact (e.g. Abu-Odah et al., 2022).

For both studies two and three, participants were a purposive sample, with the recruitment of participants supported by the Director General of the MoH. Whilst this led to a sufficient sample size of a diverse range of HCPs and policymakers who were able to provide a range of perspectives and experiences, this may have led to biases, such as social desirability bias or some of the sample being more motivated towards physical activity promotion. As such, it will be necessary to use a wider range of recruitment strategies to further explore the influences on HCPs physical activity promotion with a wider sample of participants to ensure that all influences can be considered. Furthermore, despite the strength of the stakeholder engagement, the generalisability of the findings cannot be determined due to potential variations in contextual factors and settings.

6.6 Reflexivity

My motivation for exploring this topic stemmed from a number of experiences. I was born in the United Kingdom (UK) and identify as White British. I have lived in the UK, New Zealand, Oman and the United Arab Emirates. I am a university-educated PhD student with a background in psychology, which includes a BSc in psychology and an MSc in health psychology. My education and living in Oman influenced the conception of my study. Academically, I have a keen interest in health behaviours, HCPs' professional practice, healthcare systems and the impact of psychological theory. Living in Oman from 2008 to 2020, I observed the escalating rates of type 2 diabetes, the absence of a non-pharmacological approach to disease management and the difficulties in translating research into practice.

My values are deeply rooted in the belief that understanding and enhancing behaviour requires a holistic approach that acknowledges and addresses real-world challenges. This involves considering not just the individual but also the broader socio-cultural and systemic contexts in which they operate. My worldview, shaped by critical realism, supports this perspective by recognising that while an objective reality exists, our comprehension of it is mediated by social contexts and individual experiences. This epistemological stance allows for a nuanced understanding of the complex layers of reality that influence behaviour, which is crucial for interpreting the interactions between individual, organisational, and systemic factors, especially in the context of Oman. Throughout my research, I was acutely aware of how my personal and professional background, as well as my cultural identity and experiences, could influence my interactions with participants and the interpretation of findings. This awareness was important to ensure that my research outputs were not only academically robust but also culturally sensitive and practically relevant.

Engaging with healthcare professionals and policymakers for studies two and three was influential in shaping my understanding of the issue being examined. I was aware that my interactions with these key stakeholders were critical to the research process and outcomes. This engagement demanded an acute awareness of the cultural, professional, and personal dynamics that influenced these interactions. Being a White British female who had lived in Oman for several years meant that I brought both an insider and outsider perspective to the research context. This dual perspective was beneficial in understanding the nuances of Omani culture and the healthcare system. I also noted that my background and lived experience enabled a sense of trust and acceptance from participants. For example, when talking about the challenges of being physically active within the environment (e.g., lack of pavements and weather), many participants were reassured that I had first-hand experience. Without this lived experience, developing this level of trust and understanding may have been more challenging.

However, insider and outsider perspectives also introduced possible biases, such as an overestimation of my understanding of the local cultural and professional contexts, which could have resulted in cultural misinterpretations and affected how questions are framed, and responses are interpreted. Furthermore, my experiences and preconceptions about the effectiveness of previous health interventions in Oman, such as Healthy Cities and the increasing prevalence of type 2 diabetes, had the potential to influence how I perceived and interpreted information from participants, leading to conclusions that reflected my experiences rather than the data itself. This could lead to a lack of depth in understanding the real barriers and facilitators faced by healthcare professionals in the Omani context.

Additionally, from a theoretical perspective, I was aware of my interest in theory, and this motivated my use of the TDF. In selecting this framework, I was aware of the possibility

of my own biases, such as confirmation bias, whereby I sought information that confirmed my pre-existing beliefs about barriers and facilitators to physical activity or the healthcare system. It was important throughout this thesis to ensure that the findings were grounded in data rather than personal biases or assumptions. Given that a key gap in the literature I wanted this research to address was the utility and applicability of the TDF in non-Western contexts, I continuously critically evaluated whether the TDF adequately captured the local cultural and systemic nuances or if it inadvertently imposed a Western-centric model of health behaviour change.

To mitigate the potential biases described above, it was crucial for me to consciously set aside my preconceived notions and ensure that the findings were driven by the data rather than by my interpretations or assumptions. To support this, I engaged in regular supervisory sessions and an external advisor (who was Omani) throughout the PhD to provide critical oversight and help to challenge any implicit biases or assumptions that might have crept into the research process. I also revisited the raw data and interview videos during all stages of coding and analysis whilst noting my thoughts and feelings about the research process. In doing so, I sought to enhance the credibility of my findings while remaining attuned to the complexities inherent in cross-cultural research contexts. Through this reflexive practice, I aimed not only to produce meaningful insights but also to contribute positively to discussions surrounding health promotion and using established theoretical frameworks within diverse cultural and contextual settings.

6.7 Conclusions

The overarching aim of this programme of research sought to explore and understand the barriers and facilitators to HCPs' physical activity promotion using a theory-based approach and aimed to explore the utility and applicability of the TDF (Cane et al., 2012) and the COM-B model

(Michie et al., 2014) in Oman. The programme of research achieved this aim and has provided novel insights into the challenge of translating evidence into practice in Oman. The adoption of the JBI methodological guidance for MMSRs in study one and the application of the TDF (Cane et al., 2012) in studies one and two has enabled a comprehensive and systematic exploration of HCPs' physical activity promotion for patients living with type 2 diabetes. A novel contribution stemming from this programme of research was determining the most influential TDF domains on HCPs' physical activity promotion. By adopting this approach, it was possible to determine the origins of barriers and facilitators to HCPs' physical activity promotion. This level of understanding can support the development of targeted behaviour change interventions and supports the assertion from Chater and Loewenstein (2023) that there is a need to address complex problems from a systemic level. Engaging with policymakers in study three has provided novel insights into the macro and meso-level influences on HCPs' physical activity promotion within a complex system. The findings have enabled a broader understanding of the influences of HCPs' physical activity promotion for patients with type 2 diabetes and the need to consider all levels of influence this when developing and implementing behaviour change interventions. Recommendations for practice include, the need to re-direct existing funding or explore new avenues for funding to support the physical activity agenda. Furthermore. it is recommended that HCPs' CPD is underscored by a behavioural science approach (Hart et al., 2023) and that physical activity and its promotion is embedded in the undergraduate medical curriculum (e.g. Netherway et al., 2021). Finally, the need to improve cross-sectoral collaboration was identified, and in the first instance it is recommend that a stakeholder analysis is conducted (Parnell & Gangwish, 2023).

This thesis has also addressed a gap identified by Dyson and Cowdell (2021) regarding

the lack of research using the TDF in non-Western settings and has demonstrated the utility of the framework to explore HCPs physical activity promotion in Oman. The application of implementation science and health psychology theory within this programme of research affirms the value of theory (e.g. Mitchie & Prestwich, 2008). Furthermore, the findings in this thesis support the importance of understanding the implementation context and the need for varied stakeholder engagement to support HCP behaviour change (Presseau et al., 2021; Skivington et al., 2021). It is recommended that future research builds on this understanding by adopting an implementation science approach, that is underpinned by health psychology theory, as used in this thesis, to support the translation of evidence into practice.

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Appendices

Appendix A

The Updated Consolidated Framework for Implementation Research

(Damschroder et al., 2022)

Framework Guidance: The CFIR is intended to be used to collect data from individuals who have power and/or influence over implementation outcomes. See the CFIR Outcomes Addendum for guidance on identifying these individuals and selecting outcomes (19). The CFIR must be fully operationalized prior to use in a project: 1) Define the subject of each domain for the project (see guidance for each domain below). 2) Replace broad construct language with project-specific language if needed. 3) Add constructs to capture salient themes not included in the updated CFIR.	
I. INNOVATION DOMAIN ***Innovation:*** The "thing" being implemented (20), e.g., a new clinical treatment, educational program, or city service. ***Project Innovation:*** [Document the innovation being implemented, e.g., innovation type, innovation core vs. adaptable components, using a published reporting guideline (21–24). Distinguish the innovation (the "thing" that continues when implementation is complete) (20,25) from the implementation process and strategies used to implement the innovation (26,27) (activities that end after implementation is complete) (28).]	
Construct Name	**Construct Definition** *The degree to which:*
A. Innovation Source	The group that developed and/or visibly sponsored use of the innovation is reputable, credible, and/or trustable.
B. Innovation Evidence-Base	The innovation has robust evidence supporting its effectiveness.
C. Innovation Relative Advantage	The innovation is better than other available innovations or current practice.
D. Innovation Adaptability	The innovation can be modified, tailored, or refined to fit local context or needs.
E. Innovation Trialability	The innovation can be tested or piloted on a small scale and undone.
F. Innovation Complexity	The innovation is complicated, which may be reflected by its scope and/or the nature and number of connections and steps.
G. Innovation Design	The innovation is well designed and packaged, including how it is assembled, bundled, and presented.
H. Innovation Cost	The innovation purchase and operating costs are affordable.

II. OUTER SETTING DOMAIN

Outer Setting: The setting in which the Inner Setting exists, e.g., hospital system, school district, state. There may be multiple Outer Settings and/or multiple levels within the Outer Setting (e.g., community, system, state).

Project Outer Setting(s): [Document the actual Outer Setting in the project, e.g., type, location, and the boundary between the Outer Setting and the Inner Setting.]

Construct Name	**Construct Definition** *The degree to which:*
A. Critical Incidents	Large-scale and/or unanticipated events disrupt implementation and/or delivery of the innovation.
B. Local Attitudes	Sociocultural values (e.g., shared responsibility in helping recipients) and beliefs (e.g., convictions about the worthiness of recipients) encourage the Outer Setting to support implementation and/or delivery of the innovation.
C. Local Conditions	Economic, environmental, political, and/or technological conditions enable the Outer Setting to support implementation and/or delivery of the innovation.
D. Partnerships & Connections	The Inner Setting is networked with external entities, including referral networks, academic affiliations, and professional organization networks.
E. Policies & Laws	Legislation, regulations, professional group guidelines and recommendations, or accreditation standards support implementation and/or delivery of the innovation.
F. Financing	Funding from external entities (e.g., grants, reimbursement) is available to implement and/or deliver the innovation.
G. External Pressure	External pressures drive implementation and/or delivery of the innovation. *Use this construct to capture themes related to External Pressures that are not included in the subconstructs below.*
1. Societal Pressure	Mass media campaigns, advocacy groups, or social movements or protests drive implementation and/or delivery of the innovation.
2. Market Pressure	Competing with and/or imitating peer entities drives implementation and/or delivery of the innovation.
3. Performance-Measurement Pressure	Quality or benchmarking metrics or established service goals drive implementation and/or delivery of the innovation.

III. INNER SETTING DOMAIN

Inner Setting: The setting in which the innovation is implemented, e.g., hospital, school, city. There may be multiple Inner Settings and/or multiple levels within the Inner Setting, e.g., unit, classroom, team.

Project Inner Setting(s): [Document the actual Inner Setting in the project, e.g., type, location, and the boundary between the Outer Setting and the Inner Setting.]

Construct Name	**Construct Definition** *The degree to which:*
Note:	*Constructs A – D exist in the Inner Setting regardless of implementation and/or delivery of the innovation, i.e., they are persistent general characteristics of the Inner Setting.*

A. Structural Characteristics	Infrastructure components support functional performance of the Inner Setting. *Use this construct to capture themes related to Structural Characteristics that are not included in the subconstructs below.*
1. Physical Infrastructure	Layout and configuration of space and other tangible material features support functional performance of the Inner Setting.
2. Information Technology Infrastructure	Technological systems for tele-communication, electronic documentation, and data storage, management, reporting, and analysis support functional performance of the Inner Setting.
3. Work Infrastructure	Organization of tasks and responsibilities within and between individuals and teams, and general staffing levels, support functional performance of the Inner Setting.
B. Relational Connections	There are high quality formal and informal relationships, networks, and teams within and across Inner Setting boundaries (e.g., structural, professional).
C. Communications	There are high quality formal and informal information sharing practices within and across Inner Setting boundaries (e.g., structural, professional).
D. Culture	There are shared values, beliefs, and norms across the Inner Setting. *Use this construct to capture themes related to Culture that are not included in the subconstructs below.*
1. Human Equality-Centeredness	There are shared values, beliefs, and norms about the inherent equal worth and value of all human beings.
2. Recipient-Centeredness	There are shared values, beliefs, and norms around caring, supporting, and addressing the needs and welfare of recipients.
3. Deliverer-Centeredness	There are shared values, beliefs, and norms around caring, supporting, and addressing the needs and welfare of deliverers.
4. Learning-Centeredness	There are shared values, beliefs, and norms around psychological safety, continual improvement, and using data to inform practice.
Note:	*Constructs E – K are specific to the implementation and/or delivery of the innovation.*
E. Tension for Change	The current situation is intolerable and needs to change.
F. Compatibility	The innovation fits with workflows, systems, and processes.
G. Relative Priority	Implementing and delivering the innovation is important compared to other initiatives.
H. Incentive Systems	Tangible and/or intangible incentives and rewards and/or disincentives and punishments support implementation and delivery of the innovation.
I. Mission Alignment	Implementing and delivering the innovation is in line with the overarching commitment, purpose, or goals in the Inner Setting.
J. Available Resources	Resources are available to implement and deliver the innovation. *Use this construct to capture themes related to Available Resources that are not included in the subconstructs below.*
1. Funding	Funding is available to implement and deliver the innovation.
2. Space	Physical space is available to implement and deliver the innovation.
3. Materials & Equipment	Supplies are available to implement and deliver the innovation.
K. Access to Knowledge & Information	Guidance and/or training is accessible to implement and deliver the innovation.

IV. INDIVIDUALS DOMAIN ***Individuals:*** The roles and characteristics of individuals.	
ROLES SUBDOMAIN ***Project Roles:*** [Document the roles applicable to the project and their location in the Inner or Outer Setting.]	
Construct Name	**Construct Definition**
A. High-level Leaders	Individuals with a high level of authority, including key decision-makers, executive leaders, or directors.
B. Mid-level Leaders	Individuals with a moderate level of authority, including leaders supervised by a high-level leader and who supervise others.
C. Opinion Leaders	Individuals with informal influence on the attitudes and behaviours of others.
D. Implementation Facilitators	Individuals with subject matter expertise who assist, coach, or support implementation.
E. Implementation Leads	Individuals who lead efforts to implement the innovation.
F. Implementation Team Members	Individuals who collaborate with and support the Implementation Leads to implement the innovation, ideally including Innovation Deliverers and Recipients.
G. Other Implementation Support	Individuals who support the Implementation Leads and/or Implementation Team Members to implement the innovation.
H. Innovation Deliverers	Individuals who are directly or indirectly delivering the innovation.
I. Innovation Recipients	Individuals who are directly or indirectly receiving the innovation.
CHARACTERISTICS SUBDOMAIN ***Project Characteristics:*** [Document the characteristics applicable to the roles in the project based on the COM-B system (29) or role-specific theories.]	
Construct Name	**Construct Definition:** *The degree to which:*
A. Need	The individual(s) has deficits related to survival, well-being, or personal fulfillment, which will be addressed by implementation and/or delivery of the innovation.
B. Capability	The individual(s) has interpersonal competence, knowledge, and skills to fulfill Role.
C. Opportunity	The individual(s) has availability, scope, and power to fulfill Role.
D. Motivation	The individual(s) is committed to fulfilling Role.
V. IMPLEMENTATION PROCESS DOMAIN ***Implementation Process:*** The activities and strategies used to implement the innovation. ***Project Implementation Process:*** [Document the implementation process framework (8) and/or activities and strategies (26,27) being used to implement the innovation. Distinguish the implementation process used to implement the innovation (activities that end after implementation is complete) from the innovation (the "thing" that continues when implementation is complete) (20,25,28).]	
Construct Name	**Construct Definition:** *The degree to which individuals:*
A. Teaming	Join together, intentionally coordinating and collaborating on interdependent tasks, to implement the innovation.

B. Assessing Needs	Collect information about priorities, preferences, and needs of people. *Use this construct to capture themes related to Assessing Needs that are not included in the subconstructs below.*
1. Innovation Deliverers	Collect information about the priorities, preferences, and needs of deliverers to guide implementation and delivery of the innovation.
2. Innovation Recipients	Collect information about the priorities, preferences, and needs of recipients to guide implementation and delivery of the innovation.
C. Assessing Context	Collect information to identify and appraise barriers and facilitators to implementation and delivery of the innovation.
D. Planning	Identify roles and responsibilities, outline specific steps and milestones, and define goals and measures for implementation success in advance.
E. Tailoring Strategies	Choose and operationalize implementation strategies to address barriers, leverage facilitators, and fit context.
F. Engaging	Attract and encourage participation in implementation and/or the innovation. *Use this construct to capture themes related to Engaging that are not included in the subconstructs below.*
1. Innovation Deliverers	Attract and encourage deliverers to serve on the implementation team and/or to deliver the innovation.
2. Innovation Recipients	Attract and encourage recipients to serve on the implementation team and/or participate in the innovation.
G. Doing	Implement in small steps, tests, or cycles of change to trial and cumulatively optimize delivery of the innovation.
H. Reflecting & Evaluating	Collect and discuss quantitative and qualitative information about the success of implementation. *Use this construct to capture themes related to Reflecting & Evaluating that are not included in the subconstructs below.*
1. Implementation	Collect and discuss quantitative and qualitive information about the success of implementation.
2. Innovation	Collect and discuss quantitative and qualitative information about the success of the innovation.
I. Adapting	Modify the innovation and/or the Inner Setting for optimal fit and integration into work processes.

Appendix B

Data Extraction Sheet for the Study and Participant Characteristics

Author (s) of the publication:

Year:

Title of paper:

Journal:

Country:

Clinical setting:

Study characteristics:

Participant characteristics:

Analytic technique used:

Measurement tool used:

Barriers from quantitative studies e.g. descriptive/inferential statistics:

Facilitators from quantitative studies e.g. descriptive/inferential statistics: Additional outcomes relevant to review objectives:

Authors' conclusions:

Funding:

Appendix C

Ethical Approval from Birmingham City University and the Ministry of Health for Study Two

BIRMINGHAM CITY University

Faculty of Business, Law & Social Sciences Research Office
Curzon Building, 4 Cardigan Street
Birmingham
B4 7BD

BLSSethics@bcu.ac.uk;

04/Nov/2019

Mrs Emma Gibson

emma.gibson@mail.bcu.ac.uk

Re: Gibson /3322 /R(C) /2019 /Oct /BLSS FAEC - Barriers and facilitators experienced by health care professionals in promoting physical activity for adults with type 2 diabetes attending primary health care facilities in Oman

Dear Emma,

Thank you for your application and documentation regarding the above study. I am pleased to confirm that Birmingham City University has agreed to take on the role of Sponsor.

Birmingham City University can confirm that our insurance indemnity cover includes the actions of researchers working in suitable premises and under appropriate supervision. Our policy cover will not apply to liability that is more specifically insured under any policy covering medical negligence, malpractice or indemnity, professional errors, omissions or negligence.

A copy of BCU's insurance details is available at:
https://icity.bcu.ac.uk/Legal-Services-and-Compliance/Insurance/Index

If you wish to make any changes to your proposed study (by request or otherwise), then you must submit an Amendment application to us. Examples of changes include (but are not limited to) adding a new study site, a new method of participant recruitment, adding a new method of data collection and/or change of Project Lead.

Please also note that the Committee should be notified of any serious adverse effects arising as a result of this activity.

Keep a copy of this letter along with the corresponding application for your records as evidence of approval.

If you have any queries, please contact BLSSethics@bcu.ac.uk;

I wish you every success with your study.

Yours Sincerely,

Dr. Kyle Brown

On behalf of the Business, Law and Social Sciences Faculty Academic Ethics Committee

Sultanate of Oman
Ministry of Health
Directorate General of Planning and Studies

سلطنة عمان
وزارة الصحة
المديرية العامة للتخطيط والدراسات

MoH/DGPS/CSR/PROPOSAL APPROVED/15/2020

.29.04.2020

الرقم: .....
التاريخ: .....
الموافق: .....

Emma Gibson
Principal Investigator

Study **Title:** A qualitative exploration of barriers and facilitators experienced by health care professionals in promoting physical activity for adults with type 2 diabetes attending primary health care facilities in Muscat

Proposal ID: MoH/CSR/20/9487

After compliments,

We are pleased to inform you that your research proposal 'A qualitative exploration of barriers and facilitators experienced by health care professionals in promoting physical activity for adults with type 2 diabetes attending primary health care facilities in Muscat' has been approved by the Research and Ethical Review & Approval Committee, Ministry of Health.

On completion of the study, you are required to provide a copy of the final report within 2 months to the Centre of Studies and Research.

Regards,

Dr. Ahmed Mohamed Al-Qasmi
Director General of Planning and Studies
Chairman, Research and Ethical Review & Approval Committee
Ministry of Health, Sultanate of Oman.

Cc
Day file

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مسقط ، هاتف: ٢٢٣٥٧٢٥٤، فاكس : ٢٢٣٥٧٢٦٠

Appendix D

Ethical Approval from Birmingham City University and the Ministry of Health for Study Three

Faculty of Business, Law & Social Sciences Research Office
Curzon Building, 4 Cardigan Street
Birmingham
B4 7BD

BLSSethics@bcu.ac.uk;

13/Sep/2022

Mrs Emma Gibson

emma.gibson@mail.bcu.ac.uk

Dear Emma ,

Re: Gibson /#10682 /sub2 /R(C) /2022 /Sep /BLSS FAEC - Exploring healthcare policymakers and decision makers views of type 2 diabetes care

Thank you for your application and documentation regarding the above study. I am pleased to confirm that Birmingham City University has agreed to take on the role of Sponsor for BCU's part in the research.

The Faculty Academic Ethics Committee has approved this activity for review by the external ethics committee(s) stated in the application.

Birmingham City University can confirm that our insurance indemnity cover includes the actions of researchers working in suitable premises and under appropriate supervision. Our policy cover will not apply to liability that is more specifically insured under any policy covering medical negligence, malpractice or indemnity, professional errors, omissions or negligence.

A copy of BCU's insurance details is available at:
https://icity.bcu.ac.uk/Legal-Services-and-Compliance/Insurance/Index

If you wish to make any changes to your proposed study (by request or otherwise), then you must submit an Amendment application to us. Examples of changes include (but are not limited to) adding a new study site, a new method of participant recruitment, adding a new method of data collection and/or change of Project Lead.

Please also note that the Committee should be notified of any serious adverse effects arising as a result of this activity.

Keep a copy of this letter along with the corresponding application for your records as evidence of approval.

If you have any queries, please contact BLSSethics@bcu.ac.uk;

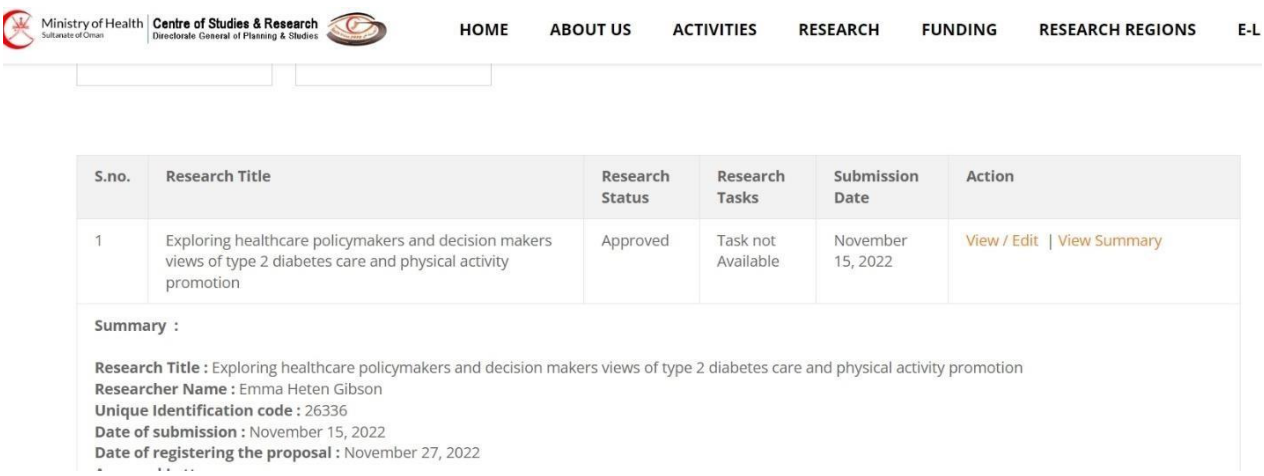
If you would like to provide feedback on the ethics process, please complete the feedback form using this link.

I wish you every success with your study.

Yours Sincerely,

Dr Sophie Drennan

On behalf of the Business, Law and Social Sciences Faculty Academic Ethics Committee



Note. Ethical approval was provided by the MoH, as evidenced above; however, a letter confirming this was not uploaded to the MoH Centre of Studies and Research electronic system.

Appendix E

Search Strategies for the Systematic Review

Search strategy for MEDLINE and PubMed

#1 EXP "Health personnel" [Mesh]

#2 EXP "Health occupations" [Mesh]

#3 OR/ 1-2

#4 EXP "Diabetes mellitus, Type 2" [Mesh]

#5 type 2 diabetes or type 2 diabetes mellitus or t2dm [Keywords]

#6 OR/4-5

#7 EXP "Exercise" [Mesh]

#8 EXP "Sports" [Mesh]

#9 "Sedentary behavio#r*" [Mesh]

#10 EXP "Exercise therapy" [Mesh]

#11 EXP "Physical fitness" [Mesh]

12 Lifestyle [Keyword]

#13 OR/ 6-11

#14 "Intervention*" [Keyword]

#15 EXP "Early medical intervention" [Mesh]

#16 EXP "Internet based intervention" [Mesh]

#17 EXP "Health promotion" [Mesh]

#18 EXP "Patient care management" [Mesh]

#19 EXP “Counsel#ing” [Mesh] or counsel* [keyword]

#20 EXP “Program evaluation” [Mesh]

#21 EXP “Health education” [Mesh]

#22 EXP “Delivery of health care” [Mesh]

#23 OR/14-22

#24 EXP “Behavio#r and behavio#r mechanisms” [Mesh]

#25 EXP “Education” [Mesh]

#26 EXP “Organization and administration” [Mesh]

#27 EXP “Health communication” [Mesh]

#28 EXP “Psychological phenomenon” [Mesh]

#29 OR/ 24 -28

#3 AND #6 AND #12 AND #23 AND #29

Adaption of the MEDLINE/PubMed search strategy for other databases

The search strategy presented above was then adapted to use in CINAHL, PsycINFO, and Web of Science. Although CINAHL also uses MeSH terms, there were some minor changes to the original search strategy; for example, MEDLINE included physical activity within the hierarchy of the MeSH term exercise; however, physical activity was an independent MeSH term in CINAH. MeSH terms are not available in PsycINFO or Web of Science, as an alternative, the APA thesaurus of psychological terms was used in PsycINFO, whilst in Web of Science, a process developed by Huang et al. (2015) was followed.

Adaption of the MEDLINE/PubMed search strategy for CINHAL (amendments in bold):

#1 EXP "Health personnel" [Mesh]

#2 EXP "Health occupations" [Mesh]

#3 OR/ 1-2

#4 EXP "Diabetes mellitus, Type 2" [Mesh]

#5 type 2 diabetes or type 2 diabetes mellitus or t2dm [Keyword]

#6 OR/4-5

#7 EXP "Exercise" [Mesh]

#8 EXP "**Physical Activity''** [Mesh]

#9 EXP "Sports" [Mesh]

#10 "**Life style sedentary**" [Mesh]

11 Lifestyle [Keyword]

#12 EXP "**Therapeutic exercise**" [Mesh]

#13 EXP "Physical fitness" [Mesh]

#14 OR/ 7-14

#15 "Intervention*" [Keyword]

#16 EXP "Early medical intervention" [Mesh]

#17 EXP "Internet based intervention" [Mesh]

#18 EXP "**Intervention trials''** [Mesh]

#19 EXP "**Nursing interventions**" [Mesh]

#20 EXP "Health promotion" [Mesh]

#21 EXP "Patient care management" [Mesh]

#22 EXP “Counsel#ing” [Mesh] or **counsel*** [keyword]

#23 EXP “Program evaluation” [Mesh]

#24 EXP “Health education” [Mesh]

#25 EXP “**Health care delivery**” [Mesh]

#26 OR/14-25

#27 EXP “Behavio#r and behavio#r mechanisms” [Mesh]

#28 EXP “Education” [Mesh]

#29 EXP “**Health facility administration and management**” [Mesh]

#30 EXP “Health communication” [Mesh]

#31 EXP “Psychological phenomenon” [Mesh]

#32 OR/ 27 -31

#3 AND #6 AND #14 AND #26 AND #32

Adaption of the MEDLINE/PubMed search strategy for PsycINFO:

#1 EXP “Health personnel”

#2 EXP “Medical personnel”

#3 OR/ 1-2

#4 EXP “Diabetes mellitus, Type 2”

#5 type 2 diabetes or type 2 diabetes mellitus or t2dm [Keyword]

#6 OR/4-5

#7 EXP “Exercise”

#8 EXP “Sports”

#9 EXP “Sedentary behaviour”

#10 Lifestyle [Keyword]

#11 EXP “Exercise therapy”

#12 EXP “Physical fitness”

#13 OR/ 6-11

#14 “Intervention*” [Keyword]

#15 EXP “Internet based intervention”

#16 EXP “Health promotion

#17 EXP “Patient care management” [Mesh]

#18 EXP “Counsel#ing”

#19 Counsel* [keyword]

#20 EXP “Program evaluation”

#21 EXP “Health education”

#22 EXP “Delivery of healthcare”

#23 OR/ 13-22

#24 EXP “Behavio#r and behavio#r mechanisms”

#25 EXP “Education”

#26 EXP “Organi#ation and administration”

#27 EXP “Health communication”

#28 EXP “Psychological phenomenon”

#29 OR/ 24 -28

#3 AND #6 AND #13 AND #23 AND #29

Development of the Search Strategy for Web of Science

Web of Science is an extensive citation database containing articles from over 34,000 journals across multiple scientific disciplines (Birkle et al., 2020). However, unlike the other databases used for this systematic review, Web of Science does not use MeSH terms, controlled vocabulary, standardised subject terms, or a thesaurus but may include author keywords if they have been included in the published paper; this represents a challenge when translating a search strategy built with MeSH terms. A systematic framework set out by Huang et al. (2015) to address this issue was used to ensure that the process was as comprehensive and replicable as possible. After the development of the Medline and CINAHL search strategies using MeSH and keyword terms, the following procedure was used to translate the search to Web of Science:

- The same PICO search terms formulated for MEDLINE and CINAHL were used.
- The adoption of recommendations for developing Web of Science Search by Huang et al. (2015).
- The mapping and recording of the source of each term used.

Tailoring search terms for Web of Science

This process involved the consultation and consideration of findings from a systematic review aimed to optimise search strategies for the Web of Science database (Huang et al., 2015). Search terms identified using stage one of the Cochrane process were then tailored for the Web of Science database. Huang et al. (2015) reported an optimum search strategy that involved some of the following techniques:

- Obtain core terms that are highly relevant to the domain field
- Ask for expert input to validate the relevance of these terms
- Extract candidate terms from the keywords of 'Author Keywords'
- Manual checking and adding (e.g., process of converting terms identified from MeSH database to 'entry field terms)
- 'Tuning' the search strategy to assure suitability to meet study aims

Mapping and recording the source of each term identified

Following the categories identified by the Cochrane criteria and informed by the Huang et al. review, search terms were identified. At this stage, a range of sources was used to ensure the thorough identification of search terms. Sources for the generation of search terms included:

- Cochrane reviews have researched the same target concept (e.g., type 2 diabetes).
- Identification of search terms used in recent Cochrane reviews was conducted.
- Keywords from target papers of interest already identified.
- Text entry terms associated with MeSH terms were previously identified using the MeSH database (for the MEDLINE search conducted prior to this).

Search strategy for Web of Science

#1 Healthcare professionals or health-care professionals or health professionals

#2 Health Personnel

#3 Health care workers

#4 Nurs* or nurse practitioner

#5 General practitioner or doctor or physician or family practice

#6 Community health workers or allied health or dieticians or physiotherapy* or pharmacist

#7 Primary care or public health or public health practice

#8 OR/1-7

#9 Diabetes Mellitus, type 2

#10 Type 2 diabetes or diabetes type 2 or type 2 diabetes mellitus

11 metabolic health or glycaemic control or insulin resistance or HBA1c

#12 T2D or T2DM or NIDDM

#13 OR/9-12

#14 Physical activity

#15 Exercise

#16 Physical Fitness

#17 Sports

#18 Lifestyle advice

#19 Lifestyle or life style

#20 Pedometer

#21 Exercise therapy

#22 Sedentary behaviour

#23 OR/ 14-22

#24 Intervention or program or trial or study or prevention

#25 Experiences of health care professionals

#26 Behavio$r change or health behavio$r or behavio$r therapy

#27 Patient-provider education or health education or patient education as topic or counselling or counsel*

#28 Prescription

#29 Health communication or health promotion

#30 Evaluation or process evaluation

#31 Patient care planning

#32 Patient compliance

#33 OR/24-32

#8 AND #13 AND #23 AND 33

Appendix F

JBI Critical Appraisal Tools for Qualitative Research

Reviewer_____ Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Is there congruity between the stated philosophical perspective and the research methodology?	☐	☐	☐	☐
2. Is there congruity between the research methodology and the research question or objectives?	☐	☐	☐	☐
3. Is there congruity between the research methodology and the methods used to collect data?	☐	☐	☐	☐
4. Is there congruity between the research methodology and the representation and analysis of data?	☐	☐	☐	☐
5. Is there congruity between the research methodology and the interpretation of results?	☐	☐	☐	☐
6. Is there a statement locating the researcher culturally or theoretically?	☐	☐	☐	☐
7. Is the influence of the researcher on the research, and vice- versa, addressed?	☐	☐	☐	☐
8. Are participants, and their voices, adequately represented?	☐	☐	☐	☐
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	☐	☐	☐	☐
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

_____

_____

Appendix G

JBI Critical Appraisal Tools for Analytical Cross-Sectional Studies

Reviewer_____ Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

_____

_____

_____

Appendix H1

Overview of the Findings for the Knowledge Domain with Exemplar Quotes

TDF Domain: Knowledge (15 studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component – Psychological Capability				
Knowledge about physical activity (13 studies)	General knowledge about physical activity (13 studies)	23	3	Twenty-nine per cent of diabetes educators reported that their own lack of ability or knowledge was a barrier to physical activity promotion in appointments with type 2 diabetic patients [qualitized author summary and statistical data (Dillman et al., 2010)] – Barrier Limited knowledge of physical activity effects on diabetes control was a barrier to physical activity counselling for the healthcare professionals [author summary (Powell et al., 2016)] – Barrier
	Lack of knowledge to support patients with comorbidities or complications (5 studies)	5	0	A challenging barrier to physical activity counselling for diabetes educators was assuring safe physical activity plans for patients with comorbidities [qualitized statistical data (Powell et al., 2016)] –Barrier *Am not sure about my knowledge and skills to support physical activity in patients with diabetes who may have multiple comorbidities and require structured physical activity advice, not just a general statement* [healthcare professional quote (Alghafri et al., 2017)] – Barrier

The impact of inadequate training and education on knowledge (5 studies)	None	6	0	*It should be well-structured physical activity consultations. I think no one is well trained in this field* [healthcare professional quote (Alghafri et al., 2017)] – Barrier Providers complained that they had received insufficient training in medical school and in their residencies to promote behavioral change [author summary (Larme et al., 1998)] – Barrier
Knowledge of the of the social and environmental context (two studies)	None	0	3	One strategy put forward by a male IMG was to ask male patients to walk to a mosque that was further away than the mosque they usually attend which would indicate that the IMGs awareness of local people's religious needs [author summary (Abouammoh et al., 2016)] – Facilitator *Community mapping for physical activity facilities (places and volunteering buddies) to inform healthcare providers is a good idea to improve PA referrals* [author summary and healthcare professional quote (Alghafri et al., 2017)] – Facilitator

Appendix H2

Overview of the Findings for the Skills Domain with Exemplar Quotes

TDF Domain: Skills (nine studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component: Psychological Capability				
Behaviour change skills required to promote physical activity (7 studies)	None	10	0	Thirty-four percent of physicians did not feel comfortable applying the physical activity recommendations with their type 2 diabetic patients and, as such, did not do so, reporting a lack of appropriate skills in physical activity prescription [qualitized author summary and statistical data (Dranebois et al., 2019)] – Barrier Despite health professionals having sufficient knowledge to provide general physical activity information, they recognised their limited skills in delivering effective behaviour change consultations [author summary (Matthews et al., 2014)] – Barrier *I know that physical activity consultations linked to behaviour change is more effective, but we don't know how to do it* [healthcare professional quote (Alghafri et al., 2017)] – Barrier

Communication skills (3 studies)	None	1	5	GPs reported feeling knowledgeable about the underlying physiological mechanisms of Type 2 diabetes, however they emphasised that it was sometimes difficult to communicate this complex information to patients. Furthermore they expressed dissatisfaction that many of their patients do not act upon the advice they provide about increasing their PA/exercise levels. As such they felt that a different approach was required to effectively communicate information about diabetes to patients, including the benefits of leading a physically active lifestyle that would be more flexible to patients' personal situations [author summary (Avery, 2014)] – Barrier *My number one aim is just to build rapport. I always feel that if people trust you and inherently like who you are, they are probably going to be more adherent because they enjoy coming* [healthcare professional quote (Zimmermann et al., 2018)] – Facilitator

Appendix H3

Overview of the Findings for the Social/Professional Role and Identify Domain with Exemplar Quotes

TDF Domain: Social/Professional Role and Identity (9 studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component: Reflective Motivation				
HCPs perception of their roles and responsibilities (6 studies)	None	18	0	*But yeah, they give low priority [to PA]. You have to see it this way, or I see it this way. (…) It irritates me. Of course, you have problems with your ankles and knees, you are 30 kilos overweight. (…) I think: 'That's just not necessary, that you became that fat. Where did it go wrong?' I experience this from my own perception, my own situation at home with two incomes, nice house. A totally different perception than from someone sitting at home. And I cannot look behind the front door, that's the problem. (…) Everybody can be active (…) just walk or cycle. (…) Priority, that's what it is all about* [healthcare professional quote (Stuij, 2018)] – Barrier *You just have two categories of people: those who sit behind the wheel, who want to have control over their life, have their own responsibility and take it, and there are people who sit in the back of the bus and let themselves be driven, who let it happen. And if those people don't undergo a change [in attitude], they have a long way to go before they get in at the front of the bus, sit there. Then you have such a different way to go before you even talk about PA* [healthcare professional quote (Stuij, 2018)] – Barrier

HCPs physical activity behaviour (5 studies)	None	0	7	All the physicians who practised regular physical activity thought that their recommendations had an impact versus 70% of physicians who did not practice regular physical activity [author summary (Dranebois et al., 2019)] – Facilitator Diabetes educators engaging in regular physical activity (at least over the past 6 months) perceived themselves as more confident counseling on physical activity compared with those who reported not engaging in regular physical activity over the past 6 months (p = .002) [author summary (Powell et al., 2016)] – Facilitator

Appendix H4

Overview of the Findings for the Beliefs about Capabilities Domain with Exemplar Quotes

TDF Domain: Beliefs about Capabilities (9 studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar quotes
COM-B model component: Reflective Motivation				
HCPs beliefs about their ability and confidence to promote physical activity (9 studies)	None	11	0	Diabetes educators who included physical activity and counselling in less than 25% of their sessions reported lower patient self-efficacy than those who included PA and counselling in more than 50% of their sessions (p <.001) [qualitized statistical data and author summary (Dillman et al., 2010)] – Barrier Diabetes educators lacked confidence in both their ability to prescribe physical activity and exercise and their ability to make appropriate physical activity and exercise-related referrals, with both averages being below the midpoint of the scale (i.e., 50%) [author summary (Dillman et al., (2010)] – Barrier

Appendix H5

Overview of the Findings for the Optimism Domain with Exemplar Quotes

TDF Domain: Optimism (four studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component: Reflective Motivation				
Pessimistic beliefs about the impact of physical activity advice on patient behaviour (four studies)		10	0	*The lack of motivation from the patient made the practitioner pessimistic about being able to manage this type of patients.* Another respondent noted: *Patients find it difficult to curb their appetite for good tasting bad foods and prefer to watch TV than exercise* [qualitized author summary and statistical data (Khairnar et al., 2018)] – Barrier *That's what you get, especially people with type 2 diabetes, nine out of ten revert to the same habits. So, I'm pessimistic about it. But in this case, it's realistic. (…) I do my best for the people I see, but, in the end, I won't create a solution with my advice* [healthcare professional quote (Stuij, 2018)] – Barrier

Appendix H6

Overview of the Findings for the Beliefs about Consequences Domain with Exemplar Quotes

TDF Domain: Beliefs about Consequences (15 studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component: Reflective Motivation				
HCPs beliefs about patients (15 studies)	Patients interest and motivation for physical activity (12 studies)	20	0	Diabetes educators perceived patients to be less receptive to physical activity and exercise for diabetes self-management than themselves (4.5 ± versus 3.2 ±0.7) [qualitized author summary and statistical data (Dillman et al., 2010)] – Barrier *When I say exercise or even activity, the walls are up* [healthcare professional quote (Berry et al., 2012)] – Barrier One hundred per cent of diabetes educators perceived that exercise is not a priority for type 2 diabetic patients [qualitized statistical data (Armstrong-Schultz et al., 2001)] –Barrier
	Patients adherence to physical activity advice (5 studies)	7	0	The PCPs believed that <50% of their patients were adherent to regular moderate exercise [author summary, (Khairnar et al., 2018)] – Barrier

				GPs expressed dissatisfaction that many of their patients do not act upon the advice they provide about increasing their PA/exercise levels [author summary, (Avery, 2014)] – Barrier
	Patient complications and comorbidities (8 studies)	25	0	General practitioners reported that a patient's low fitness level (3.06 ± 0.3) was a barrier that would stop them prescribing regular physical activity to their type 2 diabetes patients [qualitized statistical data (Lanhers et al., 2015)] – Barrier Comorbidities such as arthritis, obesity, and cardiovascular disease were also mentioned as barriers to being active. Overall, there was a general recognition that changing physical activity behaviour is very difficult and that participants "can't be rushed." [author summary (Berry et al., 2012)] – Barrier Ninety-nine per cent of diabetes educators perceived that the choices of activities for patients with type 2 diabetes are minimal because of physical limitations [qualitized statistical data (Armstrong-Shultz et al., 2001)] –Barrier *I mean a lot of them can be in wheelchairs or on walking sticks and physical activity would not be possible or a priority with them. So that would probably be the main reason* [why physical activity is not discussed] [healthcare professional quote (Matthews et al., 2014)] – Barrier

	Belief in the impact of physical activity on patient outcomes (3 studies)	0	7	To be convinced of the interest of prescription was seen as a very important facilitator by 28.8% of participants, an important facilitator by 5.5%, an average facilitator by 8.2%, and a low facilitator by 11%. [qualitized statistical data (Dranebois et al., 2019)] facilitator 83% of registered nurse-diabetes educators physical activity had overall benefits for diabetes management, which was a reason why they would include it in other education programs. [qualitized statistical data (Ruby et al., 1993)] - facilitator

Appendix H7

Overview of the Findings for the Goals Domain with Exemplar Quotes

TDF Domain: Goals (seven studies)

Theme (Frequency)		Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component: Reflective Motivation					
Goal setting (7 studies)		None	0	11	*It's usually to address specific needs, clinical needs of the patient. So it might be somebody whose HbA1C is slight higher than we'd like. So then the benefits of increasing their physical activity might get them to their desired target* [healthcare professional quote (Matthews et al., 2014)] – Facilitator *I think with exercise… give them a very specific timetable for what I expect them to have done by the next appointment. Because… if you just say 'I'd like you to start exercising, do some swimming'? [No good]. You need to say 'How about you do 3 sessions of swimming?* [healthcare professional quote (Avery, 2014)] – Facilitator *We try to tell them to make time; it starts slowly. For exercising you can start with 5 min(s) and progress from there* [healthcare professional quote (Mogre et al., 2019)] – Facilitator

Appendix H8

Overview of the Findings for the Memory, Attention and Decision Processes Domain with Exemplar Quotes

TDF Domain: Memory, Attention and Decision Processes (4 studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component: Psychological Capability				
Competing demands and prioritisation of physical activity (4 studies)	None	7	0	*We are time pressured in our interaction with patients so we can't really cover all aspects of diabetes care with them in one visit, never mind the aspects of wider care. So it's almost a focus thing, focussing it all on blood pressure, or focussing it on foot care or something like that* [healthcare professional quote (Matthews et al., 2014)] – Barrier When examining the importance placed on the 4 DSME/S content areas, diabetes educators ranked healthy eating (38.3%) and taking medications (28%) as the 2 most important content areas to address ahead of physical activity (19.7%) and blood glucose monitoring (14%) [author summary (Powell et al., 2016)] –Barrier Diabetes treatment is also harder for providers because it is more complex and requires close coordination with patients and specialists. There are more components to diabetes treatment (medications, glucose monitoring, education about diet and exercise, screening for and

				prevention of complications) than for other diseases, and diabetes has more complications and comorbidities because the biochemical changes in diabetes affect all organs in the body. The different therapies and numerous specialists required for the complications and comorbidities of diabetes are also difficult for providers to coordinate [author summary (Larme et al., 1998)] – Barrier

Appendix H9

Overview of the Findings for the Environmental Context and Resources Domain with Exemplar Quotes

TDF Domain: Environmental Context and Resources (20 studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component: Physical Opportunity				
Lack of time (17 studies)	HCPs lack of time (12 studies)	31	0	Sixty-five per cent of diabetes educators reported that lack of time was a barrier to physical activity promotion in appointments with type 2 diabetic patients [qualitized author summary and statistical data (Dillman et al., 2010)] – Barrier Time allotted for diabetes self-management education support visits was reported as the greatest barrier to physical activity counselling [qualitized statistical data (Powell et al., 2016)] – Barrier Willem (internist) mentioned both time and the focus on protocols as difficult: *I've only ten minutes and more to discuss. So that's too little [time] to seriously talk about it. (…) My first question is: 'How are you?' And they give me their sugar levels. That's not what I asked. (…) Our practice nurses are also drilled to focus on bringing those sugar levels down. That's why we have the best diabetes care in the world, but now it's time to look more at the person instead of its numbers* [author summary and healthcare professional quote (Stuij, 2018)] – Barrier

				GPs reported that their work schedule (2.90 ± 0.3) was a barrier that would stop them prescribing regular physical activity [qualitized statistical data (Lanhers et al., 2015)] – Barrier
	Perceptions of patients lack of time (6 studies)	6	0	Finally, the educators noted that for many clients making changes in diet or exercise behaviour simply wasn't a priority and, with competing demands on time, lifestyle changes fall off the list [author summary (Berry et al., 2012)] – Barrier
Access to resources (18 studies)	HCPs access to resources (17 studies)	29	10	The majority of the respondents reported not to be aware of lifestyle programs and prevention initiatives that they could refer their diabetes patients to. One respondent reported *"not to have a list of local exercise facilities"* [author summary and healthcare professional quote (Raaijmakers et al., 2013)] – Barrier The term "community mapping" was used by a senior manager who thought health workers should be aware of physical activity facilities within the geographical catchment areas of primary health care centres, in order to facilitate physical activity referrals when advised [authory summary (Alghafri et al., 2017)] – Facilitator
		12	0	Ninety-one per cent of diabetes educators perceived that their type 2 diabetic patient doesn't have any place to exercise [qualitized statistical data (Armstrong-Shultz et al., 2001)] – Barrier

	Perception of patients access to resources (7 studies)			Some health professionals indicated that exercise options are limited for rural dwellers and that a lack of diversity in options for exercise contributed to difficulty in managing type 2 diabetes: *We didn't have a swimming pool dedicated to rehab and aqua types of sports, where people, you know with joint problems or really overweight or obese people could perhaps get in the water and do some kind of exercise* [author summary and healthcare professional quote (Jones et al., 2014)] – Barrier All participants perceived a lack of PA facilities, particularly safe walking areas [author summary (Alghafri et al., 2017)] – Barrier
Financial Challenges (8 studies)	None	11	0	No reimbursement for physical activity counselling was reported as a barrier to physical activity counselling [qualitized statistical data (Powell et al., 2016)] – Barrier *But then [when the insurance fee ends after three months] people tell me, 'I quit, because I didn't get it paid anymore'. Well, yeah, you can walk outside, guys. That's what you get, especially people with type 2 diabetes, nine out of ten revert to the same habits. So, I'm pessimistic about it* [healthcare professional quote (Stuij, 2018)] – Barrier

Organisational support and priorities (7 studies)	None	10	0	Limited physician support and/or guidance for physical activity was reported as a barrier to physical activity counselling [qualitized statistical data (Powell et al., 2016)] – Barrier *Physical activities (are) not medicalised and hence there are no standard follow up, monitoring or evaluative tools for it in primary care* [healthcare professional quote (Alghafri et al., 2017)] – Barrier

Appendix H10

Overview of the Findings for the Social Influences Domain with Exemplar Quotes

TDF Domain: Social Influences (8studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component: Social Opportunity				
Social and cultural norms (8 studies)	None	15	3	Culturally, others perceive that exercise is for the rich or it is a western culture and hence will not participate in it if they think they are poor: *The practice of exercising in the Northern culture is low or non-existent if I should put it bluntly. So if someone sees you exercising (e.g. jogging) it appears strange* [author summary and healthcare professional quote (Mogre et al., 2019)] – Barrier *In our culture (we don't view physical activity as important), taking medicine is enough, no need for physical activity* [healthcare professional quote (Alghafri et al., 2017)] – Barrier Elena (practice nurse) started a weekly walking group herself, because she wanted to offer her patients something concrete and accessible instead of 'only telling them to be more active'. Marjolein (practice nurse) also started such a group. Both spent some of their spare time on the organisation. They were enthusiastic about their group, and felt it offered something important for some of their patients,

				both because of the physical activity and the social aspects [author summary (Stuij, 2018)] - facilitator.
Awareness and understanding of social and cultural differences (2 studies)	**None**	8	None	*If the doctor thinks with her mentality, culture and habits, she will never understand that it is socially unacceptable in Saudi Arabia for a woman over 40 years of age to visit the gymnasium* [healthcare professional quote (Abouammoh et al., 2016)] – Barrier *Maybe the expatriate doctor is familiar with the customs and habits but cannot link her information with providing advice to patients, it is just not in her mind because she does not live that culture, she just knows it* [healthcare professional quote (Abouammoh et al., 2016)] – Barrier

Appendix H11

Overview of the Findings for the Emotion Domain with Exemplar Quotes

TDF Domain: Emotion (5 studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component: Automatic motivation				
Feeling negative about physical activity promotion (5 studies)	None	9	0	Fifty two percent of the physicians reported feeling isolated regarding prescribing physical activity for patients with type 2 diabetes [qualitized author summary and statistical data (Dranebois et al., 2019)] – Barrier GPs expressed dissatisfaction that many of their patients do not act upon the advice they provide about increasing their PA/exercise levels. As such they felt that a different approach was required to effectively communicate information about diabetes to patients, including the benefits of leading a physically active lifestyle that would be more flexible to patients' personal situations [author summary (Avery, 2014)] – Barrier *We've got a national physical activity strategy and following that we've now got a kind of national cycling action plan and we're now developing a walking strategy. Why do we need a*

				walking strategy? We've got a perfectly good physical activity strategy that references walking [healthcare professional quote (Matthews et al., 2014)] – Barrier

Appendix H12

Overview of the Findings for the Behavioural Regulation Domain with Exemplar Quotes

TDF Domain: Behavioural Regulation (2 studies)

Theme (Frequency)	Subtheme	Barriers	Facilitators	Exemplar Quotes
COM-B model component: Psychological Capability				
Tracking, monitoring and evaluation (2 studies)	None	3	4	*Physical activity is not considered in the primary health information system 'ALSHIFA' which makes it difficult to prescribe, follow-up or evaluate* [healthcare professional quote (Alghafri et al., 2017)] – Barrier Fifty-eight per cent of clinicians recommended smartphone apps to their clients as they tracked physical activity better than traditional methods [author summary (Karduck & Chapman-Novkofski (2018))] – facilitator

Appendix I

HCPs Suggested Facilitators for Physical Activity Promotion

TDF Domain	COM-B model component	Exemplar Quotes
Knowledge	Capability psychological	Clear and well-communicated guidelines across health workers and PA stakeholders is recommended [author summary (Alghafri et al. 2017)] The general consensus was that an online training programme would allow flexibility. The programme would be useful for demonstrating new ways for healthcare professionals to communicate to their patients about diabetes, in particular why it progresses without appropriate management and how to manage it effectively by making PA/exercise lifestyle changes [author summary (Avery, 2014)] Proposed training topics were PA definitions, guidelines, measurements, consultation skills including behaviour change techniques (goal setting and motivation) and follow-up monitoring tools [author summary (Alghafri et al., 2017)] Behaviour change training provided by the Health Board aimed to limit the potential problem of information-overload by training health professionals to identify a priority behaviour for management in each visit: So potentially that individual is walking out with five referrals. "I'm stopping smoking, I'm losing weight, I'm stopping drinking, I'm increasing my activity". So it's how we manage that and that's where we deliver training around behaviour change and prioritising a single behaviour [author summary (Matthews et al., 2014)] Healthcare professionals thought that employee training might improve physical activity promotion within their health board [author summary (Matthews et al., 2014)] The family physicians suggested gathering data from patients on perceptions and barriers to PA to identify effective routes for PA promotion and intervention "*We need more studies about perceptions and then about the barriers"* [author summary and healthcare professional quote (Alghafri et al., 2017)]

Skills	Psychological capability	The dominance of healthcare professional centred 'advice-giving' approaches indicated that a key focus of the training should be on skills development of healthcare professionals in the context of PA/exercise for Type 2 diabetes utilising effective health behaviour change strategies [author summary (Avery, 2014)] Healthcare professionals reported that physical activity advice provided by GPs or consultant physicians during routine consultations was a potential strategy for future implementation of physical activity services [qualitized statistical data (Matthews et al., 2014)]
Social/Professional Role and Identity		*In a local team it would help if one person took a lead on it and had a bit more training on it* [healthcare professional quote (Matthews et al., 2014)] Healthcare professionals thought that having a key member of staff to provide physical activity advice might improve physical activity promotion within their health board [qualitized statistical data (Matthews et al., 2014)] There was also recognition that the health care system needs exercise specialists: *it would be nice to have more exercise specialists or physios involved* [author summary and healthcare professional quote (Berry et al., 2010)]
Reinforcement	Automatic motivation	The GPs reported the following as important considerations: being able to plan a programme of training in advance that can feed into their annual appraisal process, and training provision that is evidence-based and confers accreditation for the purposes of continuing professional development [author summary (Avery, 2014)]
Environmental Context and Resources	Physical opportunity	Healthcare professionals thought that access to additional resources might improve physical activity promotion within their health board [qualitized statistical data (Matthews et al., 2014)] The importance of being able to accurately identify a patient's current level of PA/exercise was emphasised by GPs (i.e. the need for tools to achieve this) [author summary (Avery et al., 2014)] *I also think health centres can coordinate with nearby private facilities (e.g.) 'the gym' for possible aerobic, Zumba or resistance exercises for interested young patients perhaps, but then sustainability may be an issue for a larger group of patients* [healthcare professional quote (Alghafri et al., 2017)]

		Community mapping for physical activity facilities (places and volunteering buddies) to inform healthcare providers is a good idea to improve PA referrals [healthcare professional quote (Alghafri et al., 2017)] *I think proximity would help. If a member of staff is giving brief advice to somebody and there were other options for good walking routes in the area, cycling routes, if there was sport or leisure centre nearby, it allows the advice to be I suppose more real. Rather than saying there's a place 5 miles away or what have you, because a person can immediately go to the setting as soon as they leave the consultation* [healthcare professional quote (Matthews et al., 2014)] *The Ministry of Health has utilised an active group of volunteers from the community to promote maternal and child health programs such as breastfeeding, I think we can utilise this group to promote physical activity too* [healthcare professional quote (Alghafri et al., 2017)] *I don't feel bringing physical activity sessions to the health centre is a good idea. However, health educators may arrange and manage activities within the community* [healthcare professional quote (Alghafri et al., 2017)] *We have these beautiful volunteers called the support group who are underutilised in PA promotion for diabetes care. We can use them to organise walkathons in the neighbourhoods or link them to walk patients. We also have the association like the elderly association of woman and the Omani Women Association who can do something similar to anti-smoking activities* [healthcare professional quote (Alghafri et al., 2017)] Healthcare professionals reported that group education was a potential strategy for future implementation of physical activity services [qualitized statistical data (Matthews et al., 2014)] Healthcare professionals thought that small local workshops for patients within a health centre or general practice might improve physical activity promotion within their health board [author summary (Matthews et al., 2014)] Healthcare professionals reported that a single 30-minute physical activity consultation delivered by a physical activity consultant, tailored to the personal circumstances of the individual was a potential strategy for future implementation of physical activity services [qualitized statistical data (Matthews et al., 2014)]

		In fact, the dieticians and health educators group went on to suggest new recruitments such as physiotherapists or trained PA nurse [author summary (Alghafri et al., 2017)] Accredited PA training for all healthcare professionals involved in diabetes care would need to be embedded and/or medicalised within primary healthcare continuous professional development training programs [author summary and healthcare professional quote (Alghafri et al., 2017)] Healthcare professionals thought that access to a referral scheme might improve physical activity promotion within their health board [qualitized statistical data (Matthews et al., 2014)] Healthcare professionals thought an established route of referral might improve physical activity promotion within their health board [qualitized statistical data (Matthews et al., 2014)] *A dedicated service to which we can refer seems best* [healthcare professional quote (Matthews et al., 2014)] Healthcare professionals thought that closer links with staff involved in current council [local authority] programmes might improve physical activity promotion within their health board [qualitized statistical data (Matthews et al., 2014)] *Nowadays using WhatsApp is common, maybe we can introduce it to promote PA* [healthcare professional quote (Alghafri et al., 2017)] The general consensus was that an online training programme would allow flexibility. The programme would be useful for demonstrating new ways for healthcare professionals to communicate to their patients about diabetes, in particular why it progresses without appropriate management and how to manage it effectively by making PA/exercise lifestyle changes [author summary (Avery, 2014)] Ninety per cent of physicians thought that there should be a sport-health module added to the speciality diploma in general medicine studies [author summary (Dranebois et al., 2019)]

Appendix J

Semi-Structured Interview Schedule for Study Two

Opening questions:

1. Tell me about your current role in the care of adults with type 2 diabetes?
    - How many years have you been doing this for?
    - What do you enjoy most about your role?
    - What do you find the most challenging about your role?
    - What do you typically discuss with type 2 diabetic patients in a routine consultation?

Main (TDF related) questions:

1. What is you understanding of lifestyle modification as a treatment for type 2 diabetes?

(Knowledge)

2. What is your understanding of the physical activity guidelines or recommendations for people with type 2 diabetes? **(Knowledge)**

Prompt: Is there anything you are not sure about?

Prompt: Do you find them easy or difficult to discuss with patients?

Prompt: Do you use anything other than these guidelines or recommendations to discuss physical activity with patients?

3. Thinking about physical activity discussions with patients, how do you currently decide on what advice to give? For example, do you use the recommended guidelines or something else? **(Memory, Attention, and Decision Processes)**

Prompt: How easy or difficult is it for you to remember this information?

Prompt: What do you think is the most challenging aspect of this?

Prompt: Is there anything that you think would make this easier (resources, systems etc)

4. When you go into a consultation with a type 2 diabetic patient do you usually intend to discuss physical activity with patients? **(Intentions)**

Prompt: Is there anything that currently makes this easier?

Prompt: Is there anything that currently makes this easier or more difficult? Prompt: Is there anything you think could help?

Prompt: What would stop you discussing physical activity with a type 2 diabetic patient?

5. Do you feel you have the necessary skills to help patients increase their physical activity? **(Skills)**

Prompt: If yes, what do you think has helped you the most to achieve this?

Prompt: If no, what skills do you think are needed to able to provide this advice to patients?

Prompt: What do you think could help you develop these skills (training…. What do you feel you need to know more about?)

6. How confident do you feel about providing physical activity advice to patients? **(Beliefs about Capabilities)**

If confidence is high what helps this?

If confidence is low what challenges are there? What could help you increase your confidence?

Prompt: Do you think if you received more training, you would feel more

confident in doing this regularly with patients? What kind of training do you think you need?

7. If you do provide physical activity advice to a patient, what do you think will happen? Do you think the patient will follow this advice? **(Beliefs about Consequences)**

Prompt: If not, why do you think that is? Prompt: Do you have any examples?

Prompt: What do you think the patient's expectations are if you discuss physical activity with them?

Prompt: What do you find most challenging about these discussions? Is there anything that helps?

8. Thinking about your appointments with patients with type 2 diabetes, do you think that providing physical activity advice will lead to them increasing their physical activity and improving health outcomes? **(Optimism)***Prompt: Can you give any examples?*

9. If you do give physical activity advice, do you monitor the patients' progress?

   Prompt: If no, would this help and what might that be?

10. Again, thinking about your appointments with type 2 diabetic patients, how do you feel when you are giving physical advice to patients? **(Emotion)**

    Prompt: Is there anything that affects whether you give the advice or not?

    Prompt: What do you find most challenging about these discussions? Is there anything that helps?

    Prompt: Are there any advantages or disadvantages to you or the patient when advising them about physical activity?

11. To what extent do you feel providing physical activity advice to patients is part of your role? **(Social/Professional Role and Identity)**

    Prompt: Do you also see this as part of anybody else's role? Prompt: ***(if they do not see it as part of their role)***

    Prompt: If you do not see it as your role, who do you think would be better placed to do it? Why?

12. Within your healthcare centre or the wider system what resources, if any, are available to you to help you to provide physical activity advice to patients? (resources, systems, referrals) **(Environmental Context and Resources)**

    Prompt: How do you think this influences your intention to have physical activity discussions and the quality of them?
    Prompt: have you found anything that helps or is there anything that you think might help?

13. Are you aware of any community or physical activity resources that you can refer patients to help them initiate and increase their physical activity? **(Environmental Context and Resources)**

    Prompt: How does this hinder your physical activity discussions?
    Prompt: What do you think would help?

14. Do you think your work environment influences your physical activity discussions with patients? **(Environmental context and resources)** (e.g., time, lack of resources, other people, other demands, organisation etc).

    Prompt: Why do you think that is? (e.g. competing demands)

15. If you have a discussion about physical activity with a type 2 diabetic patient, do you have any particular outcomes in mind? What might influence this? **(Goals)**

    Prompt: Do you feel able to tailor the advice you give to individual patients' needs and help them set goals? If yes, can you give an example?If no, what stops you doing this and what might help with this?

16. Is there anything that would motivate you to:

    a. Have more regular discussions to help patients increase their physical activity
    b. Take part in extra training to develop the skills to do this?

    Prompt: Are you incentivised (rewarded) to do either of these?

    Would this make a difference to you discussing physical activity in a consultation? What do you think would incentivise you?

    Would having targets be helpful or not? (**Reinforcement)**

17. Do you think your colleagues discuss physical activity with type 2 diabetic patients?

    (Social Influences)

    Prompt: Have you discussed ways to talk about physical activity with type 2 diabetic patient with your colleagues? What seems to be the approach about this topic within the health centre?

    Prompt: Does this influence your approach to your own discussions with patients about physical activity?

    Prompt: Is there anybody you can ask for support from to help you have these conversations? Would this help? How?

18. Is there anything that you do, or strategies, tools that you use that helps you to have physical activity discussion? **(Behavioural Regulation)**

Prompt: If no, what do you think would help the most? How do you think this would benefit you and the patient?

19. Is there anything else that you do that might act as barrier or a facilitator to physical activity discussions?

Final question

20. Is there anything else you would like to add about your experience as a healthcare professional and physical activity promotion with patients with type 2 diabetes?

Appendix K

Demographics and Informed Consent for Study Two

Consent Form

Dear Participant,

You are invited to take part in a research study that aims to explore and understand the barriers and facilitators experienced by a range of healthcare professionals when promoting physical activity to adult type 2 diabetic patients within their clinical practice. The aim of this study is to develop a better understand of what helps and hinders you when having physical activity discussion with adults with type 2 diabetes in your everyday practice, this insight will help to identify ways that healthcare professionals can be better supported to provide physical activity advice to patients. You will take part in an online interview.

Please, note that your participation is entirely voluntary, and you are free to withdraw at any time, up until two weeks after the interview, without offering any explanation. There are no right or wrong answers to the interview questions; I am only interested in your personal views.

The study is approved by the Business, Law and Social Sciences faculty of Birmingham City University, United Kingdom and Ministry of Health, Oman.

To be interviewed for this study, please confirm the following:

1. I confirm that I am over 18 years of age.
2. I confirm that I an employee of the Ministry of Health and work within a primary health care facility in Muscat.
3. I confirm that I am responsible for the care of adults with type 2 diabetes.
4. I confirm that I have read and understood the information sheet.
5. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences for my withdrawal. In addition, should I not wish to answer any particular question, or, questions, I am free to decline.
6. I agree for the one to one interview to be video recorded. I understand that the recording made of this interview will be used only for scientific data analyses and that extracts from the interview, from which I would not be personally identified, may be used in any conference presentation, report or journal article developed, as a result of the research.
7. I agree that my anonymised data will be kept, in a password-protected database, for up to seven years, for future research purposes such as publications related to this study after the completion of the study.
8. I understand that if I change my mind and would like to withdraw my participation from this study, I can do so without giving a reason, up until 2 weeks after my participation in the interview.
9. I am aware that if I have any concerns or comments about my participation in this research, that have not been answered by the research team, I can contact the Quality Section of the Directorate General of Health (+968 24782105) to discuss.
10. I agree to participate in this interview.

Please provide the following information:

Your name ……

Your role .....

Years in this role .....

Contact details .....

Your signature …….....

Date ……..……

Further information about this research project can be obtained from the principal investigator, Emma Gibson at emma.gibson@mail.bcu.ac.uk or her supervisor Dr Atiya Kamal at atiya.kamal@bcu.ac.uk.

Thank you!

Emma Gibson, PhD candidate. Department of Psychology, Birmingham City University, United Kingdom; Department of Behavioural Sciences Business, Law, and Social Sciences ethics committee at BLSSethics@bcu.ac.uk

Appendix L

Participant Information Sheet for Study Two

Participant Information Sheet

Dear Participant,

Thank you for showing interest in this study. This sheet provides information about the study. Please, read this sheet before deciding whether you would like to participate.

Who is conducting this study?

This study is conducted by Emma Gibson, PhD candidate at Birmingham City University (emma.gibson@mail.bcu.ac.uk) and Dr Atiya Kamal (atiya.kamal@bcu.ac.uk) Dr Angela Hewett (angela.hewett@bcu.ac.uk); Professor Craig Jackson (craig.jackson@bcu.ac.uk).

The study is approved by the Psychology Department of Birmingham City University, United Kingdom and Ministry of Health, Oman.

What is this study about?

This study aims to obtain in-depth information about the barriers and facilitators experienced by a range of healthcare professionals when promoting physical activity to adult type 2 diabetic patients within their clinical practice. This insight will help to identify ways that healthcare professionals can be better supported to provide physical activity advice to patients. There are no right or wrong answers. The purpose of the study is to understand your experience.

Are you eligible to participate and what will you have to do?

You are eligible to participate in this study if you are an adult who is an employee of the Ministry of Health in Muscat and are involved in the care of adults with type 2 diabetes. Prior

to participating, you'll need to sign the consent sheet that was provided to you with this information sheet and return it back to Emma Gibson or consent can be collected verbally on the day of the interview before participation. Once this is done, Emma Gibson will contact you via GSM or email to arrange a convenient date and time.

If you decide to participate, you will take part in an online one to one interview to discuss your experiences of promoting physical activity with adult type 2 diabetes patients. The interview will be held online via MS Teams. The interview will be recorded, and your responses will be analysed written up into a report. The interview should last approximately 60 minutes. Direct quotes from your responses may be used for illustrative purposes in publications arising from this research, but those quotes will not be traced back to you all names will be removed, and pseudonyms will be used in their place. Anonymized data from the study may be shared with the scientific research community, as required by conference presentations and article publications. Your responses will be treated as anonymous and confidential, and your identity will not be revealed at any time. Please, note that although you will have to provide your name and signature on the consent sheet, your name will not appear on public record. Only the research team will have access to your interview transcript, which will be anonymised and stored on a password protected computer, once transcribed the recording will be deleted. Please also note that if you change your mind and would like to withdraw your participation from this study, you can do so without giving a reason, up until 2 weeks after the date of your participation in the interview.

If you have any questions about the study and your potential participation, please do not hesitate to contact me on Emma Gibson at emma.gibson@mail.bcu.ac.uk.

If you have decided you would like to participate, please also contact me at the email

address above to arrange a suitable date and time.

Many thanks!

Emma Gibson, PhD candidate. Department of Psychology, Birmingham City University, United Kingdom; Department of Behavioural Sciences.

Supervisor: Atiya Kamal (atiya.kamal@bcu.ac.uk)

Business, Law, and Social Sciences ethics committee: BLSSethics@bcu.ac.uk

Appendix M

Debrief Sheet for Study Two

Dear Participant,

Thank you for your participation in this study. The aim of the study was to explore and understand the barriers and facilitators experienced by a range of healthcare professionals when promoting physical activity to adult type 2 diabetic patients within their clinical practice. These findings will provide an insight into how healthcare professionals can be better supported to provide physical activity advice to patients.

Please do not hesitate to contact the principal investigator, Emma Gibson, if you have any questions or comments through email: emma.gibson@mail.bcu.ac.uk. If, however, you have confidential

questions or concerns about the study or researcher please email her supervisor Dr Atiya Kamal: atiya.kamal@bcu.ac.uk. Alternatively, you can also contact the Quality Section of the Directorate

General of Health (+968 24782105) to discuss.

In closing, occasionally people may experience negative feelings after participating in psychological research. This happens very rarely but if you experience this, please contact your local primary health care centre of general practitioner.

Many thanks for your participation.

Emma Gibson, PhD candidate. Department of Psychology, Birmingham City

University, United Kingdom; Department of Behavioural Sciences.

Supervisor: Dr Atiya Kamal at atiya.kamal@bcu.ac.uk

Business, Law, and Social Sciences ethics committee at BLSSethics@bcu.ac.uk

Appendix N

Demographics and Informed Consent for Study Three

Consent Form

Dear Participant,

You are invited to take part in a research study that aims to explore your perspectives the challenges faced by healthcare professionals (HCPs) in promoting physical activity for adults with type 2 diabetes, the feasibility of implementing strategies to support HCPs in this area and the integration of evidence-based findings into policy and practice. This insight will help to identify ways that healthcare professionals can be better supported to provide physical activity advice to patients and what is feasible in terms of health care policy. You will take part in an online interview. Please, note that there are no right or wrong answers to the interview questions; I am only interested in your personal views.

To be interviewed for this study, please check the following:

1. I confirm that I am over 18 years of age.
2. I confirm that I am an employee of the Ministry of Health and am a health policymaker or decision- maker.
3. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences for my withdrawal. In addition, should I not wish to answer any particular question, or, questions, I am free to decline.

I agree for the one-to-one interview to be video recorded. I understand that the recording

made of this interview will be used only for scientific data analyses and that extracts from the interview,from which I would not be personally identified, may be used in any conference presentation, report or journal article developed, as a result of the research.

4. I agree that my anonymised data will be kept, in a password-protected database, for up to seven years, for future research purposes such as publications related to this study after the completion of the study.
5. I understand that if I change my mind and would like to withdraw my participation from this study, I can do so without giving a reason, up until 2 weeks after my participation in the interview.
6. I am aware that if I have any concerns or comments about my participation in this research, that have not been answered by the research team, I can contact the Quality Section of the Directorate General of Health (+968 24782105) to discuss.
7. I agree to participate in this interview.

Please, also provide the following information:

Your name …… **Your role**

Years in this role .....

Contact details .....

Your signature …….....

Date ……..……

Appendix O

Participant Information Sheet for Study Three

Participant Information Sheet

Dear Participant,

Thank you for showing interest in this study. This sheet provides information about the study. Please, read this sheet before deciding whether you would like to participate.

Who is conducting this study?

This study is conducted by Emma Gibson, PhD candidate (Birmingham City University), as part of a more comprehensive PhD research program. Her supervisory team are Dr Atiya Kamal (atiya.kamal@bcu.ac.uk); Dr Angela Hewett (angela.hewett@bcu.ac.uk); Professor Craig Jackson (craig.jackson@bcu.ac.uk).

The study is approved by the Psychology Department of Birmingham City University, United Kingdom and the Ministry of Health, Oman.

What is this study about?

This study aims to obtain in-depth information about your perspectives on the challenges faced by healthcare professionals (HCPs) in promoting physical activity for adults with type 2 diabetes, the feasibility of implementing strategies to support HCPs in this area and the integration of evidence-based findings into policy and practice. This insight will help identify ways healthcare professionals can be better supported to provide physical activity advice to patients and what is feasible in terms of healthcare policy. The purpose of the study is to understand your experience.

Examples of questions that will be asked during the interview include '*what do you think the challenges are for healthcare professionals caring for patients with type 2 diabetes*?' and '*if you were responsible for developing an action plan to support type 2 diabetes (including physical activity), what would you do*?'

Are you eligible to participate, and what will you have to do?

You are eligible to participate in this study if you are an adult employee of the Ministry of Health in Muscat and are involved in healthcare policy or decision-making.

Before participating, you'll need to sign the consent sheet that was provided to you with this information sheet and return it to Emma Gibson, or consent can be collected verbally on the day of the interview before participation. Once this is done, Emma Gibson will contact you via GSM or email to arrange a convenient date and time.

If you decide to participate, you will participate in an online one-to-one interview to discuss your perspectives. The interview will be held online via MS Teams. The interview will be recorded, and your responses will be analysed and written up in a report. The interview should last approximately 60 minutes. Direct quotes from your responses may be used for illustrative purposes in publications arising from this research, but those quotes will not be traced back to you. All names will be removed, and pseudonyms will be used in their place. Anonymised data from the study may be shared with the scientific research community, as required by conference presentations and article publications. Your responses will be treated as anonymous and confidential, and your identity will not be revealed at any time. Please, note that although you will have to provide your name and signature on the consent sheet, your name will not appear on the public record. Only the research team will have access to your interview transcript, which will be anonymised and stored on a password-protected computer; once transcribed, the recording will be deleted. The Ministry of Health will not have access to your data.

Please also note that if you change your mind and would like to withdraw your participation from this study, you can do so without giving a reason up until two weeks after the date of your participation in the interview.

If you have any questions about the study and your potential participation, please do not hesitate to contact me on Emma Gibson at emma.gibson@mail.bcu.ac.uk.

If you have decided you would like to participate, please also contact me at the email address above to arrange a suitable date and time.

Many thanks!

Emma Gibson, PhD candidate. Department of Psychology, Birmingham City University, United Kingdom; Department of Behavioural Sciences.

Supervisor: Atiya Kamal (atiya.kamal@bcu.ac.uk)

Business, Law, and Social Sciences ethics committee: BLSSethics@bcu.ac.uk

Appendix P

Debrief Sheet for Study Three

Dear Participant,

Thank you for your participation in this study. The aim of this study was to explore your perspectives the challenges faced by healthcare professionals in promoting physical activity for adults with type 2 diabetes, the feasibility of implementing strategies to support HCPs in this area and the integration of evidence-based findings into policy and practice. This insight will help identify ways healthcare professionals can be better supported to provide physical activity advice to patients and what is feasible in terms of health care policy.

Please, note that only the BCU research team will have access to your interview transcript, which will be anonymised and stored on a password-protected computer; once transcribed, the recording will be deleted. The Ministry of Health will not have access to your data.

Please do not hesitate to contact the principal investigator, Emma Gibson, if you have any questions or comments through email: emma.gibson@mail.bcu.ac.uk. If, however, you have confidential questions or concerns about the study or researcher please email her supervisor Dr Atiya Kamal: atiya.kamal@bcu.ac.uk. Alternatively, you can also contact the Quality Section of the Directorate General of Health (+968 24782105) to discuss. If you would like to see the findings or the anonymised results, please contact Emma Gibson through the email address noted above.

In closing, occasionally people may experience negative feelings after participating in psychological research. This happens very rarely but if you experience this, please contact your local primary health care centre of a general practitioner.

Many thanks for your participation.

Emma Gibson, PhD candidate. Department of Psychology, Birmingham City University, United Kingdom; Department of Behavioural Sciences, Ministry of Health, Oman.

Supervisor: Dr Atiya Kamal at atiya.kamal@bcu.ac.uk

Business, Law, and Social Sciences ethics committee at BLSSethics@bcu.ac.uk

Appendix Q

Interview Schedule for Study Three

Obtain informed consent

Remind the participant of the purpose of the study and the aims of the project. Obtain permission to record

I am interested in your views and experiences, there are no right or wrong answers.

This is a confidential discussion; your identifying details will be removed from the transcript and any quotations use will be anonymised.

Opening questions:

- Can you please tell me about your current role?
    - What are your overall responsibilities?
    - How long have you been in this role?

- From your perspective, what do you think are the biggest challenges for healthcare professionals caring for people with type 2 diabetes?

Main questions

Thinking about physical activity promotion by healthcare professionals, in primary care, to patients with type 2 diabetes...

1. Research shows us that physical activity can prevent or help manage type 2 diabetes but that healthcare professionals find promoting this to their patients very difficult. What is your understanding of their challenges?

Prompts – What do you think might help address this through policy?

Prompts - How feasible is this?

Prompts - What might be barriers to this?

2. In your experience, what (if any) solutions /interventions have already been tried to resolve any challenges that healthcare professionals face when trying to promote physical activity?

   Prompt - If not type 2 diabetes, more generally Prompt - How did this work?

   Prompt – What worked well? What didn't work well?

   Prompt – If you are not aware of anything do you know why this is not being addressed?

3. Are you aware of any current policies or practices are in place to support healthcare professionals to promote physical activity?

   Prompt – What, if any, involvement if, any, did you have with this?

   Prompts – what went well, what was challenging, who has supported you?

4. What more do you think could be done to support healthcare professionals to promote physical activity to people with type 2 diabetes?

   Prompt – how could policy support this?

   Prompt - if you were responsible for developing an action plan to support HCPs promote physical activity, what would you do? What do you think would facilitate physical activity promotion?

5. What training (if any) are you aware of that are available to support healthcare professionals to promote physical activity to their patients with type 2 diabetes?

Prompt – Has this training been helpful? If not, why not? If yes, how? Prompt – What else could be done? Is this feasible?

Prompt – Could policy support this? What could come specific challenges be?

6. What resources (if any) are you aware of that are available to support healthcare professionals to promote physical activity to their patients with type 2 diabetes?

Prompt – Do you think anything is missing?

Prompt – Could policy support this? What could come specific challenges be?

7. Do you think that setting quality indicators or targets healthcare professionals to meet on agreed areas of healthcare priorities to be delivered could be a successful approach to physical activity promotion in Oman?

Prompt - Do you think it would work? Prompt - If not, why not?

Prompt - If yes, how? Could this be addressed with policies?

Prompt - What do you think are some specific challenges or things that may be barriers to addressing this through policy that we should be aware of?

8. What support, if any, relating to physical activity promotion, do you think is needed from the community or other sectors?

Prompt - for healthcare professionals? Prompt - for patients?

Prompt - for policy development?

Prompt - What do you think are some specific challenges or things that may be barriers to addressing this through policy that we should be aware of?

9. What support do you think is needed for physical activity to be embedded within the existing healthcare system to support/increase physical activity promotion?

    Prompt – what could be done in the short term? Prompt – what could be done in the long term?

10. Are there anymore environmental, organisational or political barriers you can think of that might make promoting physical activity more challenging for HCPs?

    Prompt - What do you think are some facilitators or things that might help to address this through policy?

11. Can you tell me some examples of physical activity promotion good practice / innovation in your organisation or others that you have heard about in Oman?

12. What kinds of resources, knowledge, capacity, or skills do you as a policy/decision maker need to collaborate with a key stakeholder (such as a healthcare provider or researcher) to advocate and implement policy or practices?

    Prompt- What evidence do you need to consider changes in decisions/policies? Do you use research to influence your decisions/policies?

13. Do you feel you have adequate access to health research to support your decision- making?

    Prompt: *Do you find the information available to you accessible and easy to understand to support your decision-making? Is it useful?*

Prompt: What, if anything, would help you more with this? Prompt: Is there sufficient expertise to support you/advise you?

14. Do you think using health research to guide your decision making is useful?

Prompt for: If yes, why? If no, why not? What could be done differently?

15. In your opinion what do you think will be the biggest challenge in terms of policy to are the biggest issues/problems

Prompt – why do you think that is? Can you tell me more?

16. In conclusion, is there anything else we haven't discussed that you would like to raise?

Interview close

Stop recording

Thank the participant for their time.