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Development, Implementation, and Evaluation of Medication Therapy Management in Saudi Arabia

BY

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Abstract

Background: Despite global evolution of the role of pharmacists, community pharmacy (CP) practice in the Kingdom of Saudi Arabia (KSA) is still in infancy and in need of substantial upgrades. Under the Vision 2030, the Saudi healthcare system is undergoing a significant transition. In this regard, the CP sector has benefited from ongoing initiatives that aim to introduce a new approach to healthcare. This PhD work aims to develop, implement and evaluate of CP-based medication review service in KSA.

Methods: This thesis was conducted using multiple methodologies. First, a systematic review and meta-analysis were conducted to evaluate the effectiveness of community-pharmacist-led medication review services with a wide range of targeted outcomes. Second, a mixed-methods study using an embedded design was conducted to assess the impact of a CP-based medication therapy management (MTM) service on patients' outcomes. The embedded design consisted of two components, a pilot randomised control trial (RCT) and a qualitative descriptive study. The data were collected sequentially and independently. Glycated haemoglobin (HbA1c) was the primary outcome. Secondary outcomes included: clinical parameters, drug-related problems, health services utilisation, medication adherence, distress and satisfaction. Participants' experience and views about the service was evaluated using face-to-face, semi-structured qualitative interviews. The final stage involved the process evaluation, quantitative and qualitative methods were utilised to understand the processes and conditions surrounding MTM service development and implementation.

Results: Forty RCTs were included in the systematic review and twelve in the meta-analysis. Compared to the control, a significant improvement was noted in the community-pharmacist-based medication review group for the following outcomes: blood pressure (BP) in patients with diabetes (mean difference (MD) in systolic blood pressure (SBP): -6.8 [95% CI -11.3, -2.3]; MD in diastolic blood pressure (DBP): -2.1 [95% CI -3.4, -0.9]) and in the hypertension patients (MD in SBP: -6.2 [95% CI -13.3, 0.9]; MD in DBP: -2.1 [95% CI -6.5, 2.3]), HbA1c in patients with diabetes (MD -0.6; 95% CI -0.9, -0.3), and total cholesterol (TC) in patients with hyperlipidaemia (MD -0.2; 95% CI -0.3, -0.1).

One hundred sixty patients with a mean age of 50 years (standard deviation (SD) ±11.9) took part in the RCT study. One hundred twenty-nine patients completed the RCT.

Compared to standard care group, improvement was noted in MTM service group for all outcome measures. For the primary outcome, the mean HbA1c level was 0.21% (p=0.503) lower in the intervention arm at six-month. Additionally, the MTM service reduces the odds of healthcare utilisation by 93.1% (p=0.7) at six-month. Participants in the intervention group were 8 times more likely to be adherent compared to the participants in the standard group (p=0.0001). Finally, the MTM service group had a significantly higher median satisfaction score 4 [IQR 4, 4] than the standard care group 1.4 [IQR 1.3, 1.9]. For second phase, sixteen patients participated in the interview. Patients' responses were classified into three broad themes: perceived benefits from the service, factors contributing to positive patient experiences and barriers and suggestions.

Finally, the findings of the process evaluation concluded that the service delivery was achieved as initially planned in the study protocol. Although most of the MTM service components achieved high fidelity, there were challenges in implementing the personal medication record (PMR), monthly follow-up and referral. A number of facilitating factors for service implementation were explored such as: availability of qualified and enthusiastic pharmacists to run MTM clinic, choice of the pharmacy location and utilisation of collaborative agreement. On other hand, barriers to implementation included: lack of manpower and interprofessional setup.

Conclusions: CP-based MTM service was deemed to be a 'pioneer' and serve the patient considerably, connected all health practitioners with all specialties in one clinic. The service is a potentially successful opportunity in the Saudi CP setting. The MTM service can improve clinical and patient-health outcomes. The findings from this thesis have useful clinical implications that could guide future research and clinical practice.

Keywords: medication therapy management service, community pharmacy, medication review service, mixed-methods study.

External output

Publications

- Albabtain, B., Cheema, E., Bawazeer, G. and Hadi, M.A. (2021) 'Community pharmacy-based medication therapy management clinic in Saudi Arabia', in Babar, Z. (eds) *Pharmacy practice research case studies.* United Kingdom: Churchill Livingston, pp. 61-83
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****Other manuscripts are being submitted for publication at the time of submitting this thesis.**

Dedication

To my loving family.

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“In the name of Allah, the Most Gracious, the Most Merciful”

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Key abbreviations

ACR: Albumin-to-creatinine ratio
ADEs: Adverse drug events
ADR: Adverse drug reaction
BMI: Body mass index
BMQ: Brief Medication Questionnaire
BP: Blood pressure
CAQDAS: Computer-assisted qualitative data analysis software
CDTM: Collaborative drug therapy management
CMR: Clinical medication review
CONSORT: Consolidated Standards of Reporting Trials
CP: Community pharmacy
CPs: Community pharmacies
CVR: Cardiovascular risk
DASs: Drug-associated symptoms
DBP: Diastolic blood pressure
DD: Diabetes distress
DDS: Diabetes Distress Scale
DLD: Dyslipidemia
DM: Diabetes mellitus
DRPs: Drug-related problems
ED: Emergency department
EndNote©: Reference manager software
ESC/EAS: European Society of Cardiology and the European Atherosclerosis Society
FBG: Fasting blood glucose
FRIDs: Fall-risk-increasing drugs
GP: General practitioner
GPs: General Practitioners
HbA1c: Glycated haemoglobin
HDL: High-density lipoprotein
HKCP: Health Kingdom Community Pharmacy
HTN: Hypertension
ID: Identification
IQR: Interquartile range
ITT: Intention-to-treat analysis
KSA: Kingdom of Saudi Arabia
LDL: Low-density lipoprotein
MAP: Medication-related action plan
MARS-5: Medication Adherence Report Scale
MCIT: Ministry of Communications and Information Technology
MD: Mean difference
MMA: Medicare Prescription Drug, Improvement and Modernization Act
MMAS-8: Morisky Medication Adherence Scale
MMR: Medication Management Review
MOH: Ministry of Health
MRC: Medical Research Council
MRCs: Medical Research Council's
MRPs: Medication-related problems
MTA: Medicines therapy assessment
MTM: Medication therapy management
MTR: Medication therapy review
MUR: Medicines use review
NHS: National Health Service
NICE: National Institute for Health and Care Excellence
NTP: National Transformation Programme
OTC: Over the counter
PCP: Primary care physician
PMR: Personal medication record
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis
PSPS 2.0: Patient Satisfaction with Pharmacist Services 2.0
QoL: Quality of life
RBG: Random blood glucose
RCT: Randomized control trial
RCTs: Randomised controlled trials
RevMan 5.3: Review Manager
SBP: Systolic blood pressure
SCr: Serum creatinine
SD: Standard deviation
SF-36: Short-form 36
SR & MA: systematic review and meta-analysis
SR: Saudi Riyal
Stata/SE 17: Statistical software package developed by StataCorp
TC: Total cholesterol
TG: Triglyceride
VRO: Vision Realization Office

CHAPTER 1 Introduction

1.1 Chapter overview

This chapter provides background and context to the topics covered in this thesis. The chapter begins by providing an insight into the healthcare system and community pharmacy (CP) practice of the Kingdom of Saudi Arabia (KSA) along with its Vision 2030. This is followed by an overview of global CP practice with a particular focus on medication therapy management (MTM), which is the core service studied in this thesis. Then the rational for the whole study is justified by highlighting gap in current practice. Finally, the aim and objectives that guided this thesis are present together with a short summary of each of the chapter.

1.2 Background of community pharmacy practice in kingdom of Saudi Arabia and globally

1.2.1 An insight into the Kingdom of Saudi Arabia

The KSA stretches from the Red Sea and Gulf of Aqaba in the west to the Persian Gulf in the east, taking up four-fifths of the Arabian Peninsula **(The General Authority for Statistics, 2023).** It is the fifth-largest state in Asia and the second-largest state in the Arab world **(Nurunnabi, 2017),** with a total area of around 2,149,790 square kilometres and a population of 34 milion in 2021 **(The General Authority for Statistics, 2023).**

Notably, KSA is an Arab Islamic state. It is recognized as the Land of the Two Holy Mosques, Masjid al-Haram in Mecca Al Mukarramah, and Masjid Anabawi in Medina Al

Munawwarah. For Hajj and Umrah each year, millions of Muslims visit these two holiest places in Islam as well as other significant religious sites **(Nurunnabi, 2017; The General Authority for Statistics, 2023).** Administratively, KSA is divided into 13 regions, Riyadh is the capital city **(Nurunnabi, 2017).**

KSA's economy is largely based on export of petroleum and petroleum products. The country's transformation has been astonishing; in a few decades, KSA has changed from an under-developed nation into a modern, advanced state and a main player on the international stage. It has become one of the world's largest producers, exporters and holders of proved crude oil reserves, and it was one of the original 51 chartered members of the United Nations in 1945. By 2015, KSA was the world's second-largest total petroleum and other liquids producer after the United States. KSA is also a member of the Organisation of the Petroleum Exporting Countries (OPEC) **(Nurunnabi, 2017; Organization of the Petroleum Exporting Countries, 2022).**

1.2.2 Kingdom of Saudi Arabia vision 2030 and national transformation programme 2020

Vision 2030, launched in 2016, is a roadmap for economic growth and national development that was launched by the Saudi government **(Saudi Vision 2030, 2016).** Under the umbrella of Vision 2030, a broad set of reforms aimed at diversifying the economy, modernising the health sector, and ensuring a sustainable future for the

country's young and growing population were started **(Saudi Vision 2030, 2016; United Nations Interagency Task Force on the Prevention and Control of Noncommunicable Diseases, 2018)**. It was built around three main pillars: a vibrant society, a thriving economy, and an ambitious nation **(Vision 2030, 2016).**

The government established several enabling procedures to support the launching of programmes aimed at attaining Vision 2030 objectives, one of these programmes is the National Transformation Programme (NTP) **(Vision 2030, 2016).** The NTP aimed to achieve governmental operational excellence, improve economic enablers and enhance living standards, which achieved by quickening the implementation of principal and digital infrastructure and engaging stakeholders in identifying challenges, co-creating solutions, and contributing to the implementation of the programme's initiatives. The programme established strategic objectives based on Vision 2030, addressed its challenges through 2020, and presented interim indicators that measured performance **(Vision 2030, 2016).**

1.2.3 Saudi health sector transformation

The Ministry of Health (MOH) is the main provider of healthcare services in KSA. Health has featured in the national five-year development plans **(World health organization, 2013).** Since the first development plan, KSA has accorded top priority to the development of healthcare services at all levels, and its commitment is reflected in the ambitious Vision 2030 and NTP 2020. These plans feature healthcare as one of the focus areas, and the

largest sectors that significantly contribute to achieving the vision seek to improve the quality of healthcare services and facilities across KSA **(Albejaidi and Nair, 2019).**

A dedicated transformation unit, known as the Vision Realization Office (VRO), has been established by the MOH to execute the transformation of the health care system. The VRO seeks to achieve a vibrant society by restructuring the health sector to become a comprehensive and useful system. The VRO aims to shift the MOH focus away from its traditional role as a healthcare provider to become solely a regulator of healthcare in the KSA by way of the implementation of a new model of care that concentrates on prevention and improving society's health awareness. It will also improve access to health services through ideal coverage and equitable geographical distribution, as well as comprehensive and expanded e-health services and digital solutions **(Vision 2030*,* 2016).**

In 2017, Ministry of Health identified some challenges that pose serious threat to health care system and its much needed transformation. First, the kingdom's population continues to grow and age. By 2030, the population will increase by 28% to approximately 39.7 million, and the number of elderly (aged 60 to 79) is expected to grow to 4.63 million by mid-2030. Second, compared to regional and international standards, the country's rates of non-communicable diseases have continued to rise.

Third, there are significant gaps in terms of quality of care. These are mostly due to inconsistencies in protocols and pathways for treatment, and inadequate measurement of

patient outcomes. Finally, the system's orientation is resource-centric rather than patient-centric. Additionally, it focuses on institutions rather than populations. A health system needs to be both accessible and responsive to patients' overall welfare. Due to all of these challenges, the healthcare system will be under more pressure and demand for more frequent, advanced and expensive treatments **(Health sector transformation strategy, 2017).**

1.2.4 Pharmaceutical services structure and governance in Kingdom of Saudi Arabia

The healthcare system in KSA is largely governmental, providing healthcare services to all citizens **(Bawazir, 2004).** In addition, private hospitals and primary healthcare centres also provide healthcare services but relatively on a much smaller scale compared to governmental healthcare facilities. A government budget of 79,846,364 (in thousands of Saudi Riyal (SR)) is allocated to "Health and Social Development" in 2021, making KSA the biggest spender on healthcare across the Middle East and North Africa **(Vision 2030, 2016; Alharbi, 2018; Ministry of health, 2022).**

The CP business in KSA has experienced massive growth **(Khan and Azhar, 2013).** As of 2021, there were approximately 9,000 independent and large multiple CPs offering the dispensation of a wide range of pharmaceuticals and staffed by an estimated 20,900 pharmacists **(Ministry of health, 2021).** However, CP services in KSA are still in their

infancy, and these organisations need to revamp and reorganise the community pharmacist's professional role in providing patient-centred care services effectively **(Health sector transformation strategy, 2017).** CPs in KSA are privately owned, and there are many chains of pharmacies. Pharmacies are situated in a range of premises, with the majority in main streets and a few linked with private healthcare clinics **(Alaqeel and Abanmy, 2015).**

According to the law regulating Saudi pharmacy practice**,** all professional procedures in a pharmacy must be done by a licensed pharmacist, which requires individuals to pass the Saudi Commission for Health Specialties licensing exam **(Alaqeel and Abanmy, 2015).** Saudi pharmacists tend to avoid the community setting because the pay is not as good as it is in other settings, and the job satisfaction is less **(Al-jedai, Qaisi and Al-meman, 2016).** As a result, the pharmacy sector is facing a shortage of qualified practitioners and academic personnel, and the KSA Manpower Council has reported that at least 17,000 pharmacists will be needed by 2026 **(Kheir *et al.*, 2008; Al-Tannir *et al.*, 2016).**

1.2.5 Current community pharmacy practice in Kingdom of Saudi Arabia

As part of the MOH's pharmaceutical care strategies, the pharmacy practice model in KSA is being changed. Under the new model, most pharmaceutical care services will move from inpatient to community care settings with a focus on disease prevention rather than

disease treatment **(Vision 2030, 2016).** One such new initiative, WASFATY, is a process of distributing medication through community pharmacies (CPs) **(Alomi, 2017).**

Furthermore, in 2019, new regulations released from the MOH to support new model and initiatives in pharmacy practice. As a result, pharmaceutical care services in CPs have expanded to include: providing non-urgent medical care services, drug therapy management services, vaccination services, awareness and education health clinics, medication compounding, measurement of vital signs and training in the use of medical devices **(Ministry of health, 2019a).**

CPs work at the heart of communities as they are the most accessible healthcare settings **(United Nations Interagency Task Force on the Prevention and Control of Noncommunicable Diseases, 2018)** with services used by a large number of people **(Smith, Giuliano and Starkowski, 2011; Alfadl, Alrasheedy and Alhassun, 2018).** CPs offer symptomatic relief for minimal time and effort without hospital appointments and fees **(Steel and Wharton, 2011; Al-Saleh *et al.*, 2017).** Hence, community pharmacists are uniquely positioned to play a main role in patient care in the healthcare delivery system **(Alfadl, Alrasheedy and Alhassun, 2018).**

One important factor in advancing CP practice is a better understanding of the current practice and the roles and services provided by community pharmacists. A systematic review published in 2019 by Rasheed and his colleagues is important in the context of

assessing the situation in the primary care setting across KSA **(Rasheed, Hasan and Babar, 2019).** The review included 24 studies that highlighted numerous gaps in the knowledge, attitude, roles, and practices of community pharmacists in providing efficient patient-centred care services. Moreover, the review identified a lack of knowledge and time, the absence of a pharmacy information database, deficiency of continued professional development training, unavailability of adverse drug reaction (ADR) reporting forms, and professional and cultural issues as some barriers in providing patient-centred care. The authors concluded that, although community pharmacists in KSA do provide medicine counselling and other patient-centred care services, these services need substantial improvement **(Rasheed, Hasan and Babar, 2019).**

Though, the Saudi public appreciated the role of community pharmacists **(Al-Arifi, 2012).** The study by al-Tannir *et al.* (2016) illustrated that Saudi public, by culture, prefers an open discussion on medication fears and health status with the pharmacist rather than other healthcare providers **(Al-Tannir *et al.*, 2016)**. Many consumers who went to CPs for pharmaceutical services self-medicated not only with over the counter (OTC) medicines but also with other classified pharmaceutical and prescription drugs despite the strict enforcement of rules and regulations by the MOH **(Khan and Ibrahim, 2013; Alanazi, Alfadl and Hussain, 2016).** Pain killers, cough preparations, antibiotics, bronchodilators, cardiovascular and antidiabetic medications are commonly prescribed and dispensed in CPs in KSA **(Khan and Ibrahim, 2013; Kashour *et al*.,2016; Rasheed, Hasan and**

Babar, 2019). Some customers may receive treatments initiated by the community pharmacists, who provide their only contact with healthcare professionals **(Alanazi, Alfadl and Hussain, 2016; Alfadl, Alrasheedy and Alhassun, 2018).**

Furthermore, in 2019, one study measured patients' willingness to pay for participating in the MTM service led by community pharmacists. The results showed that almost all respondents (96%) perceived the MTM service to be beneficial for patient care. Moreover, 70% of respondents were willing to register in the MTM service if implemented at CPs **(Alhaddad, 2019).**

Although pharmacy practice in CPs in KSA has made some improvements, it has performed only part of their expected role in Saudi society's health and wellbeing and could assume more responsibilities to help patients to address their health problems **(Bawazir, 2004).** The clinical domain of the CP has not yet emerged in KSA, and the role of the community pharmacist is still at a very nascent stage **(Al-Hassan, 2009).** The dispensing of medicines is the primary service offered in CPs, and some community pharmacists practice their traditional roles without making efforts to detect and solve patients' drug-related problems (DRPs) **(Alanazi, Alfadl and Hussain, 2016; Nahid, 2016).** In fact, multiple studies have documented that community pharmacists provide inadequate and poor-quality medication counselling and instructions on medicines to patients **(Khan and Azhar, 2013; Alaqeel and Abanmy, 2015; Adnan *et al.*, 2015;**

Kashour *et al.*, 2016; Nahid, 2016; Gillani *et al.*, 2017; Alfadl, Alrasheedy and Alhassun, 2018; Rasheed, Hasan and Babar, 2019). Community pharmacists suggested that an overload of responsibilities, a lack of clinical knowledge of disease states, and a lack of technical knowledge on how to provide treatments were the most critical barriers to introducing advanced roles **(Nahid, 2016).**

In the current advancements towards the commitment of the community pharmacists to be more active and deliver quality pharmaceutical services, community pharmacists face challenges to keep up with new information to serve patients with updated healthcare services **(Gillani *et al.*, 2017).** Even though the majority of community pharmacists think that pharmaceutical care is the pharmacist's responsibility, only half of 224 pharmacists considered themselves knowledgeable about pharmaceutical care **(Nahid, 2016).** Unfortunately, most community pharmacists in KSA lack the knowledge and skills to provide quality healthcare in accordance with best practices **(Wajid *et al.*, 2015; Gillani *et al.*, 2017; Rasheed, Hasan and Babar, 2019).** Therefore, community pharmacists must be equipped with knowledge, skills, and professional qualifications. Thus, they need to be well trained, continued professional programmes and experienced, to develop their knowledge, confidence, and capabilities to provide high-quality healthcare services and achieve patient satisfaction **(Gillani *et al.*, 2017).**

1.2.6 Community pharmacy practice across the globe: a brief overview

Globally, pharmacists are facing new challenges, as well as new opportunities and responsibilities **(Costa, Santos and Silveira, 2006).** Over the past decade, healthcare practices around the world have drastically changed in an attempt to adapt to the growing needs of patients and healthcare services **(Sarriff *et al.*, 2012; Sadek *et al.*, 2016; Bryant, Maney and Martini, 2017).** However, these changes have been constrained by limited resources, which has led to the recognition of the under-utilisation of community pharmacists' services. Moreover, presented opportunities for developing the profession and maximising the utilisation of community pharmacists through the provision of services beyond the traditional supply function **(Hook and Windle, 2013; Sadek *et al.*, 2016; Ministry of Health, 2016a; Ministry of Health, 2016b; Bryant, Maney and Martini, 2017).** Alongside other health professionals, community pharmacists are increasingly playing a greater role in the delivery of primary care and progressively feature in global strategies to modernise healthcare **(Latif, 2018).**

Many studies around the world have provided evidence supporting the extended role of community pharmacists, resulting in many benefits for patients including improving the standard of care, optimising medicines use **(Smith, Giuliano, and Starkowski, 2011),** reducing the workload of general practitioner (GP) and lowering the cost of long-term healthcare **(Dunlop and Shaw, 2002; Giberson, Yoder and Lee, 2011)**, DRPs and hospital readmissions **(Buss *et al.*, 2018).** Furthermore, community pharmacists

themselves may experience potential benefits, including improvements in their professional status, job satisfaction, and pay **(Edmunds and Calnan, 2001; Bryant *et al.*, 2009; Paudyal *et al.*, 2011).**

Studies on patients' views and experiences towards CP services in international settings, such as in the United Kingdom, the United States, Australia and New Zealand **(Benrimoj and Frommer, 2004),** have shown that patients accept that pharmacists are qualified to write out prescriptions, provide advice, offer health consultations and promote healthcare **(Eades, Ferguson and O'Carroll, 2011; Hoti, Hughes and Sunderland, 2011).** They are satisfied with the medication consultations they receive **(Nabhani-Gebara *et al.*, 2020)** and regard the pharmacist as a key player within the healthcare system (**Ekenga *et al.*, 2018).**

Accordingly, developed nations have clearly established the extended role of the pharmacist in CPs. This role has different levels of services based on different healthcare systems in those nations **(Costa, Santos and Silveira, 2006).** For instance, in England, the National Health Service (NHS) made significant reforms to the organisation and delivery of CP services in 2005 when the concept of the "responsible pharmacist" was adopted **(Latif, 2018).** Since then, a new contractual framework for pharmacy was negotiated and introduced, which was built on policy and professional ambitions to improve services to patients **(Latif, 2018).** Consequently, the current CP practice has

three levels of service delivery **(Pharmaceutical Services Negotiating Committee, 2020a).** The first level is the essential services, which all CPs are required to provide. The second level is the advanced services, which CPs can choose to provide. The last level comprises enhanced services commissioned by NHS England local teams and clinical commissioning groups, including minor ailments management, care home services, and out-of-hours services **(Public Health England, 2017).** In recent years, a significant number of new initiatives have been delivered by the British CPs, such as medicines use review (MUR), prescription intervention services, weight management services, smoking cessation and new medicine services **(Pharmaceutical services negotiating committee, 2022b).**

In New Zealand, the scenario is similar to that in the United Kingdom **(Jokanovic *et al.*, 2016).** Most pharmacists work in CPs with core pharmacy roles, including managing and supporting the safe use of medicines, assisting with patients' self-management of complex medication regimens, medicine reconciliation and medicine interaction and allergy checking **(Allan and Wills, 2016; Ministry of Health, 2016b).** However, the extended role includes prescribing medicines for minor illnesses and recommending herbal medicines, providing technical support; performing checking, counselling, monitoring and advisory roles; and conducting medication reviews **(Bryant, Maney and Martini, 2017).** In recent years, the services have advanced to provide programmes in personal health and health promotions like MUR, medicines therapy assessment (MTA), CP

anticoagulation management service, vaccinations, minor ailments service, immunisations, medicines adherence service, comprehensive medicine management (CMM) and smoking cessation **(Allan and Wills, 2016; Ministry of Health, 2016b).** Particularly, in June 2013, legislation permitted the role of prescribing pharmacists, which has been viewed as a major advance in recognition of pharmacists' skills and a positive step towards their inclusion into core healthcare teams **(Bryant, Maney and Martini, 2017).**

Likewise, in Australia, the CP practice is highly regulated through state and territory Pharmacy and Pharmacists Acts and through the National Health Act 1953 **(Benrimoj and Frommer, 2004).** The "sixth CP agreement" introduced unique remuneration models to encourage the provision of services from CPs in the following six priority areas: dose administration aids, clinical interventions, staged supply, primary healthcare, community services support, and cognitive pharmacy services **(Moles and Stehlik, 2015).** This last category requires a comprehensive review of a patient's medicines through a service such MedsChecks, Home Medicines Reviews, and Residential Medication Management Reviews **(Moles and Stehlik, 2015).** Subsequently, community pharmacists now have a broader role beyond dispensing medication to include medication reviews and managing diseases **(George *et al.*, 2010; Buss *et al.*, 2018).**

In the United States, community pharmacists play an essential role as healthcare providers, where pharmacists provide a wide range of healthcare interventions with cognitive pharmaceutical services through remuneration by public or private payers **(George *et al.*, 2010).** In addition to writing prescriptions for medication taken for minor ailments, community pharmacists play new roles in the multidisciplinary provision of healthcare **(George *et al.*, 2010; Majchrowska *et al.*, 2019).**

In Canada, community pharmacists advise their customers on alcohol consumption, smoking cessation, physical activities, and immunisation **(Hassali *et al.*, 2018a).** In addition, community pharmacists in Canada may also practice in primary healthcare teams or long-term personal care homes, or they may specialise in areas such as geriatric pharmacy **(George *et al.*, 2010).**

However, in developing countries, the role of pharmacists is evolving at a much slower pace and the scope of practice is rather limited **(Jaber *et al.*, 2018).** For example, in Jordan, patient-centred pharmaceutical care is rarely provided, and community pharmacists are primarily responsible for dispensing medications and managing inventories, with no prescribing privileges. Patient counselling and education are seldom performed effectively, and very few pharmacies keep any patient records **(Tuffaha, 2017)**. There are ongoing efforts to understand the barriers to providing pharmaceutical care delivery and improving CP practice in the country. In this regard, in 2008, the Jordan

Pharmacists Association (JPA) launched the Good Pharmacy Practice (GPP) initiative with the mission of enhancing the role of the community pharmacist in delivering patient-focused health care **(Pharmacy profession in Jordan, 2023),** Medication Management Reviews (MMR)-based CP service is one of the extended roles of community pharmacists promised to enhance the practice in CP **(Basheti, Tadros and Aburuz, 2016).**

The Malaysian community pharmacists, as another example, are facing challenges from the professional services and economic perspectives. In 2007, the National Medicines Policy in which one of the component mentioned that quality use of medicines, prescribing and dispensing functions must be separated **(Ministry of Health Malaysia, 2007).** The absence of dispensing rights has diverted the community pharmacists' role into drug sellers**.** Meanwhile, while awaiting this cornerstone legislative change on dispensing separation, community pharmacists in Malaysia are shifting their professional responsibilities from merely dispensing to providing extended services. Transformation of the healthcare system is essential in Malaysia to a more comprehensive, clinically inclined and quality practice in order to bring about improvement in pharmaceutical care provided in the CPs **(Hassali *et al.,* 2016a).**

Finally, the current pharmacy practice in Qatar (especially in the CP sector) emulates the practice elsewhere in the Gulf Cooperation Council (GCC) region **(Kheir *et al.,* 2008).** The services provided by the CPs are the traditional services, which are dispensing drugs and

selling a range of health-related products with no advanced or specialized services are provided **(Hassali *et al.*, 2016b).** Recently, the practice of pharmacy in Qatar has witnessed rapid change and development. Accordingly, the Department of Pharmacy and Drug Control is preparing to pilot a Community Pharmacy model as outlined in the Community Pharmacy Strategy of the National Health Service (Project 1.6). There is an expectation that the CP practice shall play a pivotal role in the future when Qatar's health strategy is fully implemented **(National Health Strategy, 2011).** The onus is on the implementation of the NHS plans related to CPs and on the efforts of individuals who might establish enhanced services in some community outlets **(Hassali *et al.*, 2016b).**

1.2.7 Medication therapy management service

MTM "is a distinct service or group of services that optimise therapeutic outcomes for individual patients". In other words, MTM is the patient-centred pharmaceutical care inspired bundle of cognitive services offered by the pharmacist with the aim of optimising therapeutic outcomes through efficient drug management (**American Pharmacists Association and the National Association of Chain Drug Stores Foundation, 2008**). It was officially recognized in the Medicare Prescription Drug, Improvement and Modernization Act (MMA) approved by the US Congress in 2003 **(Medicare prescription drug, improvement, and modernization act, 2003).** It consists of following five core

elements (**American Pharmacists Association and the National Association of Chain Drug Stores Foundation, 2008**):

• Medication therapy review (MTR) involves systematic collection of the patient's drug therapies information, assessing medication therapies to identify medication-related problems (MRPs), creating a prioritised list of MRPs, and developing plan to address them.

• Personal medication record (PMR) is a comprehensive patient's medications -specific record (prescription and nonprescription medications, herbal products, and other dietary supplements).

• Medication-related action plan (MAP) is a patient-centric document taken by the MTM pharmacist, identifies a list of actions for the patient to use in tracking progress for self-management.

• Intervention and/or referral, in this stage the MTM pharmacist provides consultative services and intervenes for enhancing therapeutic care and preventing MRPs; when necessary, the pharmacist refers the patient to a physician or other healthcare professional.

• Documentation and follow-up are representing an integral and ongoing step of MTM services where the services are consistently documented, and a follow-up MTM visit is scheduled based on the patient's medication-related needs, or the patient is transitioned from one care setting to another.

Ideally, patients will receive MTM services, face-to-face at the pharmacy in a private or semiprivate area by a pharmacist to optimises the pharmacist's ability to observe signs of and visual cues to the patient's health problems and can enhance the patient–pharmacist relationship. MTM services typically are provided by appointment but may be provided on a walk-in basis. The pharmacist can initiate MTM services when complex medication therapy problems are identified through the dispensing process. A typical patient might need up to four visits per year, but additional visits would be available when necessitated by individual patient circumstances (**American Pharmacists Association and the National Association of Chain Drug Stores Foundation, 2008**).

1.2.8 The medication review services offered by community pharmacists across the globe

Broadly, medication reviews aim to improve health outcomes by identifying and resolving MRPs to improve QoL **(Verma *et al.*, 2012),** be more cost-effective **(Chumney and Robinson, 2006)** and improve patients' drug use **(Williams *et al.*, 2011; Sarriff *et al.*, 2012; Jokanovic *et al.*, 2016; Pechlivanoglou *et al.*, 2016).** Furthermore, medication review improves process outcomes of prescribing including reduced polypharmacy and use of appropriate medicine formulations and selection of medicines by educating patients about their medications and health conditions **(Pechlivanoglou *et al.*, 2016).**

There is no standardised approach to medication reviews. The services implemented so far have substantial variation in referral mechanisms, eligibility criteria, pharmacist training, reimbursement schemes and frequency, content, and location of the reviews **(Pechlivanoglou *et al.*, 2016).** Many countries have commissioned CP-based medication review services under various names, and their prevalence suggests that these services are being prioritised by many health systems. Such services include MTM in the United States; MedsCheck in Canada and Australia; MUR in the United Kingdom, New Zealand, Italy and Qatar; MTA in New Zealand; MMR in Jordan; NetCare in Switzerland; and Clinical Medication Review (CMR) in Australia and the Netherlands, among others **(Latif, 2018).**

Initially, in 2005, the United States established a medication review service known as MTM. The focus of MTM is on the individual patient, with the intention of optimising the patient's drug regimen to best achieve the appropriate therapeutic goals for that patient. MTM services present an opportunity for a patient to involve with his or her pharmacist in a more meaningful and effective way. The pharmacist takes the responsibility to avoid or identify and resolve drug therapy problems that arise by using the five core elements **(McGivney *et al.*, 2007).** However, NetCare, a medication review service in Switzerland, is a low-threshold service by which pharmacists can manage common medical conditions based on structured decision trees with a real-time backup option with a physician **(Erni *et al.*, 2016).**

Similar medication reviews form part of CP services in Australia through the MedsCheck service which launched in 2007 **(Babiker, Carson and Awaisu, 2014).** MedsCheck began as a government-funded, CP-based medication review service, in Canada as well in the same year. The service was expanded in 2010 to reach more reviews with the goal of becoming a standardised approach to assess a patient's ability to administer their medications as well as to determine the appropriateness of the medication and dosing intervals alongside potential interactions, side effects, drug allergies, and contraindications. The service includes communication with the physician and/or healthcare professionals to resolve potential drug therapy problems that are identified **(Pechlivanoglou *et al.*, 2016).**

Another form of medication review service conducted in Australia and the Netherlands is CMR. As part of this structured and collaborative service, the pharmacist conducts a face-to-face interview with the patient to complete a comprehensive review of the patient's medications, including prescription and OTC medication, dietary supplements, and full documentation of the activities undertaken **(Jokanovic *et al.*, 2016).**

Last example, the MUR service was established in the United Kingdom in 2005 as an advanced pharmacy service **(Babiker, Carson and Awaisu, 2014).** Five-year later, in 2010, the Italian MOH decided introduced MUR to their community professional services **(Manfrin, Thomas and Krska, 2015),** and the MUR service was implemented as the first

CP cognitive service in Italy **(Manfrin *et al*., 2017).** Moreover, Italy was one of the first countries to use a CP-based pharmaceutical care intervention, the Italian MUR in asthmatic patients, to evaluate the outcomes **(Manfrin, Thomas and Krska, 2015).**

1.3 Rational

After carefully overviewing of the CP practice in KSA and where this in compared to the international practice, the pharmacy practice in CPs in KSA has made some improvements but it has performed only part of their expected role in Saudi society's health and wellbeing. The practice of CP in KSA is business-oriented and primarily a commercial endeavour. In fact, the role of the community pharmacist in KSA is still at a very nascent stage and the dispensing of medicines is the primary service offered in CPs. However, Vision 2030 and its new strategies regarding pharmaceutical care promised to change the pharmacy practice model in KSA. Unfortunately, to the starting of this PhD project, the situation and condition of the Saudi community pharmaceutical service remains where it began, and the clinical domain of the CP has not yet emerged. CP services are still in their infancy, and the CP practice need to revamp and reorganise the community pharmacist's professional role in providing patient-centred care services effectively.

This thesis comes at a time when there is growing emphasis on improving the quality of healthcare delivery in the KSA. There is a need on improving the quality of healthcare

delivery in KSA. Therefore, the target of this thesis is to implement, develop and evaluate of MTM service provided by pharmacists in the CP in KSA.

1.4 Medication therapy management service and the Medical Research Council's development-evaluation implementation framework

The study is based on the UK Medical Research Council's (MRCs) development-evaluation-implementation framework for complex interventions **(Skivington *et al*., 2021).** There are four interconnected but not sequential stages in the process:

- Development: refers to the whole process of designing and planning an intervention, from initial conception through to feasibility, or pilot study which includes reviewing literature to identify best quality evidence base.
- Feasibility/piloting: this includes testing interventions, recruitment and retention rates, and estimation of sample sizes in order to make decisions about progression to next stage of evaluation.
- Evaluation: which includes assessing an intervention using the most appropriate method to address research questions.
- Implementation: This process includes disseminating findings, monitoring, and long-term follow-up to maximize the impact and uptake of successful health innovations.

These four stages feed into each other. As a first step in the development of the MTM service, a systematic review and meta-analysis (SR & MA) was conducted to evaluate the

effectiveness of the CP-based medication review service. The systematic review not only provided the evidence base for the service development but also guided the design of mixed-methods study (Chapter 3 and 4). Several meetings were held with stakeholders, field experts, and CP owners before the service was developed. A range of issues related to delivery and applicability of service were discussed during the meetings. The MTM model that was used based on the American Pharmacists Association and the National Association of Chain Drug Stores Foundation framework for implementing effective MTM services in a CP setting (original framework developed in 2005 and updated in 2008) (**American Pharmacists Association and the National Association of Chain Drug Stores Foundation, 2008**).

1.5 Aim, objectives and thesis structure

The primary aim of this thesis was to develop, implement and evaluate of CP-based medication review service in KSA. There were three secondary aims:

Aim 1: To evaluate the effectiveness of community-pharmacist-led medication review services globally involving patients with various long-term conditions by conducting a SR & MA.

Aim 2: To assess the impact of a CP-based MTM service on patients' outcomes in KSA by conducting mixed-methods study.

Aim 3: To clarify under which conditions the MTM service has been implemented and maintained while still being effective through conducting process evaluation.

Specific objectives within each aim of the thesis are set out below.

Aim 1 objectives: (Chapter 2)

1. To explore the nature of medication review services globally.

2. To investigate the clinical and health service utilisation outcomes of community-pharmacist-led medication review service.

Aim 2 objectives: (Chapter 5 and 6)

1. To determine the effectiveness of the CP-based MTM service compared to standard care on diabetic patients' health and clinical outcomes in KSA.

2. To explore the views and experiences of patients regarding the MTM service.

Aim 3 objectives: (Chapter 7)

1. To assess the reach and recruitment, fidelity and adherence and dose delivered/ received of MTM service.

2. To investigate the mechanism of impact and the practice context and consider how context affected implementation of MTM service.

This thesis was structured into eight chapters. In order to facilitate reading, each chapter begin with an overview about the contents of the chapter and the chapters are divided into small sections.

Chapter one is an introductory chapter that provided the essential background and context to the topics covered in this thesis; the health care system and CP practice in KSA and globally with respect to medication review service.

Chapter two details a SR & MA that assessed the impact of community pharmacist-led medication review services among patients with long term conditions.

Chapter three describes the methodological approach to research presented in this thesis. This methodology chapter detailed and justified the most suitable research methodology for conducting mixed-methods in order to achieve optimal results.

Chapter four describes the methods used to study the effectiveness of CP-based MTM service (quantitative phase), explore patients' experience and views about the service (qualitative phase) and process evaluation for the MTM service.

The findings of the quantitative and qualitative research are presented in **chapters five and six** helps to determine whether MTM service provided to chronic disease patients by community pharmacists will be associated with improvement in patients' health outcomes in addition to describe patients' experiences and views regarding the new service.

Chapter seven of this thesis introduces the process evaluation results using mixed-methods. It will help understand how the MTM service intervention works and ascertain

whether, and if so, how, the intervention could be successfully implemented in Saudi CP practice.

Chapter eight aim to discuss systematic review, mixed-methods study and process evaluation. The strength and limitations were highlighted and implications for research were described. Dissemination plans were also outlined.

CHAPTER 2 Impact of community-pharmacist-led medication review services on patient outcomes: a systematic review and meta-analysis of randomised controlled trials

2.1 Chapter overview

This chapter describes aim, objectives, methods and results of a SR & MA. The chapter begins with a discussion on the rationale for undertaking this review followed by detailed description of all the steps of undertaking SR & MA. Finally, the limitations are considered and implications are offered for future practice and research.

This SR & MA has been published in the Research in Social and Administrative Pharmacy journal **(Al-Babtain, Cheema and Hadi, 2022).**

2.2 Rationale for the review

Over the past few decades, pharmacists' roles have evolved from focusing on products to providing services **(Latif, 2018).** One of the innovative services offered is a medication review service, which has the potential to improve patients' health outcomes by identifying and resolving DRPs, reducing polypharmacy, improving patients' drug use, and promoting the use of appropriate drug formulations **(Chumney and Robinson, 2006; Sarriff, Nordin and Hassali, 2012; Verma *et al.,* 2012).** Additionally, pharmacist-led medication reviews help to promote safe medication use and medication adherence by enhancing patient-pharmacist communication **(George *et al.,* 2010; Williams *et al.,* 2011; Jokanovic *et al.,* 2016; Pechlivanoglou *et al.,* 2016).**

Various nomenclature is used to describe medication review services in different countries such as MTM in the United States, MUR in the United Kingdom, MedsCheck in Canada, MMR in Jordan, MTA in New Zealand, NetCare in Switzerland and CMR in Australia, among others **(Latif, 2018).**

The development and implementation of CP services has continued to be the subject of research. In several systematic reviews, medication review services have been evaluated and found to be effective in improving patient outcomes **(Holland *et al.,* 2008; Kucukarslan *et al.,* 2011; Williams *et al*., 2011; Blalock *et al.,* 2013; Hatah *et al.,* 2014; Viswanathan *et al.,* 2015; Deters *et al.,* 2018; Kallio *et al.,* 2018; Tasai *et al.,* 2021).** However, previous systematic reviews focused on a particular type of disease **(Holland *et al.,* 2008; Deters *et al.,* 2018; Kallio *et al.,* 2018; Tasai *et al.,* 2021)** or country-specific **(Williams *et al*., 2011; Blalock *et al.,* 2013)** or a specific type of medication review **(Kucukarslan *et al.,* 2011; Hatah *et al.,* 2014; Viswanathan *et al.,* 2015).** Moreover, the majority of systematic reviews included both randomised controlled trials (RCTs) and non-RCTs, as well as studies in which other healthcare professionals delivered the interventions. Therefore, the effectiveness of medication review services delivered by pharmacists in CP settings remains unclear.

It is important to generate conclusive quality evidence on the effectiveness of medication review services provided by community pharmacists in order to inform practice or policy.

However, to the best of the author's knowledge, no SR & MA has comprehensively evaluated the effectiveness of community-pharmacist-led medication review services across various countries involving patients with various chronic conditions. This SR & MA fills this gap by focusing on RCTs evaluating the effectiveness of pharmacist-led medication review services in CPs.

2.3 Aim and research question

The aim of this systematic review is to evaluate the effectiveness of community-pharmacist-led medication review services. The specific research question was:

- What is the impact of community-pharmacist-led medication review services globally on patients' clinical and health services utilisation outcomes?

2.4 Reporting

Reporting of the review conforms to Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines **(Moher *et al*., 2015).**

2.5 Study protocol and registration

For transparency and to avoid duplication, the study methodology was specified in a protocol registered with the International Prospective Register of Systematic Reviews (PROSPERO) (registration number: CRD42020165693) **(Albabtain, Hadi and Cheema, 2020).**

2.6 Methodology

2.6.1 Eligibility criteria for studies to be considered for this review

PICO (P: Participants, I: Intervention(s), C: Comparator(s)/controls, O: Outcome measures) was used as the traditional mnemonic for inclusion criteria in interventions streams.

2.6.1.1 Types of studies

Only studies with RCTs and randomized control trial (RCT) cluster designs were included. Those studies were only included if they evaluated the clinical or healthcare utilisation impact of community-pharmacist-led medication review services on patients.

2.6.1.2 Participants

All participants were adults (18 years or older), regardless of their gender and diagnosis.

2.6.1.3 Intervention(s)

The following operational definition of the medication review service was used:

‘ A set of actions undertaken by a pharmacist and structured to be delivered directly to the patient either face to face or by telephone in a CP, consisting of a critical examination of a patient’s medicines with the objective of reaching an agreement with the patient about the treatment to optimise the process of care and the impact of the medicines, with the

aim of improving the patient's health outcomes and the value of the healthcare he or she is receiving, including the detection and resolution of DRPs directly or through referral to a physician.'

All types of medication review for optimising the patients' drug regimens were considered regardless of its name, provided that the interventions were not limited to simply increasing the patients' knowledge and/or adherence. However, there should be a clear structure for interventions, not just a one-step intervention provided by pharmacists.

2.6.1.4 Comparator(s)/controls

'No intervention', 'usual care', 'standard care' and 'any other intervention delivered by a registered healthcare professional other than pharmacist'.

2.6.1.5 Outcome measures

The outcomes of this review were any clinical or/and health services utilisation outcomes taken in a CP setting.

2.6.1.6 Exclusion criteria

Editorials, systematic reviews, letters to the editor, conference abstracts and studies published in languages other than English were excluded from the review.

2.6.2 Search strategy

The literature was systematically searched in December 2019 and January 2020, with no start date restrictions, in three major electronic health-related databases: MEDLINE, Cochrane Library and Embase. An experienced librarian was consulted during the development of search strategy.

The search covered the relevant published RCTs that were uploaded into such databases from the databases' inception up to January 1, 2020. The search terms used in searching studies are illustrated in Table 2.1 and the combinations of these terms used searching electronic databases are listed in **APPENDIX II-A**.

In addition to database searches, a complementary search was conducted in order to identify any additional literature (i.e web searches (Google Scholar), legislation, government documents, annual reports, statistics, dissertations, and citation chaining for both relevant full-text studies and systematic reviews).

Table 2.1: Search terms

'Pharmaceutical care'	'Community Pharmacy Services'	'Clinical pharmacy service'
'Medscheck'	'Medication Therapy Management'	'Drug Utilisation Review'
'Pharmacies/Pharmacy'.	'Drug review'	'Medicines therapy assessment'
'Pharmacists/Pharmacist'	'Medication regimen review'	'Drug regimen review'
'Drug management'	'Medication management'	'Drug therapy management'
'Netcare'	'Medicines use review'	'Home medicines review'
'Medication review'		

2.6.3 Study identification and selection

Random testing was undertaken to check the eligibility criteria before running the search for standardisation purposes. Following that, the author ran a predefined specific search strategy on each of the chosen databases, and exported all search results to a reference manager software (EndNote©). Then, study selection was completed in two stages once de-duplication was completed. The first stage involved screening the study titles and abstracts by the author and a supervisor. At this stage, the titles and abstracts that were clearly irrelevant to the purpose of the review were excluded. The second stage involved retrieving full texts of all relevant studies and reviewed them against the study's inclusion-exclusion criteria. The screening was undertaken by the author and checked by the supervisor. In case of any difference of opinion or disagreement between the author and supervisors over the eligibility of a particular study, mutual discussion resolved the matter.

2.6.4 Data extraction

The data from all the included studies were collected and tabulated using a standardised form that adapted from Cochrane Collaboration's data collection form **(Cochrane Effective Practice and Organisation of Care [EPOC], 2017).** The data collection form was piloted before the data extraction process. While data extraction was performed independently by the author, supervisors verified the process. Disagreements were resolved through discussions between the author and supervisor. For clarification and/or

to obtain missing data, the corresponding authors of the relevant papers were contacted (if required).

2.6.5 Risk of bias assessment

The risk of bias assessment was performed by the author and checked for accuracy by the supervisors using the Cochrane Collaborations' tool for assessing risk of bias, a domain based checklist. As per Cochrane Collaboration recommendations, different domains were assessed and categorised into 'low risk', 'high risk', and 'unclear risk' **(Higgins and Green, 2011).**

2.6.6 Data synthesis

Data were analysed using Cochrane Collaboration's software Review Manager (RevMan 5.3). To assess the effect size of dichotomous data, numbers and percentages were reported. For the continuous data, weighted mean difference together with the standard deviation (SD) were calculated when the outcomes were measured in the included studies using the same scale, while standardised mean difference with SD were calculated in the included studies using different scales outcomes. A P value of ≤ 0.05 was considered statistically significant.

In the meta-analysis, the results were pooled if data on the same outcomes were available from three or more studies. Pooling of data using meta-analysis was performed depending

on the clinical homogeneity. Clinical homogeneity was ascertained on the basis of the similarities in the study population, the nature and duration of intervention and the outcomes assessed. A random-effects meta-analysis model (i.e., a model used to combine clinically homologous but statistically heterogeneous trials) was used for conducting meta-analysis.

Clinical heterogeneity was determined by discussion among the author and the supervisors, and the clinically heterogeneous trials were not combined statistically—a narrative description of the outcomes was provided. Statistical heterogeneity was measured on the basis of the I^2 statistic. This followed thresholds as stated in the Cochrane Handbook: < 25% = low heterogeneity; 25–50% = moderate heterogeneity; > 50% = significant heterogeneity **(Higgins and Green, 2011).** For the I^2 statistic, $p < 0.10$ was considered as indicating significant heterogeneity.

2.7 Results

2.7.1 Search results

The following number of articles were found during searching of electronic databases: Medline (n = 700), EMBASE (n = 696), Cochrane library (n = 536). An additional 145 studies were found through other sources, including reference list searching and website (Google Scholar) searching. After the duplicate records were removed, 1,450 studies were screened at the titles and abstract levels. For full-text screening, 222 studies were

selected, the 42 reports from 40 RCTs among them were eligible for inclusion in the systematic review, and 12 studies were included in the meta-analysis. The PRISMA flow diagram in Figure 2.1 illustrates the identification process with the reasons for study exclusion for the SR & MA.

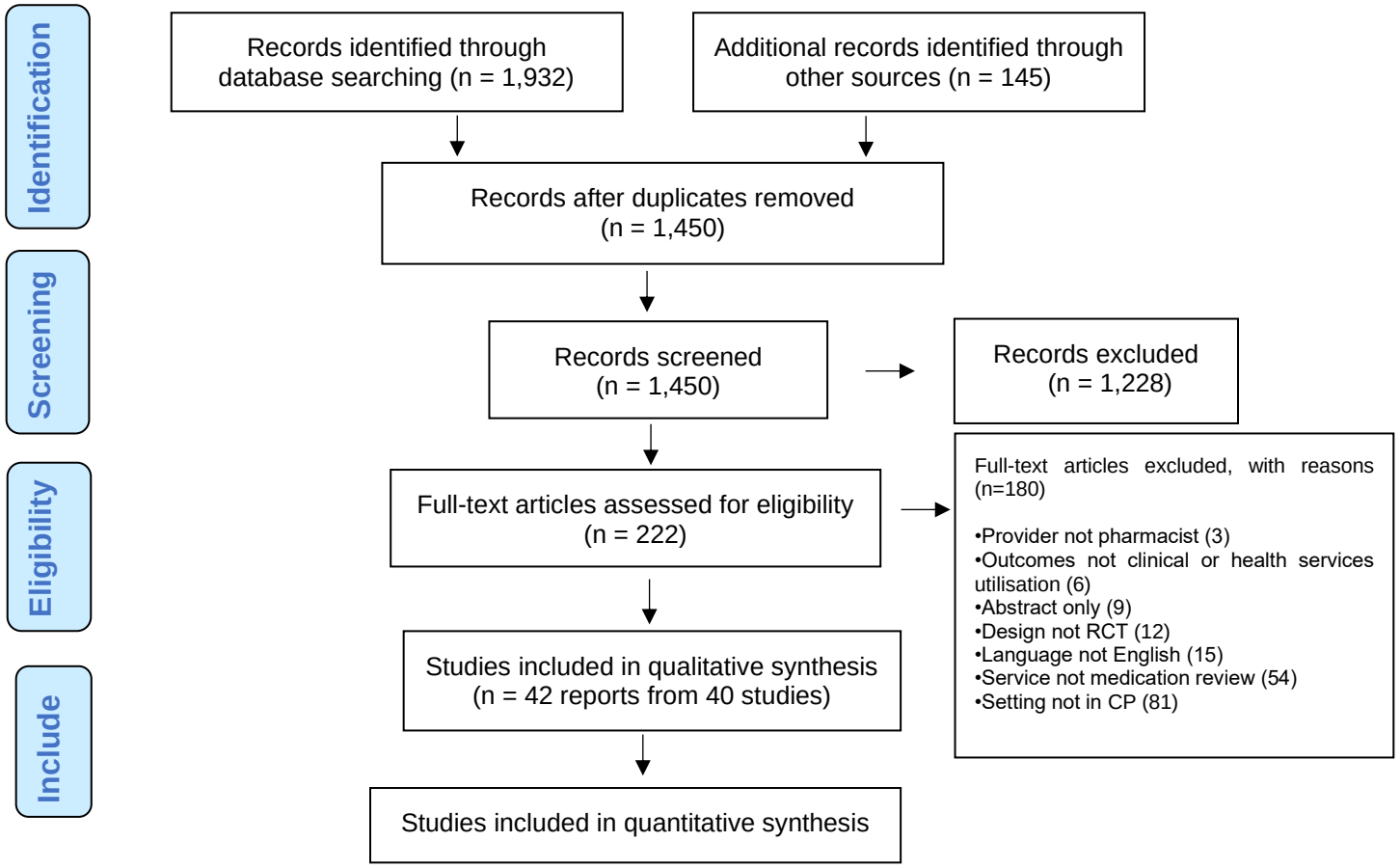


Figure 2.1: Preferred reporting items for systematic reviews and meta-analysis flow diagram

2.7.2 Study characteristics

There was heterogeneity between studies in term of population characteristics, interventions, outcomes, methods for measuring outcomes and, study duration, and origin of study. **APPENDIX II-B** summarises all the studies that were included in this review.

In terms of country of origin, eight studies were conducted in the US **(Currie *et al.,* 1997; Nola *et al.,* 2000; Mott *et al.,* 2003; McDonough *et al.,* 2005; Rickles *et al.,* 2005; Doucette *et al.,* 2009; Planas *et al.,* 2009; Planas *et al.,* 2012)**, five each were conducted in Canada **(Volume *et al.,* 2001; Mclean, Gillis and Waller, 2003; Beaucage *et al.,* 2006; Villeneuve *et al.,* 2010; Tsuyuki *et al.,* 2016),** the Netherlands **(Bouvy *et al.,* 2003; Vinks *et al.,* 2009; Schoenmakers *et al.,* 2018; Van der meer *et al.,* 2018; Verdoorn *et al.,* 2019)** and Australia **(Clifford *et al.,* 2005; Armour *et al.,* 2007; Aslani *et al.,* 2010; Armour *et al.,* 2013; Stewart *et al.,* 2014)** and four were conducted in the UK **(Richmond *et al.,* 2010; Ali *et al.,* 2012; Elliott *et al.,* 2016; Cheema *et al.,* 2018).** Two studies each were conducted in Spain **(Amariles *et al.,* 2012; Jodar-Sanchez *et al.,* 2015)** and Germany **(Hoffmann *et al.,* 2008; Schulz *et al.,* 2019),** and only one study was conducted in each of seven different European countries **(Bernsten *et al.,* 2001).** Lastly, one study each was conducted in Iran **(Jahangard-Rafsanjani *et al.,* 2015)**, Jordan **(Basheti, Tadros and Aburuz, 2016)**, Croatia **(Falamić *et al.,* 2018),** Iraq **(Al-Tameemi and Al-Tukmagi, 2017),** Malta **(Cordina, Mcelnay and Hughes, 2001)**, Portugal **(Garcao and Cabrita, 2002),** Italy **(Manfrin *et al.,* 2017)** and Denmark **(Herborg, 2001).**

Most of the included studies, 32 studies, were designed as individual RCTs, while only eight studies were designed as clusters **(Volume *et al.,* 2001; Mclean, Gillis and Waller, 2003; Mott *et al.,* 2003; Villeneuve *et al.,* 2010; Armour *et al.,* 2013; Stewart *et al.,* 2014; Jodar-Sanchez *et al.,* 2015, Manfrin *et al.,* 2017).** The included studies were published across the timeline starting from 1997 onward.

All studies except three **(Clifford *et al.,* 2005; Richmond *et al.,* 2010; Manfrin *et al.,* 2017)** compared medication review services to controls or usual care. The clinical outcomes (both disease-specific and non-disease-specific) were investigated in all included studies, whereas the health utilisation outcomes were assessed in only ten studies **(Bernsten *et al.,* 2001; Cordina, Mcelnay and Hughes, 2001; Herborg, 2001; Bouvy *et al.,* 2003; Mclean, Gillis and Waller, 2003; Richmond *et al.,* 2010; Jodar-Sanchez *et al.,* 2015; Van der meer *et al.,* 2018; Schulz *et al.,* 2019; Verdoorn *et al.,* 2019)**.

Ten studies **(Bernsten *et al.,* 2001; Volume *et al.,* 2001; Mott *et al.,* 2003; Vinks *et al.,* 2009; Richmond *et al.,* 2010; Jodar-Sanchez *et al.,* 2015; Falamić *et al.,* 2018; Van der meer *et al.,* 2018; Schulz *et al.,* 2019; Verdoorn *et al.,* 2019)** evaluated the effectiveness of the medication review service in elderly people, while six studies focused on asthma patients **(Cordina, Mcelnay and Hughes, 2001; Herborg, 2001; Mclean, Gillis and Waller, 2003; Armour *et al.,* 2007; Armour *et al.,* 2013; Manfrin *et al.,* 2017).**

The remaining studies drew attention to other chronic diseases such as diabetes mellitus (DM), hypertension (HTN) and dyslipidemia (DLD).

2.7.3 Risk of bias in included studies

Overall, the risk of bias varied across domains among the studies. The risk of bias for each study is presented in Figures 2.2 and 2.3. The blinding of pharmacists delivering the intervention and the participants receiving it was considered to be not possible due to the nature of the intervention. However, it would have been possible to blind outcome assessors of the allocation of participants to minimise detection bias. However, there were only eight studies in which outcome assessors were blinded **(Mott *et al.,* 2003; Beaucage *et al.,* 2006; Richmond *et al.,* 2010; Elliott *et al.,* 2016; Falamić *et al.,* 2018; Van der meer *et al.,* 2018; Schulz *et al.,* 2019; Verdoorn *et al.,* 2019).**

The majority of studies (20 studies) reported a low risk of selection bias for random sequence generation, where the investigators described adequate methods for random sequence generation, including computer-generated randomisation services, coin flipping and the sealed envelope technique. There were only three studies **(Volume *et al*., 2001; Rickles *et al.,* 2005; Vinks *et al.,* 2009)** with a high risk of selection bias associated with random sequence generation. However, 17 studies failed to explain adequately the process of random sequence generation.

Almost all studies except three **(Tsuyuki *et al.,* 2016; Van der meer *et al.,* 2018; Elliott *et al.,* 2016)** failed to describe the method for allocation concealment. Additionally, approximately 50% of included studies have low attrition bias, as missing data have been appropriately imputed using the intent-to-treat principle.

Nearly 50% of the studies appeared to report the same outcomes as initially stated; hence, the risk of reporting bias from selective outcome reporting was scored as low. Notably, a study protocol was available for only seven studies **(Mott *et al.,* 2003; Villeneuve *et al.,* 2010; Van der meer *et al.,* 2018; Verdoorn *et al.,* 2019; Stewart *et al.,* 2014; Elliott *et al.,* 2016; Manfrin *et al.,* 2017).**

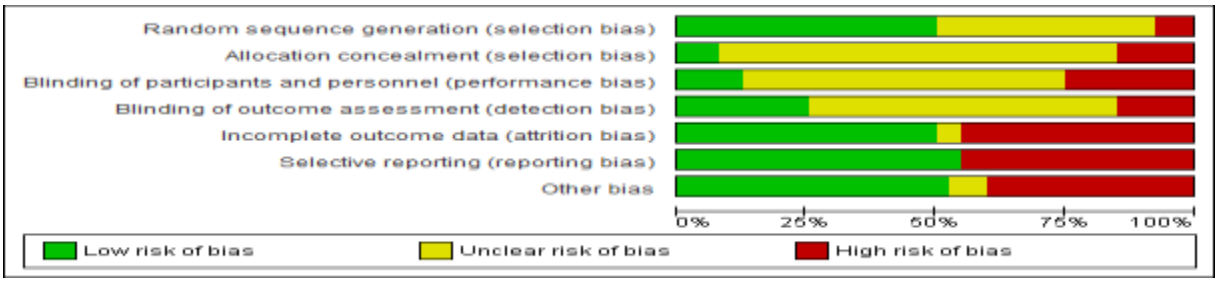


Figure 2.2: Risk of bias graph in included trials (n=40) across each domain

? = unknown risk, = high risk, = low risk

Figure 2.3: Risk of bias summary across individual trials

2.7.4 Nature of medication review services

There were more than 30 different names used in different countries to describe community-pharmacist-led medication reviews services. Pharmaceutical care was the name of the service in six countries (US, Europe, Portugal, Australia, Germany and UK) **(Currie *et al.,* 1997; Bernsten *et al.,* 2001; Garcao and Cabrita, 2002; Clifford *et al.,* 2005; Hoffmann *et al.,* 2008; Richmond *et al.,* 2010)**. In the US **(Mott *et al.,* 2003; Planas *et al.,* 2009)** and Canada **(Tsuyuki *et al.,* 2016),** the medication review service was named MTM. In the Netherlands, there were two types of medication review services, one called community-pharmacist-led medication review service **(Vinks *et al.,* 2009)** and the other called CMR service **(Schoenmakers *et al.,* 2018; Verdoorn *et al.,* 2019)**. Study duration among the studies varied from ten-week to two-year, with an average of six-month.

In 16 studies, medication reviews were conducted face-to-face, making it the most common mode of delivery. **(Herborg, 2001; Garcao and Cabrita, 2002; Mclean, Gillis and Waller, 2003; Armour *et al.,* 2007; Doucette *et al.,* 2009; Planas *et al.,* 2009; Aslani *et al.,* 2010; Villeneuve *et al.,* 2010; Ali *et al.,* 2012; Stewart *et al.,* 2014; Jodar-Sanchez *et al.,* 2015; Basheti, Tadros and Aburuz, 2016; Manfrin *et al.,* 2017; Cheema *et al.,* 2018; Van der meer *et al.,* 2018; Schulz *et al.,* 2019).** Telephonic interviews were used in two studies **(Rickles *et al.,* 2005; Planas *et al.,* 2012)** while both face-to-face and telephone interviews were used in eight studies **(Mott *et al.,* 2003;**

Clifford *et al.,* 2005; Beaucage *et al.,* 2006; Hoffmann *et al.,* 2008; Jahangard-Rafsanjani *et al.,* 2015; Elliott *et al.,* 2016; Al-Tameemi and Al-Tukmagi, 2017; Falamić *et al.,* 2018). However, 14 studies missed the mode of delivery of the intervention **(Currie *et al.,* 1997; Nola *et al.,* 2000; Bernsten *et al.,* 2001; Cordina, Mcelnay and Hughes, 2001; Volume *et al.,* 2001; Bouvy *et al.,* 2003; McDonough *et al.,* 2005; Vinks *et al.,* 2009; Richmond *et al.,* 2010; Amariles *et al.,* 2012; Armour *et al.,* 2013; Tsuyuki *et al.,* 2016; Schoenmakers *et al.,* 2018; Verdoorn *et al.,* 2019).**

Most medication review services were performed in collaboration with the patient's GP/primary care physician (PCP). However, nine studies **(Currie *et al.,* 1997; Volume *et al.,* 2001; Rickles *et al.,* 2005; Hoffmann *et al.,* 2008; Aslani *et al.,* 2010; Amariles *et al.,* 2012; Jahangard-Rafsanjani *et al.,* 2015; Al-Tameemi and Al-Tukmagi, 2017; Cheema *et al.,* 2018)** did not clearly report whether the patient's GP was involved in the process.

The medication review was part of a multi-component intervention in 22 studies, whereas it was solely pharmacist-led medication review in the 18 other studies. **APPENDIX II-C** shows more information regarding the nature of the medication review services.

2.7.5 Outcome assessment

Both the clinical and health service utilisation outcomes were assessed. All the studies included in this review evaluated more than one outcome **(APPENDIX II-B).** The evaluated clinical outcomes included both disease-specific clinical outcomes (e.g. systolic blood pressure (SBP) and diastolic blood pressure (DBP), lipid profile, fasting glucose, glycated haemoglobin (HbA1c) and cardiovascular risk (CVR)) and the non-disease-specific clinical outcomes (e.g. medication adherence, DRPs, adverse drug events (ADEs), mortality and QoL). The health services utilisation outcomes included emergency department (ED) visits and hospital re-/admissions.

2.7.5.1 Descriptive analysis

As mentioned earlier, narrative description of the outcomes was provided for clinically heterogeneous studies after grouping the studies based on their relevant outcomes.

2.7.5.1.1 Clinical outcomes

2.8.5.1.1.1 Mortality

Mortality was assessed at different time points in three studies **(Bouvy *et al.,* 2003; Van der meer *et al.,* 2018; Schulz *et al.,* 2019).** However, they were not sufficiently powered to show the effect on mortality.

The first study by Bouvy *et al*. (2003) demonstrated a non-significant reduction in mortality among heart failure patients treated with loop diuretics within the intervention group after six-month of follow-up with a relative risk of 0.6 (95% CI, 0.3, 1.4). The second study, Schulz *et al.* (2019), also found a statistically non-significant reduction in mortality after two-year in elderly patients with chronic heart failure (18% in intervention group and 21% in control group with p = 0.55). However, in the third study reported by Van der Meer *et al*. (2018) found no statistically significant increase in mortality among elderly patients with polypharmacy in the intervention group in compared to the control group after three-month of follow up (1.3% vs. 1.2%, p = 0.732).

2.7.5.1.1.2 Blood pressure

Thirteen studies assessed BP as an outcome measure and reported as SBP, DBP and the number of participants who reached their BP goal levels **(Garcao and Cabrita, 2002; Clifford *et al.,* 2005; Doucette *et al.,* 2009; Planas *et al.,* 2009; Villeneuve *et al.,* 2010; Ali *et al.,* 2012; Amariles *et al.,* 2012; Planas *et al.,* 2012; Stewart *et al.,* 2014; Jahangard-Rafsanjani *et al.,* 2015; Basheti, Tadros and Aburuz, 2016; Tsuyuki *et al.,* 2016; Cheema *et al.,* 2018)**. Ten studies investigated BP in HTN patients **(Garcao and Cabrita, 2002; Clifford *et al.,* 2005; Planas *et al.,* 2009; Villeneuve *et al.,* 2010; Amariles *et al.,* 2012; Planas *et al.,* 2012; Stewart *et al.,* 2014; Basheti, Tadros and Aburuz, 2016; Tsuyuki *et al.,* 2016; Cheema *et al.,* 2018)**, eight investigated it in

diabetes patients **(Clifford *et al.,* 2005; Doucette *et al.,* 2009; Planas *et al.,* 2009; Ali *et al.,* 2012; Planas *et al.,* 2012; Jahangard-Rafsanjani *et al.,* 2015; Tsuyuki *et al.,* 2016; Basheti, Tadros and Aburuz, 2016)** and four investigated it in DLD patients **(Clifford *et al.,* 2005; Villeneuve *et al.,* 2010; Amariles *et al.,* 2012; Tsuyuki *et al.,* 2016).**

Overall medication review had a positive effect in ten studies **(Garcao and Cabrita, 2002; Clifford *et al.,* 2005; Planas *et al.,* 2009; Ali *et al.,* 2012; Amariles *et al.,* 2012; Planas *et al.,* 2012; Stewart *et al.,* 2014; Basheti, Tadros and Aburuz, 2016; Tsuyuki *et al.,* 2016; Cheema *et al.,* 2018)**, one study reported an increase in SBP while decrease in DBP **(Villeneuve *et al.,* 2010)** and only two studies found negative effects in diabetes patients **(Doucette *et al.,* 2009; Jahangard-Rafsanjani *et al.,* 2015).** Furthermore, the BP goal was achieved among the participants in the medication review service arm across all four studies that reported such outcome **(Planas *et al.,* 2009; Amariles *et al.,* 2012; Planas *et al.,* 2012; Tsuyuki *et al.,* 2016).**

2.7.5.1.1.3 Lipid profile

Eleven studies reported a lipid profile as an outcome, but these studies reported different components of the lipid profile **(Nola *et al.,* 2000; Clifford *et al.,* 2005; Doucette *et al.,* 2009; Aslani *et al.,* 2010; Villeneuve *et al.,* 2010; Ali *et al.,* 2012; Amariles *et al.,* 2012; Planas *et al.,* 2012; Basheti, Tadros and Aburuz, 2016; Tsuyuki *et al.,* 2016; Al-Tameemi and Al-Tukmagi, 2017).** Low-density lipoprotein (LDL) cholesterol levels were

reported in seven studies **(Nola *et al.,* 2000; Doucette *et al.,* 2009; Villeneuve *et al.,* 2010; Ali *et al.,* 2012; Planas *et al.,* 2012; Tsuyuki *et al.,* 2016; Al-Tameemi and Al-Tukmagi, 2017),** total cholesterol (TC) levels were reported in seven studies **(Nola *et al.,* 2000; Clifford *et al.,* 2005; Aslani *et al.,* 2010; Villeneuve *et al.,* 2010; Ali *et al.,* 2012; Amariles *et al.,* 2012; Al-Tameemi and Al-Tukmagi, 2017),** triglyceride (TG) levels were reported in six studies **(Nola *et al.,* 2000; Clifford *et al.,* 2005; Villeneuve *et al.,* 2010; Ali *et al.,* 2012; Basheti, Tadros and Aburuz, 2016; Al-Tameemi and Al-Tukmagi, 2017)** and high-density lipoprotein (HDL) cholesterol levels were reported in five studies **(Nola *et al.,* 2000; Clifford *et al.,* 2005; Villeneuve *et al.,* 2010; Ali *et al.,* 2012; Al-Tameemi and Al-Tukmagi, 2017).** Additionally, four studies reported the participants who reached their LDL goal **(Nola *et al.,* 2000; Amariles *et al.,* 2012; Planas *et al.,* 2012; Tsuyuki *et al.,* 2016).** The author used mmol/l as the unit of measurement of lipid profile.

Overall, the medication review intervention reduced LDL levels in the seven studies. For the TC level, six studies reported positive effect while one study, Nola *et al*. (2000), showed negative effect throughout the study period for both the intervention and control groups (mean TC levels increased by 0.11 mmol/l and by 0.25 mmol/l, respectively).

Of the six studies, five reported a reduction in TG levels at follow-up **(Nola *et al.,* 2000; Clifford *et al.,* 2005; Villeneuve *et al.,* 2010; Basheti, Tadros and Aburuz, 2016; Al-Tameemi and Al-Tukmagi, 2017).** Ali *et al*. (2012) reported an increase in the TG level

among patients with diabetes after one-year follow-up for both groups (intervention: 0.17 mmol/l; control: 0.34 mmol/l).

Of the five studies that assessed HDL levels among DLD patients, three studies showed improvement during follow-up **(Nola *et al.,* 2000; Clifford *et al.,* 2005; Ali *et al.,* 2012)** while two studies reported worsening of HDL levels in both groups **(Villeneuve *et al.,* 2010; Al-Tameemi and Al-Tukmagi, 2017).** For all studies that reported the percentage of patients who achieved their cholesterol goal as an outcome, the percentage was higher in the intervention group than in the control group.

2.7.5.1.1.4 Fasting glucose and glycated haemoglobin levels

HbA1c level was reported as an outcome in six studies **(Clifford *et al.,* 2005; Doucette *et al.,* 2009; Ali *et al.,* 2012; Planas *et al.,* 2012; Jahangard-Rafsanjani *et al.,* 2015; Tsuyuki *et al.,* 2016)**, blood glucose level was reported in four **(Clifford *et al.,* 2005; Villeneuve *et al.,* 2010; Ali *et al.,* 2012; Basheti, Tadros and Aburuz, 2016)** and percentage of patients who achieved their HbA1c goal was reported in two **(Planas *et al.,* 2012; Tsuyuki *et al.,* 2016).**

For all 12 mentioned studies, the medication review service intervention showed constant improvement for fasting glucose and HbA1c with various chronic diseases at the follow-

up points. Furthermore, the medication review service group had a significantly higher percentage of patients meeting their HbA1c goal at follow-up than the control group.

2.7.5.1.1.5 Cardiovascular risk

CVR was assessed in only one study **(Tsuyuki *et al.*, 2016).** This study showed that there was decrease in the estimated CVR compared to the baseline among patients with high risk for cardiovascular events after participating in a medication review service for three-month (the mean changed from 25.6 to 20.5).

2.7.5.1.1.6 Drug-related problems

Six studies reported DRPs. In these studies, different definitions and identification methods were used **(Currie *et al.*, 1997; Bernsten *et al.*, 2001; Mott *et al.*, 2003; McDonough *et al.*, 2005; Beaucage *et al.*, 2006; Vinks *et al.*, 2009).**

Currie *et al.* (1997) reviewed patients' medication profiles to identify eight categories of DRPs and Mott *et al*. (2003) identified fall-risk-increasing drugs (FRIDs). On the other hand, Bernsten *et al.* (2001) employed self-completed questionnaires developed for use in the study to collect DRPs while McDonough *et al*. (2005) used the Outcomes Encounter Programme to identify and address five types of DRPs.

In the study by Beaucage *et al.* (2006), DRPs were grouped into six different categories for oral antibiotic treatment through pharmacist's analysis of antibiotic prescription and information gathered from pharmacy records and patient itself. Finally, Vinks *et al*. (2009) used drug utilisation profile to collect data on the DRPs to identify and validate DRPs based on the national prescribing guidelines.

Regarding the effectiveness of the medication review service on the DRPs outcome, three studies **(Bernsten *et al.,* 2001; Mott *et al.,* 2003; Vinks *et al.,* 2009)** reduced DRPs. However, one study, Beaucage *et al.* (2006), reported an increase in the number of DRPs in the intervention group compared to the control group. Finally, Currie *et al.* (1997) and McDonough *et al.* (2005) were not usable because the data were incompletely reported.

2.7.5.1.1.7 Adverse drug events

ADEs were reported in four studies **(Currie *et al.,* 1997; Beaucage *et al.,* 2006; Schoenmakers *et al.,* 2018; Van der meer *et al.,* 2018).** In these studies, different reports result due to using different methods of measuring ADEs.

Schoenmakers *et al*. (2018) used 'Patient-Reported Outcome Measure, Inquiry into Side Effects' (PROMISE), the instrument developed for patients to report the common symptoms that they experienced during CMR. A reduction in the mean of drug-associated symptoms (DASs) was shown at three-month visit (incidence rate ratio, 0.90 (95% CI,

0.62, 1.3)), along with a reduction in the percentage of patients reporting at least one DAS (odds ratio, 0.85 (95% CI, 0.38, 1.88)).

In the study by Van der Meer *et al*. (2018), the patients in the intervention reported fewer sedative and anticholinergic side effects at the three-month follow-up compared to the baseline (median 3.0 to -1.0) and (median 17.0 to -3.0), respectively.

On the other hand, studies by Currie *et al.* (1997) and Beaucage *et al.* (2006), reported that the percentage of patients who suffered from ADR was more in the medication review service group compared to the usual care group.

2.7.5.1.1.8 Medication adherence

Sixteen studies assessed medication adherence, but different questionnaires were used. The Morisky Medication Adherence Scale (MMAS-8) was commonly used in four studies **(Stewart *et al.,* 2014; Jahangard-Rafsanjani *et al.,* 2015; Elliott *et al.,* 2016; Manfrin *et al.,* 2017),** followed by the Brief Medication Questionnaire (BMQ) in two studies **(Armour *et al.,* 2007; Armour *et al.,* 2013).** Furthermore, Aslani *et al*. (2010) measured medication adherence through the Medication Adherence Report Scale (MARS-5), Schulz *et al.* (2019) used the proportion of days covered (PDC), Falamić *et al*. (2018) calculated it using a pillbox count and Bouvy *et al*. (2003) measured it through medication event monitoring systems (MEMS).

For reporting the medication adherence outcome, changing from baseline was commonly utilised **(Bernsten *et al.,* 2001; Volume *et al.,* 2001; Armour *et al.,* 2007; Planas *et al.,* 2009; Armour *et al.,* 2013; Stewart *et al.,* 2014; Jahangard-Rafsanjani *et al.,* 2015; Manfrin *et al.,* 2017).** However, comparing the intervention group to the control group at certain follow-up points was used in seven studies **(Bouvy *et al.,* 2003; Rickles *et al.,* 2005; Beaucage *et al.,* 2006; Villeneuve *et al.,* 2010; Elliott *et al.,* 2016; Falamić *et al.,* 2018; Schulz *et al.,* 2019).** In one study **(Aslani *et al.,* 2010),** medication adherence results were not reported.

Of 16 studies included in this review, 15 reported that medication review services had a positive effect on medication adherence outcomes among chronic disease patients and elderly patients. Only one study **(Volume *et al.,* 2001)** reported fluctuation in the result, where the mean adherence score increased at the six-month follow-up (0.48 ± SD 0.65) and decreased at the one-year follow-up (0.53 ± SD 0.77).

2.7.5.1.1.9 Quality of life

QoL was evaluated in 16 studies utilising different questionnaires and scales. Short-form 36 (SF-36) questionnaire was the most commonly used tool to assess QoL. **(Bernsten *et al.,* 2001; Cordina, Mcelnay and Hughes, 2001; Volume *et al.,* 2001; Hoffmann *et al.,* 2008; Richmond *et al.,* 2010; Al-Tameemi and Al-Tukmagi, 2017).** Disease-specific QoL questionnaires such Living with Asthma Questionnaire (LWAQ) and the Minnesota

Living with Heart Failure Questionnaire (MLHFQ) were used in six studies **(Cordina, Mcelnay and Hughes, 2001; Herborg, 2001; Armour *et al.,* 2007; Ali *et al.,* 2012; Armour *et al.,* 2013; Schulz *et al.,* 2019).** EuroQol-5 Dimension-3 Level/5 Level (EQ-5D-3L/5L) was used in three studies **(Jodar-Sanchez *et al.,* 2015; Van der meer *et al.,* 2018; Verdoorn *et al.,* 2019).** The other questionnaires that were used were the Juniper Questionnaire **(Mclean, Gillis and Waller, 2003),** the Nottingham Health Profile (NHP) **(Herborg, 2001)** and the Dartmouth Primary Care Cooperative Information Project/World Organisation of National Colleges, Academies, and Academic Associations of General Practice/Family Physicians Questionnaire (COOP/WONCA) **(Bouvy *et al.,* 2003).**

Overall, medication review services had a positive effect on QoL **(Cordina, Mcelnay and Hughes, 2001; Herborg, 2001; Bouvy *et al.,* 2003; Mclean, Gillis and Waller, 2003; Armour *et al.,* 2007; Ali *et al.,* 2012; Armour *et al.,* 2013; Jodar-Sanchez *et al.,* 2015; Al-Tameemi and Al-Tukmagi, 2017; Schulz *et al.,* 2019; Verdoorn *et al.,* 2019).** However, two studies reported mixed results **(Volume *et al.,* 2001; Hoffmann *et al.,* 2008),** where different domains had different impact on QoL (positive effect by SF-36 (mental health) and negative effect by SF-36 (physical health)). On the other hand, QoL worsened in three studies **(Bernsten *et al.,* 2001; Richmond *et al.,* 2010; Van der meer *et al.,* 2018).**

2.7.5.1.2 Health services utilisation

2.7.5.1.2.1 Emergency department visits

Five studies assessed hospital ED visits **(Herborg, 2001; Mclean, Gillis and Waller, 2003; Stewart *et al.,* 2014; Jodar-Sanchez *et al.,* 2015; Verdoorn *et al.,* 2019).** Except one study **(Verdoorn *et al.,* 2019),** all studies showed a positive effect of medication review service on number of emergency visits after six months and one-year follow-up.

2.7.5.1.2.2 Hospital admissions/readmissions

Hospitalisation was assessed in nine studies **(Bernsten *et al.,* 2001; Cordina, Mcelnay and Hughes, 2001; Herborg, 2001; Bouvy *et al.,* 2003; Mclean, Gillis and Waller, 2003; Jodar-Sanchez *et al.,* 2015; Van der meer *et al.,* 2018; Schulz *et al.,* 2019; Verdoorn *et al.,* 2019).** It was reported as hospitalisation rate, percentage of participants with at least one hospital admission and length of hospital stay. First, the hospitalisation rate was reported in five studies **(Herborg, 2001; Bouvy *et al.,* 2003; Jodar-Sanchez *et al.,* 2015; Van der meer *et al.,* 2018; Schulz *et al.,* 2019).** Second, the percentage of participants with at least one hospital admission was calculated in three studies **(Bernsten *et al.,* 2001; Cordina, Mcelnay and Hughes, 2001; Jodar-Sanchez *et al.,* 2015).** Finally, length of hospital stay was measured in four studies **(Cordina, Mcelnay and Hughes, 2001; Bouvy *et al.,* 2003; Mclean, Gillis and Waller, 2003; Verdoorn *et al.,* 2019).**

Of the five studies that reported hospitalisation rate, four reported a positive effect of the service on overall hospitalisation rate **(Herborg, 2001; Jodar-Sanchez *et al.,* 2015; Van der meer *et al.,* 2018; Schulz *et al.,* 2019)** while one study **(Bouvy *et al.,* 2003)** reported positive effect in planned readmission but negative effect on other hospital admissions among the intervention group compared to the control group at six-month follow-up.

In terms of the percentage of patients who participated in the medication review service and who had at least one hospital admission, a reduction was seen in all three studies that reported the outcome. Moreover, admission days, overall, were reduced in two studies **(Cordina, Mcelnay and Hughes, 2001; Mclean, Gillis and Waller, 2003).** However, in one study **(Verdoorn *et al.,* 2019),** acute admissions days were reduced but planned admissions days were increased. Another study **(Bouvy *et al.,* 2003)** showed an increase in the total number of admission days in the intervention group compared to the control group after six-month of follow-up (465 days and 332 days, respectively) but decreased in the planned readmission days among patients in the intervention group compared to those in the control group (25 days and 37 days, respectively).

2.7.5.2 Meta-analysis

Data from 12 RCTs was included in the meta-analysis. In total, 4,815 patients with chronic diseases completed these studies. To ensure clinical homogeneity, subgroup analysis by study population was used: HTN, diabetes and DLD. Data were statistically combined for

the SBP and DBP outcomes in the HTN and diabetes populations, and the HbA1c and TC outcomes in the diabetes and DLD populations, respectively.

2.7.5.2.1 Blood pressure

The SBP outcome data were pooled using meta-analysis. Nine studies were included (three studies among HTN patients; six studies among diabetes patients). Overall, the intervention group had a statistically significant decrease in SBP compared to the control group, with a mean difference (MD) of -6.6 (95% CI, -10.1, -3.1). This effect is equivalent to a 6.6 mmHg reduction in SBP. For the subgroups, a statistically significant reduction was observed among diabetes patients (MD -6.8; 95% CI, -11.3, -2.3), and no statistically significant reduction was observed among HTN patients (MD -6.2; 95% CI, -13.3, 0.9) **(Figure 2.4).**

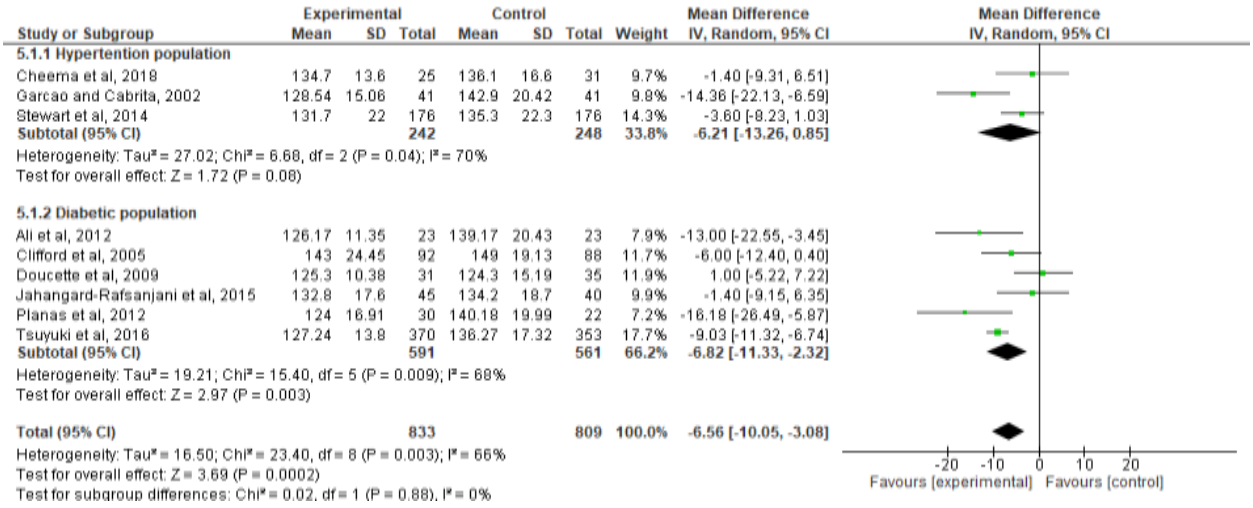


Figure 2.4: Meta-analysis of systolic blood pressure in hypertension and diabetes patients

Data on DBP were also pooled using meta-analysis for nine studies. Overall, the intervention group had a statistically significant reduction in DBP compared to the control group, with a MD of -1.7 (95% CI, -3.2, -0.2). This corresponds to a 1.7 mmHg reduction in DBP. For the subgroups, a statistically significant reduction was observed among diabetes patients (MD -2.1; 95% CI, -3.4, -0.9), and no statistically significant reduction was observed among HTN patients (MD -2.1; 95% CI, -6.5, 2.3) **(Figure 2.5).**

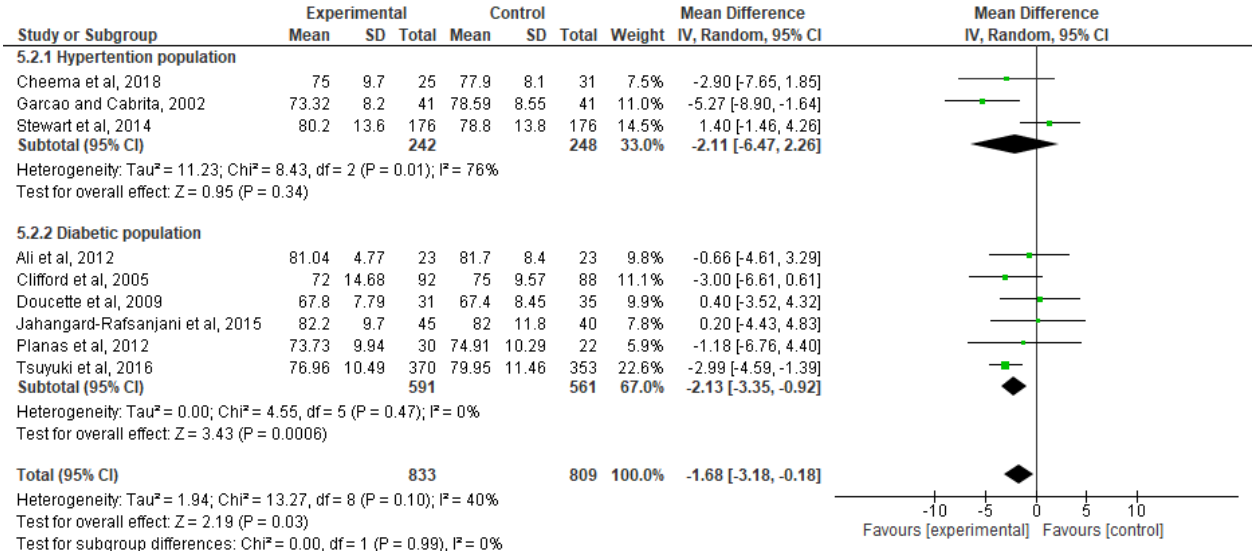


Figure 2.5: Meta-analysis of diastolic blood pressure in hypertension and diabetes patients

2.7.5.2.2 Lipid profile

The TC outcome data only were pooled using meta-analysis, including three studies with 379 DLD patients **(Figure 2.6).** For the other outcomes such as TG, LDL and HDL level a

meta-analysis was not undertaken due to clinical heterogeneity. The meta-analysis found participants receiving medication reviews had statistically significant improvements in their TC levels compared to the control (MD -0.2; 95% CI, -0.3, -0.1; p = 0.008; I2 = 0%).

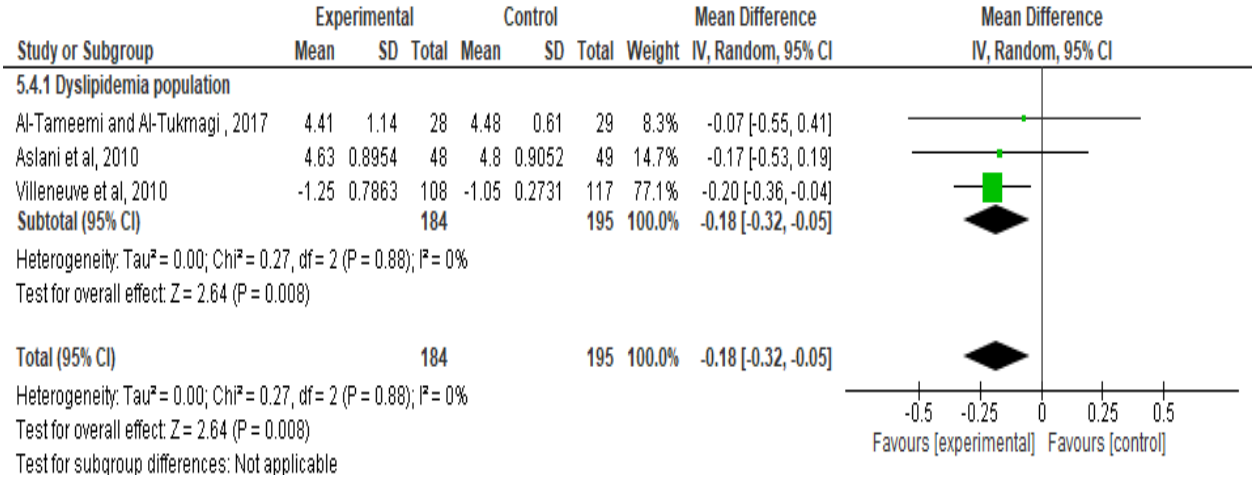


Figure 2.6: Meta-analysis of total cholesterol levels in dyslipidaemia patients,

2.7.5.2.3 Glycated haemoglobin

Data on HbA1c levels were pooled using meta-analysis for six studies to estimate the effect of community-pharmacist-led medication review service. As shown in **Figure 2.7,** the medication review service statistically improved the HbA1c in 591 diabetic patients joined the medication review services (MD -0.6; 95% CI, -0.9, -0.3, P = 0.0008).

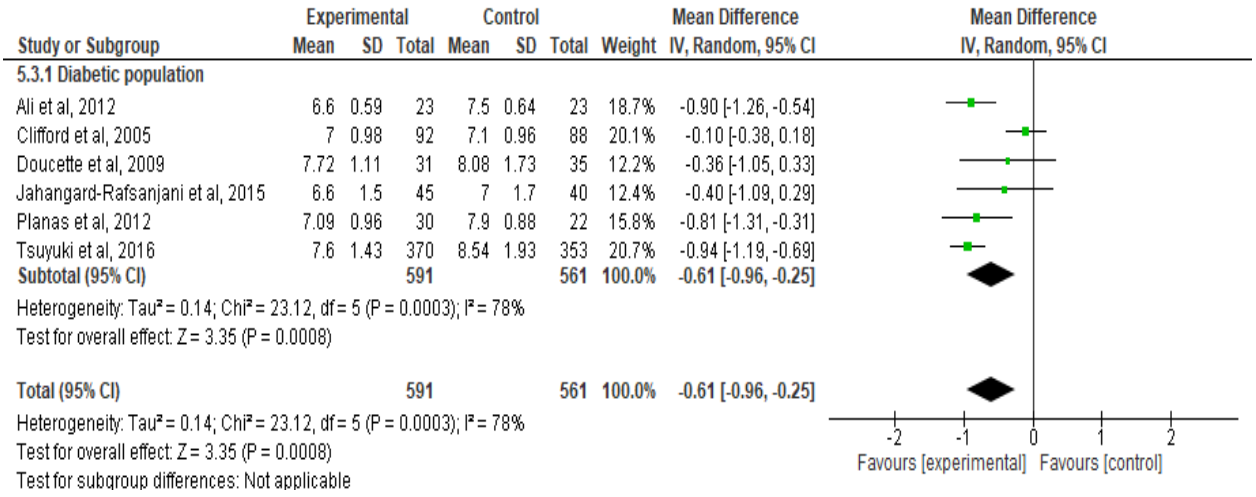


Figure 2.7: Meta-analysis of the glycated haemoglobin level in diabetes patients

2.8 Discussion

2.8.1 Main results

This SR & MA has been conducted to assess the effectiveness of CP-based medication review services with a wide range of targeted outcomes among different patient population groups. The main findings of this review indicated that active interventions by pharmacists working in CPs were associated with substantial improvement compared to the usual care.

Over the past decade, healthcare practices, including the role of community pharmacists around the world, have drastically changed in an attempt to adapt to the growing needs of patients and healthcare services **(Sarriff, Nordin and Hassali, 2012; Sadek *et al.*, 2016; Bryant, Maney and Martini, 2017).** However, the growth of healthcare services

has been constrained by limited resources, which has led to the recognition of the under-utilisation of community pharmacists' services. Moreover, it has presented opportunities for developing the profession and maximising community pharmacists' utilisation through their provision of services beyond the traditional supply function that help improve patient outcomes **(Sadek *et al.,* 2016; Bryant, Maney and Martini, 2017).** In response, health systems in several countries have established services to reimburse community pharmacists for their one-on-one reviews of patients' medications **(Pechlivanoglou *et al.,* 2016).**

In this review, patients with various chronic conditions benefited from medication review service provided by community pharmacists. As mentioned earlier, patients with chronic conditions often require polypharmacy, and this can lead to DRPs, which can be prevented by carefully reviewing medications **(Rollason and Vogt, 2003; Pirmohamed *et al.,* 2004; United Nations, Department of Economic and Social Affairs, Population Division, 2020).**

Additionally, improvements in patient outcomes were observed regardless of the length of intervention across the included studies, which ranged from ten-week to two-year. This leaves a wide window for implementing service durations. Similarly, the studies published within the period from 1997 to 2019 showed no noticeable trend in the degree of impact

on clinical and healthcare utilisation by year of publication, which proves the value of medication review services over the two decades.

There were methodological limitations in the studies included in this review. All the included studies were evaluated for the risk of bias. There were many missing data, resulting in inadequate information to assess risk of bias appropriately. This not only calls for better-designed RCTs to evaluate patients' outcomes in CP practice but also to follow Consolidated Standards of Reporting Trials (CONSORT) guidelines to improve the reporting of patient outcome **(Schulza *et al.,* 2010).** In addition, all key components should be clearly illustrated in the methods section, so that readers can make informed decisions about biases. Finally, it is important to consider publishing the protocols in peer-reviewed journals, which enhances transparency and validity of the findings.

Generally, there is limited evidence to support the effect of community pharmacists' interventions on reducing mortality. In this review, the effect of medication review on mortality was indecisive, as the trials either did not have sufficient power **(Bouvy et al., 2003, Schulz *et al.,* 2019)** or did not provide long-term follow-up data **(Van der meer *et al.,* 2018, Schulz *et al.,* 2019)** to draw any meaningful conclusions. It is significant to note that medication review, as a general rule, requires the addition or/and modification of relevant chronic medicines (e.g. statins, antidiabetics and antihypertensive) with improved medication adherence, which mainly confer beneficial effects on mortality after long-term

treatment **(Wright and Musini, 2009; Gutierrez *et al.,* 2012).** Thus, a beneficial effect on mortality in studies with shorter follow-up, ranging from three-month **(Van der meer *et al.,* 2018)** to two-year **(Schulz *et al.,* 2019)** unlikely to be observed and long-term studies are required.

Meta-analysis results showed a statistically significant improvement in clinical outcomes such as SBP, DBP, HbA1c and TC levels in the medication review group over the usual care group. However, it is important to consider these findings in light of their clinical significance. For the SBP outcome, clinically significant reduction in SBP was achieved in both HTN and diabetes patients, by 6.6 mmHg. A meta-analysis conducted in 2002 involving one million adults revealed that it could prevent 10,000 deaths related to coronary heart disease each year for every 1 mmHg SBP reduction. Consequently, health systems that adopt and implement community-pharmacist-led medication review services can prevent over 60,000 deaths from coronary heart disease **(Lewington *et al.,* 2002).**

A community-pharmacist-led medication review services also had a clinical effect on the HbA1c outcome, reducing HbA1c by 0.6 MD in diabetics patients, which is above the 0.5 effect size for a pharmacist-based diabetes management service, as measured from studies on such services reported in the review done by Wubben and Vivian. Despite HbA1c being regarded as a short-term surrogate, it contributes to long-term reduction of microvascular complications and improved QoL **(Wubben and Vivian, 2008).**

On the other hand, the clinical significance of community-pharmacist-led medication review service on DBP (decreased by only 1.7 mmHg) is limited. Previous analysis suggests that a constant decrease in DBP by 2 mmHg would lead to a 15% reduction in stroke risk and a 6% reduction in coronary heart disease risk **(Cook *et al.,* 1995).**

2.8.2 Limitations

Four limitations have been noted in this SR & MA. First, the systematic review only considered English-language studies, which might have caused selection bias. Second, unpublished grey literature was not included in the review, which might have led to publication bias. In spite of this, such bias is expected to be low due to the abundance of literature available.

Third, the economic effect of medication review services was not estimated. Although, data demonstrating the economic effect of an intervention are vital in the implementing of services, however, the plan was to concentrate on the patients' clinical and healthcare utilisation outcomes in this review.

Finally, included studies showed remarkable heterogeneity. Although this review focused on medication review intervention in CPs setting, the chosen interventions still varied, mainly in terms of study participants, intervention components, and reporting and measurement of the outcomes. Although subgroup analyses were performed based on

the study population in order to examine the causes of heterogeneity, however, discrepancies in the definition of community-pharmacist-based medication review service might partly justify the heterogeneity detected. Furthermore, there is universal diversity in the extent to which CP services are implanted in the usual clinical care of chronic medical conditions, which may also fairly justify the heterogeneity detected in the review.

2.8.3 Practice and policy implications

This study provided a systematic and comprehensive review of the evidence on the impact of community-pharmacist-led medication review services. An evaluation of this type is essential for health authorities to recognise the value of services, to improve them for patients, to determine the best way to expand their implementation, and to formulate future reimbursement strategies.

This review also communicates an important message to health professionals and policymakers regarding the critical role community pharmacists play in chronic disease management. Moreover, this review may open a new professional perspective for community pharmacists, especially in developing countries that have not yet implemented advanced services in their CPs.

2.9 Conclusion

Community-pharmacist-led medication review services have been introduced in different countries under different names. This systematic review confirmed that, notwithstanding the differences in how they are named, community-pharmacist-led medication review services have a positive effect on patient clinical and healthcare utilisation outcomes. In addition, the meta-analysis indicates that community pharmacists-led interventions were associated with statistically significant improvement in the BP and HbA1c levels in diabetes patients and the TC levels in DLD patients.

CHAPTER 3 Methodology

3.1 Chapter overview

When conducting research, it is essential that the methods used are appropriate to fully answer the research questions **(Kalu and Bwalya, 2017).** Designing a study is as much an art as a science, and it is 'an exercise of the dramatic imagination' (**Cronbach, 1982; Patton, 2015).** Therefore, the purpose of this methodology chapter is to detail and justify the most suitable research methodology for conducting this study in order to achieve optimal results. The chapter is divided into four sections. The first section provides the background of research methodology concepts. The second section discusses mixed-methods methodology. The final two sections present quantitative and qualitative research methodology. Each section includes the rationale for favouring one approach or design over the others.

3.2 Research methodology

A research methodology is a mode of systematically solving a research problem **(Dawson, 2002)**; this simply means a guide to research and how it is conducted. There are three types of research methodologies available to healthcare researchers: quantitative, qualitative, and mixed-methods. Based on the type of data needed to adequately respond to a research question, the researcher selects one of the three aforementioned approaches. The quantitative approach, which uses a single data collection method and corresponding analysis methods, is best applied to research

questions requiring data that is numerical in nature, such as dichotomous, ordinal, and interval. While the qualitative approach is best for research questions requiring textual (non-numerical) data, primarily text and images. Finally, the mixed-methods approach, which uses both qualitative and quantitative techniques, is used with research questions requiring both numerical and textural data **(Williams, 2007; Guest and Fleming, 2014).**

This variety of approaches creates an opportunity to design a study in support of inquiry questions and within the context of a given field (**Patton, 2015)**. The next section will illustrate the mixed-methods approach and give concrete rational for choosing this method.

3.3 Mixed-methods research methodology

The roots of mixed-methods are typically traced to the 1959 multimethod approach of Campbell and Fiske **(Teddlie and Tashakkori, 2009; Harwell, 2011).** It is considered a relatively new methodology that is continuing to evolve, and a number of key philosophical and methodological foundations, practice standards, frameworks, and guidelines have been proposed to guide researchers and reviewers and ensure rigor **(Harwell, 2011; Hadi and Closs, 2016).**

Mixed-methods research has become increasingly popular in many disciplines over the past few decades, including education, psychology, nursing, sociology, health sciences,

management and organisational research, and programme evaluation **(Currall and Towler, 2003; Forthofer, 2003; Hunter and Brewer, 2003; Rallis and Rossman, 2003; Twinn, 2003; Waszak and Sines, 2003; Johnson and Onwuegbuzie, 2004; U.L.T.P Gunasekare, 2015).** This methodological movement has been given many names: blended research **(Thomas, 2003),** integrative research **(Johnson and Onwuegbuzie, 2004),** multimethod research **(Hunter and Brewer, 2003),** multiple methods **(Smith, 2007),** triangulated studies **(Sandelowski, 2003),** ethnographic residual analysis **(Fry, Chantavanich and Chantavanich, 1981),** and mixed research **(Johnson and Christensen, 2004).** Indeed, the term 'mixed-methods' is perhaps the most appropriate, as mixing is an umbrella term that covers the multifaceted procedures of combining, integrating, linking, and employing multiple methods **(Creswell, 1994; U.L.T.P Gunasekare, 2015).**

Mixed-methods methodology, as its name implies, integrates quantitative and qualitative research in order to answer a research question within a single study using both numbers and words. As a result, a better understanding of the research problem can be achieved which is often not possible when using one type of data only **(Johnson and Onwuegbuzie, 2004; Tashakkori and Creswell, 2007; Johnson, Onwuegbuzie and Turner, 2007; Hadi and Closs, 2016).**

Many definitions of mixed-methods are available in the literature. These definitions vary in scope and detail, but virtually all refer to some form of integration of qualitative and quantitative research methods **(Guest and Fleming, 2014)**. In their 'Advanced Mixed-Methods Research Designs,' John W. Creswell and his colleagues have said that a more elaborate definition would specify the nature of data collection, the priority each form of data receives in the research report, and the place in the research process in which 'mixing' of the data occurs. To combine all of these features into a single definition, they suggest the following: A mixed-methods study involves the collection or analysis of both quantitative and/or qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research **(Creswell *et al.,* 2003).**

Johnson systematically reviewed 19 previously published definitions of mixed-methods and synthesized the following definition: 'Mixed-methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding and corroboration' **(Johnson, Onwuegbuzie and Turner, 2007).** After reviewing all these definitions, it can be concluded that it is important that mixed-methods research is not only a 'means of collecting both qualitative and quantitative data', but it

should also integrate qualitative and quantitative studies within or across the different stages of research **(Johnson, Onwuegbuzie and Turner, 2007; Hadi *et al.,* 2013).**

Cresswell and Plano-Clark proposed the four most commonly used mixed-methods designs in healthcare research: convergent parallel design, explanatory design, exploratory design, and embedded design **(Creswell and Plano Clark, 2011; Hadi and Closs, 2016).** However, the Embedded (or Nested) Design was chosen for this study. Greene and colleagues in 1989 **(Greene, Caracelli and Graham, 1989)** described embedded design for the first time. It has become one of the most popular design in the health sciences. Based on the purpose of the research, either the qualitative or quantitative method acts as the principal method, while the other takes a supportive role. Data can be collected sequentially or concurrently, and the principal method is given priority in answering research questions. The design would be to conduct an intervention study and embed qualitative data within the intervention procedures to understand how experimental participants experience the treatment **(Hadi and Closs, 2016).**

3.3.1 Rationale for choosing a Mixed-Methods Design

The general rationale behind using a mixed-methods approach is that quantitative or qualitative research alone is not sufficient to answer the research question(s). Using only one method may be insufficient because of the inherent weaknesses of a given approach

(Creswell, 2015; Plano Clark and Ivankova, 2016); however, by systematically combining alternative methodologies, a researcher can offset vulnerabilities, broaden the perspective of the research's purpose, and examine the complementary depth and breadth **(U.L.T.P Gunasekare, 2015; Curry and Nunez-Smith, 2015).** In short, all research methods have both strengths and weaknesses, and the combination of the strengths of quantitative and qualitative designs provides a good rationale for using mixed-methods. To be specific, quantitative research provides an opportunity for generalisation and precision, while qualitative research offers an in-depth experience of individual perspectives **(Creswell, 2015).**

Different schemes have been employed to code the justifications for combining quantitative and qualitative research i.e Greene and colleagues (1989) **(Greene, Caracelli and Graham, 1989)** and Bryman (2006) **(Bryman, 2006)**. Bryman's scheme has been used in this study, as it lists concrete rationales and covers a larger number of categories than other schemes, which helps to capture the range of reasons for conducting multi-strategy research in finer detail **(Bryman, 2006)**.

Mixed-methods approach has been used for the following three reasons in this study: answering different research questions, utility, and illustration **(Halcomb and Hickman, 2015; Plano Clark and Ivankova, 2016; Doyle, Brady and Byrne, 2016).**

3.3.1.1 Answering different research questions

Using a mixed-methods approach is excellent for answering a variety of research questions because it combines different methodologies within a study **(Plano Clark and Ivankova, 2016).** In this study, a mixed-methods methodology was used to evaluate the effectiveness and acceptability of a MTM service. Since no single methodology (quantitative or qualitative) can answer both questions comprehensively, a mixed-methods approach was adopted. The quantitative phase addressed the effectiveness of the MTM service by using a pilot RCT, and the qualitative phase explored issues around patients' experiences with and views of the service by using semi-structured interviews.

3.3.1.2 Utility

Utility refers to improving usefulness of findings, a common reason for using mixed-methods approach. As a result, practitioners and others can benefit more from the results **(Bryman, 2006; Plano Clark and Ivankova, 2016).** Both numerical and textual data were collected in the current study through mixed-methods research that helped elucidate various aspects of the service, providing a more holistic understanding of it, and resulted in better-informed recommendations. Furthermore, it provided fuller and richer information and an overview of what was going on in the clinic.

3.3.1.3 Illustration

In illustration, qualitative data is used to illustrate quantitative findings. An illustration is a useful application of mixed-methods research, particularly when evaluating health services, since a quantitative study can only provide p-values and effect sizes, which may not provide enough information for holistic service evaluations **(Bryman, 2006)**. The present study was able to answer the study objectives comprehensively because numeric values were integrated with words. The patient voice is perceived as important because of how it elucidated the complexity of the MTM service, thereby grounding the research in the real world.

3.3.2 Rationale for choosing Embedded Design

The current research supported an embedded design for two different reasons. First, this was the ideal design for addressing the different research questions requiring different methods in a single study **(Creswell and Plano Clark, 2011).** The study had two objectives: The primary objective was to investigate the effectiveness of a pharmacist-led MTM service, while the secondary objective was to explore patients' experiences with and views about the service. The first objective required the quantitative method, while the second objective required the qualitative method.

The second reason is that the embedded design gives unequal priority to the quantitative and qualitative components when addressing the study's research questions. This means

that one method of enquiry is in a supportive role, which enables both the researchers and the readers to make sense of the study in its entirety **(Creswell and Plano Clark, 2007; Plano Clark *et al.,* 2013; Almalki, 2016).** In the present study, quantitative approach was the principal method since the main research question of this thesis was assessing the effectiveness of the service while the qualitative approach explored patients' views and experiences with the service, thus provided supportive role. The embedded design in the present study consisted of a pilot RCT as quantitative research and qualitative descriptive as qualitative research. The rationale for choosing these particular designs in each research methodology is justified below.

3.3.3 Rationale for choosing a Randomised Control Trial Design

As mentioned earlier, the aim of the quantitative research question was to evaluate the effectiveness of CP-based MTM service on patients' outcomes. A RCT would be the ideal study design for evaluating the effectiveness of an intervention. However, if there is genuinely no indication of whether or not an MTM service might be effective when implemented into a new healthcare system, then a pilot trial is necessary. The overall aim of pilot trials is to demonstrate that a future trial can be undertaken **(Abbott, 2014)**

To be specific, it is recommended that formative research in the form of a pilot study is undertaken before conducting an RCT to assess the feasibility of the service's implementation with sufficient take-up and to improve the quality of the implementation.

Formative research should also be used to assess the factors behind the problem being addressed, thereby informing its design. Using an RCT to evaluate a service that is being established for the first time in a new healthcare system is likely to be inappropriate, and under most circumstances, an RCT should not take place until the service has been adequately implemented. RCTs are costly, and they will waste scarce resources and can generate misleading findings if used to evaluate a service that has not yet been fully implemented in a new healthcare system **(White, Sabarwal and de Hoop, 2014).**

The SR & MA in Chapter Two reported positive impact of medication review service in various countries. However, additional information is needed to design and plan an RCT, especially when dealing with a diverse cultural, professional, and healthcare delivery system. Pilot studies are preliminary studies conducted specifically for the purpose of establishing whether the key components necessary for conducting the proposed RCT, such as the processes for assessing eligibility and recruitment and conducting baseline assessments, randomisation procedures, treatment fidelity, and follow-up assessments, all function well together. A pilot study is a version of the main study that is run in miniature to replicate what the researchers hope will be the final design of the actual RCT, and they serve as a 'dress rehearsal' **(Abbott, 2014)**.

The pilot RCT provides the researcher with an invaluable opportunity to identify the challenges of evaluating an intervention before conducting a full-scale RCT. It is used to

assess the design, methodology, and feasibility of the larger study and to provide preliminary evidence of potential efficacy **(Gardner *et al.*, 2003).** A pilot study can also examine the possibility of unexpected outcomes, which may prompt the investigators to include additional outcomes that may have not been previously considered in the full-scale RCT **(Campbell *et al.,* 2007).** Moreover, the pilot study can be an important first step in securing funding for a full-scale RCT **(Gardner *et al.*, 2003).**

3.3.4 Rationale for choosing Qualitative Description

Qualitative description has been identified as important and appropriate for research questions focused on discovering the who, what, and where of events or experiences, aiming to produce a straight description and comprehensive summary of the phenomenon of interest using the language of the participants **(Merriam, 1998; Kim, Sefcik and Bradway, 2017).**

A variety of terms have been used in the literature to describe research that does not fit within a traditional qualitative approach, for instance 'qualitative description' (**Sandelowski, 2000)**, 'noncategorical' **(Thorne, Kirkham and MacDonald-Emes, 1997),** 'basic or generic qualitative research' **(Merriam, 1998),** 'basic or fundamental qualitative description' (**Sandelowski, 2000)**, and 'pragmatic qualitative approach'**(Savin-Baden and Major CH, 2013; Bradshaw, Atkinson and Doody, 2017).**

The philosophical underpinnings of a qualitative description approach have been described in the literature. It was designed to develop understanding and describe phenomenon **(Bradshaw, Atkinson and Doody, 2017)**, as well as to examine a phenomenon in its natural state. **(Sandelowski, 2000; Kim, Sefcik and Bradway, 2017).** It is less theoretical compared to other qualitative approaches (**Neergaard, 2009**), facilitating flexibility with regard to commitment to a theory or framework when designing and conducting a study (**Sandelowski, 2000; Kim, Sefcik and Bradway, 2017)**, and it is subjective, with each person having their own perspective and each perspective counting **(Bradshaw, Atkinson and Doody, 2017).**

The growth in qualitative health sciences research has led to the introduction of a vast array of qualitative methodologies, resulting in making the selection between qualitative designs challenging. Unlike grounded theory research, qualitative description research does not aim to build theories or focus on cultures as does ethnography or explore processes as does case study, or have a 'lived experience' as does phenomenology **(Doody and Bailey, 2016; Bradshaw, Atkinson and Doody, 2017).** Qualitative description research seeks instead provide a rich, direct description of an experience reported in a language similar to the informants' own language in order to be easily understood **(Neergaard, 2009; Bradshaw, Atkinson and Doody, 2017**).

In contrast to phenomenological, grounded theory, ethnographic, or case studies, which are based on specific methodologic frameworks emerging from distinctive disciplinary traditions (**Sandelowski, 2000)**, qualitative description is part of the naturalistic approach, which examines a phenomenon through the meanings participants assign to it **(Bradshaw, Atkinson and Doody, 2017)**. Like any other naturalistic study, it does not pre-select variables, manipulate variables, or commit to a particular theory about a phenomenon before the study begins (**Lincoln and Guba, 1985; Sandelowski, 2000).**

Although no description is free of interpretation, qualitative description, as opposed to phenomenological or grounded theory description **(Sandelowski, 2000),** involves low-inference interpretation, meaning that even though description is the aim of qualitative description, interpretation is always present (**Neergaard, 2009**). Accordingly, although unavoidably interpretive in that it is 'filtered through participant perceptions' **(Wolcott, 1994),** qualitative description is not highly interpretive in the sense that a researcher deliberately chooses to describe an event in terms of a conceptual, philosophical, or other highly abstract frameworks or systems. The description in qualitative descriptive studies entails the presentation of the facts of the case in everyday language. In contrast, phenomenological, theoretical, ethnographic, or narrative descriptions re-present events in other terms, obliging researchers to put much more of their own interpretation on what they see and hear (**Sandelowski, 2000)**. It can be concluded that researchers can confidently describe their research design as qualitative description without excluding the

fact that an exercise of thought, practice of analysis, activity of reflection, and interpretation takes place **(Bradshaw, Atkinson and Doody, 2017).**

After comparing qualitative description with the four traditional qualitative methods that are commonly used in healthcare research, qualitative description was the most appropriate study design in the current study for several reasons. Initially, a researcher conducting qualitative description will stay closer to their data and to the surface of words and events, making these a vehicle for the voices of those experiencing the MTM service in order to help transform healthcare services by developing effective, culturally sensitive interventions and making policy recommendations **(Sullivan-Bolyai, Bova and Harper, 2005; Bradshaw, Atkinson and Doody, 2017).** Meanwhile, a mixed-methods study was to be conducted, as qualitative description ties in nicely with quantitative data and is useful for mixed-methods inquiries since it can give very important and useful information that is suitable for intervention development, conceptual clarification of underlying scale development, and needs assessments (**Neergaard, 2009**, **Sullivan-Bolyai, Bova and Harper, 2005).** Finally, many practice related research questions can be answered by qualitative description since the researcher can learn from the descriptions of the patients and use this information to influence interventions **(Sullivan-Bolyai, Bova and Harper, 2005; Bradshaw, Atkinson and Doody, 2017**). Furthermore, it is a way of gaining a first insight into the informants' views of an intervention (**Neergaard, 2009**). Therefore, the

findings from this approach can often be of special relevance to practitioners and policy makers (**Sandelowski, 2000; Bradshaw, Atkinson and Doody, 2017)**.

CHAPTER 4 Methods

4.1 Chapter overview

In previous chapter, I discussed research methodologies in this thesis, and I justified the decision to use a mixed-methods methodology. In this chapter, I start with describing the methods that I have used to study the effectiveness of pharmacist-led MTM service and explore patients' experience and views about the service. Building on the methodology, the design and procedures, sampling, sample size, subject recruitment, outcome measures, data collection and instruments used and data analysis for the study are discussed. At the end of this chapter, process evaluation component for this project has been discussed as well.

4.2 Research ethics approval

The author ensured ethics remained a top priority throughout the study. Given the nature of research study, the study received the ethics approvals from Princess Nourah bent Abdulrahman University (Approval # 20-0240) (**APPENDIX IV-A**), King Fahad Medical City (Approval # 20-388E) (**APPENDIX IV-B**) and Birmingham University (Approval # ERN_20-0768) (**APPENDIX IV-C)**. In addition, approval was also obtained from the study site, Innova Saudi Health Care Company (**APPENDIX IV-D**).

Soon after, an amendment to the protocol was deemed necessary before the study could begin, and so an ethics committee notice was submitted to the Princess Nourah bent Abdulrahman University and King Fahad Medical City, for review. In regard to Birmingham

University the ethical approval was not yet received so the amendment was not required. Later the committees gave the amendments ethical approvals as shown in the appendixes (**APPENDIX IV-E and F, respectively**). The amendment included: a reduction in the questionnaires used; from five to three questionnaires (The MARS-5 **(APPENDIX IV-G)**, Diabetes Distress Scale (DDS) **(APPENDIX IV-H)** and Patient Satisfaction with Pharmacist Services 2.0 (PSPS 2.0) Questionnaire **(APPENDIX IV-I)**. These changes were made to improve response rate and to reduce patient burden. Note that the participant recruitment began only after obtaining the ethical approvals.

During the 2nd year viva, the examiners suggested to undertake process evaluation as well in order to better understand the dynamics of the intervention. Subsequently, another ethics amendment was submitted to the ethics committees of Princess Nourah bent Abdulrahman University, King Fahad Medical City and Birmingham University, for review. Later the three committees gave the amendments ethical approvals as shown in the appendixes **(APPENDIX IV-J)** from Princess Nourah bent Abdulrahman University**, (APPENDIX IV-K)** from King Fahad Medical City and from Birmingham University **(APPENDIX IV-L).** The amendment included: interview key stakeholders (clinical pharmacists providing the service, pharmacists working in the CP, physicians referring patients to the services and the pharmacy owner).

Full written informed consents were sought from all participants for their participation before randomisation. Since there were two phases of the study in addition to the process evaluation, three participant information sheets with consents forms were used. (**APPENDIX IV-M, N and O, respectively)**. The participation was voluntary, that they have their right to not obliged to participate and could withdraw from the study at any stage without giving a reason without adversely affecting the provided care.

The confidentiality of research participants and the protection of data were ensured. Only authorized individuals were allowed access to the database. Google Drive was used as password-protected server to save data electronically. All consent forms were kept in author's office inside a lockable cabinet. The paper materials related to each participant were stored in a binder, this binder was kept inside a lockable cabinet at the author's office. Each interview was recorded with two audio recorders and then transferred to Google Drive. Once transferred, the audio recordings were deleted from both recorders prior to the next interview.

4.3 Study protocol and registration

The study protocol was published in Saudi Pharmaceutical Journal **(Albabtain *et al.,* 2021)** and registered with the International Standard Randomised Controlled Trial Network (ISRCTN) on 12th December 2022 (ISRCTN60703981, https://doi.org/10.1186/ISRCTN60703981) **(Albabtain *et al.,* 2022).**

4.4 Reporting

Reporting of the mixed-methods study follows the Good Reporting of a Mixed-Methods Study (GRAMMS) **(O'Cathain, Murphy and Nicholl, 2008)** and the CONSORT guidelines for randomised pilot and feasibility trials was followed in reporting the pilot RCT (phase one) **(Eldridge *et al.,* 2016)**. While the reporting of the process evaluation conforms to the Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare: revised guideline (CReDECI 2) **(Mohler, Kopke and Meyer, 2015).**

4.5 Study aim and objectives

The study aimed to investigate the effectivness of community-pharmacist-led MTM service and to explore patients' views and experience about the service. This study sought to answer the following research questions: The specific research questions were:

1) What is the effect of CP-based MTM service compared to standard care on diabetic patients' health and clinical outcomes?
2) What is patients' experience and views about the community-pharmacist-led MTM service?

4.6 Setting

The study took place in Riyadh City, KSA. The study conducted in the Health Kingdom Community Pharmacy (HKCP). This private CP is linked to Dwaek Medical Centre. The Health Care Centre comprises 19 clinics with a broad range of specialties. Moreover, the Centre receives large number of patients with different health conditions on a daily basis who are managed, treated, and followed up as outpatients. In regular duty, the opening hours are from eight morning to midnight. An electronic prescribing system, Ministry of Communications and Information Technology (MCIT), is used in the centre. The Centre's laboratories perform all hematology, biochemistry, microscopic, hormonal and serological tests.

4.7 Overall study design

As mentioned in chapter three, a mixed-methods methodology with embedded design was used to evaluate the effectiveness of pharmacist-led MTM service. An embedded design consisting of two components, a pilot RCT and semi-structured interviews. The data were collected sequentially and independently. Figure 4.1 shows the flow of the study.

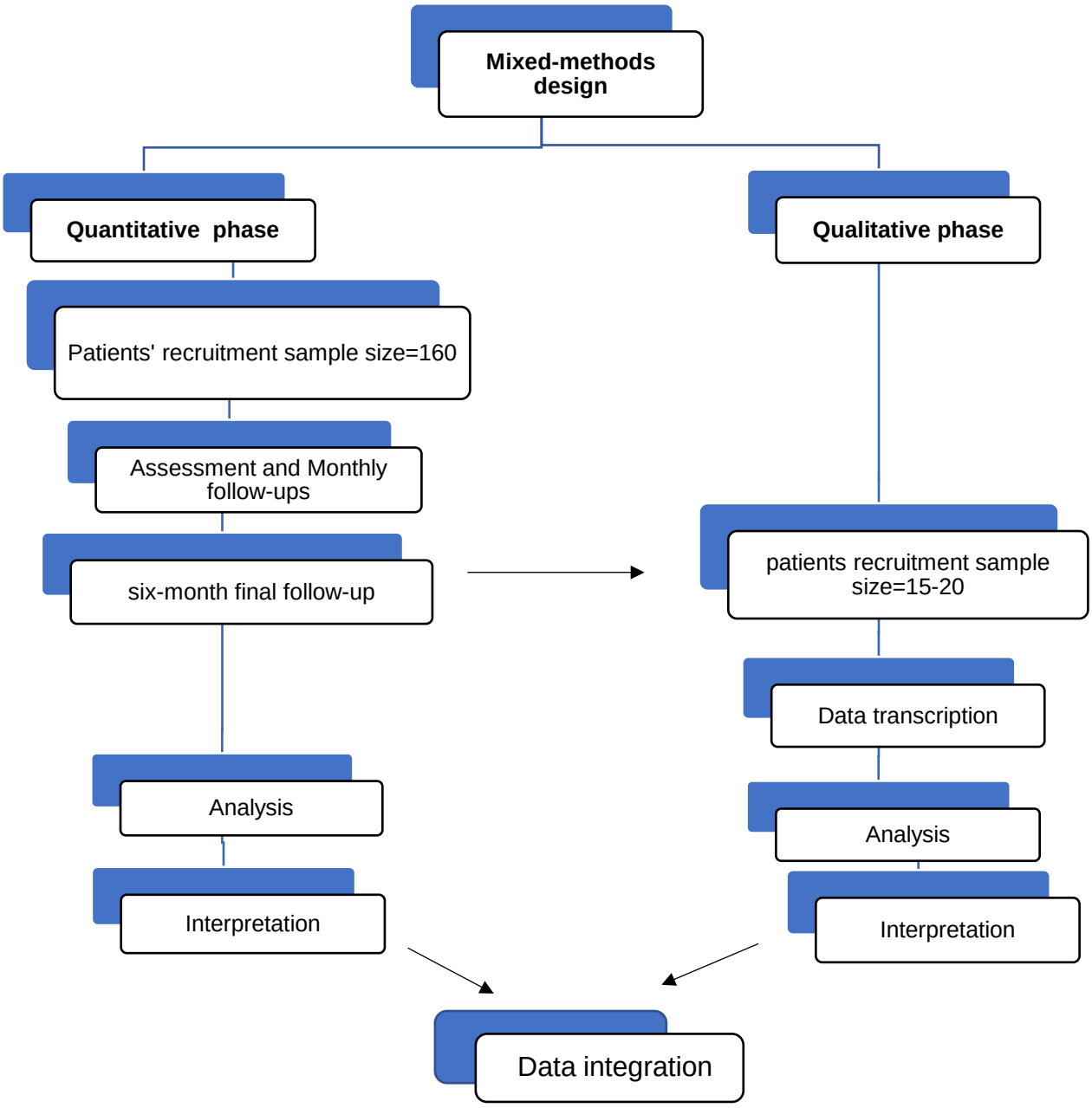


Figure 4.1: The research process

4.8 Phase one (quantitative study)

This was a two-arm, open-label, parallel-group, pilot RCT to examine potential impact of an intervention. The two arms include an active arm where participants received MTM service and a control arm where participants received standard care only.

4.8.1 Description and delivery of the study intervention

4.8.1.1 All participants

All participants were followed for six-month. Participants in both arms had one face to face visit at the baseline and at two follow-up assessment points. During the follow up, the participants were asked for any hospitalization or ED visits and an updated medication list. Medical records were also accessed to collect vitals and the following lab tests: HbA1c, lipid profile, albumin-to-creatinine ratio (ACR) and serum creatinine (SCr). The participants filled the study questionnaires (MARS-5 and DDS) before baseline visits and after the end of the study, while PSPS 2.0 questionnaire was filled at the end of study only. The CONSORT flow diagram outlines the patient flow **(Figure 4.2).**

4.8.1.2 Intervention group

The participants had a total of seven pharmacist interactions (at week 0, 4, 8, 12, 16, 20 and 24). Participants randomised to MTM arm received:

1- Initial face to face visit (≈ 60 min) with the MTM-pharmacist to conduct a MTR.

2- At the end of the visit, participants received a PMR.

3- Participant received a MAP. The action plan serves as a patient-centred document to assist the patient and pharmacist in the resolution of identified DRPs. Collaborative drug therapy management (CDTM) generated and signed by physicians to enhance the collaboration process between physicians and pharmacists.

4- At the end of the session, the participant received a referral form if needed.

5- Participants also received a follow-up call or clinic visit every month, lasting ten to twenty minutes. Arrangements were made with the participant regarding time and date. During the monthly follow-up, the pharmacist:

   a. assessed patient understanding of their medications.
   b. reviewed medications and home monitoring, if applicable.
   c. identified and resolved any new DRPs.
   d. provided additional education, if needed.

6- In the patient medical record (MCIT), the pharmacist documented patient visits and phone calls.

7- Additional follow-up was conducted based on participants' individual needs.

Week 0:

- Consent was obtained.
- MTM review was conducted face to face as illustrated above.

- Participants were asked for any hospitalization or ED visits during the last year and updated medications list.
- Lab results were obtained from medical records.
- Baseline Note- for intervention patient was filled **(APPENDIX IV-P).**
- Date and time arranged for assessment points at 12 and 24 weeks and for monthly follow up.

Week 12 and 24:

- The follow-up took place either by phone call or clinic visit.
- MTM review was conducted as illustrated above.
- Participants were asked about any hospitalization or ED visits and updated medications list.
- Lab results were obtained from medical records.
- Follow-up Note, at three-month and six-month –for intervention patient was filled **(APPENDIX IV-Q)**

Week 4, 8, 16 and 20:

- Monthly phone calls were conducted as illustrated above.
- Monthly follow up Note, for intervention patient was filled **(APPENDIX IV-R).**

4.8.1.3 Control group

The participants in the control group received standard care provided by the pharmacist during the routine dispensing of medications. The standard care defined as one-time verbal education about their medications and answered any patient questions. Participants in this group continued to visit the pharmacy to refill prescriptions without further intervention and no restriction on contacting the pharmacist for advice should they wish to. Follow up visits were arranged at week 12 and week 24.

Week 0:

- Consent was obtained.
- Face to face visit for one-time verbal education about their medications.
- Participants were asked for any hospitalization or ED visits during the last year and updated medications list.
- Lab results were obtained from medical record.
- Baseline Note- for control patient was filled **(APPENDIX IV-S).**
- Date and time arranged for assessment points at 12 and 24 weeks.

Week 12 and 24:

- The follow-up took place either by phone call or clinic visit.
- Participants were asked about any hospitalization or ED visits and updated medications list.

- Lab results were obtained from medical record.
- Follow-up Note, at three-month and six-month –for control patient was filled **(APPENDIX IV-T).**

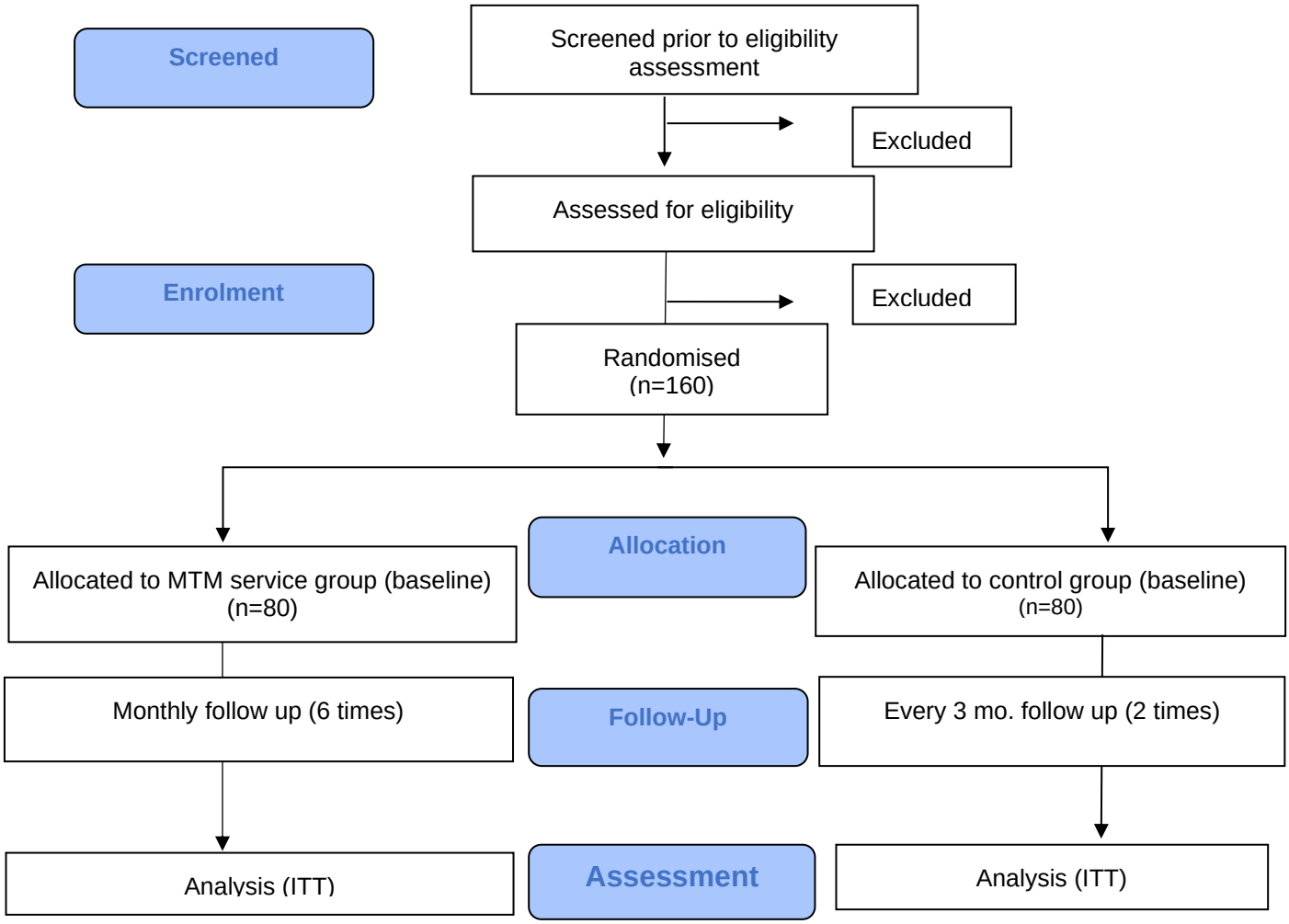


Figure 4.2: Consolidated standards of reporting trials flow diagram of the study design

4.8.1.4 Patients lost to follow-up

Participants were reminded of their follow-up by a phone or by text messages, before their scheduled follow-up phone calls. Those who did not answer (either the intermediate or final evaluation) were contacted via phone till the end of the study. If the participant did not respond, they were considered lost to follow-up.

4.8.2 Patient recruitment

The researchers' team met with the physicians at the health centre to introduce the study. This was important to facilitate the recruitment process. During the study period, physicians informed all eligible patients attending the health care centre about the study. The posters explaining the study were displayed in the lobby of the medical centre and clinics.

Eligible patients who were interested in the study, were handed a patient information sheet and referred by their physicians to the research coordinator office. At the office, all referred patients were assessed for eligibility. Verbal and written consent was obtained from all eligible patients by the author.

Interested participants were randomised in a 1:1 ratio to receive either MTM services or standard care. Randomisation was provided by author who was not directly involved in patient care. An allocation sequence based on a computer-generated list of random

numbers to allocate patients to either group to avoid selection bias was used. Sequentially numbered tamper-proof opaque sealed envelopes were used to conceal sequence allocation.

Considering the unique nature of the intervention, it was not possible to blind the pharmacists delivering the intervention or the patients. However, the data collection process was double checked by two researchers and the researchers who responsible for data analysis were blinded which reduced bias and increase fidelity. The physicians, from where patient's referral took place, were also blinded to allocation.

Since patients from both groups were attended same pharmacy the contamination could arise. We as team kept in mind the contamination issues to avoid it. Recruitment continued until the required number of participants were enrolled.

4.8.2.1 Eligibility criteria

Participants were selected according to the following eligibility criteria:

4.8.2.1.1 Inclusion criteria

Patients with uncontrolled diabetes, age 18 years and older, any sex and able to provide informed consent. The participants should have a *continuous active* status with the medical centre (defined as having at least one visit in the six-month period prior to

screening). All participants should be able to communicate in the Arabic or English language. Diabetes was chosen as the target population of this intervention as it has a high prevalence with high economic burden in KSA. Diabetes was the 3rd ranked risk factor for disability-adjusted life years in KSA **(Alhowaish, 2013; World Health Organization, 2013; Ministry of Health, 2019b; International Diabetes Federation, 2020)**.

4.8.2.1.2 Exclusion criteria

Patients diagnosed with severe mental illness, dementia and those with significant cognitive impairment (Mini-Mental State Examination score of <24). Patients with gestational diabetes. Acutely ill patients with unstable complications or with advanced illness as assessed by the physician. Patients who did not have the capacity to consent to take part in the study. Patients who did not have their recent clinical measurements, past medical and medication history.

4.8.3 Sampling

The sequential mixed-methods sampling technique was used for the current mixed-methods study. Sequential quantitative-qualitative sampling is the most common technique in the mixed-methods literature, as described by Kemper *et al.* (2003) **(Kemper, Stringfield and Teddlie, 2003)**. In sequential mixed models' studies, information from the

first sample (typically derived from a probability sampling procedure) is often required to draw the second sample (typically derived from a purposive sampling procedure) **(Kemper, Stringfield and Teddlie, 2003).** In this study, probability sampling was associated with quantitative research and purposive sampling was used in qualitative research **(Teddlie and Yu, 2007)**. In the following paragraphs, I shall discuss the probability sampling while the purposive sampling will be discussed under sampling section later in the phase two study.

Probability sampling used in quantitative research where aim to achieve representativeness. There are four types of probability sampling: random sampling, stratified sampling, cluster sampling and sampling using multiple probability techniques **(Teddlie and Yu, 2007)**. In the first (quantitative) phase, a probability random sampling technique was used to recruit patients and limit selection bias.

4.8.4 Sample size

The sample size for the pilot RCT was calculated in order to power the study to evaluate the effectiveness of the MTM service alongside the assessment of the service feasibility. Therefore, sample size calculation was based on previous research and Cohen's power tables **(Cohen, 2013)**. Using HbA1c (primary outcome), a medium effect size of 0.5 at six-month between the two groups, 80% power and 5% two-sided significance level the sample size was calculated to be 128 subjects, 64 in each study group. The effect size of

0.5 for a pharmacist-based diabetes management service was in the middle of the range of effect sizes calculated from studies of such services reported in a review by Wubben and Vivian **(Wubben and Vivian, 2008).** However, with an anticipated 20% attrition rate, 160 patients were assumed to be sufficient.

4.8.5 Data collection

Data collection for outcomes was carried out at the HKCP. The data were collected by the author using standardised data collection sheet (note and electronic) **(APPENDIX IV-P, Q, R, S, T)** which was designed by the author and reviewed for accuracy and adequacy by the supervisors. Moreover, the data collection sheet was piloted before enrolling patients to the study.

Participants demographic characteristics, vital sign, lab tests, medical history, past and current medications, and outcomes of interest were collected by the pharmacist and reviewed and entered by the author at baseline, three-month, and six-month, through patient interviews (face to face or through the phone) and by using the computerized patient's medical records**.**

Following the patients' written informed consent, the author asked them to complete two questionnaires in the coordinator's office (MARS-5 and DDS) **(APPENDIX IV-G and H, respectively)** prior to their first pharmacist visit to either for MTM service or standard care.

Later, at six-month final follow up, in coordinator office the author collected the same set of questionnaires (MARS-5 and DDS) in addition to PSPS 2.0 questionnaire from all participants (details provided below section 4.8.6.5, 4.8.6.6 and 4.8.6.7) **(APPENDIX IV-G, H, I, respectively)**.

4.8.6 Outcome measures

Table 4.1 shows the outcome measures and respective scales.

Primary outcome:

- Change in HbA1c (%) from baseline.

Secondary outcomes:

- Degree of changes in clinical parameters from baseline.
- Number and types of DRPs.
- Health services utilisation.
- Pharmacist consultation time per participant.
- Number and type of referrals (to dietitian, podiatrist, ophthalmologist).
- Number of visits/FU per patient.
- Patient medication adherence.
- Diabetes distress (DD).
- Patient satisfaction with pharmacist services.

Table 4.1: Outcome measures and scales

Outcome measures	Time	Scale
Clinical parameters	At baseline, three and six-month follow up	BP (mmHg) and Blood test for HbA1c (%), Lipid profile (mg/dL), ACR (mg/g) and SCr (mg/dL)
Feasibility of study	At baseline, three and six-month follow up	-Number of visits/FU per patient through patients report. -Pharmacist consultation time per participant (minutes) through pharmacist's report. -Number and type of referrals (to dietitian, podiatrist, ophthalmologist) through pharmacist's report.
DRPs	At baseline, three and six-month follow up	Number and types defined by Cipolle, Strand, and Morley (1998) **(Cipolle, Strand and Morley, 1998)**
Health services utilisation	At baseline, three and six-month follow up	Number for hospitalization or ED visit related to DM, HTN, and DLD complications during the study period through patients report.
Patient medication adherence	At baseline and six-month follow up	The MARS-5 questionnaire **(Horne, Weinman and Hankins, 1999) (APPENDIX IV-G)**
Diabetes distress	At baseline and six-month follow up	DDS questionnaire **(Polonsky et al., 2005) (APPENDIX IV-H)**
Patient satisfaction with pharmacist services	At six-month follow up	PSPS 2.0 questionnaire **(Sakharkar et al., 2015) (APPENDIX IV-I)**

4.8.6.1 Clinical parameters

The glycated hemoglobin blood test (HbA1c) was used to measure study participants' diabetes control. HbA1c is formed by the irreversible attachment of glucose particles to the N-terminus of haemoglobin β-chain **(Marshall and Barth, 2000)**. HbA1c is typically measured every three-month, as it reflects average glycaemia over approximately three-

month **(American Diabetes Association, 2019; National Institute for Health and Care Excellence, 2015; National Institute for Health and Care Excellence, 2022).**

HbA1c, was chosen as primary outcome for several reasons. First, several medical organisations advocate and use it as a biomarker of pharmacotherapy efficacy to ensure optimal health outcomes for diabetic patients in clinical research. Second, the decision to use HbA1c allowed standardization in the measuring patients' glycaemic levels, resulting in a better interpretation of trial results and comparison with other studies. Finally, HbA1c is an important marker for an individual's risk of developing diabetes complications **(American Diabetes Association, 2019; National Institute for Health and Care Excellence, 2015; National Institute for Health and Care Excellence, 2022).**

4.8.6.2 Feasibility of study

In general, a feasibility study is primarily concerned with the delivery and workability of the project. In this study I examined the feasibility of delivering MTM service at a CP setting through assessing whether an intervention is feasible in practice and investigating the types of settings, situations, or circumstances that are more or less likely to be effective.

Various variables regarding the feasibility of the study were collected (number of visits/FU per patient, time spent by the pharmacist in counselling patients in each visit and number and type of referrals) thorough patient interviews and patients' medical records.

4.8.6.3 Drug-related problems

There are several definitions of a DRPs in the literature but all of them are very similar. In 1998, Cipolle and his colleagues defined a DRPs as “any undesirable event experienced by a patient that involves, or is suspected to involve, drug therapy, and that interferes with achieving the desired goals of therapy and requires professional judgment to resolve”. Identifying a DRPs is a clinical judgment that detect the association between the patient's medical condition and the patient's pharmacotherapy **(Cipolle, Strand and Morley, 1998).** The purpose is to help patients achieve their goals of therapy, realize the best possible outcomes from drug therapy and avoid the consequence result in drug-related mortality and morbidity which pose a major problem to healthcare systems **(Krahenbuhl-Melcher *et al.,* 2007).**

Several classification systems are being used globally **(Van Mil *et al.,* 2004)**. In this study classification system proposed by Cipolle RJ *et al.* was used. It categorizes DRPs to seven distinct categories: additional drug therapy needed, drug without indication, ineffective drug, ADR, drug dose too low, drug dose too high, noncompliance. It is commonly used in practice, easy to use, and have proved useful in pharmacy practice **(Cipolle, Strand and Morley, 1998).**

4.8.6.4 Health services utilisation

Health care utilisation measures are central indicators of the performance of the health care system, as improved health status is the major goal **(Crozier, 1985).** Health services utilisation can be assessed from two perspectives: the patients or the physicians. The patient's perspective is somewhat subjective because it is based on patient-reported services (**Da Silva *et al.,* 2011**). The second perspective by physicians is more objective, because it is usually recorded in databases (**Da Silva *et al.,* 2011**). However, the patient's perspective, through patients interviews either face to face or telephone, is the perspective that I used in this study, because patients report more applicable compared to second perspective founded on database. The database in Saudi health system is still not well build and not connected **(World health organization, 2013).**

The use of emergency services and hospitalization are the best health service utilisation indicators in the expression of access to health system **(Chaves *et al.,* 2019)** and were commonly used in medication review studies **(Jodar-Sanchez *et al.,* 2015; van der Meer *et al.,* 2018; Schulz *et al.,* 2019; Verdoorn *et al.,* 2019).** Therefore, emergency services and hospitalization data were selected in this study as health service use indicators. Patients were asked how often they were visited ER and admitted to the hospital related to DM, HTN, and DLD complications in the previous months, and if hospitalized, the reasons of hospitalization and ER visits were reported.

4.8.6.5 Patient medication adherence questionnaire

Adherence to medications is generally poor and is challenging in chronic conditions particularly for patients with diabetes **(Cramer, 2004; Thier *et al.,* 2008).** The measurement of patients' adherence to treatment is controversial and fraught with methodological problems **(Rudd, 1993).** Even though no 'gold standard' of adherence measurement has been defined yet, there are main methods that can be direct (eg, observation and biological methods) and indirect (eg, pill counts, electronic medication monitors, prescription refill and self-report) each of which confers different advantages and disadvantages **(Farmer, 1999; Osterberg and Blaschke, 2005).**

For this study it was not possible to use other methods to assess adherence including the direct methods because such methods are often not practical on a long term basis due to their intrusive nature and are resource-intensive. Since the study was not evaluating adherence to a single medication, making direct methods even more impractical. Pill counts were not chosen for this research, because the medication is not arranged in blisters but in their original containers from CP. Whilst electronic medication monitors are able to provide a detailed profile of usage over time, the opening of the container does not guarantee ingestion of the medication. An additional issue was that they are expensive and this trial did not have external funding to provide patients with the any device. Importantly, electronic monitors cannot be fitted to many of the conventional dosage forms and packaging used in practice **(Farmer, 1999; Riekert and Rand, 2002; Chan *et al.,***

2013). In addition, prescription refills although objective and easy to perform also require a closed pharmacy system which is not yet applicable in the Saudi health system **(World health organization, 2013).** The trial has a prospective design and prescription refills could be best used for retrospective designs. Finally, most measures of adherence require that the patient is given prior warning of monitoring and this may constitute an intervention that might influence adherence behaviour. In contrast, self-report offers a convenient, "spot check" estimate of adherence behaviour. **(Ley and Llewellyn, 1995)**

The Medication Adherence Report Scale-5 **(Horne, Weinman and Hankins, 1999),** a self-reported questionnaire, was used in this study. Self-reported questionnaires have the benefits of being cheap, quick, efficiency, easy to administer and non-intrusive. Additionally, self-reporting can reveal patterns of medicine use and what leads to noncompliance by gathering social, situational, and behavioural factors **(Fialko *et al.,* 2008; Stirratt *et al.,* 2015)**. Nevertheless, self-report measures have been increasingly applied during the past decade to assess drug adherence in multiple patient populations **(George *et al.,* 2005; Jonsdottir *et al.*, 2010; Garfield *et al.,* 2011).** Many self-report questionnaires have been developed to explore non-adherence and patient's beliefs about medications (i.e MARS-5, BMQ, MMAS-8 and Adherence to Refills and Medications Scale (ARMS)) **(Alsous *et al.,* 2017)**.

The Medication Adherence Rating Scale (MARS), a ten-item self-report instrument, was developed by Thompson and her colleagues **(Thompson, Kulkarni and Sergejew, 2000).** It was developed from two existing scales, the 30-item Drug Attitudes Inventory **(Hogan, Awad and Eastwood, 1983)** and the 4-item Medication Adherence Questionnaire **(Morisky, Green and Levine, 1986),** with the aim of developing a more reliable and valid tool for assessing medication adherence behaviour in psychosis.

The MARS-5, a shorter version of MARS-10 that is modified to offer more details and differentiability between individuals **(Horne, Weinman and Hankins, 1999),** was used in this study. The choice was supported by a review by Clifford S and her colleagues in 2014, they examined a wide range of methodologies used to assess medication adherence in patients with diabetes, MARS-5 was one of the most commonly used in those patients **(Clifford et al., 2014).**

The MARS-5, developed by Horne *et al.,* 1999 **(Horne, Weinman and Hankins, 1999),** addressed some limitations of the existing questionaries. Importantly, it indicates the reasons for poor adherence, which can be used to identify whether non-adherence is intentional or unintentional. Even it is effective at identifying whether patients are at risk of non-adherence **(Yan Chana *et al.*, 2020).** The MARS-5 is a quick, non-intrusive measure and can measure adherence over the course of the treatment with good validity and reliability (**Fialko *et al.,* 2008; Yan Chana *et al.*, 2020**) across different long-term

conditions including diabetes **(McAdam-Marx *et al.,* 2014; Wei *et al.,* 2017; Owiredua, Quarshie and Atorkey, 2018).** In addition, it had been used to measure medication adherence in diabetic patients in KSA **(Alyami *et al.,* 2019)**

In this study, the questionnaire was completed at the start of the study and after six-month follow-up. Arabic version of MARS-5 was used. Professor Robert Horne holds exclusive copyright of MARS-5. An agreement with the originator was signed to ensure lawful use of the questionnaire **(APPENDIX IV-U).** The Arabic translations of MARS-5 have proved to be valid and reliable tools that can be used in clinical practice to measure adherence and beliefs about medications in Arabic speaking patient populations **(Alsous *et al.,* 2017).**

The MARS-5 comprises five items that ask about the frequency with which participants did not adhere to their medication. The first item is concerned with forgetfulness (unintentional non-adherence), whereas the other 4 items are concerned with changing doses, stopping doses, skipping doses, and taking less medication than instructed (intentional non-adherence). It was scored using a five-point Likert scale ranging from “1= always” to “5= never”. Scores for each of the five items were summed to give a scale score ranging from 5 to 25, where higher scores indicate higher levels of reported adherence **(Horne, Weinman and Hankins, 1999)**. A clear cut-off point to define non-adherence has not yet been defined, with some studies using a score of ≤ 24 to indicate

non-adherence **(McAdam-Marx *et al.,* 2014),** while other studies used a score of > 20 to indicate adherence **(Wei *et al.,* 2017).** However, consistent with previous research with Arabic-speaking populations **(Alsous *et al.,* 2017)**, patients with a score of ≥ 24 were considered adherent in this study.

Adherence was measured as a continuous scale, as recommended in the literature rather than as dichotomous division into adherent/nonadherent categories **(Oppenheim, 1992)**. This method of quantifying self-report has been validated **(Morisky, Green and Levine, 1986).** Thus, the adherence scale used in this study was allowed the categorisation of patients in terms of their position along the 'adherence dimension', anywhere between complete adherence and complete non-adherence, providing more detail and differentiation between **(Yan Chana *et al.*, 2020).**

4.8.6.6 Diabetes distress scale questionnaire

Living with DM can be tough **(Polonsky *et al.,* 2005).** DD had significant effects on patients with DM. A higher level of DD was strongly associated with poor QoL, reduced psychological well-being **(Glasgow *et al.,* 1997; Jannoo *et al.,* 2017**), poor glycaemic control **(Rogvi *et al.,* 2012; Strandberg *et al.,* 2015),** and unsuccessful self-management behaviours **(Zulman *et al.,* 2012; Hammad *et al.,* 2015).** DD was also found to have a positive relationship with anxiety **(Kong *et al.,* 2013)** and depression **(Baradaran *et al.,* 2013).**

In this study, Diabetes Distress Scale was chosen to measure the participants' stress. The DDS has certain potential advantages. It is a newer scale that is considered a brief, generalisable factor structure, stable, easy to administer and clear, internally consistent, and conceptually driven measure of diabetes-related distress to be used in research and clinical practice. The DDS has comprehensible to a majority of patients (both sexes and from at least several major ethnic groups) **(Polonsky *et al.,* 2005).**

DDS was first published in 2005 by Polonsky and his colleagues and it has been used widely around the world **(Polonsky *et al.,* 2005)**. It was completed at the start of the study and after six-month follow-up. Arabic version of DDS was used to assess DD. The measure was found to be psychometrically sound for evaluating DD among Arab patients with diabetes mellitus **(Darawad *et al.,* 2017)**. Research and clinical use of this copyrighted scale is free of charge for non-profit institutions.

The DDS-17 consists of 17 items with four subscales: emotional burden (5 items), physician distress (4 items), regimen distress (5 items) and interpersonal distress (3 items). Response to each item was based on a 6-point Likert scale, rated from 1 (not a problem) to 6 (a very serious problem) concerning diabetes for the past one-month. The total mean item score was calculated by summing up the responses to all items and dividing by 17. A higher score indicates higher distress level with considered clinically significant if total or subscale score > 2.0 (moderate distress) which may be helpful to

inquire further or to begin a conversation with patient. Participants categorized to little or no distress if score < 2.0, moderate distress if score 2.0 -2.9 and high distress if score > 3.0 **(Polonsky *et al.,* 2005).**

4.8.6.7 Patient satisfaction with pharmacist services 2.0 questionnaire

Patient satisfaction with health care services has gained increased attention as a valuable indicator to measure and improve the quality of healthcare services **(Sakharkar *et al.,* 2015; Hassali *et al.,* 2018b).** Furthermore, researchers such as Donabedian recommended measuring ‘‘patient satisfaction’’ as an outcome of care **(Donabedian, 1966).** Since then, patient satisfaction is referred to as a humanistic or patient reported outcome that, in addition to clinical and economic outcomes, serves as an important determinant of the success, viability and sustainability of health care services **(Aharony and Strasser, 1993)**

In the present study, PSPS 2.0 questionnaire, developed by Sakharkar *et al.,* 2015 (**Sakharkar *et al.,* 2015)**, was used to determine the value of pharmacist-run services conducted among diabetic patients. PSPS 2.0 questionnaire is a validated and reliable instrument for measuring patient satisfaction with pharmacist services. PSPS 2.0 questionnaire was chosen for the present study because of several advantages. The PSPS 2.0 questionnaire most common type of instrument used for validation process, since it is reproducible, psychometric tested and relatively simple to use in practice;

scoring of the questionnaire is easy and satisfaction scores can be compared with other pharmacies or within a single pharmacy over time. Moreover, it useful for measuring patients' reactions to improve or change in the pharmacy services. The validity and reliability of the instrument have been documented for measuring patient satisfaction with pharmacists providing services in different languages and setting including the CP **(Sakharkar *et al.,* 2015, Hassali *et al.,* 2018b; Shrestha *et al.,* 2020)**

The questionnaire directions instructed participants to evaluate satisfaction with the recent pharmacist services. It was administered to participants after six-months' follow up. The PSPS 2.0 questionnaire consisted of 20-items related to three domains identified as quality of care (10 items), interpersonal relationship (pharmacist/patient) (6 items) and overall satisfaction (4 items). It assessed patients' level of agreement with 4-point, Likert-type scale (strongly agree, agree, disagree, and strongly disagree). Based on this, the mean level of satisfaction of patients was calculated by averaging their ratings for the 20 parameters of measuring satisfaction. The resulting mean was interpreted by considering the closest Likert scale to it **(Sakharkar *et al.,* 2015).**

Drs. Anandi V Law and Mark Bounthavong have the exclusive copyright for PSPS 2.0 questionnaire. A non-commercial license agreement was signed to enable the use of PSPS 2.0 questionnaire in this research project **(APPENDIX IV-V)**. The questionnaire was administered in Arabic. The availability of the PSPS 2.0 questionnaire in Arabic version

would facilitate patient satisfaction and enhance pharmacy services in KSA. Since there are no Arabic version, the translation and cross-cultural adaptation were carried out and described in the next section.

4.8.6.7.1 Translation, cross-cultural adaptation of patient satisfaction with pharmacist services 2.0 questionnaire into the Arabic version

To date, there is no Arabic version of PSPS 2.0 questionnaire for use in the local setting of KSA. Hence, the translation and culturally adaptation of PSPS 2.0 questionnaire into the Arabic version was done for measuring patient satisfaction with the CP services provided by pharmacists in KSA.

Formal permission to translate and culturally adapt the instrument PSPS 2.0 questionnaire was granted before testing from the authors via email. The translation and cultural adaptation of the PSPS 2.0 questionnaire into Arabic language follows the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) Good Practice Guidelines for linguistic and cultural adaptation **(Wild *et al.,* 2005).** This guideline was recommended by PSPS 2.O questionnaire authors to ensure the translated version would be grammatically sounded and the terms used were correct. At the same time, meanings and contents of original PSPS 2.0 questionnaire were well preserved. The translation and cross-cultural adaptation process explained in Figure 4.3 in seven different stages:

Stage 1 (forward translation):

The forward translation of the original English version of PSPS 2.0 questionnaire to Arabic (A1 and A2) was performed independently by two bicultural, native Arabic speakers (GA and AB) with a good command of English. One of the translators was academic pharmacist (GA) and another was a medical physician (AB).

Stage 2 (reconciliation):

The two Arabic forward translated versions were evaluated, revised and critically appraised by the researcher team along with the two forward translators in order to produce a single “reconciled version” of the translated questionnaire (A12).

Stage 3 (backward translation):

The reconciled version (A12) was then back-translated into the source language (English) by another pair, independent back-translators (MY and GK) one of the translators was clinical pharmacist (MY) and another was an academic pharmacist (GK). The translators were bicultural, native Arabic speakers who were also fluent in English. During translation, translators were asked to report any difficulties.

Stage 4 (back-translation panel review of the back translation):

Both back-translations (E1 and E2) were compared and reviewed by the researcher team against the original English version to ensure the conceptual equivalence of the translation and identify any discrepancies. Necessary modifications were made to the items to

generate reconciled version (E12). Then, the reconciled version (E12) was sent via email to the questionnaire developer for review and feedback. After reaching consensus, approved preliminary of the translated Arabic version “intermediate version” of PSPS 2.0 questionnaire was used in the pilot study.

Stage 5 (cognitive debriefing):

After ensuring consistency between the translated and original English versions, the author pre-tested the preliminary Arabic version of PSPS 2.0 questionnaire in a small group of ten conveniently selected patients who received CP services. Patients visited the HKCP and received the services from the pharmacist were approached. The HKCP is one of a private medium-sized-chain pharmacy group, which linked to private Polyclinic Medical Centre (Dwaek Medical Centre). The HKCP consist of MTM clinic, where the main study was conducted. To adequately represent the target population, the subjects were selected from one CP that have MTM clinic which is the only available clinic, since the MTM service is a new service introduced in the Saudi CP.

Patients responded to the PSPS 2.0 questionnaire Arabic version and then evaluated it for intelligibility, appearance, clarity, and wording. Patients were also encouraged to give suggestions for improvement. Aiming to assess the level of comprehensibility and cognitive equivalence of the translation and test any translation alternatives, highlight any

items that may be inappropriate at a conceptual level and identify any other issues that cause confusion on understanding the questions.

Stage 6 (review of cognitive debriefing results and finalization):

The researcher team reviewed and incorporated the findings that results from cognitive debriefing to improve the performance of the translation and identifies translation modifications necessary for improvement. Following agreement on changes, the translation of Arabic version of PSPS 2.0 questionnaire was finalized.

Stage 7 (proofreading):

The researcher team checked the final translation and corrected any errors in spelling, diacritical, grammatical, or other errors which have been missed during the translation process.

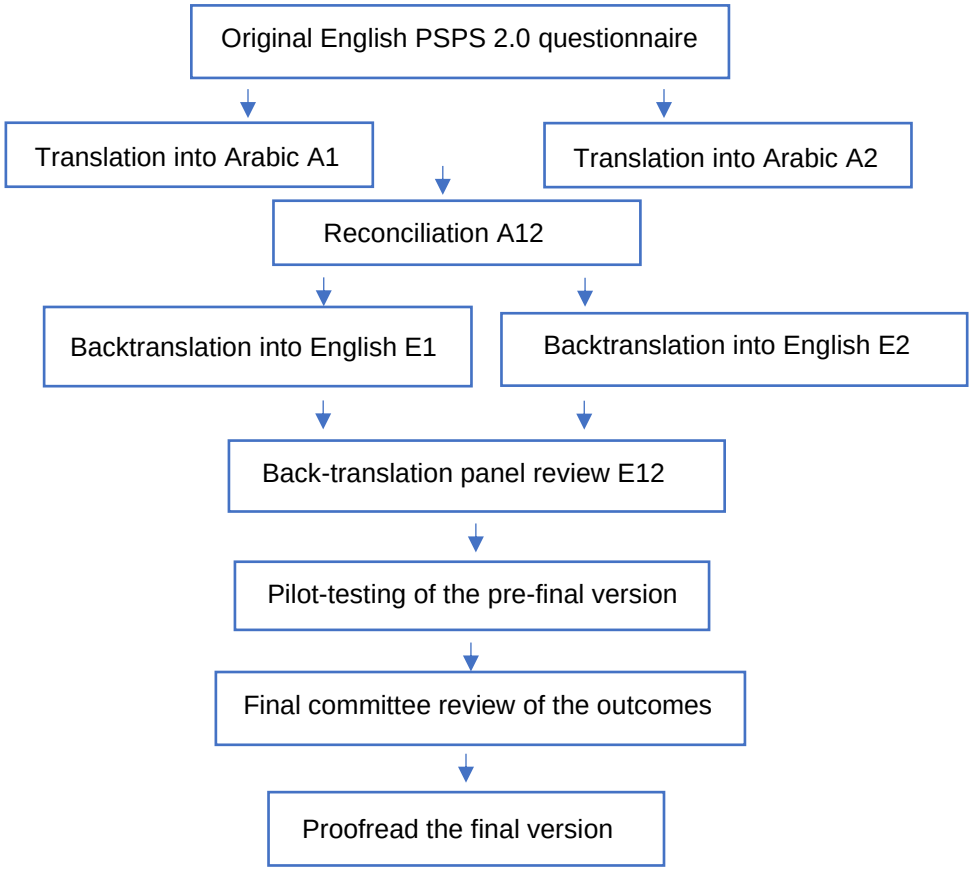


Figure 4.3: Overview of the process of translation and cross-cultural adaptation of the PSPS 2.0 questionnaire

4.8.7 Data analysis

All statistical analyses were performed using statistical software package developed by StataCorp (Stata/SE 17) to analyse the impact of the intervention by comparing baseline, three-month, six-month changes between the intervention and control groups. The quantitative data were coded numerically and directly entered in the Stata/SE 17. The

results of questionnaires were also exported to Stata/SE 17 for further analysis after scoring had been completed. Subsequently a code sheet was prepared.

The dataset consisted of three types of data: count, continuous and categorical data. For continuous data there were two types; normally distributed and non-normally distributed (skewed) data. The skewness value was calculated using Stata/SE 17 and considered normal if it fell between +1 and -1.

Outcomes for count and categorical variables were compared using chi square tests and reported as numbers and percentages. While the continuous variables were analysed using: paired t-tests to examine the effect within each study group, and independent sample t-tests to examine the effect between the study groups if normally distributed data and reported as means (SD) and Mann Whitney test if non-normally distributed data and reported as medians (interquartile range (IQR)). P values with two-tailed significance levels of 0.05 were used.

Different analysis tests were used with different outcomes. For continues variables (HbA1c, BP, lipid profile and SrCr), linear regression was used. For categorical variables, logistic regression was used to calculate binary variables (MARS-5 questionnaire) and ordinal logistic regression was used to calculate more than two categories (DDS questionnaires). Additionally, firth logistic regression for healthcare utilisation and linear regression with robust standard error was used for ACR. In addition, an intention-to-treat

analysis (ITT), in which all patients recruited to the study were included in the analyses irrespective of whether they received the full intervention or remained in the study until completion, was undertaken to avoid withdrawal bias.

4.9 Phase two (qualitative study)

A descriptive qualitative study using individual face-to-face semi-structured interviews was conducted with a sample from patients who were randomised to the intervention arm (MTM group). The primary objective of the qualitative phase was to explore patients' views around their experiences with the CP based MTM service.

The rationale for choosing a descriptive qualitative design has been explained in chapter 3. In the following sections, delivery of the interview, procedures for subject recruitment, sampling, sample size and data collection, management and analysis are explained.

4.9.1 Description and delivery of the interview

For the present study, all interviews were conducted by the author individually, face to face, in the clinic. All interviews were conducted within one week upon completion of the MTM service. Furthermore, two digital audio recorders were used to record the interviews. Using a tape recorder has the advantage that the interview report is more accurate than writing out notes **(Opdenakker, 2006).** The author briefly described purpose of the interview and measures taken to ensure confidentiality. Following this, the format and the

estimated length of the interview were clarified. After explanations, patients were asked to sign the consent form **(APPENDIX IV-N)** and permission to audio record the interview was also obtained.

Data collection for the interest demographic characteristics, medical history, lab tests and outcomes for all participants was collected by data collection sheet **(APPENDIX IV-W)** which designed by the author and reviewed for accuracy and adequacy by the supervisors.

The topic guide was developed to ensure uniformity **(APPENDIX IV-X),** constructed based on the study objectives and literature review. As a result, the topic guide covers the following area: expectations from the service and prognosis; efficacy of the service; understanding and self-management; interaction with pharmacist; and overall satisfaction with the service. After preparing the topic guide, the author discussed it with her supervisors, who have substantial experience conducting qualitative research, and amended it accordingly. Pilot interviews were conducted with other PhD students.

4.9.2 Patients recruitment and eligibility criteria

The process of patient recruitment for the qualitative phase was integrated with the process of patient recruitment for the quantitative phase. Whilst seeking the consent for the pilot RCT study (quantitative phase), patients were also asked whether they would be

willing to participate in a qualitative interview upon their discharge from the service. However, the patients had the right to withdraw consent at any time without giving any reason. The author then scheduled the time and day of the interview depending on the patients' preferences, if the participants were willing. The following inclusion and exclusion criteria were used for the descriptive qualitative phase in addition to the inclusion and exclusion criteria for the pilot RCT phase.

4.9.2.1 Inclusion criteria

The participants who had been completed the MTM service for a minimum of six-month.

4.9.2.2 Exclusion criteria

Patients who are unwilling to participate in an interview, in addition to the exclusion criteria for phase one.

4.9.3 Sampling

As discussed previously in **section 4.8.3**, purposeful sampling technique was used for the qualitative phase. Purposeful sampling is a technique widely used in qualitative research for the identification and selection of information-rich cases related to the phenomenon of interest. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry. Studying information-rich cases

yields insights and in-depth understanding **(Patton, 2002).** This has two principal aims, symbolic representation and diverse (**Ritchie, Jewis and Elam, 2003**). Purposeful sampling strategies, consists of more than 40 different techniques, are non-random ways of ensuring that particular categories of cases within a sampling universe are represented in the final sample of a project **(Mason, 2002).**

To ensure a diversity of views, patients were recruited using two purposeful sampling techniques, first convenience sampling then maximum variation sampling. The convenience sampling is the least rigorous technique and commonly used in qualitative description designs. It allows the researcher to select participants who meet the required criteria and readily accessible or available on a first-come-first-served basis **(Parahoo, 2014).** Maximum variation sampling, on the other hand, is a popular form of qualitative sampling **(Sandelowski, 1995).** This approach consists of determining in advance some criteria that differentiate the participants, and then selecting participants that are quite different on the criteria. Aims to identify central themes which cut across the variety of people, it increases the likelihood that the findings will reflect differences or different perspectives **(Creswell, 2013).**

The sample frame was a population from intervention arm of the larger clinical trial. In this case, the sample for the qualitative study was a subset of a quantitative random sample. Any patient who expressed initial interest and met inclusion criteria and was willing to take

part in phase two was contacted by the author. Initially, first five patients were recruited using convenience sampling. The remaining 11 interviews were chosen using maximum variation sampling to guarantee representation of various patient categories referred to the clinic.

Based on the pattern of HbA1c values, duration of diabetes, and gender, a framework for maximum variation sampling was created **(Figure 4.4).** Based on the HbA1c value, patients were divided into two groups: those whose HbA1c improved and those whose HbA1c varied (i.e., improved then worsened or worsened then improved). Following that, the patients were further divided into two groups based on how long they had had diabetes: diabetes duration < ten-year and diabetes duration ≥ ten-year. These four groups were then further divided based on gender. Any patient who met the inclusion requirements and demonstrated interest in taking part in the interview was, however, recruited.

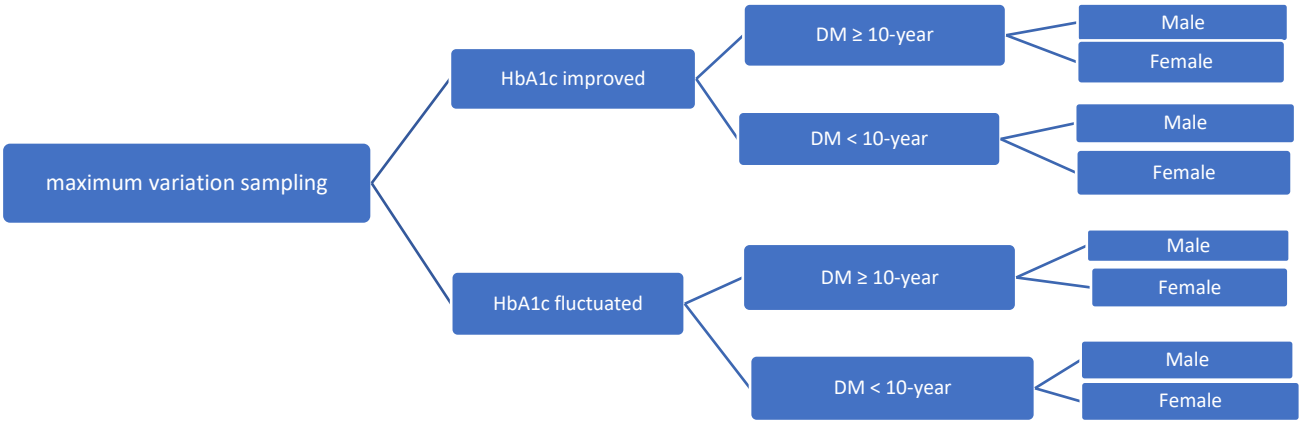


Figure 4.4: Framework of maximum variation sampling

4.9.4 Sample size

There are no rules to calculate the sample size in qualitative research and cannot be predicted by formulae **(Malterud, Siersma and Guassora, 2015),** instead a number of factors should be considered. These include careful consideration of the research design, recruitment strategies, diversity (heterogeneity) of the population, number of selection criteria, sampling procedure, type of data collection methods and analysis, the duration of a project and the budget and resources available **(Ritchie, Jewis and Elam, 2003; Morse and Niehaus, 2009; LoBiondo-Wood and Haber, 2014)**.

The prevailing concept for sample size in qualitative studies is “saturation”; either data saturation (informational redundancy) **(Lincoln and Guba, 1985)** or theoretical saturation **(Strauss and Corbin, 1990).** Although they are connected, informational redundancy and theoretical saturation are two distinct ideas. When no new information is revealed during data collection from the study participants, the term "informational redundancy" might be used **(Coyne, 1997).** On the other side, it is believed that the theoretical saturation occurs when gathering more data adds no value to the properties of a theoretical category. In contrast to informational redundancy, theoretical saturation is related with data interpretations rather than data collection and is attained by the constant comparison analytical technique **(Strauss and Corbin, 1990).**

The sample sizes in published studies might provide a baseline for the researcher to then tailor estimates to particular circumstances when planning a study. For example, Morse (1994) suggested six participants to understand the essence of an experience **(Morse, 1994),** while Creswell (2013) the ranges are a little different, recommended between 5 and 30 interviews **(Creswell, 2013).** However, Kuzel (1992) tied his recommendations to sample heterogeneity and research objectives, recommending six to eight interviews for a homogeneous sample and 12 to 20 data sources “when looking for disconfirming evidence or trying to achieve maximum variation.” **(Kuzel, 1992).** Finally, Green and Thorogood (2009) suggested saturation occurs after 20 interviews for an interview-based study **(Green and Thorogood, 2009).**

In this study, the author interviewed patients until no new information was coming out from interview. After 12 interviews, the author began to feel that the data were saturated, but she nevertheless performed four more interviews to make sure. Following each interview, the author listened again and took notes on important aspects. This assisted the author in determining data saturation.

4.9.5 Data collection

Interviews were used in this study to explore participant experiences and contributed to the "richness of data" necessary for qualitative description design **(Bradshaw, Atkinson and Doody, 2017).** Using interviews as a data collection tool has a limitation of providing

access to ‘what people say’ which may not be true reflection of their actions. However, they are a relatively efficient way of generating data on almost all health topics **(Green and Thorogood, 2009).** Specifically, the purpose of the current study was not to document participants' behaviour, but rather to explore their views about MTM services that’s why interviews were best suited. All interviews were conducted in the MTM clinic, private room, in CP where the most settings easiest to interview and that the interviewee feels is ‘theirs’, compare to the patients’ home which can seem very intrusive **(Green and Thorogood, 2009).**

Interviews can be of different types: structured, semi-structured, in-depth, narrative and informal interviews **(Green and Thorogood, 2009).** For the purpose of this study, the author used semi-structured interviews, because of its usefulness in allowing subjects to express sentiments that are important to them beyond what the author has anticipated **(Chadwick *et al.,* 2008),** which the author valued as she sought to understand the service from the interviewees’ perspectives. Another benefit of choosing semi-structured interviews is the method’s compatibility with thematic analysis.

Semi-structured interviews are typically based on a flexible topic guide that can be used to orientate the interviewer to the areas to cover (**Pope, Royen and Baker, 2002; Green and Thorogood, 2009).** According to Sandelowski (2000), a semi structured interview guide can be used to assist participants in expressing themselves freely. No matter what

template is used, it is essential to keep the focus on the original phenomenon **(Sandelowski, 2000).** However, the interview guide used in qualitative descriptive is slightly more structured than in other qualitative methods although it is still modified and transformed as themes emerge during the analysis **(Neergaard *et al.,* 2009).**

Conducting interviews can be done in several ways face-to-face, telephone and internet. The all three interview techniques share common principles/basics and can be equally used for conducting interviews in research. The face-to-face style is the most commonly used method, whilst the telephone and internet interviews are useful for dispersed and hard-to-reach populations **(Opdenakker, 2006; Rapport *et al.,* 2018**). For this study, face-to-face interviews were conducted.

4.9.6 Data management

For the purposes of this study, as mentioned above, all interviews have been audio-recorded. Subsequently all interviews were transcribed verbatim by author. Since all the interviews were transcribed by a single transcriber, the transcripts were reviewed by another person from the research team. Furthermore, since all interviews conducted in Arabic language, participants primary language, transcripts were translated to English by certified translation office. For the purpose of translation, the Arabic transcripts were uploaded on a secure online server, which were only accessed by the author and the translator.

Once transcripts were received, the author was read it to check the translation for accuracy. Subsequently, data was transferred it to one of the most commonly used computer-assisted qualitative data analysis software (CAQDAS); NVivo®. The CAQDAS package, NVivo, is fully integrated with framework analysis and this was used to categorised data and documented any themes and sub-themes. Data management using the coding retrieval and search facilities within NVivo® was the first stage of more in-depth analysis because it facilitated preliminary thoughts to emerge across cases and develop linkages between initial themes, while retaining links to the original data **(Smith and Firth, 2011).**

4.9.7 Data analysis

Qualitative research is generally characterized by the simultaneous collection and analysis of data whereby both mutually shape each other **(Sandelowski, 2000).**

There are various methods undertaking qualitative data analysis but thematic analysis approach was chosen for this research as this is the most widely used approach to analyse interviews **(Braun and Clarke, 2006).** According to Braun and Clarke (2006), thematic analysis is a method used for 'identifying, analysing, and reporting patterns (themes) within the data'. A thematic analysis is different from other analytic methods in that it does not depend on any pre-existing theoretical framework, so it can be adapted to fit into various theoretical frameworks and accomplish different things within them **(Braun**

and Clarke, 2006, page no.79). Using a thematic analysis provides researchers with a flexible and useful tool that provides a 'thick description' and detailed. Furthermore, thematic analysis generates unanticipated insights and highlights similarities and differences among the data set that can be helpful for informing policy development through qualitative analyses **(Braun and Clarke, 2006).**

4.9.7.1 Process of data analysis

Although thematic analysis is widely used, there is no clear agreement about what it is and how to conduct it **(Boyatzis, 1998).**

In this study, thematic analysis was undertaken using approach proposed by Braun and Clarke (2006). Their thematic analysis method consisted of interconnected stages including: data familiarisation, data coding, theme development and revision, and producing the report **(Braun and Clarke, 2006)**.

Phase I: familiarising with data

The familiarisation phase serves as the foundation for the rest of the analysis. In this phase, the data transcribing, reading, rereading and noting down initial ideas **(Braun and Clarke, 2006)**.

It was easily getting familiarising with data since all interviews were conducted and transcribed by the author. Also, the author compared the transcripts to the original audio

recordings a number of times for their accurate transcription. And even on several occasions the author had to re-listen to the tapes whilst reading the transcript to identify the participants' feelings and to immerse herself more in the data to the point where she is familiar with the depth and breadth of it.

Phase II: Generating initial codes

Coding the transcriptions or breaking them down into meaningful and manageable chunks of data, was a critical part of the data analysis. This process enables the author to begin to understand the world from each participant's perspective **(Sutton and Austin, 2015).** Codes describe a feature of the data that appears interesting to the analyst, and refer to "the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon" **(Boyatzis, 1998).**

Coding was instrumental in focusing the interview analysis on the experience of the participants in a structured way. During the codes process, the author kept in her mind important points. First, code for as many potential themes and patterns as possible. Second, code extracts that include all data. Lastly, code individual extracts of data in as many different ''themes" as possible **(Bryman, 2001; Braun and Clarke, 2006).**

There are three approaches to qualitative coding: deductive, inductive or combination of it **(Braun and Clarke, 2006; Given, 2008; Saldana, 2009)**. Deductive coding is a top down approach where started by developing a codebook with initial set of codes, based

on the research questions or an existing research framework or theory, and stick with them. At the end of the analysis, the codes still closely resemble the initial codebook. This is good when you have a pre-determined structure for how you need your final findings to be. On the other side, the inductive coding is ground up approach where the codes derive from the data and doesn't start with preconceived notions of what the codes should be but allow the narrative or theory to emerge from the raw data itself. This is great for exploratory research when you want to come up with a new theories, ideas or concepts. However, combining both approaches for coding is often in research studies. For example, you could deductively start with a set of codes, but then inductively come up with new codes and iterate on the codes as you sift through your data **(Braun and Clarke, 2006; Given, 2008; Saldana, 2009).**

The current qualitative data underwent a three-step thematic analysis **(Boyatzis, 1998).** The literature review served as the basis for step one. Step two was influenced by author's prior understanding of the disease and health care system in KSA. The information from this study's data guided step three. Therefore, there was a combination of a deductive approach (Steps 1 and 2) and an inductive approach (Step 3). The inductive method can be argued to remove bias and prior conceptions **(Boyatzis, 1998).**

Coding, as mentioned, was conducted using qualitative research software; NVivo®. The initial coding framework and transcripts from which it was derived were reviewed by two

different experienced researchers (supervisors) than the coder (author) as part of the ongoing measures taken to ensure the rigour of the study; improve trustworthiness and credibility and validity of the findings **(Smith and Firth, 2011).** In case of disagreement, the issue was discussed. Some examples of coding from an interview are provided in Table 4.2.

Table 4.2: Example of coding

Data extract	Code
Yes, by God, after I saw your concern, your contact, and your appointments, and changing the date to a time that suits me, these expectations have certainly changed	Flexibility
Yes, I am now able to protect my health. I never delay in taking my medications, under any circumstances, I must take them regularly.	Self-management
Yes, I suggest to increase the number of clinics to follow up with more patients.	Patients' suggestion regarding the service

Phase III: Searching for themes

The third stage was the theme development which started once a long list of the different codes were formed. In NVivo®, the coded nodes were read and reread to sort the different codes into potential themes and collate all the relevant coded data extracts within them. In the end, some of the initial codes developed into main themes, and others became sub-themes, while others were discarded **(Braun and Clarke, 2006)**.

The process of determining themes need to be consistent to identify significant broader patterns of meaning (potential themes). The theme reflects the key idea of the data related to the research question and represents some kind of pattern response or meaning within the data set **(Braun and Clarke, 2006).** Visual representations were used to help sort different codes and themes.

Phase IV: Reviewing themes

Reviewing themes phase begins once a set of candidate themes has been devised. During the review process, it became evident that some candidate themes were not really themes, while others collapsed into one another and others might need to be separated into different themes. The reviewing and refining the themes comprised of two levels. First level involved reviewing the coded data extracts to determine if the themes ‘’work" in relation to the data set. Result in producing a thematic ‘’map" of the analysis. Second level involved reviewing the entire data set to code any other data within themes that has been missed in prior coding stages. At this level, the author considered the validity of individual themes within the data set, as well as whether the candidate thematic map accurately reflects the data set’s meanings **(Braun and Clarke, 2006).**

The author considered Patton's (1990) dual criteria for judging categories, namely, that data within themes should cohere meaningfully (internal homogeneity), but different themes should have clear and identifiable distinctions (external heterogeneity) **(Patton,**

1990). At the end, this phase should result in a fairly good understanding of what different themes are, how they fit together, and what the overall story is **(Braun and Clarke, 2006).**

Phase V: Defining and naming themes

Ongoing analysis to define and further refine the specifics of each theme. The refinement is identified whether or not a theme contains any sub-themes and sub-themes are essentially themes-within-a theme. This was also the time to start thinking about the theme's names in the final analysis. A good name should be concise, punchy, and immediately convey the theme to the reader **(Braun and Clarke, 2006).**

Phase VI: Producing the report

This last stage involves the final analysis and writing up of the report once a set of themes have been fully developed. The aim of the report is to tell the comprehensive story of the data in a way that satisfies the reader of the merits and validity of data analysis. The write-up, more than just provide data, must provide sufficient evidence of the themes within the data **(Braun and Clarke, 2006).**

4.10 Process evaluation

4.10.1 MRC Process evaluation frameworks

The framework aims to help researchers make explicit their choices of research questions and methods. However, as awareness of the importance of process evaluation has grown,

several frameworks have been established to provide guidance about the key process evaluation measures that may be considered and used to structure process evaluations **(Nielsen and Randall, 2013)**.

In 2015 the Medical Research Council (MRC) guidance on process evaluation of complex interventions was published through an iterative process of literature review, case studies of process evaluations and consultation with stakeholders. As such, this guidance provided a comprehensive review of different theories for process evaluation and practical guidance on how to perform a process evaluation, resulting in a model summarizing the key features of process evaluations with adjacent theories and frameworks for each feature, as shown in Figure 4.5 **(Moore *et al.,* 2015).**

For these reasons the process evaluation for MTM service follows recommendations using MRC guidance framework to guide evaluation **(Moore *et al.,* 2015)**. The recommendations are not intended to be prescriptive but to help in making decisions.

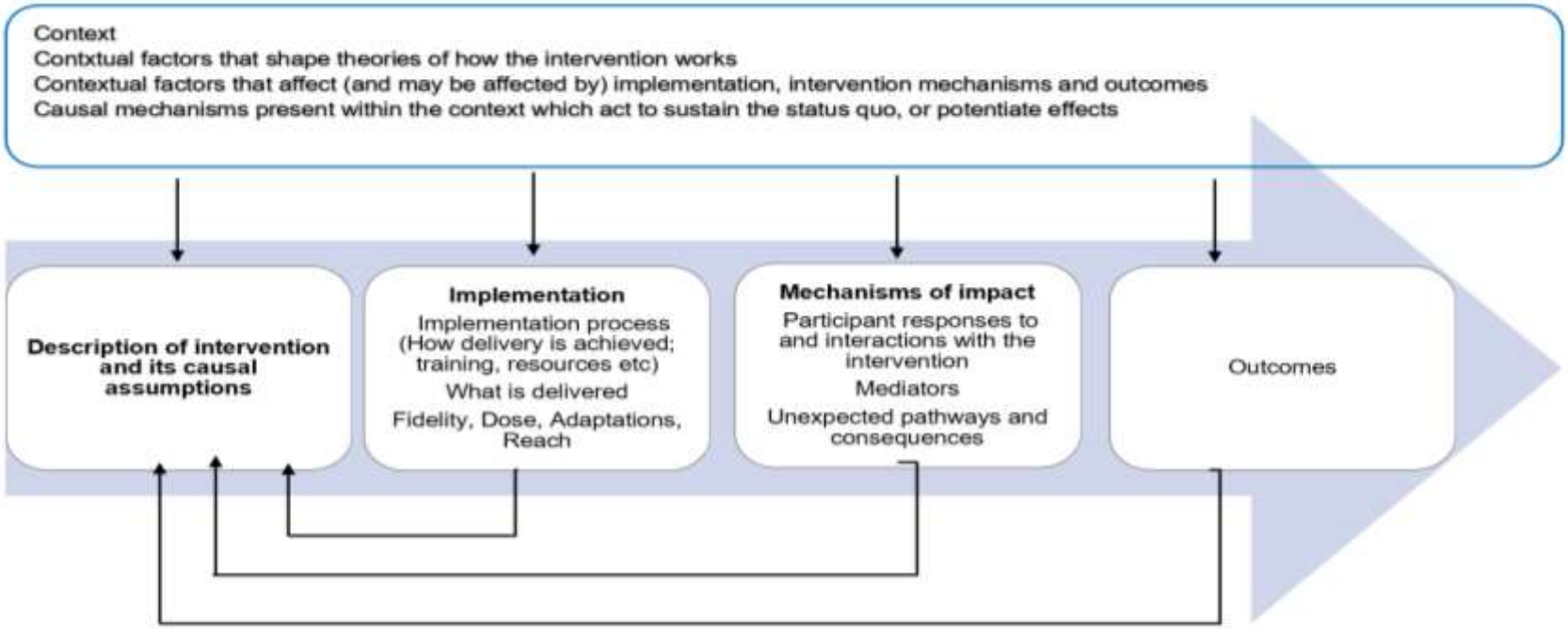


Figure 4.5: Key functions of process evaluation and relations among them (blue boxes are the key components of a process evaluation. Investigation of these components is shaped by a clear intervention description and informs interpretation of outcomes)

4.10.2 Choice of research method

The method of process evaluation for complex interventions are correspondingly wide-ranging, may range from studies assessing satisfaction with the intervention to large mixed-methods evaluations **(Griffin *et al.,* 2014; Berendsen *et al.,* 2015; Moore *et al.,* 2015)**. For this process evaluation, a mixed-methods design was chosen where the quantitative and qualitative data collection were carried out concurrently and synthesised in the final analysis **(Creswell and Plano Clark, 2011).** The designing and planning of the data collection was based on MRC framework for the evaluation of complex interventions **(Moore *et al.,* 2015)**.

4.10.3 Objectives

The objectives of the process evaluation were:

1- To assess the reach and recruitment, fidelity and adherence, dose delivered/ received of MTM service.

2- To investigate mechanism of impact and the practice context and consider how context affected implementation of MTM service.

4.10.4 Design and Structure of process evaluation

Although it is increasingly recognized that process evaluations can contribute much, they are not yet standardised. The best way to design and carry out the process evaluation is

not clear **(Oakley *et al.,* 2006; Moore *et al.,* 2014)**. Researchers will be confronted with different options about what questions to focus on and which methods to use. However, the most appropriate design depends on the aim and objective of the process evaluation **(Oakley *et al.,* 2006; Grant *et al.,* 2013).**

To make the evaluation approach more formally structured, should be drawn from the lists of components or framework compiled by one of the authors (**Baranowski and Stables, 2000; Glasgow *et al.,* 2001; Linnan and Steckler 2002).** Therefore, as mentioned, the design and structure of the process evaluation used was guided by the MRC framework for process evaluation of complex interventions. As per MRC guidelines, a logic model is an essential component of a process evaluation, which details the interventions and outcomes they aim to achieve **(Moore *et al.,* 2015)**.

The starting point of any process evaluation is the logic model of the intervention and this model is used as a structure for carrying out data collection and analysis. Thus, from the logic model of the intervention, process evaluations investigate the key features proposed in the model **(Figure 4.5).** Figure 4.6 illustrate the logic model of the MTM service and the key concepts in process evaluation according to the MRC guidance **(Moore *et al.,* 2015)**.

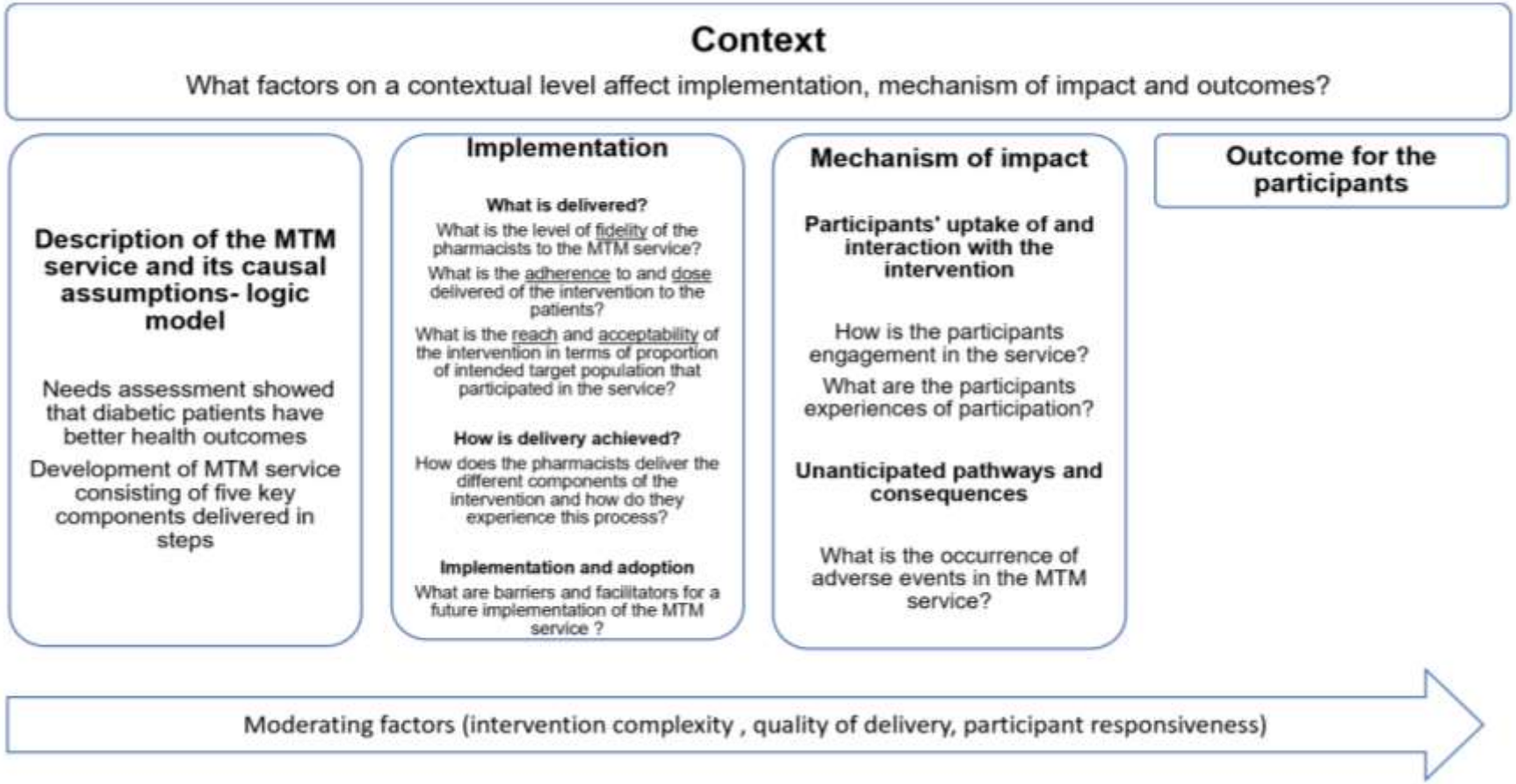


Figure 4.6: Overview of the process evaluation of the medication therapy management service

4.10.5 Domain and participants

The domain of this process evaluation, same as the trial, was the HKCP. The participants in this evaluation were two types: 1) quantitative sample included diabetic patients randomised to the MTM service (n=80) and 2) qualitative sample, nested within the quantitative sample of the intervention study. This qualitative sample involved participating diabetic patients along with key stakeholders. Notably, the process of stakeholder recruitment was incorporated all accessible stakeholders involved in implementation and developing process of MTM service, included clinical pharmacists provided the service, pharmacists worked in the CP, physicians referred patients to the services and the pharmacy owner. As much as possible, I tried to ensure that the participants' characteristics varied so that I could capture a diverse range of perspectives.

4.10.6 Process evaluation components and research questions

In this process evaluation, as mentioned previously, the evaluation elements were based on the process evaluation of complex interventions framework of MRC guidance **(Moore *et al.,* 2015)**. This was done by assessing the following process elements, namely: implementation which include reach and recruitment, fidelity and adherence, dose delivered/ received; context and mechanism of impact **(Table 4.3).**

Table 4.3: Elements and related research questions that were chosen to guide the process evaluation

Process evaluation components	Process evaluation elements	Definition	Process evaluation question
Implementation	Reach and recruitment	The proportion of intended target group that participates in an intervention **(Stevens *et al.,* 1998).**	Was the intervention delivered to at least 80% of the referred/ eligible patients?
	Fidelity and adherence	The degree/ extent to which the intervention was implemented as planned. It is representing the quality and integrity of the intervention as conceived by the developers and implementers **(Moore *et al.,* 2015)**	To what extent was the MTM service implemented as planned?
	Dose of intervention delivered	The proportion/ amount of the intervention described in the study protocol was actually delivered to those who were reached **(Steckler and Linnan, 2002).**	To what extent were all components within the service implemented?
	Dose of intervention received	The extent to which the recipients who received the intervention were aware of it and responded to it **(Steckler and Linnan, 2002).**	To what extent were service components received by participants?
Mechanism of impact		How the activities performed within the intervention produce intended or unintended effects **(Moore *et al.,* 2015)**	How is the participants engagement in the service? What are the participants experiences of participation?
Context		The identifying meaningful factors from the environment that could affected the implementation of intervention **(Moore *et al.,* 2015)**	What factor (barriers and facilitators) on contextual level affect implementation, mechanism of impact and outcomes? What is the wider context in which the service is being conducted?

4.10.7 Process evaluation data

First, the elements to be included in the process evaluation were defined, guided by MRC guidance framework **(Moore *et al.,* 2015)**. Second, specific questions were developed and mapped onto the different evaluation elements **(Table 4.3).** Having identified research questions that would meet the objectives, the next step is to devise the documents necessary to support data collection. Data collection began from development of the intervention and continued throughout the delivery of the intervention. This permitted investigation of the whole process from set-up through to completion.

The data collection sources that are commonly used for process evaluation fall broadly into four groups: 1) checklists or logbooks completed by intervention providers or author; 2) surveys, interviews or focus groups with patients, intervention providers and key stakeholders; 3) behavioural observations by author; and 4) use of routine monitoring data, such as database, attendance or case records. For this process evaluation, data from across these four groups were selected to capture different perspectives of key process variables. Data collection methods are described below.

The routine monitoring data, surveys and semi-structured face-to-face interviews with key stakeholders and patients were used. The study protocol and baseline trial data were combined with routine monitoring data to profile the process elements while interviews explored participants' perceptions about MTM service implementation and processes of change.

4.10.7.1 Quantitative data collection

The quantitative data include document material generated by the MTM service research team. These data were amalgamated and entered into a Stata/SE 17 spreadsheet whereby the author then extracted this data for analysis as part of the process evaluation. Four primary data sources were used: 1) study protocol 2) baseline data 3) questionnaires and 4) routine monitoring data.

4.10.7.1.1 Study protocol

The study protocol **(Albabtain *et al.,* 2021)** used to identify the background information on MTM service (rationale, aims and objectives) also identify how the MTM service intervention was planned. Keep in mind that the protocol usually contained limited information about the process evaluation plan.

4.10.7.1.2 Baseline data

Baseline data retrieved from the trial, included sociodemographic sheet, MARS-5 **(Horne, Weinman and Hankins, 1999)** and DDS **(Polonsky *et al.,* 2005)** were completed prior to randomisation. It was collected for the purposes of the trial, used in this process evaluation for the purposes of examining the characteristics of those who engage and participate in the intervention, as well as those who do not (e.g., dropouts), and how this affects the service's reach. Use of this data allowed quantification of social patterning using measures which would subsequently also be available to assess patterning in trial outcomes.

4.10.7.1.3 Questionnaires

Questionnaires were developed for the main study. Three questionnaires used, MARS-5 **(Horne, Weinman and Hankins, 1999)**, DDS **(Polonsky *et al.,* 2005)** and PSPS 2.0 **(Sakharkar *et al.,* 2015),** to assess improvement in patients care and satisfaction as part of outcome evaluation.

4.10.7.1.4 Routine monitoring data

Each patient in the intervention group received a MTM service in which the care is documented. After every patient encounter, the author filled out the enrolment and implementation forms. In these forms, the author registered the time spent on various MTM tasks, such as pharmacist consultation time/patient, number and type of referral and number of visits/follow up per patient. The data collected from each information source, and how this relates to the elements of process evaluation are presented in Table 4.4 bellow.

Table 4.4: Sources of information and tools used to inform the medication therapy management service intervention process evaluation

Process evaluation elements	Data sources and procedures
Reach and recruitment	• Percentage of referred patients entering or not entering the scheme. [EF] • No. of patients presented. [EF] • Social profiling between patient complete and not complete the service. [BD] • Intervention reaches target group. [BD] • Patients' encouragement to participate. [PI] • Recruitment procedure. [SI] • Barriers for recruitment [SI]
Fidelity and adherence	• Method of delivery. [IF] • Patients' adherence. [IF] • Implemented as planned. [SI, PI and SP] • Lack of resources. [SI]
Dose delivered	• Service length: Calculating time expired between scheme entry and exit allowed for service duration to be quantified. [IF]

	• Consultation length: Length of consultations between patients and MTM pharmacists IF • Application of monthly follow ups for intervention group at 4, 8, 16 and 20 weeks. IF • Number of referrals to another specialty. IF • Extent of MTM service component implemented as protocol SI
Dose received	• Percentage of the recruited patients that complete six-month service. EF • Percentage of intervention patients contacted monthly. EF • Percentage of intervention patients contacted at three-month. EF • Reasons for non-adherence/attendance. EF, PI and SI • Target population. PI and SI
Mechanism of impact	• Medication adherence. MARS-5 • DD. DDS • Patients satisfaction PSPS 2.0 • Patients' responses to, interaction with, and experiences of the MTM service. SI and PI • Enthusiasm of stakeholders. SI • Stakeholders' perception. SI • Perceived benefits. SI and PI
Context	• Current practice. SI and PI • Distinguishing MTM from traditional practice. SI and PI • Barriers and facilitators. SI • Suggestion. SI and PI

BD: Baseline data. DDS: diabetes distress scale questionnaire. EF: Enrolment form. IF: Implementation form. MARS-5: Medication adherence report scale questionnaire. PI: Patients interview. PSPS 2.0: Patient satisfaction with pharmacist services questionnaire 2.0. SI: Stakeholders interview. SP: Study protocol.

4.10.7.2 Qualitative data collection

Qualitative data was collected and analysed by author. All interviews were conducted in Arabic, individually, face to face in MTM clinic at the HKCP. Justification for choosing interview techniques was explained before in qualitative phase for mixed-methods study **(section 4.9.5).**

4.10.7.2.1 Semi-structured interviews with patients

Patients were interviewed about their experiences after completion of the MTM service. An interview guide was used, described previously in **section 4.9.1**. Data management was described previously in **sections 4.9.6.**

4.10.7.2.2 Semi-structured interviews with key stakeholders

key stakeholders' interviews were performed at the end of trial to capture recent experiences, and prevent loss of data to avoid recall bias. Each participant's interview took place in a single interview session and were audiotaped after receiving written and verbal informed consent **(APPENDIX IV-O).**

A topic guide was prepared to ensure uniformity and to ensure that key topics were addressed in the interviews, based on study objectives and literature review **(APPENDIX IV-X)**. The interview questions were adapted to reflect the characteristics of each stakeholder group (MTM pharmacists, community pharmacists, pharmacy owner and physicians).

The topic guide was developed to increase understanding of the dose received by the participants, potential moderating factors on intervention delivery, acceptance of the intervention and possible improvements for a future implementation of the MTM service into current practice. Moreover, interviews were aimed to describe stakeholder's experiences of implementing the MTM service, facilitators and barriers and to determine what contextual factors on a local and organisational level effect implementation.

4.10.8 Data analysis

The main aim of the analysis for MTM service evaluation was to identify the implementation plan of the service and focus on the participants' response those implement, deliver and receive the MTM service.

The process of analysing both quantitative and qualitative data have been described earlier in section 4.8.7 and section 4.9.7, respectively.

Presenting the evaluation elements was followed the MRC guidance. This was done by assessing the following process elements: implementation, mechanism of impact and context. Both qualitative and quantitative data were used in this process evaluation.

4.10.8.1 Integration of findings

Data from the process evaluation were analysed before the main results of the MTM trial were known. After completing both trial and process evaluation analyses, integrating findings can help in identifying how and why some components were delivered successfully, while others were not, and to understand why the intervention improved care for diabetic patients (or not).

CHAPTER 5 Results of quantitative phase of mixed-methods study

5.1 Chapter overview

The results are presented in the next three chapters; this chapter (quantitative phase of mixed-methods study), chapter six (qualitative phase of mixed-methods study) and chapter seven (process evaluation).

This chapter begins with the description of the recruitment and follow-up process, baseline characteristics of the participants and completeness of participant data included in the study. Following that, clinical outcomes are presented in addition to demonstrate the feasibility of the service, DRPs and health services utilisation outcomes. Later sections describe the individual feedback using three different questionnaires; The MARS-5, DDS and PSPS 2.0. Outcome measures are analysed comparing the control and intervention groups at baseline, three-month and six-month follow-up. To assist reading and comprehension, figures and tables have been incorporated into the text.

5.2 Recruitment and follow up

One hundred and sixty participants were recruited into the study. Recruitment process was completed over a 19-week period. The first consented participant was on 13.04.2021. The recruitment stopped with the last participant who was randomised on 08.09.2021. The recruitment rate was 35 participants per month. The average number of participants recruited per day, excluding days when there was no clinic, was 3-5. The flow of participants through the study is summarised in illustration 5.1.

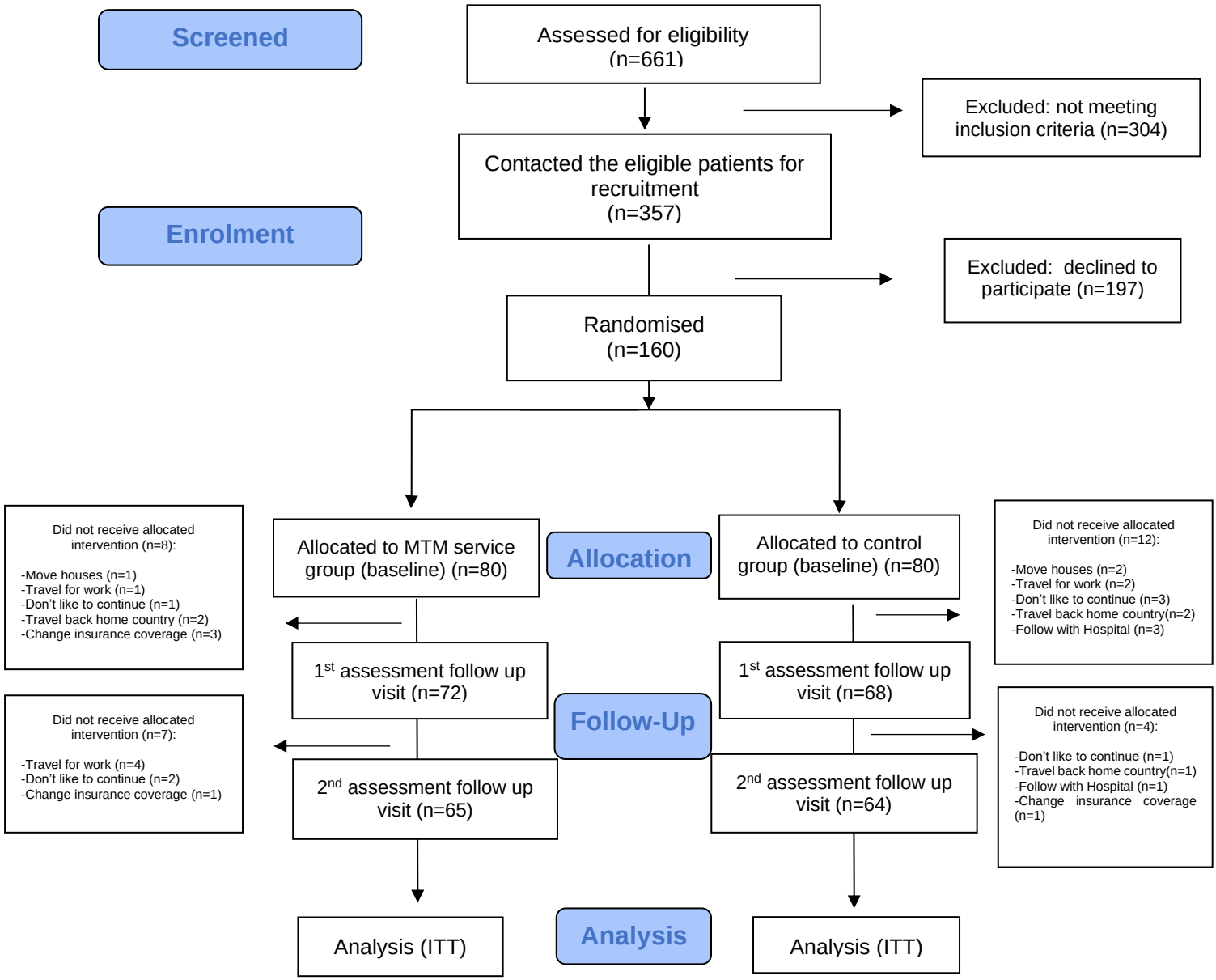


Figure 5.1: Consolidated standards of reporting trials flow diagram

The data reported here were collected over a 14-month period from April 2021 to June 2022. Several participants experienced significant delays in their appointments. The study protocol established that after consenting the participant, the participants were randomised to one of the arms and they received their first visit immediately by either MTM pharmacists or community pharmacist depend on which group participant was

allocated and followed with a minimum period of six-month for both groups. The second assessment visit was scheduled for three-month from baseline while the third assessment visit was scheduled at three-month after the first follow-up appointment. In practice, this was not always feasible as often participants were not free in the exact given time frame. These caused differences between the intervention and control group in terms of visit delays. These delays lead to a median follow up time of 98 days from baseline to visit 2 for intervention group and 94 days for control group. For the final visit (Visit 3) the delays were almost the same with a median of value of 98 days for the intervention group and 98.5 days for the control group. On average an intervention participant spent over 208 (SD 56.4) days as part of the study while control participants spent over 206 (SD 46.6) days **(Table 5.1).**

Table 5.1: Time spent between follow-up appointments (by days)

Time	Control group	Intervention group
Baseline -Visit 2, median [IQR]	94 [75.5, 111.5]	98 [73.5, 126.5]
Visit 2 -Visit 3, median [IQR]	98.5 [90, 117]	98 [89, 111]
Overall time in study, average (SD)	206 (46.6)	208 (56.4)

5.3 Baseline characteristics

5.3.1 Sociodemographic characteristic of the participants

The trial groups had no statistically significant difference in relation to their sociodemographic characteristics and homogenous at the point of recruitment. In terms of gender, male in both groups were representing approximately two-thirds of the participants; intervention group consists of 71.3% men and 28.8% women vs control group consists of 65% men and 35% women (p=0.4). Whereas the age of the participants was well matched between intervention and control participants; the mean

age of the participants in both groups were around 50 years with SD ± 12.3 vs ± 11.7, respectively (p=0.9).

In term of nationality, Saudi to non-Saudi participant represent just about a ratio of 1:2; intervention group consists of 31.3% Saudi and 68.8% non-Saudi vs control group consists of 35% Saudi and 65% non-Saudi. In both groups, there were few participants without education (7 (8.8%) in the intervention group and 10 (12.5%) in the control group). On the other hand, the highest number of participants in intervention group acquire Bachelor's degree or higher at 21 (26.3%) while the highest number of participants in control group acquire Diploma/high school at 21 (26.3%) (p=0.7).

The income range of the participants was balanced between intervention and control participants; most of the participants have low income (<5000 SR) with 33.8% vs 30%, respectively. Furthermore, the minority of participants were eligible on one of the governmental hospitals (10% intervention and 12.5% control) while the majority of participants had an insurance company (58.8% intervention and 50% control).

Two questionnaires, MARS-5 or DDS were used at baseline to measure the adherence to medication and DD. The data shows that there were a larger proportion of participants identified as non-adherent in control group compared to intervention group (75% versus 72.5%, respectively). Whereas the intervention group had a larger percentage of participants that categorised as high distress (40%) while the control group the highest percentage come with only moderate distress (43.8%). Details of sociodemographic characteristics of participants are presented in Table 5.2.

Table 5.2: Baseline participant sociodemographic characteristics by study groups

Sociodemographic characteristics	Control group (n=80) N (%)	Intervention group (n=80) N (%)	p- value
Gender			0.396
Male	52 (65%)	57 (71.3%)	
Female	28 (35%)	23 (28.8%)	
Age (year), mean ± (SD)	50.2 ± (11.7)	49.9 ± (12.3)	0.8851
Nationality			0.614
Saudi	28 (35%)	25 (31.3%)	
Non- Saudi	52 (65%)	55 (68.8%)	
Smoking status			0.399
Never smoker	46 (57.5%)	54 (67.5%)	
Ex-smoker	12 (15%)	8 (10%)	
Current smoker	22 (27.5%)	18 (22.5%)	
Education			0.740
Illiterate	10 (12.5%)	7 (8.8%)	
Elementary	17 (21.3%)	17 (21.3%)	
Intermediate	17 (21.3%)	18 (22.5%)	
Diploma/high school	21 (26.3%)	17 (21.3%)	
Bachelor's degree or higher	15 (18.8%)	21 (26.3%)	
Income range (SR)			0.890
<5000	24 (30%)	27 (33.8%)	
5000- <10000	20 (25%)	20 (25%)	
10000- <15000	21 (26.25%)	17 (21.3%)	
≥ 15000	15 (18.75%)	16 (20%)	
Insurance coverage			0.538
Governmental	10 (12.5%)	8 (10%)	
Insurance company	40 (50%)	47 (58.8%)	
None	30 (37.5%)	25 (31.3)	
BMI (kg/m2), median [IQR]	29.82 [26.3, 34.3]	29.63 [25.6, 33]	0.329
Diet habit			0.186
Follow diet	10 (12.5%)	16 (20%)	
No regular diet	57 (71.3%)	46 (57.5%)	
Not sure	13 (16.3%)	18 (22.5%)	
Physical activities			0.238
Inactive	46 (57.5%)	37 (46.3%)	
Moderate	22 (27.5%)	32 (40%)	
Highly active	12 (15%)	11 (13.8%)	
Family history			0.871
None	16 (20%)	18 (22.5%)	
DM	19 (23.8%)	24 (30%)	
HTN	2 (2.5%)	3 (3.75%)	
DM & HTN	14 (17.5%)	11 (13.8%)	
DM & DLD	5 (6.25%)	3 (3.75%)	
HTN & DLD	1 (1.25%)	2 (2.5%)	
DM, HTN &DLD	23 (28.8%)	19 (23.8%)	
MARS-5			0.719
Not adherent	60 (75%)	58 (72.5%)	
Adhere	20 (25%)	22 (27.5%)	
DDS			0.384
< 2.0 (little or no distress)	20 (25%)	21 (26.3%)	
2.0 -2.9 (moderate distress)	35 (43.8%)	27 (33.8%)	
> 3.0 (high distress)	25 (31.3%)	32 (40%)	

5.3.2 History of diabetes and other chronic disease/ medical problems

Overall, the trial groups had no statistically significant difference in relation to their comorbidities at the point of recruitment. Diabetic patients from the trial groups presented almost same value of HbA1c with median 9.6% [IQR, 8.9, 11.7] in MTM group vs 9.9% [IQR, 8.8, 10.9] in standard group. Furthermore, there were no baseline differences between the MTM and standard care groups in median random blood glucose (RBG) 192 mg/dl [IQR, 134, 310] vs 197.5 mg/dl [IQR, 147, 265] and in median fasting blood glucose (FBG) (222.9 mg/dl [IQR, 164, 281.4] vs 240.3 mg/dl [IQR, 170.2, 294]), respectively. MTM participants, however, have had diabetes longer than standard care participants, with medians of nine-year [IQR, 3, 14.5] and six-year [IQR, 3, 14] respectively.

In terms of comorbidities, there were zero to seven pre-existing comorbidities among participants. Almost half, 36 (45%) of the participants in MTM group and 37 (46.3%) of the participants in standard care group, had no other pre-existing comorbidity while 44 (55%) participants had at least one comorbidity in MTM group and 43 (53.8%) participants in standard care group. The median number of medication participants on at baseline was balanced between the study groups, 5 medications [IQR, 4, 7] in intervention group and 4 medications [IQR, 3, 7] in standard care group. Table 5.3 shows the presence of comorbidities within trial groups.

Table 5.3: Comorbidities at the baseline

Feature	Control group (n=80)	Intervention group (n=80)	p-value
HbA1c (%), median [IQR]	9.9 % [8.8, 10.9]	9.6 % [8.9, 11.7]	0.725
RBG mg/dl, median [IQR]	197.5 [147, 265]	192 [134, 310]	0.967
FBG mg/dl, median [IQR]	240.3 [170.2, 294]	222.9 [164, 281.4]	0.448

Diabetes duration year**,** median [IQR]	6 [3, 14]	9 [3, 14.5]	0.2
Number of comorbidities, n(%)			0.623
None	37 (46.3%)	36 (45%)	
1	27 (33.8%)	22 (27.5%)	
2	10 (12.5%)	12 (15%)	
3	3 (3.75%)	7 (8.8%)	
4	2 (2.5%)	3 (3.8%)	
5 or more	1 (1.3%)	0	
Number of medications, median [IQR]	4 [3, 7]	5 [4, 7]	0.258

5.4 Missing data

5.4.1 Missing participants follow up

At visit 2 (first follow-up) point, the author was unable to contact eight participants (10%) in the intervention group for various reasons, such as moving houses, traveling for work, travel back to home country, change insurance coverage and start follow-up at a government hospital. While in the control group, the same reason led to the inability to obtain data from 12 participants (15%) **(Figure 5.1).**

At visit 3 (last follow-up) point, both intervention and control groups experienced a decrease in lost to follow up, with 9.7% (7 participants) and 5.9% (4 participants) respectively. Overall, 31 participants left the trial after signing the consent form, representing only 19.4% of those recruited. Figure 5.1 illustrates the flow chart of participants through the study.

Participants who completed and withdrew from the study had comparable characteristics. Both groups had the same ratio of male to female participants (2:1). Also, there were some similarities in the mean age in years of the two groups which

was within two-year (mean ages 50.5 years v 48.2 years), and the mean length of time since diagnosed with diabetes which was also within two-year. However, participants those with a high value of HbA1c were more likely to continue to participate (completed the study group, 9.8 [IQR, 8.9, 11.2] and withdrew from the study group 9.3 [IQR, 8.7, 11.3]). Participants' comorbidities between the two groups also comparable. The difference between the completed and withdrew groups presented in Table 5.4**.**

Table 5.4: Descriptive statistics for both groups (completed and withdrew from the study)

Variables	**Participants withdrew from the study (n=31)**	**Participants completed the study (n=129)**	**p-value**
Gender, n (%)			0.959
Male	21 (67.7%)	88 (68.2%)	
Female	10 (32.3%)	41 (31.8%)	
Age (year), mean (SD)	48.2 (12.2)	50.5 (11.9)	0.336
HbA1c (%), median [IQR]	9.3 [8.7, 11.3]	9.8 [8.9, 11.2]	0.387
Duration of diabetes (year), median [IQR]	6 [2.5, 18]	8 [4, 14]	0.751
Number of medications, median [IQR]	4 [3, 7]	5 [4, 7]	0.309
Number of comorbidities, median [IQR]	0 [0, 1]	1 [0, 1]	0.424

5.4.2 Missing data within trial outcomes

Overall, there were no missing data for the primary outcome, HbA1c, but there was a missing data within secondary outcomes. At baseline, LDL and ACR were not measured for 59.4% and 83.8% of the participants, respectively. This is because the LDL and ACR were not requested by the physician under insurance.

At three-month, LDL readings were missed in more than 61%, whereas ACR results were missed in more than 81% of the trial sample. At the six-month, the percentages of missing data have similar trend to approach 65.9% and 84.5% among LDL and ACR readings, respectively. In Table 5.5, missing data for secondary outcomes during the study are presented across trial groups.

Table 5.5: Percentages of missing data of secondary outcomes for all participants and across trial groups at baseline, three-month and six-month

Missing variables	Control group	Intervention group	All participants
LDL, n (%)			
Baseline	48 (60%)	47 (58.8%)	95 (59.4%)
Visit 2	45 (66.2%)	41 (56.9%)	86 (61.4%)
Visit 3	47 (73.4%)	38 (58.5%)	85 (65.9%)
Toal	140	126	
ACR, n (%)			
Baseline	71 (88.8%)	63 (78.8%)	134 (83.8%)
Visit 2	59 (86.8%)	55 (76.4%)	114 (81.4%)
Visit 3	57 (89.1%)	52 (80%)	109 (84.5%)
Total	187	170	

5.5 Outcomes measures

5.5.1 Primary outcome

5.5.1.1 Glycated Haemoglobin

A reasonable HbA1c goal for non-pregnant adults with diabetes, according to National Institute for Health and Care Excellence (NICE) **(National Institute for Health and Care Excellence, 2015; National Institute for Health and Care Excellence, 2022)** and the American Diabetes Association (ADA) guidelines **(American Diabetes Association, 2019)**, is <7%. Accordingly, participants in both trial arms were classified into controlled (HbA1c <7) or uncontrolled (HbA1c ≥7) based on their glycaemic levels at baseline, three-month and six-month.

Of those, who received MTM intervention at three-month visit, eleven participants (15.3%) had a controlled level compared to eight participants (11.8%) of those who did not receive the MTM intervention. For six-month visit, nine participants (13.9%) who

received MTM intervention had a controlled level compared to nine participants (14.1%) of those who did not receive the MTM intervention **(Table 5.6).**

Table 5.6: Proportions of participants who had a controlled and uncontrolled level of HbA1c for both trial groups across trial visits

HbA1c	Control group Frequency (%)		Intervention group Frequency (%)	
	Uncontrolled (HbA1c≥7)	Controlled (HbA1c<7)	Uncontrolled (HbA1c≥7)	Controlled (HbA1c<7)
Three-month	60 (88.2)	8 (11.8)	61 (84.7)	11 (15.3)
Six-month	55 (85.9)	9 (14.1)	56 (86.2)	9 (13.9)

Moreover, a linear regression was conducted to compare the means of HbA1c between the intervention group and the control group as demonstrated in Table 5.7**.** Participants in control group had lower mean level of HbA1c 8.9% ±(1.8) than baseline at three-month and then continue same level at six-month visit with mean 8.9% ±(2.0). In contrast, participants in the intervention group had lower mean levels of HbA1c 8.9% ±(1.8) than baseline at three-month and then reduced further to reach mean of 8.6% ±(1.7) at six-month visit.

Furthermore, after adjusting for baseline HbA1c, the mean HbA1c level was 0.03% (95% CI, 0.6, 0.5) lower in the intervention arm compared to the control arm at three-month and 0.21% (95% CI, -0.8, 0.4) lower at six-month. There was no statistically significant reduction in mean HbAIc between intervention and control group at three-month (p=0.9) and six-month follow up (p=0.5).

Table 5.7: Mean of glycated haemoglobin for both trial groups across trial visits with the differences, 95% confidence interval differences and P value

HbA1c level	Mean ± (SD) Control group	Intervention group	Coefficient (95% CI)	P- value
Baseline	10.3 ± (1.7)	10.3 ± (1.9)		
Three-month	8.9 ± (1.8)	8.9 ± (1.8)	-0.03 (-0.6, 0.5)	0.928
Six-month	8.9 ± (2)	8.6 ± (1.7)	-0.21 (-0.8, 0.4)	0.503

The results showed that the mean HbA1c level was equal in both groups at three-month. However, when compared to the control group, the HbA1c level in intervention group decreased by 0.23 % at six-month as shown in the Figure 5.2 below.

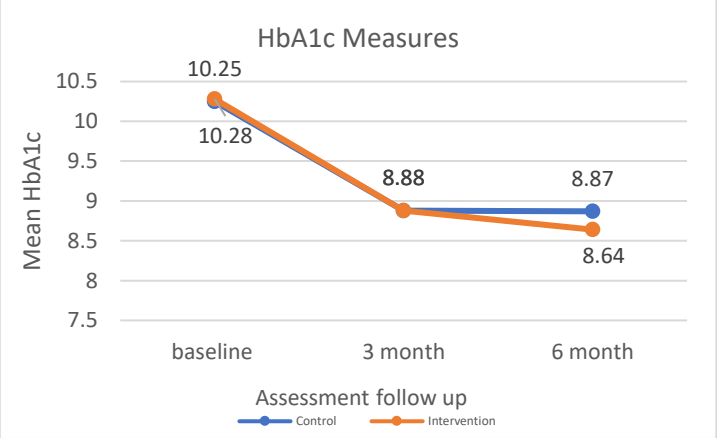


Figure 5.2: Glycated haemoglobin for both trial groups across trial visits

5.5.2 Secondary outcomes

5.5.2.1 Blood pressure

BP was measured during study. A linear regression was conducted to compare the means of BP between the intervention group and the control group.

The improvement on both SBP and DBP were statistically significant after six-month. For the SBP, at three-month, the intervention group and the control group have similar

means of SBP of 140.4 ± (19.4) and 139.7 ±(19.7), respectively. However, at six-month compared to the control group participants who had a mean SBP of 140.3 ±(20.4) the intervention group had lower mean SBP of 132.9 ±(15.5). Furthermore, after adjustment for baseline SBP, mean SBP is 2.9 mmHg (95% CI, -2.4, 8.2, p=0.28) higher in the intervention arm compared to the control arm at three-month. However, at six-month, mean SBP is 5.8 mmHg (95% CI, -11.2, -0.5, p= 0.03) lower in the intervention arm compared to the control arm **(Table 5.8).**

For DBP, at three-month, the intervention group and the control group have similar means of DBP of 83.4 ±(10.9) and 84.5 ±(12.3), respectively. However, at six-month compared to the control group participants who had a mean DBP of 85 ±(11.4) the intervention group had lower mean DBP 78.5 ±(8.1). As observed for SBP, after adjustment for baseline DBP, mean DBP is 0.7 mmHg (95% CI, -2.6, 3.9, p=0.69) higher in the intervention arm than the control arm at three-month. However, at six-month, mean DBP is 4.8 mmHg (95% CI, -7.8, -1.7, p=0.002) lower in the intervention arm than the control arm **(Table 5.8).**

Table 5.8: Mean of blood pressure measurements for both trial groups across trial visits with the differences, 95% confidence interval differences and P value

BP	**Mean ± (SD)** Control group	Intervention group	**Coefficient (95% CI)**	**P-value**
SBP level				
Baseline	141.2 ±(21.4)	137.9 ±(17.6)		
Three-month	139.7 ±(19.7)	140.4 ±(19.4)	2.9 (-2.4, 8.2)	0.280
Six-month	140.3 ±(20.4)	132.9 ±(15.5)	-5.8 (-11.2, -0.5)	0.033
DBP level				
Baseline	86.4 ±(11.6)	82.9 ±(11.2)		
Three-month	84.5 ±(12.3)	83.4 ±(10.9)	0.7 (-2.6, 3.9)	0.693
Six-month	85 ±(11.4)	78.5 ±(8.1)	-4.8 (-7.8, -1.7)	0.002

The results show that SBP in the intervention group at three-month increased by 2.5 mmHg but at six-month dropped by 7.6 mmHg. In the control group SBP decreased by 1.5 mmHg at three-month but return to increase by 0.6 mmHg at six-month as shown in the Figure 5.3 below**.** Similar trend obsereved in DBP, the results show that DBP in the intervention group at three-month increased by 0.5 mmHg but at six-month dropped by 4.9 mmHg, if compared to the control group in which DBP decreased by 1.8 mmHg at three-month but return to increase by 0.5 mmHg at six-month as shown in the Figure 5.3 below.

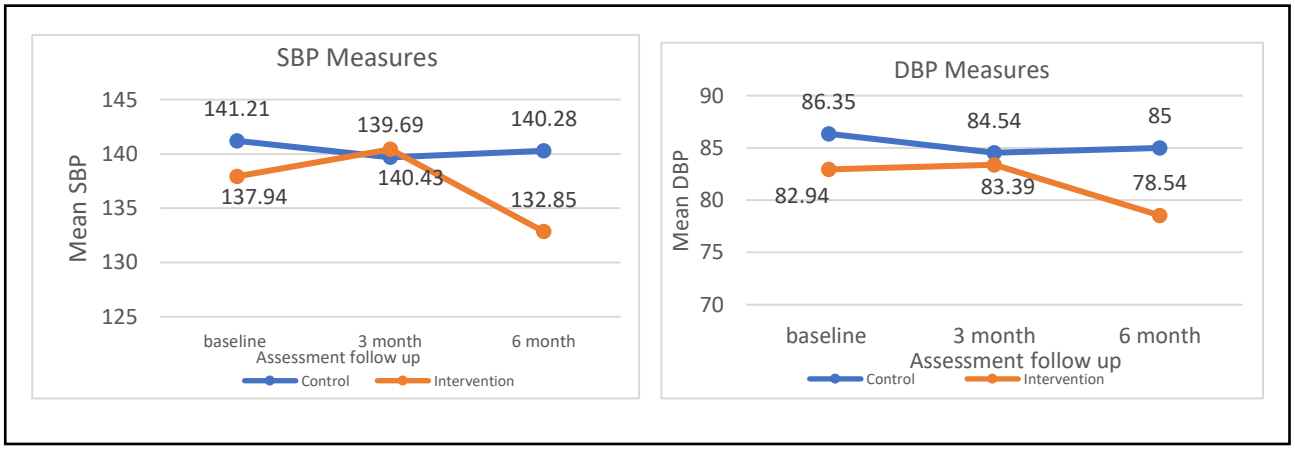


Figure 5.3: Blood pressure results for both trial groups across trial visits

5.5.2.2 Lipid profile

Lipid profile include LDL, TC and TG were measured at baseline and follow up points. A linear progression was conducted to compare the means of LDL and TC and median of TG between the intervention group and the control group.

According to 2019 European Society of Cardiology and the European Atherosclerosis Society (ESC/EAS) Guidelines for the Management of DLD, LDL should be the primary

target for lipid-lowering therapy **(Mach *et al.,* 2020).** However, the result on LDL should be addressed with caution due to the missing data as mentioned in **(section 5.4.2).**

Table 5.9 shows that the participants in MTM service group had a lower mean LDL compared to participants in standard care group at three-month (127.1 ±(51.6) and 135.6 ±(38.1) and at six-month 138.2 ±(44.8) and 141.4 ±(41.2), respectively. Furthermore, after adjusting for baseline LDL, the mean LDL level was 13.8 mg/dl (95% CI, -34.3, 6.6, p=0.18) lower in the intervention arm compared to the control arm at three-month and 4.2 mg/dl (-19.8 – 28.2, p=0.72) higher at six-month.

As observed for LDL, the participants in MTM service group had a lower mean TC compared to participants in standard care group at three-month 173.6 ±(39.9) and 195.3±(44.9) and at six-month 177.4 ±(47.2) and 191.3 ±(47.2), respectively. Furthermore, after adjusting for baseline TC, the mean TC level was 16.7 mg/dl (95% CI, -26.9, -6.4, p=0.002) lower in the intervention arm compared to the control arm at three-month and 11.1 mg/dl (95% CI, -24.2, -2.2, p=0.1) lower at six-month **(Table 5.9).**

Similar trends continue with TG, the participants in MTM service group had lower median TG compared to participants in standard care group at three-month 122 [IQR, 88, 188] and 141 [IQR, 106, 203] and at six-month 127 [IQR, 88, 192] and 135 [IQR, 102.5, 189], respectively. Furthermore, data shows that after adjusting for baseline TG, the TG mg/dl in the intervention arm was 9.9% (95% CI, -20.5, 3.0) lower than the control arm at three-month and 1.2% (95% CI, -15.6, 16.2) at six-month **(Table 5.9).**

Table 5.9: Lipid profile measurements for both trial groups across trial visits with the differences, 95% confidence interval differences and P value

	Mean ± (SD) Control group	Intervention group	**Coefficient (95% CI)**	**P-value**
LDL level				
Baseline	131.8 ±(42.9)	131.3 ±(43.9)		
Three-month	135.6 ±(38.1)	127.1 ±(51.6)	-13.8 (-34.3, 6.6)	0.179
Six-month	141.4 ±(41.2)	138.2 ±(44.8)	4.2 (-19.8, 28.2)	0.726
TC level				
Baseline	207.9 ±(45.6)	202.6 ±(46.5)		
Three-month	195.3 ±(44.9)	173.6 ±(39.9)	-16.7 (-26.9, -6.4)	0.002
Six-month	191.3 ±(47.2)	177.4 ±(47.2)	-11.1 (-24.2, 2.2)	0.100
TG level				
	Median [IQR] Control group	Intervention group	**Geometric MD (95% CI)**	**P-value**
Baseline	150 [114.9, 232.2]	150.39 [106.7, 245]		
Three-month	141 [106, 203]	122 [88, 188]	9.9% (-20.5, 3.0)	0.115
Six-month	135 [102.5, 189]	127 [88, 192]	1.2% (-15.6, 16.2)	0.881

Overall, the lipid profile measures improved in MTM service group compared to standard care group. Compared to the standard care participants, the MTM service participants had mean LDL lower by 8.6 mg/dl and 3.25 mg/dl at three-month and six-month, respectively. Furthermore, compared to the standard care participants, the MTM service participants had mean TC lower by 21.8 mg/dl and 13.9 mg/dl at three-month and six-month, respectively. Finally, compared to the standard care participants, the MTM service participants had median TG lower by 19 mg/dl and 8 mg/dl at three-month and six-month, respectively, as shown in the Figure 5.4.

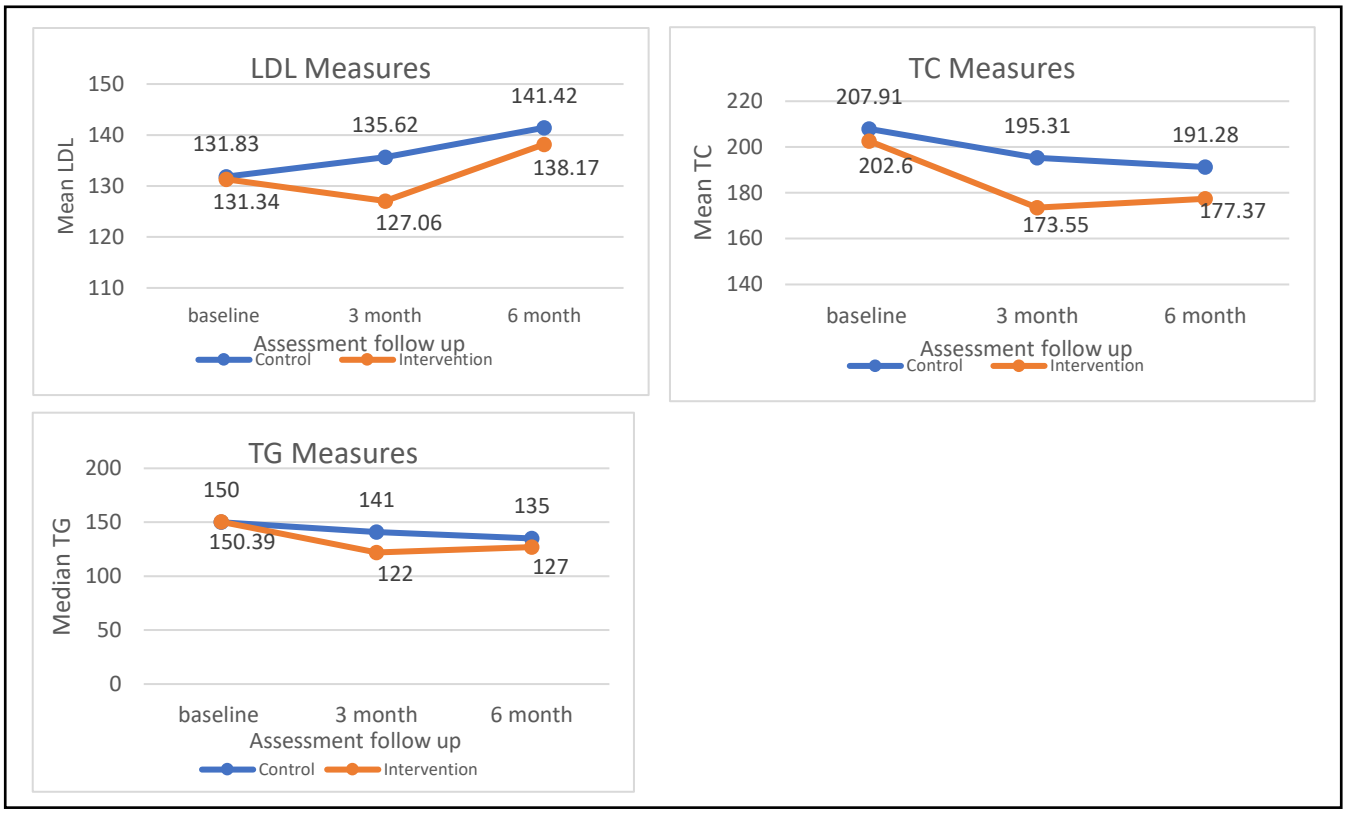


Figure 5.4: Lipid profile results for both trial groups across trial visits

5.5.2.3 Albumin-to-creatinine ratio

The result on ACR, same as LDL, should be addressed with caution due to the missing data as mentioned in **(section 5.4.2).** Thus, linear regression with robust standard error was conducted to compare the median of ACR between the study groups.

As depicted in Table 5.10, participants in standard care group have lower median ACR compared to participants in MTM service group at three-month 12 [IQR, 5, 43] and 20 [IQR, 8, 90] but almost equal median ACR at six-month 13 [IQR, 8, 31] and 13.5 [IQR, 6, 25.5], respectively. Furthermore, data shows that after adjusting for baseline ACR, the mean ACR level was 24.4 mg/g (95% CI, -131.6, 82.8) lower in the intervention arm compared to the control arm at three-month and 21 mg/g (95% CI, -17.9, 59.9) higher at six-month.

Table 5.10: Median of albumin-to-creatinine ratio measurements for both trial groups across trial visits with the differences, 95% confidence interval differences and P value

ACR level	Median [IQR] Control group	Intervention group	Coefficient (95% CI)	P- value
Baseline	45.9 [15.6 ,50.4]	25.8 [5.3 ,146.9]		
Three-month	12 [5, 43]	20 [8, 90]	-24.4 (-131.6, 82.8)	0.631
Six-month	13[8, 31]	13.5 [6, 25.5]	21 (-17.9, 59.9)	0.259

Overall, the intervention group showed steady improvement in ACR measures during the MTM service while the standard care group showed decrease at three-month visit and then increase at six-month visit **(Figure 5.5).**

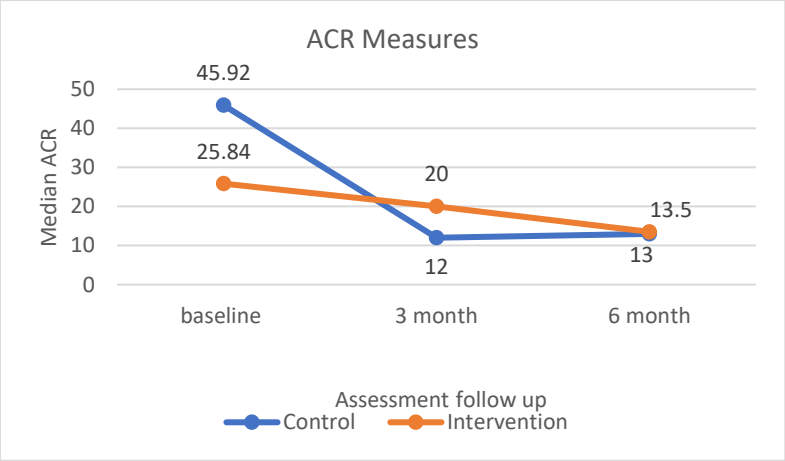


Figure 5.5: Albumin-to-creatinine ratio results for both trial groups across trial visits

5.5.2.4 Serum creatinine

SCr was measured at baseline, three-month and six-month. A linear regression was conducted to compare the median of SCr between the study groups.

As shown in Table 5.11, participants in the MTM service group had lower median score at three-month and six-month visits of 0.8 [IQR, 0.6, 0.9] and 0.7 [IQR, 0.6, 0.9], respectively, compared to the baseline 0.9 [IQR, 0.7, 0.9]. While participants in the

standard care group had higher median score at three-month and six-month visits 0.8 [IQR, 0.7, 0.9] and 0.9 [IQR, 0.7, 0.9], respectively, compared to baseline 0.8 [IQR, 0.64, 0.98]. Furthermore, data shows that after adjusting for baseline SCr, the SCr mg/dl in the intervention arm was 5.6 % (95% CI, -12.3, 1.5) lower than the control arm at three-month and 9.2 % (95% CI, -15.9, -1.8) at six-month.

Table 5.11: Median of serum creatinine for both trial groups across trial visits with the differences, 95% confidence interval differences and P value

SCr level	Median [IQR] Control group	Intervention group	Geometric MD (95% CI)	P-value
Baseline	0.8 [0.6, 0.9]	0.9 [0.7, 0.9]		
Three-month	0.8 [0.7, 0.9]	0.8 [0.6, 0.9]	5.6 % (-12.3, 1.5)	0.12
Six-month	0.9 [0.7, 0.9]	0.7 [0.6, 0.9]	9.2 % (-15.9, -1.8)	0.01

The results show that median SCr in the intervention group trending down while the median SCr in the control group was trending up. At three-month the intervention group lower than control group by only 0.05 mg/dl however at six-month the difference was larger which reach 0.16 mg/dl as shown in the Figure 5.6 below.

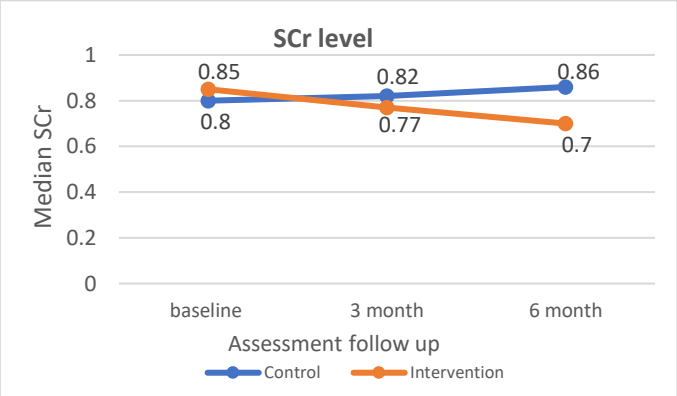


Figure 5.6: Serum creatinine results for both trial groups across trial visits

5.5.2.5 Feasibility of MTM service

The measures considered to determine the feasibility of the MTM service in this study were number of monthly follow-up, number and type of referrals and pharmacist consultation time per participant.

Overall, the number of monthly follow-up made by participant to the MTM clinic during the service was low. The median number of monthly follow up per participants was only 1 [IQR, 0, 1]. By protocol, each participant in intervention group had four monthly-follow-ups (at 1, 2, 4 and 5 months), however no participant attended all monthly follow-up appointments, while only 3% of participants had three monthly follow ups, 15% of participants had 2 monthly follow ups and 36% of participants had only one monthly follow up. Moreover, 45% of participant did not have any monthly follow up.

From 80 participants who started MTM service, 65% of participants were referred to other specialty at baseline visit, 15.3% of participants referred at three-month visit and only 9.2% of participants referred at six-month visit. While the number of referrals was made for participants to the other health care practitioners was 68 referrals at baseline assessment visit, 12 referrals at three-month assessment visit and six referrals at six-month visit. Ophthalmology (n = 41) followed by physician (n= 19) and dietitian (n = 4) were the most commonly made referrals.

In addition, the median consultation time that spends by pharmacists to each participant was different depend on the time point. At baseline the median time 35 [30, 44.5] was longer since the first visits require full MTR which consume time. However, in the two follow up visits, the encounter went faster (15 [10, 30] and 20 [10, 25] at three-month and six-month, respectively).

5.5.2.6 Drug-related problems

In the MTM programme group, the total number of DRPs were dropped from 191 at baseline to 69 at three-month follow-up and 60 at six-month follow-up. The mean number of DRPs per participant decreased significantly (p=0.0001) as well from 2.4 (1.1) in the first visit to 0.96 (1) at second visit and 0.9 (0.9) at last visit. Furthermore, number of participants with DRPs dropped significantly (p=0.0001) from baseline (80 (100%) participants) to half after three-month (41 (56.9%) participants) and six-month of follow-up (42 (64.6%) participants). Moreover, 43% and 35% of participants had no DRPs at three-month and six-month of follow-up visits, respectively **(Table 5.12).**

Table 5.12: Drug related problems

Item	At baseline (80 participants)	At three-month (72 participants)	At six-month (65 participants)
No. of DRPs	191	69	60
Mean number of DRPs per participants (SD)	2.4 (1.1)	0.9 (1)	0.9 (0.9)
No. of participants with DRPs (%)	80 (100)	41 (56.9)	42 (64.6)

The most reported DRPs over the follow up visits included additional drug therapy needed, drug dose too low and noncompliance **(Figure 5.7).**

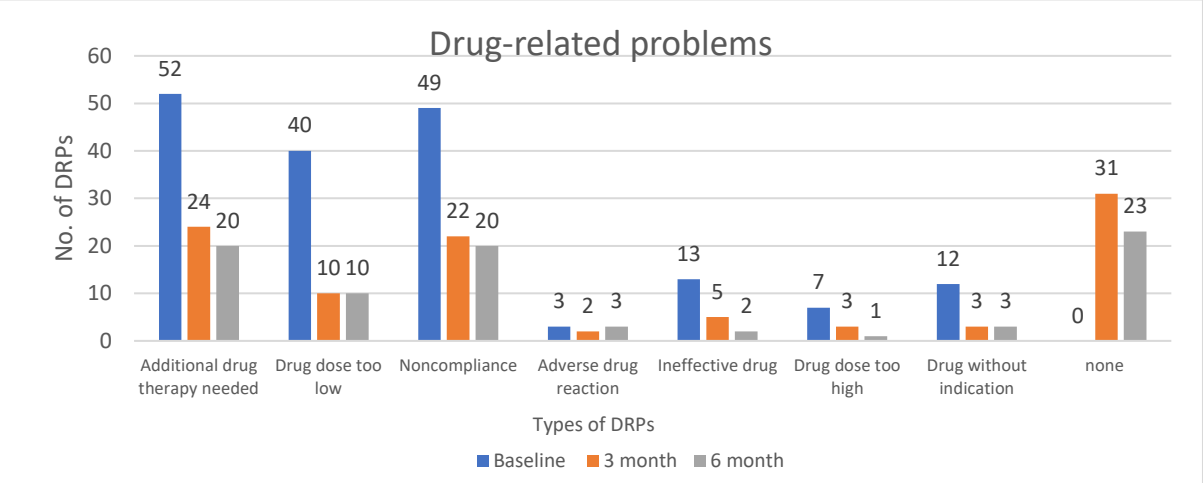


Figure 5.7: Drug related problems reported by participants in the medication therapy management service over baseline, three-month and six-month follow up

5.5.2.7 Health services utilisation

In this study, health services utilisation was assessed by the number for hospitalization or ED visit related to DM, HTN, and DLD complications during the study period. Firth logistic regression was used for analysis.

None of the intervention participant utilised healthcare service during the MTM service, while 14 participants (8 (11.8%) participants at three-month and 6 (9.4%) participants at six-month) in the standard care utilised the healthcare services, as presented in Table 5.13.

Additionally, at three-month the MTM service significantly reduces the odds of healthcare utilisation by 95.1% compared to standard care. While at six-month the reduction in odds of healthcare utilisation reach 93.1% in MTM service group.

Table 5.13: Healthcare utilisation (hospitalization/ emergency department visits) for both trial groups across trial visits with the differences, 95% confidence interval differences and P value

Healthcare utilisation	Control group, N (%)		Intervention group, N (%)		Odds ratio (95% CI)	P-value
	No	Yes	No	Yes		
Baseline	72 (90)	8 (10)	65 (81.3)	15 (18.8)		
Three-month	60 (88.2)	8 (11.8)	72 (100)	0	0.049 (0.003, 0.9)	0.04
Six-month	58 (90.6)	6 (9.4)	65 (100)	0	0.069 (0.004, 1.3)	0.07

5.5.2.8 Patient medication adherence

MARS-5 questionnaire was used to measure the adherence to medication **(Horne, Weinman and Hankins, 1999).** A logistic regression was conducted to compare the median of adherence between the two study groups.

At baseline, the median adherence was similar between the intervention group (20 [IQR, 16, 24]) and the control group (20 [IQR, 15, 23.5]). At the end of the study, there was an improvement in median adherence in the intervention group (25 [IQR, 24, 25]) compared with the control group (21 [IQR, 15, 24]). At the end of the intervention, participants in the intervention group were 8 times more likely to be adherent compared to the participants in the standard group (p=0.0001) **(Table 5.14 and Figure 5.8).**

Table 5.14: Median adherence by medication adherence report scale for both trial groups across trial visits with the differences, 95% confidence interval and P value

Patient medication adherence level	Median [IQR] Control group	Intervention group	Odds ratio (95% CI)	P- value
Baseline	20 [15, 23.5]	20 [16, 24]		
Six-month	21 [15, 24]	25 [24, 25]	7.89 (3.6, 17.4)	0.0001

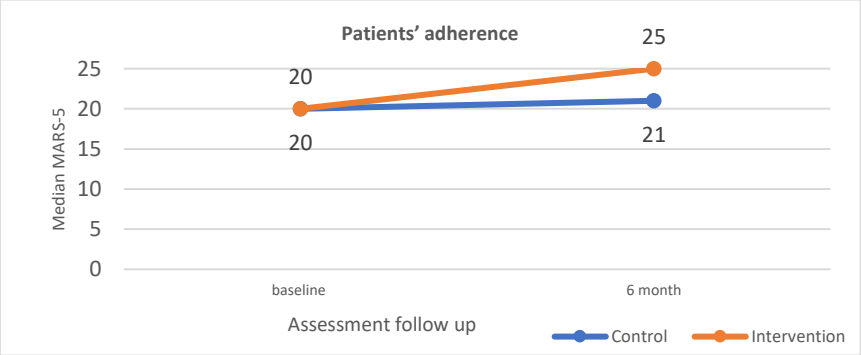


Figure 5.8: Median adherence by medication adherence report scale for both trial groups across trial visits

At the end of the study, the intervention group (50 (76.9%)) had significantly more adherent participants than the control group (19 (29%)). Data is illustrated in Table 5.15.

Table 5.15: Categorisation of participants based on medication adherence report scale scores

MARS-5	Non adherent	Adherent	p-value
Baseline, n (%)			0.719
Control	60 (75)	20 (25)	
Intervention	58 (72.5)	22 (27.5)	
			0.0001
End of the study, n (%)			
Control	45 (70.3)	19 (29.7)	
Intervention	15 (23.1)	50 (76.9)	

5.5.2.9 Diabetes distress

The participants' distress was measured by DDS questionnaire **(Polonsky *et al.*, 2005).** These results however should be interpreted with caution. The purpose of presenting these results was to provide an overview of the data that was gathered through this study and not to provide a clinical diagnosis for distress of this participant population. Ordinal logistic regression was used for analysis.

Participants in standard care group had higher median distress score 2.7 [IQR, 2, 3] at six-month visit than baseline score 2.5 [IQR, 1.9, 3.1]. In contrast, participants in MTM service group had lower median distress score 1.6 [IQR, 1.2, 2] at six-month visit than baseline score 2.6 [IQR, 1.9, 3.5]. Additionally, at the end of the study the MTM service significantly reduces the odds of participants' distress by 93.4% compared to standard care **(Table 5.16 and Figure 5.9).**

Table 5.16: Median distress by diabetes distress scale for both trial groups across trial visits with the Odds ratio, 95% confidence interval and P value

DDS	Median [IQR] Control group	Intervention group	Odds ratio (95% CI)	P- value
Baseline	2.5 [1.9, 3.1]	2.6 [1.9, 3.5]		
Six-month	2.7 [2, 3]	1.6 [1.2, 2]	0.066 (0 .03, 0.2)	0.0001

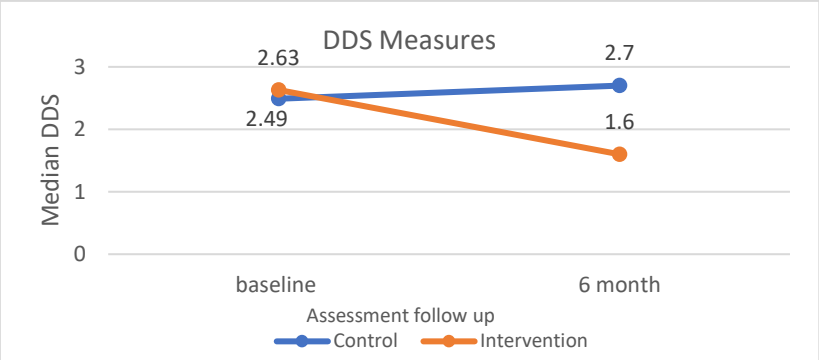


Figure 5.9: Median score of the diabetes distress scale questionnaire for both trial groups across trial visits

Table 5.17 shows that at baseline the majority of MTM service participants (32 (40%)) had high distress and 35 (43.8%) participants in the standard care group had moderate distress. However, the difference in the DD score was not statistically significant (p = 0.384). For the six-month follow-up DD scores were available for 129 participants. The majority of MTM service participants 47 (72.3%) likely not to suffer from any distress compared to standard care participants where the majority of them 50 (78.2%) had moderate and high distress (p = 0.0001).

Table 5.17: Categorisation of participants based on diabetes distress scale scores

DDS	No or little distress	Moderate distress	High distress	p-value
Baseline, n (%)				0.384
Control	20 (25)	35 (43.8)	25 (31.3)	
Intervention	21 (26.3)	27 (33.8)	32 (40)	
End of the study, n (%)				0.0001
Control	14 (21.9)	25 (39.1)	25 (39.1)	
Intervention	47 (72.3)	16 (24.6)	2 (3.1)	

5.5.2.10 Patient satisfaction with pharmacist services

All participants completed the PSPS 2.0 questionnaire. A Mann-Whitney test was conducted to compare the median scores of the two groups at the six-month visit. The

results show that the MTM service group had a significantly higher median satisfaction score 4 [IQR 4, 4] than the standard care group 1.4 [IQR 1.3, 1.9], with a p-value = 0.0001.

CHAPTER 6 Results of qualitative phase for mixed-methods study

6.1 Chapter overview

This chapter aims to describe patients' experiences and views regarding the MTM service. An overview of sociodemographic characteristics of the interview participants is provided, followed by an analysis of the key themes and subthemes that emerged from the interviews. Anonymized verbatim quotes have been used to illustrate themes and to aid the interpretation of the data. To facilitate reading and comprehension, figures and tables have been embedded in the text.

6.2 Sociodemographic characteristics of the patients

The 16 patients participating in the study were purposefully selected between October 2021 and March 2022. All the interviews were conducted face-to-face at the MTM clinic. The average interview length was 11 minutes, ranging from 5 to 30 minutes. Of the 16 participants, more than half of them (9; 56.3%) were male. The mean age for the patients was 52.0 (DS ±8.9) years, whilst the mean number of years since first diagnosed with diabetes was 11.2 (SD ±7.3) years. HbA1c results were fluctuated in most of the participants **(Table 6.1).**

Table 6.1: Sociodemographic characteristics of participants (n=16)

ID	Age in years	Gender	Diabetes duration in Years	Trending of HbA1c
Pt. 1	54	female	13	Improve
Pt. 2	42	male	9	Fluctuate
Pt. 3	38	male	7	Fluctuate
Pt. 4	65	male	30	Improve
Pt. 5	49	male	7	Improve
Pt. 6	54	female	20	Fluctuate
Pt. 7	46	male	13	Fluctuate
Pt. 8	66	male	10	Fluctuate
Pt. 9	59	female	18	Fluctuate
Pt. 10	61	female	2	Improve
Pt. 11	56	male	12	Worse

Pt. 12	47	male	10	Improve
Pt. 13	59	female	12	Fluctuate
Pt. 14	40	female	0.66	Improve
Pt. 15	42	female	3	Fluctuate
Pt. 16	54	male	13	Improve

6.3 Themes and codes

Inductive-deductive thematic analyses of participants' experiences and views about the MTM service were captured in three themes. Each main theme is comprised of several sub-themes which capture different facets of the main theme. These are not exhaustive of the information that arose from the interviews but represent those that were considered most relevant to the research questions. Figure 6.1 shows the themes and their sub-themes. Full mind-maps are illustrated in appendixes, **Appendixes VI-A and VI-B** describes the first draft and final themes.

The themes are presented descriptively alongside direct quotations from the interview transcripts to show how the theme was derived from the data. Participants' quotes that illustrate each of the themes are presented in italics. Pseudonyms are used throughout the analysis to protect participant confidentiality. All personal identifiable information has been removed. Participants are denoted through their unique study ID number (e.g. Pt 1, Pt 2). In the following section, each theme and its sub-themes are described in detail.

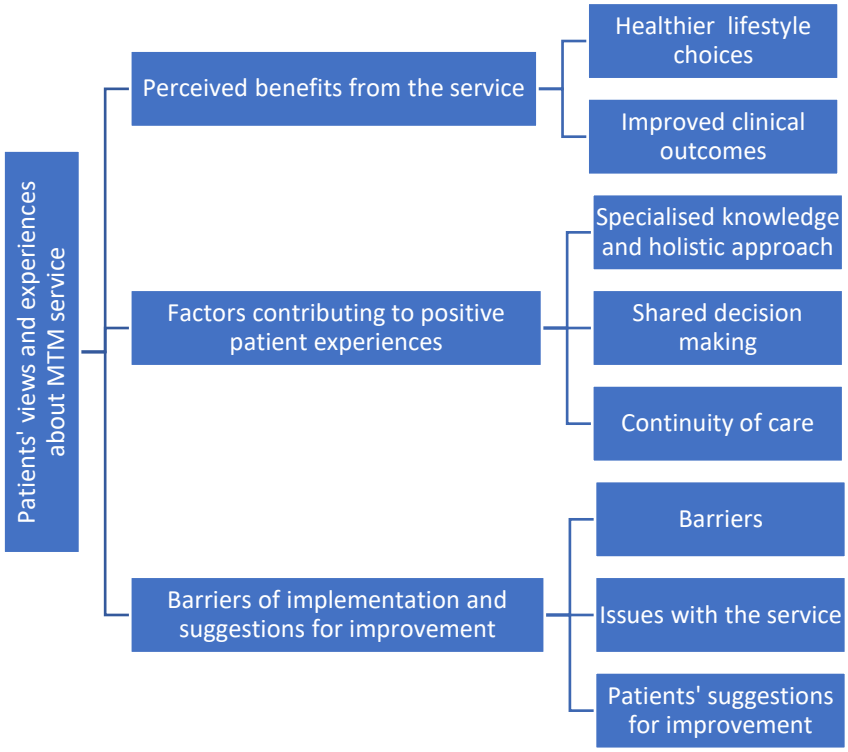


Figure 6.1: Qualitative analysis matrix

6.3.1 Key themes

Three broad themes emerged from patients' responses: perceived benefits from the service, factors contributing to positive patient experiences and barriers of implementation and suggestions for improvement as illustrated in Figure 6.2.

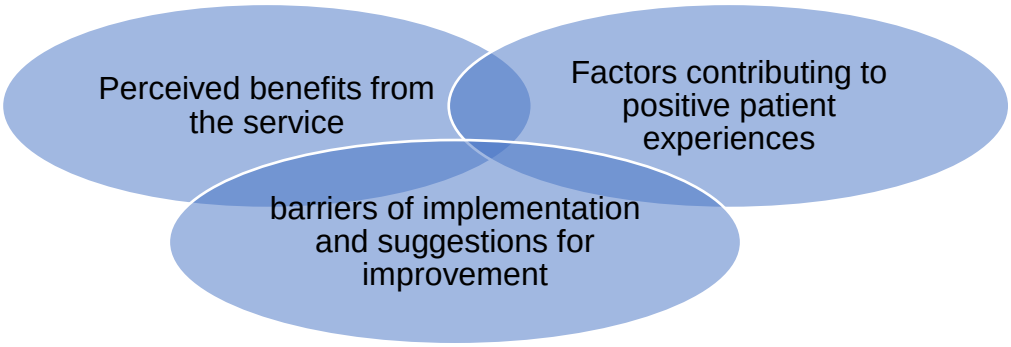


Figure 6.2: Main themes identified

6.3.2 Perceived benefits from the service

Generally, The MTM service was rated highly by patients in terms of quality of service. According to the patients, their participation in the service enabled them to make healthier lifestyle choices and improve clinical outcomes leading to better overall health.

> *"Really, I benefited more here in the clinic than from following-up with the doctor." [Pt 12]*

6.3.2.1 Healthier lifestyle choices

Healthier lifestyle choices were the first of many perceived benefits reported by patients. Patients reported that consultation with MTM pharmacist helped them make better decisions regarding healthier lifestyle choices. The MTM pharmacist highlighted the importance of changing poor diet habits and engaging in physical activity in controlling blood sugar.

> *"Frankly speaking, I would not practice the sport of walking, but after the pharmacist's talk about the importance of walking and her encouragement to me, I thought about the matter….. Now I walk an hour a day, 30 minutes in the morning and 30 minutes in the evening." [Pt 14]*

In addition, patients talked positively about being provided with more information regarding their diagnosis and clearer instructions about their medicines use. Patients' knowledge and understanding of diabetes and its treatment improved with structured and written education.

> *"My understanding of my treatment and my disease has changed a lot, and I now feel that I am able to control it because I understand it well." [Pt 13]*

In addition, having regular follow-ups offered MTM pharmacists the opportunity to identify knowledge gaps and reinforce the importance of healthy lifestyle and medication adherence. Subsequently, many patients described in terms of feeling empowered or having greater responsibility for promoting their own health. Resulting

in most of the patients, started managing their diabetes themselves because of such positive features provided by MTM service.

> *"Yes, it urged me to adhere more to the treatment plan because I kept feeling that there were people following up with me." [Pt 8]*

> *"Yes, I managed to understood a lot about what I had, so I was able to deal with the problems I encounter." [Pt 9]*

6.3.2.2 Improved clinical outcomes

HbA1c, medication adherence, weight control and psychological condition were perceived to improve by patients with implementation of MTM service. Patients also mentioned the consequences involved in understanding tests and their results. Before, they were uncertain of why the tests had been done or what the results meant.

> *"I took control on it because I managed to understand it, even understand how to read the laboratory results, and I will have more control, God willing." [Pt 9]*

Majority of the patients highlighted medical improvements in HbA1c, in addition to experience the benefits of weight loss and how become motivating them in control diabetes and improve their health.

> *"This result of HbA1c I reached is the biggest evidence of the good services you provide, for which I would like to express my gratitude." [Pt 3]*

Likewise, medication reviews facilitated patients' acceptance of their conditions and helped them adopt behavioural changes necessary for adequate medication adherence.

> *"I never delay in taking my medications, under any circumstances, I must take them regularly." [Pt 1]*

Patients also emphasized the importance of motivational support, which enabled them to push themselves harder than they would have otherwise. Patients specifically stressed in the potentially exerting a positive effect of MTM pharmacists in calming patients' stresses and anxieties by providing reassurance during the service. Even one

patient highlighted valued improvements in psychological condition even more than the diabetes itself.

> *"The follow-up and care also gave me a sense of comfort and reassurance, so I liked this thing…. Their encouragement has brought me to the reassuring results, praise be to God!" [Pt 15]*

6.3.3 Factors contributing to positive patient experiences

Generally, patients reported negative experiences with healthcare professionals, expressing dissatisfaction and distrust of the service they received from numerous healthcare professionals, particularly pharmacists in CPs.

> *"I never trusted a pharmacist; I visit the doctor, then I only go to the pharmacist to take my medication …. He only gives me the treatments prescribed for me; if I ask him about anything, he would tell me to go back to the doctor as this is better." [Pt 15]*

With introducing the MTM service in CP, patients' expectations with the role of pharmacists changed. Patients started to understand the role and importance of pharmacists within healthcare settings. They hoped that such services are offered by all pharmacies across the Kingdom. Furthermore, many patients mentioned that MTM approach would improve health service practices and increase patient satisfaction.

> *"When you talk to the pharmacist, it seems as if you are talking to your doctor; they give you excellent information, God willing, and blessed be God!" [Pt 14]*

> *"On the first visit, my expectations have entirely changed. On the second visit, I was frankly astonished by the services you offer." [Pt 16]*

Overall, patients appreciated and recognised the pharmacist's role at MTM service and were pleased with the quality of care that was provided. Three factors contributing to positive patient experiences were identified: specialised knowledge and holistic approach, shared decision making, and continuity of care. These factors are discussed in detail in the following sections.

6.3.3.1 Specialised knowledge and holistic approach

Patients highlighted that the lack of specialised knowledge in medicines was the main reason for general practitioners' (GPs) inability to effectively manage diabetes. There was concern expressed by patients regarding the competency of GPs to deal with and manage diabetes, and they found that they did not receive much help from them.

> *"…. now I have stopped talking to the doctor because I am talking to pharmacist who specialises in medicines, so when she tells me, for example, to take this medicine in a higher dose and it is safe, I am reassuring." [Pt 2]*

Patients also stressed the need for a holistic approach and expressed frustration with the current practice. They felt that perhaps the MTM service will meet necessarily needs to improve chronic disease management. For example, one patient mentioned that he needs more information about his medication to increase his understanding and morale.

> *"…. I needed to explain the medicines and understand their purpose, and I was in need of a raise to my morale." [Pt 5]*

Furthermore, patients were highlighted that the reinforcement and encouragement provided by MTM pharmacists often benefited them to be enlightened about diabetes and chronic disease in general which reflected in commitment to control diabetes and incentive to move forward and reach the sited goals.

> *"I did not expect that the information is at this level and that I get encouragement and motivation to reach what I have reached..... it gave me an incentive to move forward, to be honest." [Pt 12]*

It was soon apparent to the patients that the pharmacist had in-depth specialized knowledge regarding medication optimisation either diabetic medicines or other medicines involved in diabetes management. On other hand, the situation was different in doctor office when doctors prescribed treatments without counseling. Consequently,

many patients felt that they needed more information on how to use their medications and what their purposes were.

> *"…. you have paid much attention to the pharmacological side, i.e., you have talked in much detail about how I could achieve best laboratory results, as well as the mechanism with regards to medication, commitment in a medicines, and method of taking medicines." [Pt 2]*

Of the specific aspects that the patients found, counseling with useful information that helped them to bring the recommended changes in their lifestyle (diet and physical activities).

> *"Really, they talked about medicines, physical activity and diet." [Pt 4]*

Compared to GP, the MTM service offered a more holistic approach to medication management, this was especially the case for medication safety and efficacy, medication adherence and organise daily patient's doses with his/her meals were often not known.

> *"Keeping on medications and making sure that the medicines taken are safe and appropriate, and that medications are not interrupted or suspended under any circumstances. Also, trying to coordinate diets, arrange dosages of medications and clarifying the dosage to be taken before or after eating." [Pt 16]*

Moreover, the MTM service provided a holistic approach through regular follow up and monitoring, recommendation and advice, therapeutic plan and referral. Regular communication was the service patients like it the most. This is because patients recognized the specific contribution of pharmacist expertise in terms of provision of regular follow up and monitoring.

> *"…. what I liked most was communication, i.e., the periodic contact, I liked it a lot. It is for the first time in my life that I witness such service, frankly speaking." [Pt 14]*

As well, patients considered the usefulness and appropriateness of the MTM pharmacist recommendations and therapeutic plan. And reported that their knowledge had improved as they recalled specific advice that had been given by the pharmacist.

"The clinic provides rich and distinguished information that brings you very beautiful insights during the course of your treatment until you reach the desired result." [Pt 16]

In the event that other services were needed, such as ophthalmology, the patients were referred to those services after assessing their needs. As a result of these referrals, patients were satisfied with the service overall.

"They also asked me to examine the retina and I already did so." [Pt 1]

6.3.3.2 Shared decision making

This sub-theme involved the decision making and factors involved in patients' choice between therapeutic plans. Many patients indicated that they were not involved and consulted in deciding which medication they preferred and sometimes not even the indication of their medicines was explained to them.

"Yes, there was no moral support at all. There was no explanation. It was only the doctor writing the treatments and leaves the patient alone so that usually the doctor does not discuss with me the results of the laboratory tests or the results of the HbA1c at least." [Pt 5]

On contrast, in the MTM service, careful consideration was given to individual patient's needs. In consultation with the patients, the MTM pharmacist developed a therapeutic plan, which explored both pharmacological and non-pharmacological options. In MTM service, the shared decision making model was used to develop therapeutic plans. Patients regarded the MTM service as having provided an opportunity to obtain a clear and sufficient information about their problems and medicines from the pharmacist. The pharmacist asked about each medicine and answer each question in turn provided patients with confidence that they were "doing the right thing".

"…. it is completely different now with your clinic, where you sit with me more and allow me to speak freely and ask you and you answer me, unlike the doctor." [Pt 13]

"I am very satisfied with the level of information and I feel that it is sufficient because you answer all my questions in a clear, sufficient and calm manner." [Pt14]

And when asked to reflect on how useful the MTM service had been, participants responded by described the MTM as "satisfying" and "very useful" for ensuring optimum care.

> *"More than wonderful; honestly speaking, everything is excellent. Yes, I am 100 percent satisfied." [Pt 10]*

> *"This [clinic] would be better than the private clinics because the clinic provides advice and follow-up and at the same time the patient feels comfortable, as the time is sufficient and the information is very useful." [Pt 12]*

Patients perceived pharmacists in the MTM service as knowledgeable. The patients felt that through MTM pharmacists would get valuable information on their perspective and deepen their understanding for their health status. Even they learned more about treatments and their importance (effects) which affect their compliance. Several patients said they knew very little about their disease prior to visiting MTM.

> *"Firstly, the doctor I was following up with, used to only prescribe the treatment and says, "If the sugar rises, walk for a little time", but with you, the situation is different. I mean, you give me a chance to speak and ask and you answer all my questions." [Pt 9]*

> *"…. I was completely ignorant of the health problems I had. Moreover, the doctor did not advise me to follow a certain regimen." [Pt 13]*

When asking the participants about the acceptability of the MTM pharmacists' recommendation, it appeared that the pharmacist's recommendations were accepted when patients could associate perceived benefit or avoidance of harm with the recommendation.

> *"I agree to the treatment plan, or else I would not follow it, and we would not have seen such good results." [Pt 15]*

> *"Yes, the treatment plan was in my favour as I managed to control my diabetes." [Pt1]*

Moreover, patients felt confident approaching pharmacists at MTM clinic. Their confidence in MTM service appears to be based on their trust in pharmacists' advice.

A pharmacist's knowledge and understanding of medicines should enable participants to receive good advice from them.

> *"…. I felt safe because she was reassuring me. Indeed, after I started the new dose, I have no problems, praise be to God." [Pt 2]*

In addition, the patients felt that they were given ample time to express their views in the clinic, contrary to the limited consultation time with the GP. Therefore, GPs were not able to fully understand the patient's story and were unable to design an individualised therapeutic plan.

> *"Well, I will tell you, since I am a pharmacist, I expected that you will only spend more time with patients because the Doctor, as you know, treats many patients, where he does not have enough time to explain or make clear the details of patients' prescriptions." [Pt 2]*

The patients viewed the interaction as an opportunity for them to discuss their own concerns about disease and medicines. Most participants suggested that they valued the time they spent with the pharmacist. Patients commented that this had made them feel special and they appreciated the opportunity to speak to them privately.

> *"…. it completely different now with your clinic, where you sit with me more and allow me to speak freely and ask you and you answer me." [Pt 13]*

> *"As for here, I feel that there is enough time and detailed questions, i.e., there is care about patients." [Pt 12]*

Moreover, patients were considered that the MTM pharmacists not only spent full time with them but also have a good interpersonal communication skill where the pharmacists interested in listening to their problems allowing tailored therapeutic plans based in their problems, which sometimes might have been of more importance to the patients. Patients felt relieved to finally have someone smile at them and interact with them.

> *"She treats me very well….Yes, she was listening to me…..Yes, she used to always ask me if I have any other question…your style of communication is very beautiful,*

always smiling and optimistic, always mentioning that all things are getting better and the future is better." [Pt 14]

6.3.3.3 Continuity of care

Within the context of standard care, poor coordination among healthcare professionals and lack of continuity of care were the key challenges described by patients which made it more difficult for patients to develop effective therapeutic relationships and adversely affected levels of care and confidence in the management plans.

> *"When I attend followed-up appointment with the doctor, at every visit, I had to explain to him about my condition from the beginning. This makes me tired and I find it difficult to understand, and for sure the level of care decreases." [Pt 15]*

The factors accountable for the continuity of care in the MTM service included availability, accessibility and flexibility of the service. First factor reported by patients is the availability of the service. In terms of patients' perspectives, the right services are available for those who need them, with adequate opening hours, laboratory supplies and waiting times that meet their expectations.

> *"By God, there are no obstacles, and the time is suitable for me after work, because the clinic started in the evening." [Pt 5]*

Secondary, some patients approached MTM pharmacists because of their convenient and affordable accessibility. Patients expressed that they would choose a medical centre close to them instead of the government hospital, that why the MTM service was their first choice.

> *"Well, the day the doctor informed me about the clinic I was very happy because I would follow up in the military hospital and the journey was far for me but you are close to my house, so it is easier for me to follow up with you." [Pt 6]*

> *"In the clinic, they provided me with a 50% discount on tests." [Pt 7]*

> *"Secondly, the voluntary service you provide," [Pt 16]*

Lastly, many patients appeared happy with the flexibility of schedule time offered in MTM service in compared to frustrated in GPs appointments with more restricted schedule.

> *"This flexibility in dealing gives a good impression about the medical team, unlike some doctors who obligates you to a specific time and day, which is not practical at all." [Pt 16]*

6.3.4 Barriers of implementation and suggestions for improvement

Patients reported a number of follow-up barriers that affected the quality of care, issues with the service as well reported some suggestions for improvement.

6.3.4.1 Barriers of implementation

This sub-theme highlighted important barriers reported by patients towards the follow up in the MTM clinic. Barriers have been classified into three categories: financial, geographic, and personal. First, even patients know the importance of laboratory tests for the follow up, the high costs meant that they couldn't afford it. This was considered as barrier to sustaining effective diabetes management. One patient only was not pleased by the fact that the MTM service did not afford lab tests for him.

> *"The problem of lab tests is the main problem for the follow-up of patients. The results of the lab tests are crucial. Without them, neither the patient nor the medical team can move. Frankly, clinic is distinguished and provide a 50% discount on lab tests necessary for diabetic patient follow up. This is a nice gesture on their part." [Pt 16]*

> *"…. the laboratory tests were not free of charge which caused burden for the patients who follow up with you in the clinic." [Pt 6]*

Second, MTM service was offered in one pharmacy connected to medical centre. People mostly choose medical centres based on proximity to home, choosing the one nearest to them. This is the reason why all interviewee, except one, stated that the

accessing MTM service was easy. The only patient indicated that accessing the clinic involved substantial long time.

> *"The clinic is far away from home." [Pt 15]*

Third, despite the high quality of care provided at the MTM clinic, not all patients achieved their goals. Some patients reported that because of their uncommitted, random, and non-adhering behaviour either to the diet, physical activities, or treatment plan.

> *"…. I was the one who failed them through not adhering to the treatment plan prescribed for me." [Pt 7]*

> *"…. it was me who was negligent as I did not commit to diet and physical activities." [Pt 13]*

6.3.4.2 Issues with the service

Only two patients reported issues during follow-up. The first patient expressed concern about the long waiting time during the three-month follow-up appointment. Nevertheless, the patient did not have to wait in the six-month follow-up appointment.

> *"Yes, but I have a note about the long wait before the appointment, but today, praise be to God, it is good." [Pt 4]*

The second patient expressed concern about the amount of time spent with the pharmacists at MTM clinic. She commented that there were some questions she couldn't ask the MTM pharmacists because the clinic was crowded with patients awaiting their appointments.

> *"Yes, right, I remembered that I had a few questions in the previous follow-up, but because of the crowding, I could not asked them; I felt ashamed and went out." [Pt 15]*

6.3.4.3 Patients' suggestions for improvement

The patients made various suggestions to improve the delivery of the MTM service. They suggested expanding the clinic space and include a suitable waiting area. Lack

of waiting area cause inconvenience to patients while waiting for their appointments outside the clinic.

> *"I know that this is the first clinic in the Kingdom, and it started recently, but if it is possible that the clinic has a larger area with a waiting area for patients." [Pt 2]*

Also, they believed that having more than one MTM pharmacist operating the clinic at the same time make the service move smoother and faster.

> *"Yes, there is a suggestion, I hope if the number of pharmacists can be increased." [Pt 4]*

Furthermore, one patient proposed the importance of clinic's location inside the pharmacy to be more accessible. Patient recommended being in clear and in front of patients.

> *"It [MTM clinic] is in the corner and I feel that it is not suitable. It would be better if the location is facing the patient and closer to him." [Pt 16]*

Other patient preferred to move the MTM clinic from the CP to inside the medical centre to have greater impact and avoid the commercial perspective.

> *"…. if the clinic is inside a health centre, it will have a greater and better impact. The association of the clinic with a commercial pharmacy gives you a purely commercial perception." [Pt 16]*

On the other hands, several suggestions collected from patients to improve MTM service. Some patients suggested increasing the frequency of the communication to be every month instead of every three-month.

> *"I hope so. For example, a visit or two may be conducted during the period of the three-month between first and second visit or between second and third visit….Mashallah, everything is excellent, but it would be better if you increase communication." [Pt 3]*

One patient recommends activating the educational messages to raise patients' awareness and follow up messages which reflect positively on patients and gives them the feeling that there is someone who care of them.

> *"You can raise awareness of patients by sending educational messages via social media, when there are any new developments in the treatment of diabetes. The messages can even be like a follow-up with regard to taking the medications and*

reminding the patients, as this gives the patient the feeling that there is someone who care and follows up with him." [Pt 7]

They also suggested MTM service activating more the referral and cooperating with other specialists as required. Some patients need more attention on diet while other need more information about physical activity.

"……through the clinic if you could transfer to dietician, so that the patient follows up with them." [Pt 2]

One patient wished the clinic would be under insurance coverage to facilitate the follow up.

"Well, if you turn it into a private clinic and it is covered by insurance, it will be better and easier to follow up." [Pt 5]

Patient was expressed the need to dispense medication from the MTM clinic or at least connect the clinic system MOH system or to 'WASFATY' programme (a process of distributing medication through CPs) to allowed him to dispense medications from the pharmacy before he leaves.

"…. I wish to link clinic system to Ministry of Health system to dispense some medicines, especially the expensive medicines." [Pt 7]

"Yes, I would like to dispense medicines from the clinic, meaning that they link 'WASFATY' to the system of your clinic, where upon leaving your clinic I can dispense medicines from any pharmacy." [Pt 13]

Finally, some patients were not pleased by the fact that the MTM service did not afford to them test streps and monitoring devices. Patients felt that this caused financial burden and they wished to be free of charge.

"…. if you can provide the diabetes test strips every month or two, you will encourage patients to monitor their sugar readings. You may also provide blood glucose monitoring devices for those who do not have them." [Pt 1]

CHAPTER 7 Results of process evaluation

7.1 Chapter overview

In the previous chapters findings of pilot RCT and qualitative descriptive study have been presented. This chapter is the third results chapter in this thesis. Due to the extensive nature of the process evaluation, which covers a variety of aspects of service delivery, the results are reported separately in this chapter. The design and structure of the process evaluation used was according to the MRC framework for process evaluation of complex interventions **(Moore et al., 2015).** Results are described below using three components comprising in pre-defined study parameters: implementation, mechanism of impact and context.

7.2 Participants

Participants in this process evaluation were from two domains, patients and key stakeholders. First domain was patients. Patients' data for the process evaluation were taken from the mixed-methods study, which consist of 80 intervention patients from quantitative RCTs phase including 16 patients from the qualitative interview phase, described in detail previously. Briefly, they were 50-year old diabetic patient with median of HbA1c 9.6% [IQR, 8.9, 11.7] on 5 chronic medications. The majority was male 71.3% and were residents. Most of them identified as non-adhere (72.5%) and categorised as high distress (40%). For more details of sociodemographic characteristics and comorbidities of patients were presented in Table 5.2 and 5.3 in chapter 5.

Whereas second domain is stakeholders. Stakeholders' data were taken from interviews with key stakeholders involved in implementation and developing process of MTM service. They represent a variety of implementer groups across different

specialities, included: two clinical pharmacists provided the service, four pharmacists worked in the CP, two physicians referred patients to the services and the pharmacy owner.

Eventually, nine qualitative interviews were conducted. The composition of stakeholders interviewed provided diverse professional and personal characteristics, representing a wide range of views and opinions. All stakeholders took part in the semi-structured interviews were males except three females with a mean age of 39-year (SD±12.05) with a mean of 12 (SD±9.73) years' experience in their field. Patients' demographic information already explained in detail in chapter 5 however, the demographic details for stakeholders are provided in Table 7.1.

Table 7.1: Key stakeholders characteristics

Participant ID	Age range in years	Gender	Position (area of practice)	Years' experience range
1	35-40	Male	Community pharmacist	10-15
2	20-25	Female	Community pharmacist	<5
3	40-45	Male	Community pharmacist	15-20
4	55-60	Male	Pharmacy owner	25-30
5	30-35	Male	GP	5-10
6	25-30	Female	Community pharmacist	<5
7	55-60	Female	MTM pharmacist	5-10
8	40-45	Male	GP	15-20
9	25-30	Male	MTM pharmacist	<5

7.3 Thematic areas

Results of the interviews are presented as themes and illustrated with quotes from the participants, in italics. Anonymity was preserved by removing identifiable data and assigning all participants a unique study ID number. The following themes under the three major constructs of MRC framework were found to potentially influence the implementation of the MTM service **(Figure 7.1).** The themes described in more detail

under process evaluation components **(section 7.4).** The mid map illustrated in appendix **(APPENDIX VII-A).**

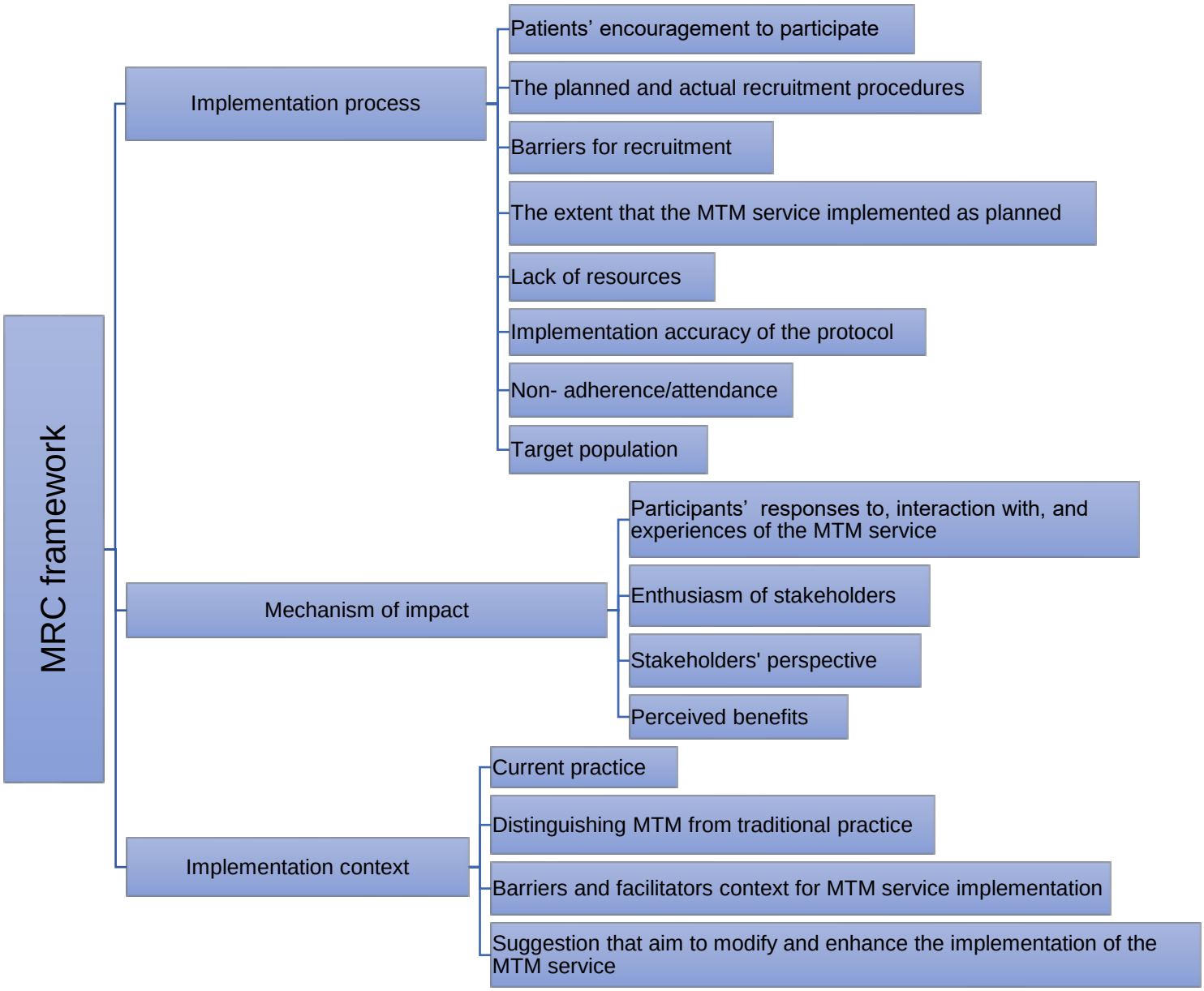


Figure 7.1: Summary of themes based on the key constructs of the medical research council framework

7.4 Process elements outcomes

7.4.1 Implementation process

Implementation as a process evaluation feature referred to how the intervention was delivered within the RCT and what was delivered to the intervention participants. Overall, the MTM service was planned to be implemented in a way that adhered to the American Pharmacists Association and the National Association of Chain Drug Stores Foundation framework for implementing effective MTM services in a CP setting, which included the 5 core elements of MTM: MTR, PMR, MAP, intervention and referral, and documentation and follow-up (**American Pharmacists Association and the National Association of Chain Drug Stores Foundation, 2008**). However, there were components and implementation steps of the MTM service that were challenging to implement, these challenges are described below.

7.4.1.1 Reach and recruitment

7.4.1.1.1 Quantitative results

The service was proposed to 357 patients, of which 160 accepted to participate, resulting in an acceptance rate of 44.8%. The recruitment process took 19-week, 80 patients were randomised to the usual care and 80 to the MTM service. The proportion of the intended target group that participated in the intervention group was 100% because the inclusion criteria were rigorously applied.

The socioeconomic and clinical characteristics of patients that were lost to follow up (n=15) or completed the service (n=65) have been presented in Table 7.2**.** Overall, socioeconomic and clinical characteristics of patients who completed the service and those who were lost to follow-up were not statistically significant. However, non-Saudi

male and younger patients were more likely not to complete the service. However, low income (<5000 SR per month) patients and patients with insurance coverage were more likely to complete the service.

Patients not on regular diet and with higher BMI (median [IQR], 29.8 [26.4, 33,1]) were the most likely to continue in service. While inactive patients were the most likely not to complete the service.

Patients already non-adherent to his/her medication and distressed (DDS > 3.0) at baseline were the most likely not to complete the service. In the other hand, complete the service was higher among patients with higher HbA1c (median [IQR], 9.8 [8.9, 11.7]), higher number of chronic medications (median [IQR], 5 [4,7]) and longer duration since diagnosed with diabetes (median, 9-year).

Table 7.2: Difference between patients who loss of follow up and complete the medication therapy management service

Sociodemographic characteristics	Loss of follow up (n=15) N (%)	Complete service (six-month) (n=65) N (%)	p-value
Gender			0.406
Male	12 (80)	45 (69.2)	
Female	3 (20)	20 (30.8)	
Age (year), mean ± (SD)	47 ± (11.9)	50.55 ± (12.4)	0.3164
Nationality			0.097
Saudi	2 (13.3)	23 (35.4)	
Non- Saudi	13 (86.7)	42 (64.6)	
Smoking status			0.424
Never smoker	8 (53.3)	46 (70.8)	
Ex-smoker	2 (13.3)	6 (9.23)	
Current smoker	5 (33.3)	13 (20)	
Education			0.862
Illiterate	1 (6.7)	6 (9.23)	
Elementary	4 (26.7)	13 (20)	
Intermediate	3 (20)	15 (23.1)	
Diploma/high school	2 (13.3)	15 (23.1)	
Bachelor's degree or higher	5 (33.3)	16 (24.6)	
Income range (SR)			0.771
<5000	4 (26.7)	23 (35.4)	
5000- <10000	3 (20)	17 (26.2)	

10000- <15000	4 (26.7)	13 (20)	
≥ 15000	4 (26.7)	12 (18.5)	
Insurance coverage			0.687
Governmental	1 (6.7)	7 (10.8)	
Insurance company	8 (53.3)	39 (60)	
None	6 (40)	19 (29.2)	
BMI (kg/m2), median [IQR]	27 [22.7, 31.9]	29.8 [26.4, 33.1]	0.1934
Diet habit			0.906
Follow diet	3 (20)	13 (20)	
No regular diet	8 (53.3)	38 (58.5)	
Physical activities			0.210
Inactive	9 (60)	28 (43.1)	
Moderate	3 (20)	29 (44.6)	
Highly active	3 (20)	8 (12.3)	
Family history			0.551
None	5 (33.3)	13 (20)	
DM	5 (33.3)	19 (29.2)	
HTN	1 (6.7)	2 (3.1)	
DM, HTN, DLD	2 (13.3)	17 (26.2)	
DM, HTN	1 (6.7)	10 (15.4)	
DM, DLD	0	3 (4.6)	
HTN, DLD	1 (6.7)	1 (1.5)	
MARS-5			0.470
Not adhere	12 (80)	46 (70.7)	
Adhere	3 (20)	19 (29.2)	
DDS			0.178
< 2.0 (little or no distress)	5 (33.3)	16 (24.6)	
2.0 -2.9 (moderate distress)	2 (13.3)	25 (38.5)	
> 3.0 (high distress)	8 (53.3)	24 (36.9)	
Diabetes duration year, median [IQR]	8 [2, 18]	9 [4, 14]	0.5701
HbA1c (%), median [IQR]	9.4 [8.9, 11.4]	9.8 [8.9, 11.7]	0.9754
FBG mg/dl, median [IQR]	233.38 [136.9, 276]	222.9 [164, 285.4]	0.8502
RBG mg/dl, median [IQR]	200 [135, 337]	185.25 [134, 300]	0.8196
Number of comorbidities			0.115
None	9 (60)	27 (41.5)	
1	3 (20)	19 (29.2)	
2	0	12 (18.5)	
3	3 (20)	4 (6.15)	
4	0	3 (4.6)	
Number of medications, median [IQR]	4 [3, 5]	5 [4,7]	0.0786

7.4.1.1.2 Qualitative results

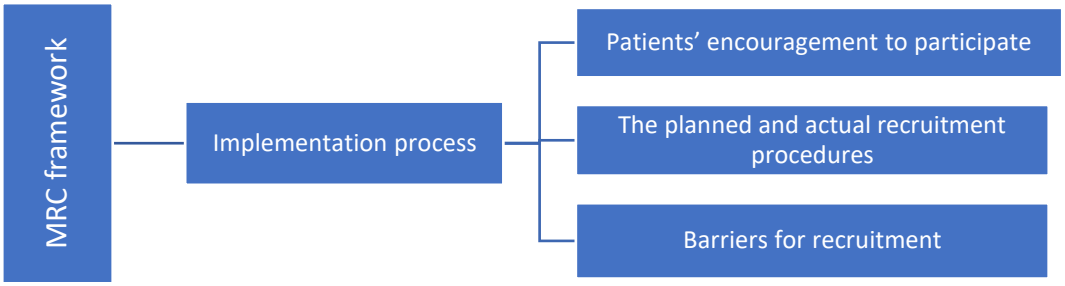


Figure 7.2: Summary of reach and recruitment themes

Patients' encouragement to participate

Patients cited multiple motivations for participation, including the possibility for additional education, follow-up and encouragement opportunity.

> *"I thought that I might benefit from this clinic through follow-up and getting my medications and other necessary matters." [Pt 1]*

Another important motivation for participating was physiological improvement needs, such as improve HbA1c, eating behaviour and increase physical activity.

> *"…. I needed encouragement to start walking." [Pt 1]*

> *"…. I will follow up with you in an attempt to improve my health condition and benefit." [Pt 11]*

Accessibility to the MTM service in terms of its location and timing encouraged participants and made it possible for them to attend the clinic. The staff were flexible to accommodate patients' request for appointment timing.

> *"Your closeness to work made it easy to follow up with you." [Pt 11]*

Furthermore, deference to professional status, trust and goodwill toward the pharmacists were frequently sufficient grounds for patients to accept the invitation.

> *"…. I am talking to pharmacist who specialises in medicines, so when she tells me, for example, to take this medicine in a higher dose and it is safe, I feel reassured." [Pt 2]*

The quality of service received by patients at the MTM service compared to other governmental hospitals also encouraged them to continue attending follow-up appointments. Patients were happy with discounts on laboratory tests and prompt availability of test results.

> *"…. they transferred me to a government hospital, the Prince Muhammad Hospital, but their services were bad, and I was extremely confused." [Pt 13]*

The planned and actual recruitment procedures

As per the study protocol, the recruitment process depended on patients' referral by the physician to mimic the actual practice.

> *"Of course, this clinic is not the main one, but rather a referral. All patients, or most of them, are referred from clinics affiliated with doctors." [MTM ph 2]*

Notwithstanding physician cooperation and realizing the important of the MTM service, most of the patients were self-referral. The MTM pharmacist stated that the perceived lack of GPs engagement was reflected in terms of number of referrals to the service. She suggested the need to involve them in the collaborative agreement development and addressing their concerns, instead of sending it to them to sign.

> *"Yes, in general, the clinic helped the patients… It is certainly a good addition to the patient's health care… its positive impacts on patients are very clear… Yes, the presence of the clinic helps my work." [GP 1]*

> *"…. if we do a collaborative agreement, we should work it out with details where everyone should be involved and addressing their concerns; we should discuss the details together." [MTM ph 1]*

Furthermore, the community pharmacists reported that they can help in refer patients since they meet a lot of patients who in need MTM service but they had been hindered by workload and unaware of clinic schedule.

> *"Frankly speaking, I think that on our part, we are supposed to refer to you more patients. Unfortunately, we are failing for two reasons: First, due to the pressure of work; and second, according to my knowledge." [Ph 1]*

Barriers for recruitment

Interviewed stakeholders reported several reasons why patients not participated in the study. First, participation was scheduled as an extra visit followed physician appointment, so they were overwhelmed and didn't like to talk about their medication.

> *"… about 10% of patients consider it a burden that he comes again to obtain a MTM service, for example, or that he considers communication and follow-up annoying to him." [GP 2]*

One community pharmacist even felt that the name of the service was a barrier for recruitment. Some patients were confused in understand of clinic name and unsured about the purpose of the clinic. The 'Medication Therapy Management' literally translated 'Administration of drug therapy', could have led to wrong expectations of participants, possibly caused disengagement.

> *"I think the patients do not understand the meaning of the name. Even when the patient sees the clinic, he must ask what its meaning." [Ph 3]*

Another pharmacist mentioned that some patients not being able to understand the objectives and expected benefits of the service. Even, some they were afraid from it.

> *"I just feel that some patients are afraid that they will come to the clinic and follow up with you." [Ph 3]*

Furthermore, MTM pharmacist raised the issue of low physicians' knowledge and confidence about pharmacists' role in the MTM service which affected the recruitment.

> *"The first concern was whether the doctors really had complete knowledge, confidence and familiarity with the fact that the pharmacist being able to perform the task?" [MTM ph 2]*

7.4.1.2 Fidelity and adherence

The five core elements of MTM service; MTR, PMR, MAP, intervention or referral, and documentation and follow-up, are the main mechanisms for the service **(American Pharmacists Association and the National Association of Chain Drug Stores Foundation, 2008)**, and therefore crucial in the fidelity assessment. The application of the five core elements was discussed in the interviews with the patients and stakeholders also the study protocol and implementation form were reviewed to identify how the MTM service intervention was planned.

7.4.1.2.1 Quantitative results

As per protocol, MTM service can be conducted in the clinic or by phone. While majority of patients received assessment follow up in the clinic, some patients chose to conduct the follow up by telephone, 8 (11.1%) and 12 (18.5%) at three-month and six-month, respectively.

Initially, 80 patients were recruited in to MTM service. The drop-off after first assessment follows up (after three-month) was 10%. MTM service was completed by 65 (81.3%) of recruited patients, which implied a high retention-participation rate of 0.81. Figure 7.3 shows the flow of participants through MTM service.

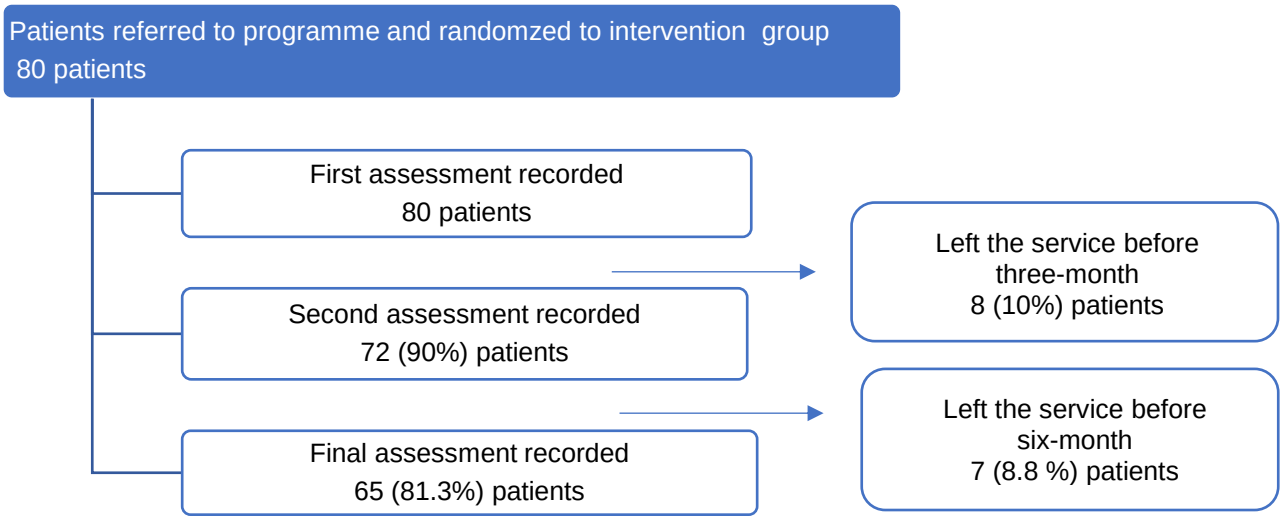


Figure 7.3: The flow of participants through medication therapy management service

7.4.1.2.2 Qualitative results

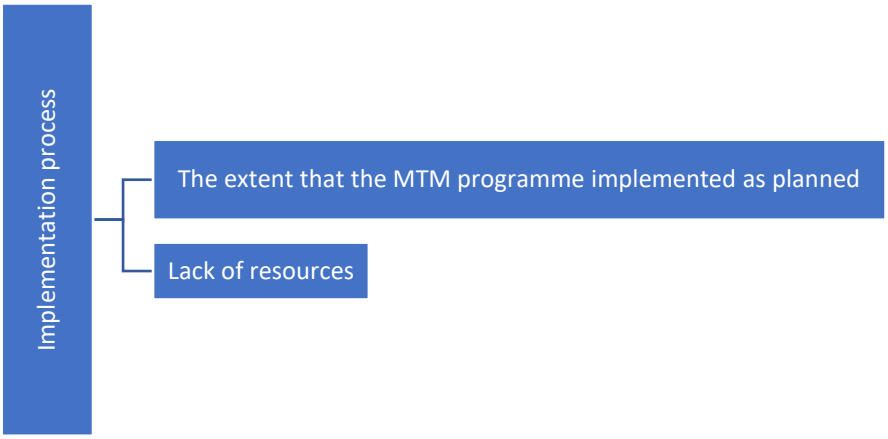


Figure 7.4: Summary of fidelity and adherence themes

The extent that the MTM service implemented as planned

In order to measure implementation fidelity, MTM pharmacists were asked to indicate the extent they had implemented service requirements as planned.

In the interviews, MTM pharmacists indicated that they utilised the five core elements of MTM service with the patients. The service was achieved as initially planned in the study protocol, no major changes were made in design, model, components, and method of delivery. The level of fidelity was reported as largely compliant. Although most of the MTM service components achieved high fidelity, there were components or aspects of components that did not. For instance, the PMR, follow up and referral were challenge in implementing these components.

> *"Let's say that four out of the five. We have achieved medication therapy review, (i.e., patient file review); developed medication-related action plan; periodical follow-up reviews, and documentation. But as for the personal medication record, there was a challenge in the presence of the system as well as in the presence of a specific format specific to the patient. Out of five, we achieved four…..We can say ninety percent." [MTM ph 2]*

Most healthcare stakeholders reported understanding what was required of them, shared its aims with other healthcare professionals, believed it was the right thing to be doing and constructed potential value from the service.

> *"My role is to diagnose the patient and set the treatment service for him, then ask him to go to the clinic for follow-up." [GP 2]*

> *"…. we are not here to replace the role of doctors, rather in order to complete their role and to have a whole balanced equation composed of a doctor, a pharmacist, and a patient, where this will benefit everyone." [MTM ph 1]*

Lack of resources

Lack of appropriate resources was seen as one of the major challenges in nationwide implementation of MTM service. The respondents highlighted three dimensions of resources including infrastructure, skilled human resource and logistics are required for a successful and quality delivery of MTM service.

> *"Let's talk on three levels: The first resource has to do with construction, so it needs special resources for establishing clinics and the accompanying services. It also needs manpower resources to hire or to find pharmacists working in this sector. The third thing is the logistical resources." [MTM ph 2]*

The human resource dimension was not only limited to skilled pharmacy workforce but also emphasized the need to have support staff to undertake administrative tasks.

> *"…. possible to support us with supporting staff who can remove the burden from the pharmacist in matters accompanying the service." [MTM ph 1]*

Access to patients' electronic medical records and having an electronic document storage system to document MTM service activities were considered as infrastructure resources which crucial for smooth operational workflow and quality assurance.

> *"I wish we could have access to the patient's file because currently we do not have it…… Financially, as I have said, the area and the MTM documentation system." [MTM ph 1]*

7.4.1.3 Dose delivered

7.4.1.3.1 Quantitative results

The spreadsheet of results based on the implementation form data, produced monthly, recorded the number of components delivered. Table 7.3 summarises indicators of dose delivery.

The mean time elapsed between service entry and exit was approximately 7.5 months (30 weeks or 208.9 days), though the median was somewhat lower at approximately 7.3 months (29 weeks or 202 days). For the consultation length, the median length for baseline assessment was 35 [IQR 30, 44.5] minutes and 15 [IQR 10, 30] minutes for the second assessment appointment. For the third assessment after six-month, median length was 20 [IQR 15, 25] minutes.

In comparison to the protocol, the overall number of monthly follow up was lower. Also, according to the implementation form, referrals to other specialties were low.

Table 7.3: Dose delivered components

service components	Indicator	Implementation
Service length	Mean (SD) by days	208.9 ±(56.4) days
Consultation length between patients and MTM pharmacists	Median [IQR] consultation length at baseline (minutes) Median [IQR] consultation length at three-month (minutes) Median [IQR] consultation length at six-month (minutes)	35 [30, 44.5] minutes 15 [10, 30] minutes 20 [15, 25] minutes
Monthly follow ups	Number of follow up at 4-week Number of follow up at 8-week Number of follow up at 16-week Number of follow up at 20-week	42 follow up 10 follow up 9 follow up 2 follow up
Referral to another speciality	Number of referrals at baseline Number of referrals at three-month Number of referrals at six-month	68 referrals 12 referrals 6 referrals

7.4.1.3.2 Qualitative results

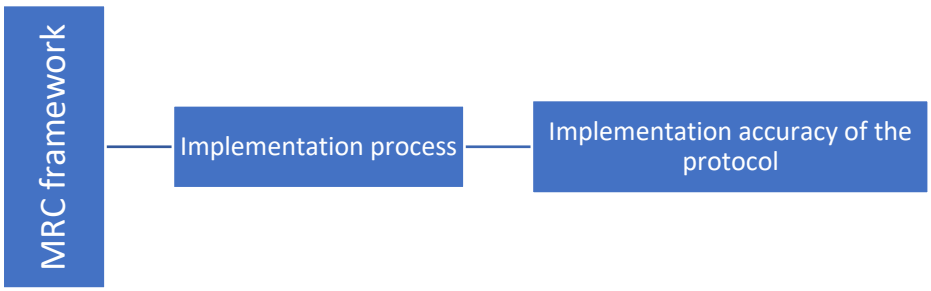


Figure 7.5: Summary of dose delivered themes

Implementation accuracy of the protocol

The number, content and characteristics of service components were discussed in the interviews with MTM pharmacists to compare it with the study protocol.

First, MTR was applied as protocol. For PMR, the MTM pharmacists stated that most of patients refused take the record. They would have been better implemented with more time to study how best way to implemented depend on patients' wishes and/or needs. For the MAP, it was implemented but kept in patient's file. Next, for documentation it was utilised as protocol. Then, the MTM pharmacist reported that at least they did three-month and six-month follow up. However, monthly follow up was not applicable, and therefore planned fewer meetings than prescribed by the protocol.

> *"Thus, we can say that as for the comprehensive medication review, we had no problem with it; as for the personalized medication record, I repeat again that it was valuable, and if we had a supporting staff, it would have been better implemented …; as for the action plan, it was implemented but it was not delivered to the patient, rather, it was recorded and reserved by us. As for the other thing, documentation, it was implemented. It is true that it was manual but it was implemented. Finally, as for the follow up, there are at least the three-month and six-month follow-ups. As for the monthly follow-up, we implemented it as much as possible based on the limitation that we have." [MTM Ph 1]*

Finally, the referral to other specialties, as needed, component was not used as per protocol. Ineffective communication between healthcare professionals and specific organisational challenges made referrals to other specialties difficult.

> *"Possibly the last challenge I can add is the referral, because interprofessional setup was not available so that there could be a referral at the same time. There were an ophthalmologist and a nutritionist who helped us, but the referral is still not as required. If all the specialties or at least those that interest us are in the same place, the referral will be more practical." [MTM ph 1]*

7.4.1.4 Dose received

The number of drop-outs and reasons were reviewed from enrolment form. In addition, attempted reduction of drop-out as well as target population who will benefited from the MTM service were discussed in the interviews with the stakeholders and patients.

7.4.1.4.1 Quantitative results

Based on the enrolment form, 72 (90%) patients were contacted for three-month follow-up and 65 (81.3%) patients completed the planned six-month service. While 15 (18.8%) patients did not complete the service, the main reasons were: five (33.3%) travelled for work, four (26.7%) changed insurance coverage, three (20%) didn't like to continue, two (13.3%) travelled back home country and one (6.7%) moved houses.

As protocol, the monthly follow-up should have been conducted by MTM pharmacists 4 times (at 4, 8, 16 and 20 weeks). However, none of the patients were contacted 4 times as protocol. Only 3 (3.8%) patients were contacted 3 times, 12 (15%) patients were contacted 2 times and 29 (36.3%) patients only contacted 1 time. The median number of monthly follow up per patients was 1 [IQR, 0, 1].

7.4.1.4.2 Qualitative results

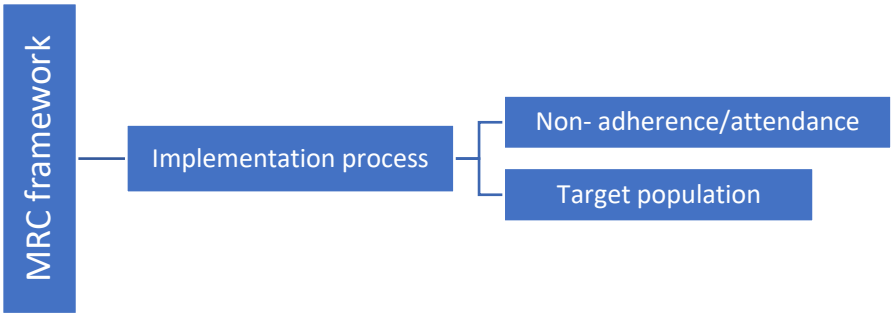


Figure 7.6: Summary of dose received themes

Non- adherence/attendance

Stakeholders described helplessness in ensuring regular attendance at follow-up appointments, mentioned that they cannot forced patients to adhere. The healthcare

professionals also used regular attendance during follow-up visits as an indicator of patient satisfaction.

> *"As long as the patient follows up with you, he will keep feeling the benefit of the clinic, or otherwise, he would not have continued following up with you." [GP 1]*

> *"I expect that they join the service out of satisfaction. Otherwise, I do not expect that they will continue, and no one can force anyone." [MTM ph 1]*

Although the MTM service was available free of cost to patients, however, the patients had to pay for laboratory tests. For service users who engaged with MTM service reported that one of the adherence difficulties they encountered during the service and can cause non-attendance was costs of the laboratory tests.

> *"…. the cost of lab tests is the main problem for the follow-up of patients." [Pt 16]*

Strategies to reduce drop-out consisted mainly of contacting the participant after no show via telephone or WhatsApp and offered the MTM service free of charge.

> *" …. periodic follow-up of patients had a role in the continuity with the clinic." [Ph 2]*

> *"…. I think if fees are added to the service, the numbers of patients visiting the clinic will decrease." [Ph 4]*

Target population

In the interviews, I asked participants about the target population they believed will benefits from CP based MTM service. The participants wished to expand the service to other health conditions. They believed that patients taking multiple medications and with multiple comorbidities will benefit from the service.

> *"Yes, of course, as I told you, you should not be limited to diabetics, it is better to expand." [GP 2]*

> *"Yes, of course. It really helped them, especially patients who take many medications…. patients who have a problem with the medicines or have a problem with their response to the same medicines." [Ph 3]*

> *"…. I just want that this clinic actually reaches every patient, whether a diabetic or a person with high blood pressure, where one can come to receive treatment" [Pt 12]*

A few stakeholders also suggested that clinic should also target patients directly from the community who are having difficulty accessing specialised hospital services either because they are not eligible or they live quite far away from the hospitals.

> *"The Medication Therapy Management (MTM) service in general is a good and targeted service that reaches patients who need to regulate their medications." [MTM ph 2]*

7.4.2 Mechanism of impact

Mechanisms of impact as a process evaluation feature referred to how the activities performed within the intervention result in intended or unintended effects, and are studied through the assessment of participants' responsiveness and interaction with the intervention. In the following section the mechanism of impact components have been explored.

7.4.2.1 Quantitative results

Patients benefited from MTM service, as described in the chapter 5. Three questionnaires were used to examine participants' responses to MTM service intervention in order to get more better understanding of the mechanism of impact aspect of process evaluation; medication adherence, DD and patients' satisfaction.

First, for adherence to medication, MARS-5 questionnaire was used **(Horne, Weinman and Hankins, 1999).** All participants completed the questionnaire at baseline and at the end of the service. When compared patients' medication adherence before and after the service, there was a great difference. Furthermore, at the end of the service, the number of adherent patients (score >=24) were more compared to before starting the service **(Table 7.4).**

Table 7.4: Result on adherence by medication adherence report scale

Value	Before the service (n=80)	After service (n=65)	p-value
Medication adherence score, Median [IQR]	20 [16, 24].	25 [24, 25].	0.001
Adhere patients, n (%)	22 (27.5%)	50 (76.9%)	0.001

In this study, the patients' distress was measured by DDS questionnaire **(Polonsky *et al*., 2005)**. It was measured before and after the service. Overall, the patient scores pointed towards a higher median score at baseline and a decreasing tendency of these values at the end of the study. The number of distressed patients (having DDS scores > 3) reduced dramatically after they had completed the service as presented in Table 7.5.

Table 7.5: Result on distress by diabetes distress scale questionnaire

Value	Before the service (n=80)	After service (n=65)	p-value
DD score, Median [IQR]	2.6 [1.9, 3.5].	1.6 [1.2, 2].	0.001
Distressed patients, n (%)	32 (40%)	2 (3.1%)	0.001

Finally, patient satisfaction was measured by PSPS 2.0 questionnaire **(Sakharkar *et al*., 2015)** at the end of the service. Overall patients' satisfaction with their experience was significantly higher among patients who received the intervention than those who did not (control group) as presented in Table 7.6.

Table 7.6: Result on satisfaction by patient satisfaction with pharmacist services 2.0 questionnaire

Groups	Standard care	MTM service	p-value
Overall satisfaction, Median [IQR]	1.4 [1.3, 1.9]	4 [4, 4]	0.0001

7.4.2.2 Qualitative results

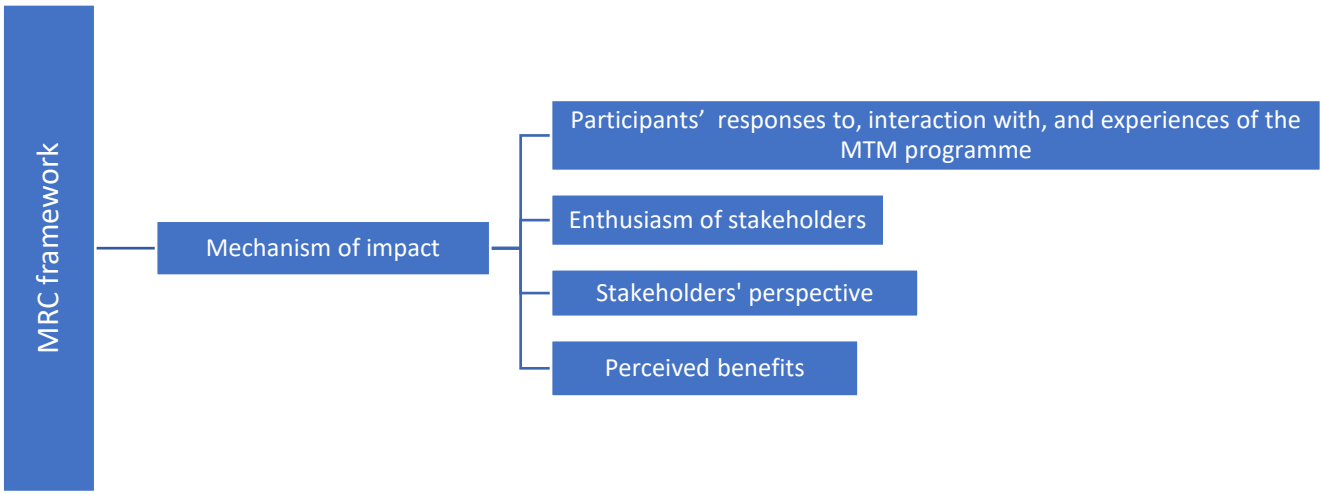


Figure 7.7: Summary of mechanism of impact themes

Participants' responses to, interaction with, and experiences of the MTM service

Participants described their views and experience of involvement and/or providing MTM service. Initially, patients have minimal expectations from the service. Some patients' first impression was that the entire process is designed to make profit but were surprised to receive a quality of care that they had received.

> *"By God, I expected that you would pose some questions about my health, and this would be all. I did not expect that you would follow me up and review my labs tests and focus on them and compare it each visit." [Pt 10]*

> *"On the first visit, my expectations have entirely changed. On the second visit, I was frankly astonished by the services you offer." [Pt 16]*

Both patients and stakeholders express their satisfaction with their experience of service. The patients' sense of satisfaction was also reflected in the findings of the quantitative analysis of the PSPS 2.0 questionnaire, as described in the Table 7.6.

> *"I wish if I could write a thanks letter and send it to the administration. Everything was better than expected, honestly, and the services I received exceeded my expectations." [Pt 2]*

"Yes, greatly, the patient's satisfaction after every visit to us exceeded expectations…." [MTM Ph 2]

From the interviews with the participants, the quality of delivering the MTM service was generally deemed to be high and in line with the service theory and the regulation and procedures of the MTM service as unambiguously and solid.

"The management of the service now is very excellent." [MTM Ph 1]

In terms of how the MTM affected interprofessional working between GPs, MTM pharmacists and community pharmacists, the participants reported differing levels of engagement. Where existing positive relationships already established, MTM pharmacists were noted the limit communication with GPs.

"Communication and understanding were excellent." [GP 1]

"My relationship with them [MTM pharmacists] is excellent, may God bless them!... No, never, I have never faced any troubles in communication between us." [Ph 1]

Furthermore, stakeholders generally found pharmacists' recommendations to be very useful and helped patients make the necessary lifestyle and health changes. However, one of MTM pharmacist raised the ambiguous rejection for their recommendation from some GPs.

"I mostly accept them, and I think that they are necessary for the patient." [GP 1]

"…. making the right recommendation, so I do not think I will object to your recommendations." [Ph 1]

"Most of the communication was good except for some health practitioners who were not accepted due to special interests of the doctors." [MTM Ph 2]

However, all GP and community pharmacists stated that they did not have to change their work routine after establishing the clinic, except one community pharmacist raised the work pressure issue and the need for work arrangement with MTM pharmacists.

"God willing, your treatment is very good, and to be honest with you, sometimes the work pressure results in some discomfort if you come and ask us to print the patient's medicines for you, but we want to understand the matter." [Ph 3]

Enthusiasm of stakeholders

Overall, stakeholders described their excitement of involvement and/or providing MTM service. Participants were generally very positive about having advance service in CP practice and enthusiastic about potential benefit in improving the practice and the quality of healthcare services and facilities in KSA, stating that they believed in the MTM service and in its importance for chronic patients with diabetes.

> *"…. it is considered a huge leap in our community because we are the only ones who have provided the MTM service…. As for my experience regarding the project, I see that it is a comprehensive project which is most needed. There is no doubt about that." [MTM Ph 1]*

The MTM pharmacists welcomed opportunities to utilise their professional expertise and education and expressed enthusiasm for their role as MTM service providers. Even they saw it as legitimizing greater pharmacist involvement and offered greater job satisfaction.

> *"It also made me feel that I am able to apply what I studied and trained on and make use of it in benefiting the community." [MTM Ph 1]*

Stakeholders' perspective

Stakeholders expressed a clear and positive viewpoint about the future of MTM service. Hesitancy was focused on different aspects; I will discuss it in detail in this section.

> *"…. I see that this clinic is extremely wonderful and very important and I believe in it greatly and it should be circulated to all community pharmacies." [Ph 1]*

In the beginning, stakeholders had a perspective regarding the location of MTM clinic inside the CP. They believed that the service can be more efficient if the location of clinic changed. Various opinions from stakeholders were received in relation to the site of clinic. First, community pharmacists preferred to provide MTM service from the

pharmacy counter instead of from inside clinic. In contrast, pharmacy owner saw that the clinic should be moved inside the medical centre to be close to physicians' office.

> *"As I told you, I do not like that the service be provided by an independent clinic. I would like that this service be provided at the counter of community pharmacy so that it can be available to all patients." [Ph 4]*

Furthermore, community pharmacists also stated that clinic must be established in pharmacies affiliated to a medical centre to be close to the medical decision-maker, which will enhance the position of the pharmacist in the medical team. But GPs expressed different opinion, stated that clinic must be established inside independent pharmacies because the independent pharmacies are provided the services from the pharmacist only unlike pharmacies affiliated to a medical centre.

> *"…. It is better to have the pharmacies that are connected with a medical centre to access the files of the patients who follow up in the centre." [Ph 3]*

Stakeholders provided dissimilar viewpoints regarding best way to communicate with pharmacists in MTM clinic. Community pharmacists preferred phone to communicate while the GPs preferred sending the patients with required recommendations on paper.

> *"The phone is very good, even with the doctors, the phone is faster. It is right that the place is near, but with the crowds of patients, the phone is the fastest way." [Ph 2]*

> *"I think sending the recommendations on a paper with the patient is the best way. This is because sometimes we become very busy and unable to answer the phone. if I need to inquire about something, I will use the phone." [GP 1]*

Generally, stakeholders welcomed the utilisation of CDTM arrangements to clarify the nature of cooperation between the doctor and the pharmacist. The agreement will help MTM pharmacists doing their work easily and providing better services to the patients specially with doctors who are difficult to deal with.

> *"It is very important to have the arrangement because it shows the nature of cooperation between the doctor and the pharmacist and renders the work more comfortable." [GP 2]*

The idea of introducing an MTM service in routine practice was strongly supported by all of the stakeholders. Stakeholders thought that with time MTM service will be included in the daily routine practice. However, they suggested some steps to facilitate incorporation of the service in routine practice. First, using automatic referral for target patients to the clinic. Second, to employ pharmacists as coordinator to work both inside the clinic and on the counter. Finally, to let the MTM pharmacists provide the service from the pharmacy counter instead of separate clinic to deal directly with patients who need care.

> *"It is possible for any patient with a large number of medications to be automatically referred to the MTM clinic for follow-up in the clinic, or it is possible to give us some measurements that the patient must have in order to be referred to the clinic directly." [Ph 2]*

The stakeholders highlighted a number of factors to ensure continuity of the service including empowerment of MTM pharmacists, support, cooperation of doctors and medical centre, strong marketing, robust legislation and financial return on the pharmacy in terms of investment.

> *"Through leadership and improving the compensation for the pharmacists in order to increase the turnout of the willing pharmacists. The procedures of the Ministry of Health should be smooth and uncomplicated." [MTM Ph 1]*

> *"I think the financial return is important, and so is a certificate explaining their work in the service of the clinic, which is important for the pharmacist to put in his CV." [Ph 2]*

Perceived benefits

The benefits of MTM service were not limited only to patients, but they also expanded to team functioning. Patients benefit from patients' perspective were discussed in detail previously, in chapter 6. Here I will investigate patients' benefits from viewpoint of stakeholders' perspective, in addition to service benefits on stakeholders and health system in general.

For patients' benefits part, the stakeholders in the interviews emphasized that service had a strong and positive impacts on patients, they highlighted a number of key areas of benefit, including preventing drug interaction, increase awareness and education, understands their health problem, reduce expenses and medication use. Thus, improving in these aspects enhanced the feeling of patients' control. This resulted in giving the patients confidence and feeling less stressful and unsure about their health, here some of their comments.

> *"First, the clinic helped them regarding the issue of interaction between medicines and in making suggestions about how to use medicines …Of course, this will increase trust and enforce the relationship between the patient and the pharmacist." [Ph 1]*

On the other side, the MTM service was suggested as being 'very important' and has a valuable impact on the stakeholders and health system in general. Stakeholders were generally very positive about the service and enthusiastic about the large benefits would have from the service. First, GPs were stated that presence of the clinic helps their work, and they feel that always had a scientific support from MTM pharmacists. Sample from GPs comments.

> *"You also benefit us with your experience….. Yes, the presence of the clinic helps my work." [GP 1]*

Second, the pharmacists agreed that service can be reflected through increase in pharmacists' expertise and satisfaction. In the sense of activate role of pharmacists, they can apply what studied and trained on. The positive aspect of the service in terms of MTM pharmacists' benefits was typified in the following examples.

> *"As for the impact of the service from my point of view as a pharmacist, the first thing is that the percentage of satisfaction has increased regarding that the pharmacist can have a role and influence in the field." [MTM Ph 1]*

> *"That the pharmacists become pioneers in their specialisation in primary care." [MTM Ph 2]*

Finally, when I asked stakeholders, if the MTM service was important for CP sector, they highlighted a number of key areas of benefit. They mentioned that the medical centre benefits from presence of clinic despite the presence of clinic in the pharmacy affiliated to the centre. Furthermore, the clinic affects the quality of the medical services that provided in the pharmacy. As well as enhance patient's loyalty to the CP which reflected in the patient's return to the pharmacy and putting his trust in the pharmacy which increases purchasing medicines.

> *"Of course, the medical centre benefits from your presence in all cases. This is because the centre considers you a clinic affiliated with them, despite your presence in the pharmacy." [GP 1]*

> *"Yes, it began to give the patient the impression that the pharmacy is not just a commercial idea and is all about buying and selling." [Ph 1]*

7.4.3 Implementation context

Context as a process evaluation feature referred to explore contextual factors that affected (or were affected by) implementation and mechanisms. Interviews contained discussion about the current practice with investigation the hindering and promoting factors of implementation of the service in the Saudi CP. Also, suggestions that aim to modify and enhance the utility of the MTM were discussed.

7.4.3.1 Qualitative results

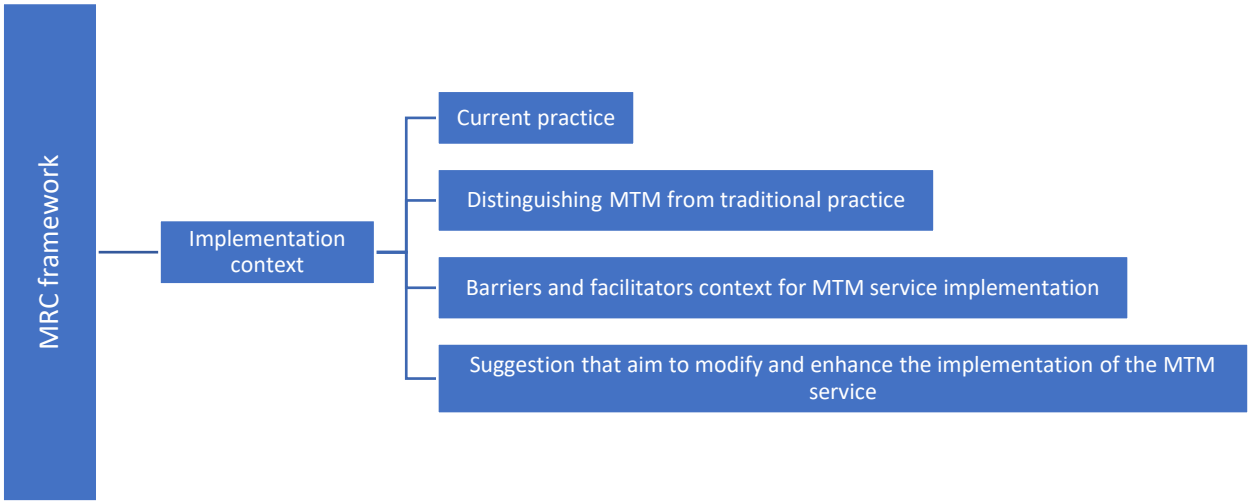


Figure 7.8: Summary of context themes

Current practice

Generally, Saudi CPs are still predominantly commercial ventures, and unfortunately, the current practice is business oriented. Pharmacists saw the introduction of MTM as a significant change in direction for pharmacy as a profession. MTM pharmacists provided more information, time and followed up patients. Pharmacists in community pharmacies do not have access to patient case files unlike pharmacists at MTM clinic.

> *"Someone follows up on their medications, i.e., we can dispense medication during crowded times and give them to the patient without any instructions. On the other hand, the situation in the clinic is different." [Ph 2]*

MTM service was implemented by Inova Saudi Health Care Company through the MOH. The MTM service was not covered by the basic health insurance scheme. Recent changes in legislation by MOH paved the way for establishing non-urgent services including MTM service. However, stakeholder believed that there was lack of

clarity in terms of scope of service, indemnity for pharmacists and qualifications required by pharmacists to provide such service.

> *"…. in terms of legislation, one of the nice things is that the Ministry of Health have added an article for non-urgent services, including the MTM." [MTM Ph 2]*

> *"Yes, there are laws, legislation and articles mentioned in the regulations of the Ministry of Health, but they are not accurate and do not contain all the accurate information that may serve the health practitioner and protect him legally." [MTM Ph 2]*

The patients and stakeholders interviewed were asked to characterize the current practice that they observed. The participants gave details on their notice of the present traditional care, especially in the private sector.

> *"Perhaps the current traditional care, especially when we talk about the private sector, lacks many things: First, there is no treatment protocol. Second, there are no standards related to evidence-based practices and evidence for treatment, and then comes the different schools for all doctors and the way of their belief and learning which differ from one country to another, where we find that there is a kind of fragmentation. The fourth point is that there is not enough time for the doctor to sit with the patient so that he can direct him or review the old medicines that the patient received." [Ph owner]*

In term of GP practice, interviewee stated that doctors' treatment was cruel. There was limited supply of information, insufficient knowledge, and a lot of mistakes. Indeed, patients described challenges in obtaining information from GPs.

> *"Yes, there was no moral support at all. There was no explanation. It was only the doctor writing the treatments and leaves the patient alone so that usually the doctor does not discuss with me the results of the laboratory results or the results of the HbA1c at least." [Pt 5]*

The above comment reflects patient's frustration in getting low quality of care from the GPs. However, the comments from community pharmacists also frustrated because their role was only limited to dispensing of medicines. The scope of services being offered by community pharmacist wouldn't entering into clinical evaluation of the patient's medicines list.

> *"At the present time, our [pharmacist] role is only limited to dispensing generic drugs." [Ph owner]*

Distinguishing MTM from traditional practice

Participants described how MTM differed from usual practice based on their perceptions. The MTM service was deemed to be a ‘pioneer’ and serve the patient considerably and connected all health practitioners with all specialties in one clinic.

> *“It is the wonderful example that I can really say that it is the distinguished service that we provided and served the patient greatly because we really connected all health practitioners with all specialties in one clinic that we put to the patient in one mould.” [MTM Ph 2]*

Most patients highlighted a number of positive features of MTM service compared to the GPs clinic including: procession of specialised knowledge and holistic approach, shared decision making concept and assured continuity of care, which was discussed in detail previously in chapter 6 when I investigated patients views and experience about MTM service.

> *“When I followed up with the doctor, at every visit, I had to explain to him about my condition from the beginning. This tires me and I find it difficult to understand, and for sure the level of care decreases.” [Pt 15]*

Furthermore, the viewpoint of the MTM pharmacist is completely different from the viewpoint of the doctor. One of MTM pharmacist stated that the MTM service's perspective is start from end to beginning that it looks at the patient from the side of medicine and then turns to the side of chronic diseases, while the services provided in GPs’ clinic start from the diagnostic side to dispense the medicine.

> *“The clinic's perspective is that it looks at the patient from the side of medicine and then turns to the side of chronic diseases.” [MTM Ph 2]*

Finally, the participants indicated that CPs do not offer a similar service to MTM. They noticed the difference between MTM service and other services implemented in CPs. The MTM service goal is improve patients’ health, not increase financial return. Also, the MTM service is more comprehensive in providing pharmaceutical care, not dedicated to specific work parts as in other services.

"They are few [services]. I see that maybe the immunization service is good because it does not involve a long-term follow-up. As for the rest, I do not know about the level of service provided in the education or counseling clinics." [MTM Ph 1]

Barriers and facilitators context for MTM service implementation

Stakeholders reported a mixed response in implementing the MTM service. They identified both facilitation and obstacles for implementing the service in CP practice. The facilitating factors are hugely important but are small in number compared to the barriers identified to implementation.

Clinical setup and logistical issues were cited by pharmacists as potential barriers to implementation. Especially, space, arrangement for privacy, waiting area, documentation system, educational material and the equipment to motivate the work. Even though, the clinic was built for the MTM service but the pharmacy owner had difficulty in finding a suitable and private space. From the stakeholders' interviews results revealed that MTM clinic was located in the end corner of the pharmacy which not visible to the patients and hindered communication with community pharmacists.

"Of course, there are many challenges: The first thing I want to talk about is the subject of clinic setups, where I want the clinic to be set up on a larger space, there should be more arrangement and privacy, and a waiting room, and I want to have a system and we should have a kind of educational material because we used to arrange it only according to the needs of each patient." [MTM Ph 1]

"I think the location of the clinic, because it is located in the corner of the pharmacy. This may be an obstacle, but it is not a big obstacle, because the patient who wants to benefit from the clinic will come to the clinic wherever the place may be." [Ph 2]

Moreover, MTM pharmacists felt frustrated and disappointed by lack of manpower and interprofessional setup which are significant barriers against delivering meaningful MTM service.

"It may be due to the resources or in a more correct sense manpower." [MTM Ph 2]

> *"Possibly the last challenge I can add is the referral, because interprofessional setup was not available so that there could be a referral at the same time." [MTM Ph 1]*

MTM pharmacist participants reported that the only area they needed training on was the logistics of insurance. Similarly, physicians interviewed noticed that the MTM pharmacists experienced vagueness regarding the affairs of insurance companies and accepting the recommended medicines.

> *"One more challenge we can add has to do with our experience and knowledge of insurance matters. Yet, it was not a major challenge, but for any pharmacist who runs the clinic, he must have sufficient knowledge about insurance. We were not able to help patients and direct them regarding insurance." [MTM Ph 1]*

Also, MTM pharmacists reported that financial challenges affected the quality of services provided to the patients and found this frustrating. Indeed, it affected the decision they made in medication recommendation. Yet, physicians feel that patient would consider the clinic services from a financial point of view.

> *"The presence of the clinic in a private centre. I think that financial matters will be an obstacle when the patient finds himself forced to pay for the service. This is different from the governmental primary care which provide free services, so the patient may consider the clinic services from a financial point of view." [GP 1]*

A number of participants believed there were internal organisation issues that might had slowed down or affected work processes, especially high MTM pharmacists' workload and pressure, since they are part-time employer in MTM service. In addition, opening time for the clinic was usually in the evening which limited patients access to category of employees no others.

> *"Perhaps the most important challenges are the time and the fatigue factors that comes as a result of spending the whole day working in the university and hospital." [MTM Ph 1]*

Patients' factors were the commonly mentioned obstacles for the implementation of MTM service included patients' employment, patients' cooperation with MTM pharmacists and patients' understanding of MTM service concept.

“Finally, the challenges of the nature of the work of the employee who comes to us.” [MTM Ph 2]

“…. there are some patients who do not understand the objectives and expected benefits of the service.” [Ph 3]

Finally, persuasion is the one of the biggest challenges, there was resistance from some physicians. Physicians may have seen the service not as we expected due to lack of awareness of the positives, do not understand the idea of the service, unconfident with the fact that the pharmacist being able to perform the task and consider that the MTM service takes his work or experience. The resistance was interfered with implementation process. However, over time, these attitudes gradually became more positive, as the physicians noticed that the work of the MTM service as a whole was not a threat and its supportive care for patients’ health.

“I expected obstacles in communicating with some doctors in the clinic. First, some doctors unfortunately do not understand the idea because not all of them are open to new ideas. Some of them have a certain method that they are comfortable with in treatment and they do not like to change and they are not ready to develop unfortunately and misunderstand that this is interference in their work.” [Ph 3]

On other hand, stakeholders identified a wide range of facilitating factors provided to implement the MTM service. These facilitations existed at several levels, spanning micro and macro- organisation.

For macro-organisational level, several facilitation strategies were identified that were used to achieve implementation: support from the Inova Saudi Health Care Company and health centre management. These facilitation strategies all helped the functioning team implemented the new service.

“This is the most important facilitators; the other thing is the presence of support from Innova company or even the affiliated medical centre. They support the idea.” [MTM Ph 1]

“…. supporting the health centre management to develop the service by, for example, providing special lab tests offers to the clinic, as well as giving the clinic access to patient files to reach patients in need of service.” [GP 2]

As well as pharmacy owner reported in interview that choice of the pharmacy location, which affiliated to medical centre was helpful because the presence of medical centre connected to pharmacy will guarantee the access to medical decision-maker and patients' file. In addition, availability of qualified and enthusiastic pharmacists to run MTM service emerged as beneficial.

> *"Second, the location we chose. We did not choose pharmacies on the street, rather we first chose pharmacies working under a medical centre, which therefore provided us with 3 things: First, the proximity to the medical decision-maker; Second, the medical clinics helped us in the process of procedures regarding patients; Third, presence of patients easily, and this was positive. Third, finding the clinical pharmacist on whom this clinic was established and his strong desire to be part of this project." [Ph owner]*

In terms of legislation, recently the MOH have added an article for non-urgent services, including the MTM which paved the way to implement advanced service in CP practice and supported the role of the pharmacist in the MTM service

> *"The facilitators were the presence of Ministry of Health decisions that supported the role of the pharmacist in the "MTM" clinic." [MTM Ph 1]*

For micro-organisational level, utilisation of CDTM and presence of research coordinator were also perceived as facilitators for successful service implementation.

> *"I think the memo helped you provide better services to the patients." [GP 1]*

> *"…. since without a coordinator, we would not have been able to provide such well-organised management." [MTM Ph 1]*

Suggestion that aim to modify and enhance the implementation of the MTM

In this sub-theme, patients' and stakeholders' suggestion contributing towards modify and enhance the implementation of the MTM service have been explored. However, patients' suggestion was explained extensively in previous chapter, chapter 6. For stakeholders' suggestions, we got three different domains for suggestions; Setup, service and organisation.

The suggestions related to the setup.

Stakeholders advised that clinic must be well prepared, and the setup must be more comfortable. Additionally, they suggested expanding the clinic to include waiting and vital sign room beside the MTM pharmacist room. Also, it should be occupied with certain devices or tools help pharmacists to examine the patients and educational material either brochures or videos.

> *"…. I want the clinic to be set up on a larger space, there should be more arrangement and privacy, and a waiting room, and we should have a kind of educational material." [MTM Ph 1]*

> *"…. from among the tools needed to examine the patient, for example, diabetics, there are certain devices that it would be nice to be present." [MTM Ph 2]*

There were comments that there was need for a computer software to make the process more of a standard practice and that currently system was not practical. The advanced software could help pharmacists save time and creating an electronic medical file for patient.

> *"…. I hoped for was the electronic system in which there are many details like greater documentation, and that there is an investment for the patient's medical file in the clinic of the MTM." [MTM Ph 2]*

Community pharmacists suggested providing a phone to support the communication with pharmacists in the clinic.

> *"It is possible that if there is an internal phone system, this will render communication between us easy." [Ph 1]*

The suggestions related to the MTM service

Community pharmacist advised MTM pharmacists to be found in the pharmacy counter and provide the service directly to the patients who need care.

> *"I would like that this service be provided at the counter of community pharmacy so that it can be available to all patients." [Ph 4]*

Furthermore, stakeholders suggested increasing the number of the clinic working days to be daily. The most important thing is that the clinic does not close, this way the patients and the community can feel its value more.

> *"The clinic opens three days a week that may be suitable for the number of selected patients, but if there is an increase in numbers, I do not think that they are enough, so they need to be at least five days a week, or every day." [MTM Ph 2]*

Stakeholders recommended diversity of services. The service should be expanded and be more comprehensive not be limited to diabetes, i.e obesity, growth failure or smoking. They recommended also to have additional services added on patient's need, i.e., annual vaccination, vaccinating children. Even they proposed introducing MTM service to home health care service to reach patients at home.

> *"I think you are focused on diabetic patients only. I hope if the service can be expanded and be more comprehensive and diversified. Patients from nearby neighborhoods, with different health problems, can all follow up in the same place." [Ph 1]*

The organisational suggestions

In community pharmacists' interview, they suggested that there should be periodic meetings with MTM pharmacists to collaborate and arrange the work.

> *"It only has to do with organising the time between us so that you send us the names of the patients who need the names of their medicines, perhaps a day earlier, so that we are not late for you and at the same time we are not pressured at work." [Ph 3]*

Also, both pharmacists and GPs suggested conducting monthly medical lectures or journal club between pharmacists and the doctors. These periodical meetings will strengthen relationship, update GPs information and bring them to the evidence base practice.

> *"…. supposed to provide periodical lectures or journal club to bring doctors to the evidence base practice, update their information, provide them with support, or even introduce them with computer programmes to help them." [MTM Ph 1]*

MTM pharmacists suggested that they need financial, recognition and leadership support. They asserted the important of improving the compensation and recognition

for the pharmacists in order to increase the turnout of the willing pharmacists. Another pharmacist expressed how the support staff maintained the running of the core business while providing advanced services.

> *"…. the pharmacist must be recognized and compensated because it is not a simple effort, the effort is great; the pharmacist may receive compensation from more than one side, where the financial support is just one of them" [MTM Ph 1]*

The good marketing was suggested through stakeholders' interview. They mentioned the need to establish a vision about the way to enter the market in a way that is more acceptable, without harming others nor incurring harm.

> *"…. use of advertisements and media on various channels of communication. This is important for the patient i.e., to reach patients and help them in understanding the idea of the clinic, especially as it is a new idea for patients." [Ph 1]*

The interviewed MTM pharmacists wished to include the service under insurance umbrella and introduce pharmacists' status to provide the service easier.

> *"…. adding powers to the health practitioner by insurance companies and health departments, thus making it easier to provide the service, whether for cash or insurance patients." [MTM Ph 2]*

Stakeholders advised that legislation should be clear, accurate and complete to clarify the role of the pharmacist in MTM service and enabling pharmacists in general to provide pharmaceutical services.

> *"Exactly, there should be protocols and laws that explain everything to the pharmacist." [MTM Ph 1]*

Finally, stakeholders suggested necessity of training courses for community pharmacists to provide MTM service and for MTM pharmacists to keep on developing the work.

> *"Of course, they need training. At least they should have 3-year of experience in direct practice patients care or community care, or whatever other training, the most important thing is to have a certificate." [MTM Ph 1]*

CHAPTER 8 Discussion

8.1 Chapter overview

The full results of the two phases (quantitative and qualitative) of the study and the process evaluation have been presented in Chapters 5, 6 and 7 respectively. The purpose of this chapter is therefore to integrate these chapter-specific findings in order to develop a comprehensive understanding of the research question(s) and to discuss these findings within the broader context of the existing literature. These integrated findings from the two phases and process evaluation have provided the basis for conclusions and recommendations. Subsequently, the strengths and limitations of the thesis as a whole will be addressed. Furthermore, the implications for policy and practice, as well as future research, have been discussed. At the end of the chapter, the dissemination plan is outlined.

Since the systematic review findings have already been discussed in detail in chapter 2, they are not discussed here. Nevertheless, where relevant, references have been made to the systematic review findings.

8.2 Restatement of thesis aim

The primary aim of this thesis was to develop, implement, and evaluate CP-based MTM service. This aim was achieved through the use of a range of research methodologies including SR & MA, mixed-methods approach with a quantitative phase followed by a qualitative phase and process evaluation.

Each of above mentioned studies have the following secondary aims:

- To evaluate the effectiveness of CP-based medication review service globally involving patients with various long-term conditions through a SR & MA.

- To assess the impact of a CP-based MTM service on patients' outcomes in KSA through a mixed-methods study.
- To understand conditions under which the MTM service has been implemented and maintained while still being effective using a process evaluation.

8.3 Key summary from the three sections of the thesis

This thesis has three sections: SR & MA, mixed-methods study and process evaluation. For the sake of clarity, the key findings are summarised in relation to the specific objectives in **APPENDIX VIII-A.**

8.4 Reflection on thesis findings

8.4.1 Sociodemographic and clinical characteristics of the patients

The sociodemographic and clinical characteristics of the patients received the MTM service were comparable to the characteristics of patients visiting medication review services in other countries. In the current study, the mean age was 50 (SD ±11.9). Similarly, the mean age of patients attending a community pharmacist's diabetes support service in Iran (**Jahangard-Rafsanjani *et al.,* 2015)** and a MMR service in Jordan **(Basheti, Tadros and Aburuz, 2016)** were 56.6 (SD±8.6) years and 53 (SD ±15.39) years, respectively.

The majority of the diabetic participants were male (68.1%). Males are more likely to develop diabetes than females. The high prevalence of DM in male is associated with larger amount of visceral fat and low testosterone levels **(Nordström *et al.,* 2016; Simmons, 2022)**. Also, males were more likely to participate in health research than

female **(Chen *et al.,* 2017; Otufowora *et al.,* 2021)**. Possibly, this explains why the sample contains high number of males.

Current study demonstrated that the median HbA1c level was 9.8% [IQR 8.9, 11.2] which is comparable to HbA1c for diabetic patients following in other international CP-based medication review services **(Doucette *et al.,* 2009; Ali *et al.,* 2012; Tsuyuki *et al.,* 2016).** Furthermore, the average duration since being diagnosed with diabetes for those patients was 8 [IQR 3, 14] years. Similarly, the average duration of diabetes for patients attending a CP-based medication review services in United Kingdom **(Ali *et al.,* 2012)** and a pharmaceutical care programme on vascular risk in Australia **(Clifford *et al.,* 2005)** were 7.2 (SD±8.6) years and 9 [IQR 6, 13] years, respectively.

In the present study, 38.8% of patients had DDS scores between 2.0 - 2.9 (likely to suffer from moderate distress) and 35.6% of patients score of 3 or above (likely to suffer from high distress). Distress is common among diabetic patients **(Sapkota *et al.,* 2015)**, which explain the high incidence of DD among patients followed in MTM service.

Moreover, current data showed that there were a larger proportion of diabetic patients (73.8%) identified as non-adherent to medication as measured by the MARS-5 questionnaire. The low level of medication adherence is common in diabetic patients **(Cramer, 2004; Arifulla *et al.,* 2014; Bagonza, Rutebemberwa and Bazeyo, 2015)** and most likely to be one of the leading causes of suboptimal diabetes management worldwide **(Rhee *et al.,* 2005; Bailey and Kodack, 2011)** and in KSA as well **(Alramadan *et al.,* 2018).** The study's sociodemographic and clinical characteristics

represent a typical DM population; therefore, its findings may be generalisable to diabetic patients.

8.4.2 Study outcomes

The rationale behind the selection of the outcome measures and scales has been explained in detail in chapter 4 **(section 4.8.6).**

8.4.2.1 Primary outcomes (HbA1c)

The study showed that, compared to the baseline, the provision of MTM service to diabetic patients lead to a statistically significant reduction within the group ($p<0.0001$). However, no significant differences were found between the groups, the reduction in HbA1c was 0.21% (95% CI, -0.8, 0.4, p=0.5) in the intervention group in compared to the control group at six-month follow up. This reduction in HbA1c is lower than previously published literature. The SR & MA also reported a reduction of 0.6% in HbA1c with similar MTM service **(Al-Babtain, Cheema and Hadi, 2022).** The difference between the two results can be explained by several reasons.

First, the time effect suggested that gradual improvement in HbA1c was possible **(Kraemer *et al.,* 2012; Paulo *et al.,* 2016)**. Data comply with the systematic review **(Al-Babtain, Cheema and Hadi, 2022)**, 4 out 6 studies, measured the HbA1c, introduced the intervention for more than six-month, either one-year (**Clifford *et al.,* 2005; Doucette *et al.,* 2009; Ali *et al.,* 2012)** or nine-month **(Planas *et al.,* 2012).** The duration of current study was only six-month, the time effect makes a suggestion that gradual improvement in HbA1c was possible at nine-month or one-year. However, as a PhD student, long-term follow-up was not possible.

Second, the standard of care was provided to the control group patients instead of usual care, which may have affected positively on results. This was seen clearly in the significant improvement within the group. However, the standard of care was provided to facilitate the study recruitment, impove patient retention and to represent ideal pharmacists role.

Third, from the process evaluation, stakeholders revealed that although the service was achieved as initially planned in the study protocol, there were challenges in implementing some MTM service components including the PMR, monthly follow up and referral. In comparison to the protocol, the overall number of monthly follow up and referral were lower and most of the patients refused take the PMR, which may have affected the quality of service delivery.

Finally, the impact of pharmacist intervention is greatest among those with higher baseline levels of HbA1c **(Nowak *et al.,* 2002; Rothman *et al.,* 2003; Cioffi *et al.,* 2004; Choe *et al.,* 2005; Odegard *et al.,* 2005; Osborn *et al.,* 2011).** Data comply with current study, the median HbA1c level at baseline was 9.9% in control group while 9.6% in intervention group. These issues may have affected the net results.

Control the blood glucose among diabetic patients substantially decreases the risk of microvascular and macrovascular complication **(National Institute for Health and Care Excellence, 2015; National Institute for Health and Care Excellence, 2022)**. According to epidemiological scrutiny of the UK prospective diabetes study (UKPDS), each 1% decrease in HbA1c over ten-year reduces the risk of diabetes-related end points by 21%, diabetes-related mortality by 21%, myocardial infarctions by 14%, and microvascular complications by 37% **(Stratton *et al.,* 2000).**

8.4.2.2 Secondary outcomes

A number of secondary outcomes were also studied as comorbidities are common among patients with diabetes. From process evaluation and qualitative phase, MTM service was more comprehensive in providing pharmaceutical care, not dedicated to specific disease. MTM service helped to improve diabetes and other comorbidities through multiple approaches. First, in-depth specialised knowledge of the MTM pharmacist in terms of medication optimisation for individual patients to best achieve the appropriate therapeutic goals for that patient. Second, reinforcement and encouragement provided by MTM pharmacists often benefited them to be enlightened about diabetes and chronic disease in general. Third, shared decision making model was used to develop therapeutic plans included clarity and acceptability of the instruction and recommendation with enough time for follow up. Fourth, MTM pharmacists' knowledgeability, provided patients with more information regarding their diagnosis and clearer instructions about their medicines use.

For the BP outcome, this research reported that MTM service interventions showed greater reductions in mean SBP (−5.8 mmHg (95% CI, -11.2, -0.5), p= 0.03) and DBP (−4.8 mmHg (95% CI, -7.8, -1.7), p=0.002) than standard care. Similar finding has been reported in the meta-analysis which highlighted the mean reductions in SBP (-6.6 mmHg (95% CI, -10.1, -3.1), p=0.0002) and DBP (-1.7 mmHg (95% CI, -3.2, -0.2), p=0.03). **(Al-Babtain, Cheema and Hadi, 2022).** Even, MTM service were more effective in reducing the DBP than other medication review services from the review.

BP control is one of the key measures which are known to reduce the risk of significant events in diabetic patients (**Cook *et al.*, 1995; Lewington *et al.*, 2002).** Every 1 mmHg

reduction in SBP would prevent about 10,000 deaths each year caused by coronary heart disease **(Lewington *et al.,* 2002).** Moreover, sustained reductions of 2 mmHg in DBP are expected to result in 6% lower risk of coronary heart disease and 15% lower stroke risk **(Cook *et al.,* 1995).** Thus, health systems that adopt and implement CP-based MTM services can prevent over 58,000 deaths resulting from coronary heart disease alone, as well as prevent 36% of strokes from occurring.

For the lipid profile outcomes, compared to the systematic review (**Al-Babtain, Cheema and Hadi, 2022)**, the RCT showed better effect on TC and TG outcomes. However, medication review service intervention from the review had a positive effect on LDL levels while negative effect in the RCT with increase in the mean LDL level (4.2 mg/dl (-19.8 – 28.2, p=0.726) in the intervention arm after six-month of follow-up.

The lack of intervention effect in terms of LDL might be attributed to two reasons. First, missing of LDL data because of LDL measures were not requested by the physician under insurance. Since the outcome measures were not sensitive enough to detect a difference, this figure may not accurately represent the effectiveness of the MTM service. Second, short duration of the study. Long term follow up is vital for good control of lipid profile which necessary to reduce long term morbidity **(Mach *et al.,* 2020).** In the systematic review, 4 out of 7 studies, measured the LDL, followed the patients more than six-month **(Doucette *et al.,* 2009; Villeneuve *et al.,* 2010; Ali *et al.,* 2012; Planas *et al.,* 2012)** which gives explanation for the improvement in the LDL outcome. Therefore, the results of the two studies could not be compared.

In line with the increase in use of medicines and ageing population, the incidence of hospitalisations due to DRPs was found to increase by 78% over the ten-year **(Wu *et***

***al.,* 2010)** resulting in an annual cost to the NHS of £455 million over six-month **(Patel *et al.,* 2007).** DRPs are common and responsible for at least 5000 deaths per year **(Pirmohamed *et al.,* 2004).** Thus, prevent DRPs incidence helped to reduce the overall number of inappropriate drugs use, hospitalization and expenses and consequences the mortality.

Generally, DRPs are preventable with careful medication review **(Rollason and Vogt, 2003; Pirmohamed *et al.,* 2004).** In fact, the MTM service identified and resolved DRPs. The number of DRPs dropped in the intervention arm at three-month and six-month. The number of participants with DRPs dropped significantly (p=0.0001) and mean number of DRPs per participant decreased significantly (p=0.0001) as well. This finding supported by previous literatures **(Bernsten *et al.,* 2001; Mott *et al.,* 2003; Vinks *et al.,* 2009)**

The literature review identified that DM is responsible for extensive patient morbidity and cost to the NHS, whilst the prevalence is increasing dramatically **(Department of Health, 2008).** Between 2005 and 2012 the total number of items used to treat diabetes in England rose from 27.1 million to 40.6 million **(Duerden, Avery and Payne, 2013)**.

Establishing the MTM service was responsible in reducing the expenditures by substantial improvement in ER visits and hospital admissions/readmissions. None of the intervention patient hospitalized or visited ER during the MTM service. However, the evidence of low healthcare utilisation with medication review service has not been supported by two RCTs (**Bouvy *et al.,* 2003; Verdoorn *et al.,* 2019)** where they recorded an increase in hospital admissions rate in the intervention group compared to the control group.

Medication adherence was improved with implementation of MTM service. The RCT showed that MTM service is more effective than standard care in improving medications adherence. Similarly, the systematic review (**Al-Babtain, Cheema and Hadi, 2022)** concluded that medication review service intervention was more likely to be effective.

Interviewed patients believed that MTM service assisted patients in accepting their conditions and adapting to behavioural changes required to adhere to their treatments adequately. Furthermore, the regular follow-ups and provision of structured and written education on diabetes and its treatment offered by MTM pharmacists, gave an opportunity to identify knowledge gaps, helped patients improved their understanding and reinforced the importance of medication adherence.

Patients with chronic illnesses (such as DM) often have difficulty adhering to their medication regimens **(Arifulla *et al.,* 2014)**. Additionally, literature showed that the persistence with treatment declined with time and only 63% of patients continued with their medication after one year **(Cramer *et al.,* 2008).**

Poor adherence to antidiabetic medication is common which causes a reduction in the desired positive outcomes, severe health complications and may increase mortality **(Cramer *et al.,* 2004; Ho *et al.,* 2006; Simpson *et al.,* 2006; Cramer *et al.,* 2008).** Therefore, enhancing medication adherence is a primarily determinant of treatment success and consequently controlling chronic conditions, improve patient outcomes and well-being. The impact of medication adherence primarily results from the effects of medications, but it might also be attributed to the overall effect of a healthy adherer

(Simpson *et al.,* 2006; Williams *et al.,* 2007; Cramer *et al.,* 2008; Tang *et al.,* 2010; Duncan *et al.,* 2011).

Patients with diabetes often have DD **(Glasgow *et al.,* 1997; Jannoo *et al.,* 2017, Bruno *et al.,* 2019)** due to the fear of complications, worry and stress in their ability to manage the illness (**Rubin and Peyrot, 1999**; **Pintaudi *et al.,* 2015**, **Bruno *et al.,* 2019**). Data consistent with the study where 74.4% of participated diabetic patients had moderate to high distress at the time of enrolment.

A higher level of DD was strongly associated with depression, poor QoL and poor glycaemic control **(Baradaran *et al.,* 2013; Strandberg *et al.,* 2015; Jannoo *et al.,* 2017).** Glycaemic control is influenced by a number of factors, lower diabetes-related emotional distress is one of these factors **(Rogvi *et al.,* 2012).**

The MTM service has a positive effect on DD feeling. There was a significantly reduced patients' distress compared to standard care, 72.3% of MTM service patients didn't suffer from any distress at the end of the service. Moreover, patients in the interviews highlighted significant impact of reinforcement, encouragement and reassuring provided by MTM pharmacists that often benefited them to be enlightened about diabetes which reflected in their overall experience. Patients highlighted that they valued improvements in psychological condition even more than the diabetes itself.

The quantitative work reported that participants in the MTM service group were more satisfied with pharmacist services (median 4 [IQR 4, 4]) than participants in the standard care group (median 1.4 [IQR 1.25, 1.9]). Similarly, the process evaluation for MTM service revealed that the Saudi CPs are still predominantly commercial ventures

and there were no health promotions strategies. The interviewee patients were frustrated with the current practice, and they regarded pharmacy as point of purchase for medication only, the community pharmacists also frustrated because their role was only limited to dispensing of medicines. The data comparable to other study distributed 500 questionnaires in KSA, found that only 41 % of the patients were satisfied with current Saudi pharmacy services **(Al-Tannir *et al*., 2016)**.

On the other hand, patients valued the comprehensive and advanced service and express their satisfaction and excitement of involvement in MTM service. The positive experience was contributed to multiple factors included introduce specialised knowledge and holistic approach, shared decision making, and continuity of care through MTM service. Patients felt that they were given full time to express their views and discussed their problem fully. Patients appreciated the opportunity to speak to pharmacists privately in MTM clinic where careful consideration was given to individual patient's needs. However, Ogden and his colleagues **(Ogden *et al.,* 2004)** investigated the link between patient satisfaction with the consultation time available.

Patient satisfaction is important when implementing new health services **(Mira and Aranaz, 2000),** because it is used as one of the benchmark indicators to evaluate and identify of specific areas of the service which need improvement **(El-Sharif *et al.,* 2017).** As well as patient satisfaction evaluation may help detect patients' needs, perceptions, and concerns **(Ford, Bach and Fottler, 1997).** Patients with high level of satisfaction have been reported to result in improved health outcomes because they were more likely to comply with treatment, take an active role in their own care, continue using medical care services, treasure their relationship with their healthcare

providers and increase their adherence to medication **(Pascoe, 1983; Smith and Coons, 1990; Aharony and Strasser, 1993; Asadi-Lari, Tamburini and Gray, 2004; Speight, 2005; Tinelli *et al.,* 2007).**

8.5 Strengths and limitations of the study

The study's findings should be considered within the context of its limitations. The quantitative study had five main limitations.

First, participants were recruited from one pharmacy site only, individualised RCT, and therefore views may not be generalisable to CP practice in other countries or even all Saudi CP practice. However, a cluster randomised design was not appropriate because of MTM service is a new service introduced in the Saudi CP, we established the clinic and start this study after we obtained the license and approval. This is the first MTM clinic in Saudi CP.

Second, this research has focused solely on diabetic patients' participants, and therefore views may not be generalisable to other diseases. A degree of caution should be considered when interpreting results and applying to wider population. Future studies should investigate the impact of MTM service on other chronic medical conditions including obesity and ischemic heart disease.

Third, a total of 109 males and 51 females recruited in the study, meaning that the sample did not represent the gender balance of the wider diabetic population. This is a potential limitation, and future research should aim to recruit a more representative number of females in the study sample. Fourth, few patients' referrals were made by the GPs despite repeated contacts with them. When I asked the GPs for low referrals

rate reason, they mentioned that there was only one reason which is the workload. Finally, participants and pharmacists in this study could not be blinded due to the nature of interventions. However, the data collection process was double checked by two researchers and data analysis was undertaken by author and statistician, blinded to study allocation.

For the qualitative descriptive study, there were four main limitations. First, lack of views from stakeholders, who would play key roles in the implementation of MTM in pharmacy care. However, in the followed step, I conducted a comprehensive process evaluation among stakeholders to converge viewpoints from different stakeholders for identifying critical issues related to MTM implementation and making an implementation plan with feasible strategies and practices.

Another limitation is that despite the fact that a saturation of data was deemed to have been reached after 16 patient interviews, there was no guarantee that saturation had been achieved for each theme. Often the limitations with interviews are that they are largely not generalisable because studies may have small participant numbers and individual differences. However, interviews studies gain their strength from its ability to link quantitative findings to previous studies and theories. Additionally, qualitative studies do not seek to achieve large representative samples from which results can be generalised to other populations. Rather, I seek insights developed through looking at issues in-depth.

Next, one potential limitation arises from the fact that the patients who completed the six-month follow-up were only interviewed. Such patients, theoretically, are those who are either interested in the service or made desired progress, which may explain their

satisfaction. However, as described earlier in method chapter, a framework for maximum variation sampling was developed and progress of HbA1c-result were considered in developing the framework. Finally, the patients who drop out of service were not interviewed, which could lead to a more positive overall experience and view about the service.

Notwithstanding these limitations, this study has strengths too. To my knowledge this is the first study utilising mixed-methods to assess the effectiveness and feasibility of MTM service in Saudi CP practice in addition to explore patients views and experience about the new service. In fact, ours was an entirely novel use of MTM service in CP practice in KSA. The mixed-methods used in this research would be relevant to other medication review services, particularly those in KSA.

One of the strengths of this PhD was the use of such method. In mixed-methods research, qualitative and quantitative approaches are combined to gain a broader and deeper understanding and corroboration. Furthermore, the key advantage of using mixed-methods is that it provides strengths that counteract the disadvantages of both qualitative and quantitative methodologies when used alone **(Hadi *et al.,* 2013).**

Another major strength is the multidisciplinary team including research team, key stakeholders, field experts, and CP owner that were involved in developing the research proposal and planning the service which has arguably generated a number of avenues to pursue.

In terms of study design, RCT is considered the most robust method for evaluating effectiveness of intervention **(Sibbald and Roland, 1998).** Before the study began, a

sample size was calculated and independently verified by a statistician. Moreover, inclusion and exclusion criteria were rigorously applied to ensure the target population was represented in the study. Randomisation was conducted by an author who was not directly involved in patient care using computer-generated numbers in order to minimize selection bias.

As described in the methods chapter, in this study, all three questionnaires have been shown to be valid and reliable. All assessments (baseline and follow-up) were conducted with the same questionnaires to minimize instrumentation threats to internal validity. Before implementing the questionnaires, they were piloted on the appropriate population to ensure their effectiveness. Before beginning all research phases, the author attended relevant training in order to reduce bias in design and data generation.

Finally, to enhance transparency, method was clearly documented in the relevant chapter and the study protocol was published **(Albabtain *et al.,* 2021)** and registered (ISRCTN60703981, https://doi.org/10.1186/ISRCTN60703981) **(Albabtain *et al.,* 2022)**.

Moreover, the findings of the RCT study were supported by the findings of the qualitative descriptive study. Semi-structured interviews allowed for in-depth understanding of patients' experiences and opinions of MTM service, by asking open-ended questions focusing on the topics of interest. The full range of views, both positive and negative, expressed during the study suggests that patients felt able to speak freely during the research interviews. The pilot interviews conducted with patients visit same pharmacy permitted the author to gain more experience in interview techniques. Additionally, formal training in qualitative research was completed by author.

To minimise reporting bias, participants were clearly informed about the research aim and given ample opportunity to clarify any issues with the author. Furthermore, to ensure the accuracy of recorded information, interviews were audio recorded and transcribed verbatim by the author shortly after each interview.

Throughout the process, participants were assured of the confidentiality and anonymity of the data. They were also informed that there was no right or wrong answer. The research design was described clearly, and the coding framework and thematic analysis were independently reviewed by supervisors and consulted expert. Noted that each stage of the analysis was overseen by the author's supervisors to reduce the risk of bias.

Finally, participants in interview varied in gender, number of years since diagnosed with diabetes and HbA1c progress results during the study. This diversity, predominantly enabled through purposive sampling (convenience then maximum variation sampling), generated a wide range of views and experience, reflected in the themes and sub-themes. This robust research, however, is expected to provide implementers with relevant and applicable concepts.

8.6 Implications for research

8.6.1 Potential implication for Saudi pharmaceutical health services

As mentioned earlier, the country is undergoing rapid development and transformation in line with the goals of Vision 2030 and the health sector including the pharmacy practice is no different. However, to date, a number of reforms targeting upskilling of workforce and expanding the scope of pharmacy practice are required in order to

further enhance the quality of health care. In this regard, the CP sector has benefited from ongoing initiatives and some expanded services have been piloted in a few CPs. One of such services is the MTM service presented in this thesis.

Although, this service targeted only patients with uncontrolled diabetes but other long term conditions can also be targeted and patient outcomes can be improved. It would not be wrong to label this work as 'ground breaking' within the context Saudi CP practice as it would trigger a series of reforms and encourage other community pharmacist to expand the scope of practice. To date, in Saudi Arabia, community pharmacists remain underutilisation and heavily dependent on expatriate workforce, however with growing number of local graduates and generation of local evidence to support expanded role of community pharmacists the current practices are likely to evolve quickly. We hope that this pioneered intervention will become incorporated into the mainstream of Saudi CP practice. The integration of MTM service into routine CP practice will be significant interest to the growing number of organisations attempting to implement such advanced services to improve the practice and to support MOH strategies for pharmaceutical care. Data from this thesis could help benchmark practice. Furthermore, this study generated conclusive quality evidence to support the effectiveness of CP-based medication review services and important potential management of long-term medical conditions from CP setting.

The CP practice is poised to play a pivotal role in the near future when KSA moves toward a pharmaceutical care new model. However, these exciting developments require a great deal of committed effort to follow them through. The current pharmacy law has to be comprehensive, and a set of pharmacy regulations should be written

clearly and enforced. Clear competency standards should be developed for pharmacy graduates, interns, specialist pharmacists and consultant pharmacists. Pharmacists already working in Cs should receive necessary education and training required for advanced and enhanced pharmacy practice services. As these new CP initiatives take place, pharmacy services in hospitals must continue its efforts toward excellence in practice while acknowledging the new role of the CP practice in an integrated health care environment.

8.6.2 Implication for policy and practice

This thesis provides possible directions for clinical practice and policy. Many of the lessons learned from this thesis will likely be of use in informing the implementation of similar complex interventions regardless of the effectiveness of MTM service.

- Employing clinical pharmacists in community care practices can potentially facilitate effective diabetes management in the community.
- The decision-makers in the MOH should articulate clear roles and responsibilities for pharmacists in MTM service to serve as a basis for future contractual frameworks for delivering enhanced pharmaceutical services from CPs.
- Structured and specialised training models with supporting manual must be developed to establish the most effective and appropriate methods of preparing pharmacist for medication reviews service which help in improve their knowledge and skills and wider use of the service in CP practice. As well as this must include evaluating if this training models can be incorporated into the undergraduate curriculum.

- Findings of the current thesis emphasised the problem of community pharmacists' access to patients' medical records, which results from lack of the electronic medical record for patients' health file where any healthcare provider who provide services for that individual patient can access and follow up the patients care plan. It is essential that the IT infrastructure is developed with a plan to link all sectors in Saudi health care system.
- As evidenced in this research, patients with chronic disease are currently experiencing difficulties in accessing community care specially after COVID-19 pandemic. Establishing a national care pathway would provide guidance to referrer patients to such CP-based services. Implementation of such a care pathway would require ongoing research and review to ensure its effectiveness.
- The lack of interprofessional setup is one of the barriers faced by MTM pharmacists during operating the service. There is a special need of sustain collaboration between MTM service and dieticians and physiotherapists services since diet and physical activities can interfere with the management of diabetes.
- Healthcare professionals in primary care centres need to be encouraged to share information with community pharmacists where this would support and enhance patient care. GPs should be encouraged to work proactively with pharmacists on establishing new services that may be beneficial to their patients.
- In return, community pharmacists should be encouraged to provide more information to healthcare professionals and the public on the range of services provided, and any rules or restrictions on these through awareness campaigns.

National campaign on nationally contracted services would support awareness of CP services, especially after the release of new regulation in 2019.

- The MOH should also intensify the promotion and advertisement of CP services to other health professional groups. Such promotion should include disseminating results of research that demonstrate favourable outcome of pharmacists' role in the advanced pharmaceutical services.

8.6.3 Recommendation for future research

This thesis has provided evidence on the outcomes of MTM service within a mixed-methods study, along with identifying implementation, mechanisms responsible for outcomes and the role of context in this process. Nevertheless, there are several areas that need further investigation and new opportunities for future work have emerged from these findings. The key recommendations points for future research from triangulation of the findings from the mixed-methods and process evaluation in this doctoral research include:

- This research has focused solely on diabetic patients. Future studies should also investigate the impact of MTM service on other chronic medical conditions.
- Future studies that measure the effectiveness of MTM service should have a more equal gender balance. This would allow for a more effective comparison between genders, and representation of the wider population.
- A future trial should employ a cluster randomised design to mitigate any risk of contamination between the study arms.

- The factors encourage GPs to use the MTM service and the training or resources that GPs might need to support the referral to the service should be investigated in the future research.
- Future research should also aim to explore collaborative partnerships and trusting relationships between pharmacists themselves, the public and members of the primary care team since any future extended role for community pharmacists relies on these human relationships
- Usually, additional health professional-led interventions for improving patients' health are cost more than usual care, however no analysis of cost-effectiveness was undertaken for such new MTM service in KSA. The findings from a future health economic study could be used to inform policy on the most appropriate funding stream to sustain a new service for chronic disease management in the CP practice, to decipher cost implications to the health service and to the pharmacy's business viability.
- Future research should focus on increasing awareness and understanding of pharmacy-led services among patients and GPs.
- Future research should focus on strategies to improve sustainability and long-term effectiveness of such CP-based MTM service.

8.7 Dissemination plans

The work presented in this thesis has been disseminated in a number of ways throughout my PhD candidature, and publications in the medical press are underway **(Table 8.2).** In addition to this thesis, I have published three peer-reviewed papers on various aspects of the work presented here.

The findings have also been presented in various conferences. First, I presented 'Impact of community-pharmacist-led medication review services on patient outcomes: A systematic review and meta-analysis of randomised controlled trials' at the Dubai International Pharmaceuticals and Technologies Conference and Exhibition (DUPHAT) (Dubai, April 2021). Second, I had the opportunity of presenting 'Nature and severity of DRPs among diabetic patients attending community-pharmacist-led MTM clinic' at the European Symposium on Clinical Pharmacy (ESCP) Conference (Prague, October 2022), which facilitated wider dissemination in the international arena. Last, I presented 'MTM Program: Pearls from the First Experience in a CP in KSA' at the Saudi International Pharmaceutical (SIPHA) Conference & Workshop (Dammam, January 2023).

As part of the dissemination activities for the research, I presented interesting results to key stakeholders and insurance companies in KSA who work in CP practice field. This was an important way of informing and getting feedback from a potential future setting for the medication review services. The findings of the research have also been presented to the pharmaceutical practice department faculty, college of pharmacy at Princess Nourah Bent Abdulrahman University. This provided an important role in getting my research known about in the public arena and educational intervention.

Table 8. 1: Anticipated papers for publication

Paper title	Anticipated journal	Anticipated date of submission
Impact of Medication Management Programme on Diabetes Healthcare Outcomes in a Community Pharmacy Setting: A Randomised Controlled Study	Pharmacotherapy Journal	July-2023
Implementing the First Medication Therapy Management Programme in Saudi Community Pharmacy: A Qualitative Study of Patients' Experiences and Views	PLOS ONE Journal	July-2023
Translation, Cultural Adaptation and Validation of Patient Satisfaction with Pharmacist Services 2.0 Questionnaire into the Arabic Language	PLOS ONE Journal	July-2023

8.8 Overall conclusion

Globally, community pharmacist-led medication review services can improve clinical and humanistic outcomes among chronic disease patients. In KSA. the pilot RCT has demonstrated that MTM service provided by pharmacists can improve diabetes management. In addition to reducing diabetes distress and improving medication adherence, such CP-based service can not only reduce the DRPs events but also reduce burden on the health system by reduce ER visits and hospitalization.

The implementation of the MTM service allowed the pharmacist to undertake full medication review and develop an individualised management plan by addressing patients' need. Patients felt that they were treated well from their perspective by pharmacists with specialised knowledge using a holistic and shared decision making approach. Notwithstanding, Saudi community appreciated the role of the pharmacist at the MTM service and were satisfied with the quality of care that they received at the MTM clinic, they revealed some barriers for follow with MTM service for instance, long waiting time, lab tests fees and short time spent with the MTM pharmacists during the follow up visits.

The process evaluation for such service was important as the evaluation allowed differentiation between interventions that are inherently faulty and those that are badly delivered. The evaluation of the MTM service concluded that although most of the MTM service components achieved high fidelity, there were challenges in implementing the PMR, monthly follow up and referral. There were some implementation barriers detected such as lack of manpower and interprofessional setup. There were suggestions targeted at enhancement of the implementation of MTM service including the need for an advanced computer software, use of effective marketing strategies and recognition and reimbursement for pharmacists providing such services.

Although this thesis has provided evidence on the outcomes of MTM service within a mixed-methods study, there are several areas that need further investigation to shape up the role of community pharmacists in delivering advanced patient care activities in Saudi CP practice. In addition, future research is required for health economic assessment for the new service to inform policy on the most appropriate funding stream to sustain a new service for chronic disease management in the Saudi CP practice.

References

- Abbott, J.H. (2014) 'The Distinction Between Randomized Clinical Trials (RCTs) and Preliminary Feasibility and Pilot Studies: What They Are and Are Not', *Journal of Orthopaedic & Sports Physical Therapy,* 44(8), pp. 555-558.
- Adnan, M., Karim, S., Khan, S. and Al-Wabel, N.A. (2015) 'Comparative evaluation of metered-dose inhaler technique demonstration among community pharmacists in Al Qassim and Al-Ahsa region, Saudi-Arabia', *Saudi Pharmaceutical Journal*, 23, pp. 138-142.
- Aharony, L. and Strasser, S. (1993) 'Patient satisfaction: what we know about and what we still need to explore', *Medical Care Review*, 50, pp. 49–79.
- Alanazi, A.S., Alfadl, A.A. and Hussain, A.S. (2016) 'Pharmaceutical care in the community pharmacies of Saudi Arabia: present status and possibilities for improvement', *Saudi Journal of Medicine and Medical Sciences*, 4, pp. 9-14.
- Alaqeel, S. and Abanmy, N. (2015) 'Counselling practices in community pharmacies in Riyadh, Saudi Arabia: a cross-sectional study', *BMC Health Services Research*, 15, p. 557. doi: 10.1186/s12913-015-1220-6.
- Al-Arifi, M.N. (2012) 'Patients' perception, views and satisfaction with pharmacists' role as health care provider in the community pharmacy setting at Riyadh, Saudi Arabia', *Saudi Pharmaceutical Journal*, 20 (4), pp. 323-330.
- Al-Babtain, B., Cheema, E. and Hadi, M.A. (2022) 'Impact of community-pharmacist-led medication review programmes on patient outcomes: A systematic review and meta-analysis of randomised controlled trials', *Research in Social & Administrative Pharmacy*, 18 (4), pp. 2559-2568.
- Albabtain, B., Hadi, M.A. and Cheema, E. (2020) Impact of community-pharmacy led medication review programmes on patients' outcomes: systematic review and meta-analysis of randomized controlled trials. PROSPERO CRD42020165693. Available at: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020165693
- Albabtain, B., Hadi, M.A., Bawazeer, G., Alqahtani, A., Bahatheq, A., Alhossan, A. and Cheema, E. (2021) 'Evaluation of a community pharmacy-based medication therapy management programme: A study protocol of a pilot randomized controlled trial with an embedded qualitative study', *Saudi Pharmaceutical Journal*, 29 (7), pp. 706-712.
- Albabtain, B., Hadi, M.A., Paudyal, V., Bawazeer, G., Alqahtani, A., Cheema, E., Bahatheq, A. and Price, M.J. (2022) Impact of medication therapy management programme on diabetes healthcare outcomes in a community pharmacy setting. ISRCTN Registry: ISRCTN60703981. Available at: https://doi.org/10.1186/ISRCTN60703981
- Albejaidi, F. and Nair, K.S. (2019) 'Building the health workforce: Saudi Arabia's challenges in achieving Vision 2030', *The International Journal of Health Planning and Management*, 34, pp. e1405-e1416. doi:10.1002/hpm.2861.
- Alfadl, A.A., Alrasheedy, A.A. and Alhassun, M.S. (2018) 'Evaluation of medication counseling practice at community pharmacies in Qassim region, Saudi Arabia', *Saudi Pharmaceutical Journal*, 26, pp. 258-262.
- Alhaddad, M. (2019) 'Youth experience with community pharmacy services and their perceptions toward implementation of medication therapy management services by community pharmacists in the Western region of Saudi Arabia', *Therapeutic Innovation and Regulatory Science*, 53 (1), pp. 95-99.
- Alharbi, M.F. (2018) 'An analysis of the Saudi health-care system's readiness to change in the context of the Saudi National Health-care Plan in Vision 2030', *International Journal of Health Sciences*, 12 (3), pp. 83-87.

- Al-Hassan, M. (2009) 'Community pharmacy practice in Saudi Arabia: an overview', *The Internet Journal of Pharmacology*, 9 (1). doi:10.5580/8e2.
- Alhowaish, A.K. (2013) 'Economic costs of diabetes in Saudi Arabia', *Journal of Family and Community Medicine*, 20, pp. 1–7.
- Ali, M., Schifano, F., Robinson, P., Phillips, G., Doherty, L., Melnick, P., Laming, L., Sinclair, A. and Dhillon, S. (2012) 'Impact of community pharmacy diabetes monitoring and education programme on diabetes management: a randomized controlled study', *Diabetic Medicine,* 29, pp. e326-e333. doi:10.1111/j.1464-5491.2012.03725.x.
- Al-jedai, A., Qaisi, S. and Al-meman, A. (2016) 'Pharmacy practice and the health care system in Saudi Arabia', *The Canadian journal of hospital pharmacy, 69(3), 231–237.*
- Allan, B. and Wills, M. (2016) *Community based pharmacy services in Hawke's Bay strategic direction 2016-2020*. Available at: http://www.ourhealthhb.nz/assets/Publications/Community-Based-Pharmacy-Services-in-HB-Strategic-Direction-2016-2020-Final-August-2016.pdf (Accessed: 1 February 2020).
- Almalki, S. (2016) 'Integrating Quantitative and Qualitative Data in Mixed Methods Research—Challenges and Benefits', *International Journal of Education and Learning*, 5 (3), pp. 288-229.
- Alomi, Y.A. (2017) 'New pharmacy model for Vision 2030 in Saudi Arabia', *Journal of Pharmacy Practice and Community Medicine*, 3 (3), pp. 194-196.
- Alramadan, M.J., Magliano, D.J., Almigbal, T.H., Batais, M.A., Afroz, A., Alramadhan, H.J., Mahfoud, W.F., Alragas, A.M. and Billah, B. (2018) 'Glycaemic control for people with type 2 diabetes in Saudi Arabia - an urgent need for a review of management plan', *BMC endocrine disorders*, 18(1), pp. 62. doi:10.1186/s12902-018-0292-9.
- Al-Saleh, H., Al-Houtan, T., Al-Odaill, K., Al-Mutairi, B., Al-Muaybid, M., Al-Falah, T. and Ashraf Nazir, M. (2017) 'Role of community pharmacists in providing oral health advice in the eastern province of Saudi Arabia', *Saudi Dental Journal*, 29, pp. 123-128.
- Alsous, M., Alhalaiqa, F., Abu Farha, R., Abdel Jalil, M., McElnay, J. and Horne, R. (2017) 'Reliability and validity of Arabic translation of Medication Adherence Report Scale (MARS) and Beliefs about Medication Questionnaire (BMQ)–specific for use in children and their parents', *The Public Library of Science ONE,* 12(2), pp. e0171863. doi:10.1371/journal.pone.0171863
- Al-Tameemi, D. and Al-Tukmagi, H. (2017) 'The application of pharmaceutical care program on patients with dyslipidemia in Iraqi community pharmacy', *International Journal of Pharmaceutical Sciences Review and Research,* 47, pp. 45-51.
- Al-Tannir, M., Alharbi, A.I., Alfawaz, A.S., Zahran, R.I. and AlTannir, M. (2016) 'Saudi adults satisfaction with community pharmacy services', *SpringerPlus*, 5, p. 774. doi:10.1186/s40064-016-2442-8
- Alyami, M., Serlachius, A., Mokhtar, I. and Broadbent, E. (2019) 'Illness Perceptions, HbA1c, And Adherence in Type 2 Diabetes in Saudi Arabia', *Patient Preference and Adherence*,13, pp. 1839–1850.
- Amariles, P., Sabater-Hernandez, D., Garcia-Jimenez, E., Rodriguez-Chamorro, M.A., Prats-Mas, R., Marin-Magan, F., Galán-Ceballos, J.A., Jiménez-Martín, J. and Faus, M.J. (2012) 'Effectiveness of dader method for pharmaceutical care on control of blood pressure and total cholesterol in outpatients with cardiovascular disease or cardiovascular risk: EMDADER-CV randomized controlled trial', *Journal of managed care pharmacy*, 18, pp. 311-323.
- American Diabetes Association (2019) 'Introduction: Standards of Medical Care in Diabetes-2019', *Diabetes Care*, 42 (Supplement 1): pp. S1-S2
- American Pharmacists Association and the National Association of Chain Drug Stores Foundation (2008) 'Medication therapy management in pharmacy practice: core elements of an MTM service model (version 2.0)', *Journal of the American Pharmacists Association*, 48, pp. 341–53.

- Arifulla, M., John, L.J., Sreedharan, J., Muttappallymyalil, J. and Basha, S.A. (2014) 'Patients' Adherence to Anti-Diabetic Medications in a Hospital at Ajman, UAE', *The Malaysian journal of medical sciences, 21*(1), pp. 44-49.
- Armour, C., Bosnic-anticevich, S., Brillant, M., Burton, D., Emmerton, L., Krass, I., Saini, B., Smith, L. and Stewart, K. (2007) 'Pharmacy Asthma Care Program (PACP) improves outcomes for patients in the community', *Thorax*, 62, pp. 496-502.
- Armour, C.L., Reddel, H.K., Lemay, K.S., Saini, B., Smith, L.D., Bosnic-anticevich, S.Z., Song, Y.J., Alles, M.C., Burton, D.L., Emmerton, L., Stewart, K. and Krass, I. (2013) 'Feasibility and effectiveness of an evidence-based asthma service in Australian community pharmacies: a pragmatic cluster randomized trial', *Journal of Asthma,* 50, pp. 302-309.
- Asadi-Lari, M., Tamburini, M. and Gray, D. (2004) 'Patients' needs, satisfaction, and health related quality of life: Towards a comprehensive model', *Health and Quality of Life Outcomes*, 2(1), p.32. doi:10.1186/1477-7525-2-32.
- Aslani, P., Rose, G., Chen, T.F., Whitehead, P.A. and Krass, I. (2010) 'A community pharmacist delivered adherence support service for dyslipidaemia', *European Journal of Public Health,* 21, pp. 567-572.
- Babiker, A.H., Carson, L. and Awaisu, A. (2014) 'Medication use review in Qatar: are community pharmacists prepared for the extended professional role?', *International Journal of Clinical Pharmacy*, 36 (6), pp. 1241-1250.
- Bagonza, J., Rutebemberwa, E. and Bazeyo, W. (2015) 'Adherence to anti diabetic medication among patients with diabetes in eastern Uganda; a cross sectional study', *BMC health services research*, *15*, pp.168. doi:10.1186/s12913-015-0820-5.
- Bailey, C.J. and Kodack, M. (2011) 'Patient adherence to medication requirements for therapy of type 2 diabetes', *International Journal of Clinical Practice*, 65(3), pp. 314-22.
- Baradaran, H.R., Mirghorbani, S.M., Javanbakht, A., Yadollahi, Z. and Khamseh, M.E. (2013) 'Diabetes distress and its association with depression in patients with type 2 diabetes in Iran', *International Journal of Preventive Medicine,* 4, pp. 580-584.
- Baranowski, T. and Stables, G. (2000) 'Process evaluations of the 5-a-day projects', *Health Education and Behavior*, 27(2), pp. 157-66.
- Basheti, I.A., Tadros, O.K. and Aburuz, S. (2016) 'Value of a Community-Based Medication Management Review Service in Jordan: a Prospective Randomized Controlled Study', *Pharmacotherapy*, 36, pp. 1075-1086.
- Bawazir, S. (2004) 'Consumer attitudes towards community pharmacy services in Saudi Arabia', *The International Journal of Pharmacy Practice*, 12, pp. 83-89.
- Beaucage, K., Lachance-Demers, H., Ngo, T.T.T., Vachon, C., Lamarre, D., Guevin, J.F., Martineau, A., Desroches, D., Brassard, J. and Lalonde, L. (2006) 'Telephone follow-up of patients receiving antibiotic prescriptions from community pharmacies', *The American Journal of Health-System Pharmacy*, 63, pp. 557-563.
- Benrimoj, S.I. and Frommer, M.S. (2004) 'Community pharmacy in Australia', *Australian Health Review*, 28 (2), pp 238-248.
- Berendsen B.A.J, Kremers, S.P.J., Savelberg, H.H.C.M., Schaper, N.C. and Hendriks, M.R.C. (2015) 'The implementation and sustainability of a combined lifestyle intervention in primary care: mixed method process evaluation', *BMC Family Practice*, 16, pp. 37.
- Bernsten, C., Bjorkman, I., Caramona, M., Crealey, G., Frokjaer, B., Grundberger, E., Gustafsson, T., Henman, M., Herborg, H., Hughes, C., Mcelnay, J., Magner, M., Van Mil, F., Schaeffer, M., Silva, S., Sondergaard, B., Sturgess, I., Tromp, D., Vivero, I. and Winterstein, A. (2001) 'Pharmaceutical care of the elderly in Europe research group. Improving the well-being of elderly patients via community pharmacy-based provision of pharmaceutical care: a multicentre study in seven European countries', *Drugs & Aging*, 18, pp. 63-77.

- Blalock, S.J., Roberts, A.W., Lauffenburger, J.C., Thompson, T. and O'Connor, S.K. (2013) 'The effect of community pharmacy–based interventions on patient health outcomes: a systematic review', *Medical Care Research and Review*, 70, pp. 235-266.
- Bouvy, M.L., Heerdink, E.R., Urquhart, J., Grobbee, D.E., Hoes, A.W. and Leufkens, H.G. (2003) 'Effect of a pharmacist-led intervention on diuretic compliance in heart failure patients: a randomized controlled study', *Journal of Cardiac Failure,* 9, pp. 404-411.
- Boyatzis, R.E. (1998) *Transforming qualitative information: Thematic analysis and code development.* Thousand Oaks, CA: SAGE.
- Bradshaw, C., Atkinson, S. and Doody, O. (2017) 'Employing a Qualitative Description Approach in Health Care Research', *Global Qualitative Nursing Research*, 4, pp. 1–8
- Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology', *Qualitative Research in Psychology,* 3 (2), pp. 77-101
- Bruno, B.A., Choi, D., Thorpe, K.E. and Yu, C.H. (2019) 'Relationship Among Diabetes Distress, Decisional Conflict, Quality of Life, and Patient Perception of Chronic Illness Care in a Cohort of Patients with Type 2 Diabetes and Other Comorbidities', *Diabetes Care*, 42(7), pp. 1170-1177.
- Bryant, L., Maney, J. and Martini, N. (2017) 'Changing perspectives of the role of community pharmacists: 1998 – 2012', *The Journal of Primary Health Care*, 9 (1), pp. 34-46.
- Bryant, L.J., Coster, G., Gamble, G.D. and McCormick, R.N. (2009) 'General practitioners' and pharmacists' perceptions of the role of community pharmacists in delivering clinical services', *Research in Social and Administrative Pharmacy*, 5 (4), pp. 347-362.
- Bryman, A. (2001) *Social Research Methods*. Oxford: Oxford University Press.
- Bryman, A. (2006) 'Integrating quantitative and qualitative research: how is it done?', *Qualitative Research,* 6(1), pp. 97–113.
- Buss, V.H., Shield, A., Kosari, S. and Naunton, M. (2018) 'The impact of clinical services provided by community pharmacies on the Australian healthcare system: a review of the literature', *Journal of Pharmaceutical Policy and Practice*, 11, p. 22. doi: 10.1186/s40545-018-0149-7.
- Campbell, N.C., Murray, E., Darbyshire, J., Emery, J., Farmer, A., Griffiths, F., Guthrie, B., Lester, H., Wilson, P. and Kinmonth, A.L. (2007) 'Designing and evaluating complex interventions to improve health care', *British Medical Journal*, 334, pp. 455–459
- Chadwick, B., Gill, P., Stewart, K. and Treasure, E. (2008) 'Methods of data collection in qualitative research: Interviews and focus groups', *British Dental Journal*, 204(6), pp. 291-295.
- Chan, A.H.Y., Reddel, H.K., Apter, A., Eakin, M., Riekert, K. and Foster, J.M. (2013) 'Adherence monitoring and e-health: how clinicians and researchers can use technology to promote inhaler adherence for asthma', *The Journal of Allergy and Clinical Immunology: In Practice*, 1, pp. 446-54.
- Chaves, L.A., de Souza Serio dos Santos, D.M., Campos, M.R. and Luiza, V.L. (2019) 'Use of health outcome and health service utilization indicators as an outcome of access to medicines in Brazil: perspectives from a literature review', *Public Health Reviews,* 40(5). doi:10.1186/s40985-019-0115-1
- Cheema, E., Sutcliffe, P., Weickert, M.O. and Singer, D.R.J. (2018) 'A randomised controlled trial of the impact of structured written and verbal advice by community pharmacists on improving hypertension education and control in patients with high blood pressure', *European Journal of Clinical Pharmacology,* 74, pp. 1391-1395.
- Chen, S.C., Sinaii, N., Bedarida, G., Gregorio, M.A., Emanuel, E. and Grady, C. (2017) 'Phase 1 healthy volunteer willingness to participate and enrollment preferences', *Clinical Trials,* 14, pp. 537-46.

- Choe, H.M., Mitrovich, S., Dubay, D., Hayward, R.A., Krein, S.L. and Vijan, S. (2005) 'Proactive case management of high-risk patients with type 2 diabetes mellitus by a clinical pharmacist: a randomized controlled trial', *The American Journal of Managed Care*, 11(4), pp. 253-260
- Chumney, E.C. and Robinson, L.C. (2006) 'The effect of pharmacist interventions on the patients with polypharmacy', *Journal of Pharmacy Practice,* 4, pp. 103-109.
- Cioffi, S.T., Caron, M.F., Kalus, J.S., Hill, P. and Buckley, T.E. (2004) 'Glycosylated hemoglobin, cardiovascular, and renal outcomes in a pharmacist-managed clinic', *Annals of Pharmacotherapy*, 38(5), pp. 771-775.
- Cipolle, R.J., Strand, L.M. and Morley, P.C. (1998) *Pharmaceutical Care Practice*. 3rd edn. New York, NY: McGraw-Hill Book Co.
- Clifford, R.M., Davis, W.A., Batty, K.T. and Davis, T.M.E. (2005) 'Effect of a pharmaceutical care program on vascular risk factors in type 2 diabetes: the Fremantle diabetes study', *Diabetes Care,* 28, pp. 771-776.
- Clifford, S., Perez-Nieves, M., Skalicky, A.M., Reaney, M. and Coyne, K.S. (2014) 'A systematic literature review of methodologies used to assess medication adherence in patients with diabetes', *Current Medical Research & Opinion*, 30 (6), pp. 1071–1085.
- Cochrane Effective Practice and Organisation of Care (EPOC) (2017) *Data collection form*. Available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fepoc.cochrane.org%2Fsites%2Fepoc.cochrane.org%2Ffiles%2Fpublic%2Fuploads%2FResources-for-authors2017%2Fgood_practice_data_extraction_form.doc&wdOrigin=BROWSELINK (Accessed: 1 December 2019)
- Cohen, J. (2013) Statistical power analysis for the behavioral sciences. London: Routledge
- Cook, N.R., Cohen, J., Hebert, P.R., Taylor, J.O. and Hennekens, C.H. (1995) 'Implications of small reductions in diastolic blood pressure for primary prevention', *Archives of Internal Medicine,* 155, pp. 701-709.
- Cordina, M., Mcelnay, J.C. and Hughes, C.M. (2001) 'Assessment of a community pharmacy-based program for patients with asthma', *Pharmacotherapy*, 21, pp. 1196-1203.
- Costa, S., Santos, C. and Silveira, J. (2006) 'Community pharmacy services in Portugal', *Annals of Pharmacotherapy*, 40, pp. 2228-2234.
- Coyne, I.T. (1997) 'Sampling in qualitative research: Purposeful and theoretical sampling, merging or clear boundaries?', *Journal of Advanced Nursing*, 26, pp. 623–630.
- Cramer, J., Okikawa, J., Bellaire, S. and Clauson, P. (2004) 'Compliance with inhaled insulin treatment using the AERx® iDMS insulin diabetes management system', *Diabetes technology and therapeutics*, 6(6), pp. 800-807
- Cramer, J.A. (2004) 'A systematic review of adherence with medications for diabetes', *Diabetes Care*, 27, pp. 1218-24
- Cramer, J.A., Benedict, Á., Muszbek, N., Keskinaslan, A. and Khan, Z.M. (2008) 'The significance of compliance and persistence in the treatment of diabetes, hypertension and dyslipidaemia: a review', *International Journal of Clinical Practice*, 62(1), pp. 76-87.
- Creswell, J.W. (1994) *Research design: Qualitative and quantitative approaches*. Thousand Oaks. CA: Sage.
- Creswell, J.W. (2013) *Qualitative Inquiry & Research Design: Choosing among Five Approaches*. 3rd edn. Thousand Oaks, CA: SAGE.
- Creswell, J.W. (2015) *A concise introduction to mixed methods research*. USA: SAGE.
- Creswell, J.W. and Plano Clark, V.L. (2007) *Designing and Conducting Mixed Methods Research.* Thousand Oaks, CA, SAGE.

- Creswell, J.W., Plano Clark, V.L., Gutmann, M.L. and Hanson, W.E. (2003) 'Advanced mixed methods research designs', in Tashakkori, A. and Teddlie, C. (eds) *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, CA: SAGE, pp. 209–240.
- Creswell, W.J and Plano Clark, V.L. (2011) *Designing and conduction mixed methods research*. 2nd edn. Thousand Oaks: Sage Publications.
- Cronbach, L.J. (1982) *Designing evaluations of educational and social programs*. San Francisco, CA: Jossey-Bass.
- Crozier, D. (1985) 'Data Watch: Health Status and Medical Care Utilization', *Health Affairs*, 4 (1), pp. 114-128.
- Currall, S.C. and Towler, A.J. (2003) 'Research methods in management and organizational research: toward integration of qualitative and quantitative techniques', in Tashakkori, A. and Teddlie, C. (eds) *Handbook of Mixed Methods in Social and Behavioral Research.* Thousand Oaks, CA: SAGE, pp. 513–526.
- Currie, J.D, Chrischilles, E.A., Kuehl, A.K. and Buser, R.A. (1997) 'Effect of a training program on community pharmacists' detection of and intervention in drug-related problems', *The Journal of the American Pharmacists Association,* NS37 (2), pp. 182-191.
- Curry, L. and Nunez-Smith, M. (2015) *Mixed Methods in Health Sciences Research- a practical primer*. Thousand Oaks, CA: SAGE.
- Da Silva, R.B., Contandriopoulos, A.P., Pineault, R., Tousignant, P. (2011) 'A Global Approach to Evaluation of Health Services Utilization: Concepts and Measures', *Health Policy*, 6(4), pp. e106–e117
- Darawad, M.W., Hammad, S., Samarkandi, O.A., Hamdan-Mansour, A.M. and Khalil, A.A. (2017) 'Evaluating the Psychometric Properties of the Arabic Version of the Diabetes Distress Scale', *Journal of Psychosocial Nursing and Mental Health Services,* 55(9), pp. 43-51.
- Dawson, C. (2002) *Practical Research Methods.* New Delhi: UBS Publishers Distributors.
- Department of Health (2008) *Pharmacy in England: building on strengths - delivering the future*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/228858/7341.pdf (Accessed: 12 December 2022)
- Deters, M.A., Laven, A., Castejon, A., Doucette, W.R., Ev, L.S., Krass, I., Mehuys, E., Obarcanin, E., Schwender, H. and Laeer, S. (2018) 'Effective interventions for diabetes patients by community pharmacists: a meta-analysis of pharmaceutical care components', *Annals of Pharmacotherapy*, 52, pp. 198-211.
- Donabedian, A. (1966) 'Evaluating the quality of medical care', *The Milbank Memorial Fund Quarterly*, 44(3), pp. 166–206.
- Doody, O. and Bailey, M.E. (2016) 'Setting a research question, aim and objective', *Nursing Research*, 23(4), pp. 19–23.
- Doucette, W.R., Witry, M.J., Farris, K.B. and Mcdonough, R.P. (2009) 'Community pharmacist-provided extended diabetes care', *Annals of Pharmacotherapy,* 43, pp. 882-889.
- Doyle, L., Brady, A.M and Byrne, G. (2016) 'An overview of mixed methods research – revisited', *Journal of Research in Nursing,* 21(8), pp. 623–635
- Duerden, M., Avery, T. and Payne, R. (2013) *Polypharmacy and medicines optimisation: Making it safe sound*. Available at: https://www.kingsfund.org.uk/sites/default/files/field/field_publication_file/polypharmacy-and-medicines-optimisation-kingsfund-nov13.pdf. (Accessed: 12 December 2022)
- Duncan, I., Ahmed, T., Li, Q.E., Stetson, B., Ruggiero, L., Burton, K., Rosenthal, D. and Fitzner, K. (2011) 'Assessing the value of the diabetes educator', *Diabetes Education*, 37, pp. 638-57
- Dunlop, J.A. and Shaw, J.P. (2002) 'Community pharmacists' perspectives on pharmaceutical care implementation in New Zealand', *Pharmacy World and Science*, 24 (6), pp. 224-230.

- Eades, C.E., Ferguson, J.S. and O'Carroll, R.E. (2011) 'Public health in community pharmacy: a systematic review of pharmacist and consumer views', *BMC Public Health*, 11, p. 582. doi:10.1186/1471-2458-11-582.
- Edmunds, J. and Calnan, M.N. (2001) 'The re-professionalization of community pharmacy? An exploration of attitudes to extended roles for community pharmacists amongst pharmacists and general practitioners in the United Kingdom', *Social Science & Medicine*, 53 (7), pp. 943-955.
- Ekenga, V., Bailey-Wheeler, J., Sarpong, D., Hart, T. and Earls, M. (2018) 'Patients' perception of community pharmacists as healthcare providers and willingness to participate in pharmacist services: a pilot study', *Journal of Pharmaceutical Health Services Research*, 9, pp. 297-300.
- Eldridge, S.M., Chan, C.L., Campbell, M.J., Bond, C.M., Hopewell, S., Thabane, L. and Lancaster, G.A. (2016) 'CONSORT 2010 statement: extension to randomised pilot and feasibility trials', *British Medical Journal*, 2, pp. 355-i5239
- Elliott, R.A., Boyd, M.J., Salema, N.E., Davies, J., Barber, N., Mehta, R.L., Tanajewski, L., Waring, J., Latif, A., Gkountouras Avery, A.J., Chuter, A. and Craig, C. (2016) 'Supporting adherence for people starting a new medication for a long-term condition through community pharmacies: a pragmatic randomised controlled trial of the New Medicine Service', *British medical journal Quality & Safety*, 25, pp. 747-758.
- El-Sharif, S.I., Alrahman, N.A., Khaled, N., Sayah, N., Gamal, E. and Mohamed, A. (2017) 'Assessment of patient's satisfaction with pharmaceutical care services in community pharmacies in the United Arab Emirates', *Archives of Pharmacy Practice*, 8, pp. 22-230.
- Erni, P., Overbeck, J.V., Reich, O. and Ruggli, M. (2016) 'netCare, a new collaborative primary health care service based in Swiss community pharmacies', *Research in Social and Administrative Pharmacy*, 12(4), pp. 622-626.
- Falamić, S., Lucijanić, M., Hadžiabdić, M.O., Marušić, S. and Bačić Vrca, V. (2018) 'Pharmacists' interventions improve time in therapeutic range of elderly rural patients on warfarin therapy: a randomized trial', *International Journal of Clinical Pharmacy*, 40, pp. 1078-1085.
- Farmer, K.C., (1999) 'Methods for measuring and monitoring medication regimen adherence in clinical trials and clinical practice', *Clinical Therapeutics*, 21, pp. 1074–1090
- Fialko, L., Garety, P.A., Kuipers, E., Dunn, G., Bebbington, P.E., Fowler, D. and Freeman, D. (2008) 'A large-scale validation study of the Medication Adherence Rating Scale (MARS)', *Schizophrenia Research*. 100, pp. 53–59
- Ford, R.C., Bach, S.A. and Fottler, M.D. (1997) 'Methods of measuring patient satisfaction in health care organizations', *Health Care Management Review*,22(2), pp. 74-89.
- Forthofer, M.S. (2003) 'Status of mixed methods in the health sciences', in Tashakkori, A. and Teddlie, C. (eds) *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, CA: SAGE, pp. 527–540.
- Fry, G., Chantavanich, S. and Chantavanich, A. (1981) 'Merging quantitative and qualitative research techniques toward a new research paradigm', *Anthropology & Education Quarterly*, 12, pp. 145-158.
- Garcao, J.A. and Cabrita, J. (2002) 'Evaluation of a pharmaceutical care program for hypertensive patients in rural Portugal', *Journal of the American Pharmacists Association*, 42, pp. 858-864.
- Gardner, G., Gardner, A., MacLellan, L. and Osborne, S. (2003) 'Reconceptualising the objectives of a pilot study for clinical research', *International Journal of Nursing,* 40, pp. 719–724.
- Garfield, S., Clifford, S., Eliasson, L., Barber, N. and Willson. A. (2011) 'Suitability of measures of self-reported medication adherence for routine clinical use: a systematic review', *BMC Medical Research Methodology*,11, p.149.

- George, J., Kong, D.C.M., Thoman, R. and Stewart, K. (2005) 'Factors associated with medication nonadherence in patients with COPD', *Chest*, 128 pp. 3198-3204.
- George, P.P., Molina, J.A., Cheah, J., Chan, S.C. and Lim, B.P. (2010) 'The evolving role of the community pharmacist in chronic disease management—a literature review', *ANNALS Academy of Medicine Singapore,* 39, pp. 861-867.
- Giberson, S., Yoder, S. and Lee, M.P. (2011) *Improving patients and health system outcomes through advanced pharmacy practice. A report to the U.S. Surgeon General*. Available at: http://www.accp.com/docs/positions/misc/Improving_Patient_and_Health_System_Outcomes.pdf (Accessed: 22 February 2020).
- Gillani, S.W., ur Rahman, S.A., Mohammad Abdul, M.I. and Syed Sulaiman, S.A. (2017) 'Assessment of community pharmacists' perceptions of healthcare services in Saudi Arabia', *Journal of Pharmaceutical Health Services Research*, 8, pp. 269-274.
- Given, L.M. (2008) *The Sage Encyclopedia of Qualitative Research Methods*. Swinburne University, Australia, Charles Sturt University, Australia: SAGE.
- Glasgow, R.E., McKay, H.G., Piette, J.D. and Reynolds, K.D. (2001) 'The RE-AIM framework for evaluating interventions: what can it tell us about approaches to chronic illness management?', *Patient Education and Counseling*, 44, pp. 119-127.
- Glasgow, R.E., Ruggiero, L., Eakin, E.G., Dryfoos, J. and Chobanian, L. (1997) 'Quality of life and associated characteristics in a large national sample of adults with diabetes', *Diabetes Care*, 20, pp. 562–567
- Grant, A., Treweek, S., Dreischulte, T., Foy, R. and Guthrie, B. (2013) 'Process evaluations for cluster-randomised trials of complex interventions: a proposed framework for design and reporting', *Trials*, 14, pp. 15.
- Green, J. and Thorogood, N. (2009) *Qualitative Methods for Health Research*. London: SAGE.
- Greene, J., Caracelli, V.J. and Graham, W.F. (1989) 'Toward a conceptual framework for mixed method evaluation designs', *Educational Evaluation and Policy Analysis*, 11, pp. 255–274.
- Griffin, T.L., Pallan, M.J., Clarke, J.L. Lancashire, E.R., Lyon,A., Parry, J.M., Adab, P. and On behalf of the WAVES study trial investigators (2014) 'Process evaluation design in a cluster randomised controlled childhood obesity prevention trial: the WAVES study', *International Journal of Behavioral Nutrition and Physical Activity*, 11, pp. 112
- Guest, G. and Fleming, P.J. (2014) 'Mixed Methods Research', in Guest, G. and Namey, E. (eds) *Public Health Research Methods.* Thousand Oaks, CA: Sage, pp. 581- 610.
- Gutierrez, J., Ramirez, G., Rundek, T. and Sacco, R.L. (2012) 'Statin therapy in the prevention of recurrent cardiovascular events: a sex-based meta-analysis', *Archives of Internal Medicine*, 172 (12), pp. 909-919.
- Hadi, M.A. and Closs, S.J. (2016) 'Applications of mixed-methods methodology in clinical pharmacy research', *International Journal of Clinical Pharmacology,* 38, pp. 635–640
- Hadi, M.A., Alldred, D.P., Closs, S.J. and Briggs, M. (2013) 'Mixed-methods research in pharmacy practice: basics and beyond (part 1)', *International Journal of Pharmacy Practice,* 21, pp. 341–345
- Halcomb, E. and Hickman, L. (2015) 'Mixed methods research', *Nursing standard,* 29 (32), pp. 41-47.
- Hammad, S., Darawad, M., Haourani, E. and Demeh, W. (2015) 'Predictors of glycated hemoglobin among Jordanian diabetic patients', *Iranian Journal of Public Health*, 44, pp. 1482-1491
- Harwell, M.R. (2011) 'Research Design in Qualitative/Quantitative/Mixed Methods', in Conrad, C.F and Serlin, R.C. (eds) *Research in Education: Pursuing Ideas as the Keystone of Exemplary Inquiry*. 2nd edn. Thousand Oaks, CA: SAGE, pp. 147-164

- Hassali, A.M.A., Shafie, A.A., See, O.G. and Wong, Z.Y. (2016a) 'Pharmacy Practice in Malaysia' in Fathelrahman, A.I., Mohamed Ibrahim, M.I., Wertheimer, A.I. (eds) *Pharmacy Practice in Developing Countries, Achievements and Challenges*. United Kingdom: Academic Press, pp. 23-40
- Hassali, A.M.A., Shafie, A.A., See, O.G. and Wong, Z.Y. (2016b) 'Pharmacy Practice in Qatar' in Fathelrahman, A.I., Mohamed Ibrahim, M.I., Wertheimer, A.I. (eds) *Pharmacy Practice in Developing Countries, Achievements and Challenges*. United Kingdom: Academic Press, pp. 233-252
- Hassali, M.A., Nordin, N., Sarriff, A. and Saleem, F. (2018a) 'Community Pharmacy Marketing in the New Era: A Global Picture of Extended Community Pharmacy Services', in Oflazolu, S. (eds) *Marketing*, IntechOpen. London. doi:10.5772/intechopen.74326.
- Hassali, M.A., Saleem, F., Verma, A.K., Choy, W.Y., Nouri, A.I. and Asmani, M.F.M. (2018b) 'Translation and Validation of Patient Satisfaction with Pharmacist Services Questionnaire (PSPSQ 2.0)', *Journal of Young Pharmacists,* 10(4), pp. 427-432.
- Hatah, E., Braund, R., Tordoff, J. and Duffull, S.B. (2014) 'Systematic review and meta-analysis of pharmacist-led fee-for-services medication review', *British Journal of Clinical Pharmacology*, 77, pp. 102-115.
- Health sector transformation strategy (2017) *Saudi Ministry of Health*. Available at: https://www.moh.gov.sa/en/Ministry/vro/Documents/Healthcare-Transformation-Strategy.pdf (Accessed: 1 February 2020).
- Herborg, H. (2001) 'Improving drug therapy for patients with asthma part 1: patient outcomes', *Journal of the American Pharmacists Association,* 41, pp. 539-550.
- Higgins, J.P.T., Green, S. (ed.) (2011) *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0. The Cochrane Collaboration. Available at: www.handbook.cochrane.org. (Accessed: 8 July 2021).
- Ho, P.M., Rumsfeld, J.S., Masoudi, F.A., Mcclure, D.L., Plomondon, M.E., Steiner, J.F. and Magid, D. J. (2006) 'Effect of medication nonadherence on hospitalization and mortality among patients with diabetes mellitus', *Archives of internal medicine*, 166(17), pp. 1836-1841
- Hoffmann, W., Herzog, B., Mühlig, S., Kayser, H., Fabian, R., Thomsen, M., Cramer, M., Fiß, T., Gresselmeyer, D. and Janhsen, K. (2008) 'Pharmaceutical care for migraine and headache patients: a community-based, randomized intervention', *Annals of Pharmacotherapy*, 42, pp. 1804-1813.
- Hogan, T.P., Awad, A.G. and Eastwood, R. (1983) 'A self-report scale predictive of drug compliance in schizophrenics — reliability and discriminative validity', *Psychological Medicine*, 13, pp.177-183.
- Holland, R., Desborough, J., Goodyer, L., Hall, S., Wright, D. and Loke, Y.K. (2008) 'Does pharmacist-led medication review help to reduce hospital admissions and deaths in older people? A systematic review and meta-analysis', *British Journal of Clinical Pharmacology,* 65, pp. 303-316.
- Hook, S. and Windle, J. (2013) 'Community pharmacy influenza immunisation increases vaccine uptake and gains public approval', *The Australian and New Zealand Journal of Public Health*, 37 (5), pp. 489-490.
- Horne., R., Weinman, J. and Hankins, M. (1999) 'The beliefs about medicines questionnaire: the development and evaluation of a new method for assessing the cognitive representation of medication', *Psychology and Health.*14, pp. 1–24.
- Hoti, K., Hughes, J. and Sunderland, B. (2011) 'Pharmacy clients' attitudes to expanded pharmacist prescribing and the role of agency theory on involved stakeholders', *International Journal of Pharmacy Practice*, 19, pp. 5-12.

- Hunter, A. and Brewer, J. (2003) 'Multimethod research in sociology', in Tashakkori, A. and Teddlie, C. (eds) *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, CA: SAGE, pp. 577–594.
- International Diabetes Federation (2020) *IDF MENA Members.* Available at: https://idf.org/our-network/regions-members/middle-east-and-north-africa/members/46-saudi-arabia.html (Accessed: 1 October 2022)
- Jaber, D., Aburuz, S., Hammad, E.A., El-Refae, H., Basheti, I.A. (2018) 'Patients' attitude and willingness to pay for pharmaceutical care: an international message from a developing country', *Research in Social and Administrative Pharmacy*, 15 (9), pp. 1177-1182.
- Jahangard-Rafsanjani, Z., Sarayani, A., Nosrati, M., Saadat, N., Rashidian, A., Hadjibabaie, M., Ashouri, A., Radfar, M., Javadi, M. and Gholami, K. (2015) 'Effect of a community pharmacist-delivered diabetes support program for patients receiving specialty medical care: a randomized controlled trial', *Diabetes Educator,* 41, pp. 127-35.
- Jannoo, Z., Wah, Y.B., Lazim, A.M. and Hassali, M.A. (2017) 'Examining diabetes distress, medication adherence, diabetes self-care activities, diabetes specific quality of life and health-related quality of life among type 2 diabetes mellitus patients', *Journal of Clinical and Translational Endocrinology*, 9, pp. 48–54
- Jodar-Sanchez, F., Malet-Larrea, A., Martin, J.J., Garcia-Mochon, L., Lopez del Amo, M.P., Martinez-Martinez, F., Gastelurrutia-Garralda, M.A., Garcı´a-Ca´rdenas, V., Sabater-Herna´ndez, D., Sa´ez-Benito, L. and Benrimoj, S.I. (2015) 'Cost-utility analysis of a medication review with follow-up service for older adults with polypharmacy in community pharmacies in Spain: the conSIGUE program', *Pharmacoeconomics,* 33, pp. 599-610.
- Johnson, R.B and Onwuegbuzie, A.J. (2004) 'Mixed methods research: a research paradigm whose time has come' *Educational Researcher*, 33(7), pp. 14–26
- Johnson, R.B. and Christensen, L.B. (2004) *Educational research: Quantitative, qualitative, and mixed approaches*. Boston, MA: Allyn & Bacon.
- Johnson, R.B., Onwuegbuzie, A.J. and Turner, L.A. (2007) 'Toward a definition of mixed methods research', *The Journal of Mixed Methods Research*, 1, pp. 112–133.
- Jokanovic, N., Tan, E.C., van den Bosch, D., Kirkpatrick, C.M., Dooley, M.J. and Bell, J.S. (2016) 'Clinical medication review in Australia: a systematic review', *Research in Social and Administrative Pharmacy*, 12, pp. 384-418.
- Jonsdottir, H., Opjordsmoen. S., Birkenaes. A.B., Engh, J.A., Ringen, P.A., Vaskinn, A., Aamo, T.O., Friis, S. and Andreassen, O.A. (2010) 'Medication adherence in outpatients with severe mental disorders relation between self-reports and serum level', *Journal of Clinical Psychopharmacology*, 30, pp. 169-175.
- Kallio, S.E., Kiiski, A., Airaksinen, M.S.A., Mantyla, A.T., Kumpusalo-Vauhkonen, A.E.J., Jarvensivu, T.P. and Pohjanoksa-Mantyla, M.K. (2018) 'Community pharmacists' contribution to medication reviews for older adults: a systematic review', *Journal of the American Geriatrics Society*, 66, pp. 1613-1620.
- Kalu, F.A., Bwalya, J.C (2017) 'What Makes Qualitative Research Good Research? An Exploratory Analysis of Critical Elements', *International Journal of Social Science Research*, 5(2), pp. 43-56.
- Kashour, T.S., Joury, A., Alotaibi, A.M., Althagafi, M., Almufleh,A.S., Hersi, A. and Thalib, L. (2016) 'Quality of assessment and counselling offered by community pharmacists and medication sale without prescription to patients presenting with acute cardiac symptoms: a simulated client study', E*uropean Journal of Clinical Pharmacology*, 72, pp. 321-328.
- Kemper, E., Stringfield, S. and Teddlie, C. (2003) 'Mixed methods sampling strategies in social science research', in Tashakkori, A. and Teddlie, C. (eds) *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, CA: SAGE, pp. 273-296

- Khan, T.M. and Azhar, S. (2013) ‘A study investigating the community pharmacist knowledge about the appropriate use of inhaler, eastern region Al Ahsa, Saudi Arabia’, *Saudi Pharmaceutical Journal*, 21, pp. 153-157.
- Khan, T.M. and Ibrahim, Y. (2013) ‘A qualitative exploration of the non-prescription sale of drugs and incidence of adverse events in community pharmacy settings in the Eastern Province of the Kingdom of Saudi Arabia’, *European Journal of Hospital Pharmacy*, 20, pp. 26-31.
- Kheir, N., Zaidan, M., Younes, H., El Hajj, M., Wilbur, K. and Jewesson, P.J. (2008) ‘Pharmacy education and practice in 13 Middle Eastern countries’, *American Journal of Pharmaceutical Education*, 72(6), pp.133. doi:10.5688/aj7206133.
- Kim, H., Sefcik, J.S. and Bradway, C. (2017) 'Characteristics of Qualitative Descriptive Studies: A Systematic Review', *The Research in Nursing & Health,* 40(1), pp. 23–42
- Kong, L., Cai, Y., Mei, G., Gu, R., Zhang, X., Qin, Y. and Yang, T. (2013) ‘Psychological status and diabetes-related distress of Chinese type 1 diabetes patients in Jiangsu province, China’, *Journal of Biomedical Research*, 27, pp. 380-385
- Kraemer, D.F., Kradjan, W.A., Bianco, T.M. and Low, J.A. (2012) ‘A Randomized Study to Assess the Impact of Pharmacist Counseling of 315 Employer-Based Health Plan Beneficiaries With Diabetes’, *Journal Of Pharmacy Practice*, 25, pp. 169-179.
- Krahenbuhl-Melcher, A., Schlienger, R., Lampert, M., Haschke, M., Drewe, J., Krähenbühlet, S. (2007) ‘Drug-related problems in hospitals: a review of the recent literature’, *Drug Safety*, 30(5), pp. 379-407
- Kucukarslan, S.N., Hagan, A.M., Shimp, L.A., Gaither, C.A. and Lewis, N.J. (2011) ‘Integrating medication therapy management in the primary care medical home: a review of randomized controlled trials’, *The American Journal of Health-System Pharmacy*, 68, pp. 335-345.
- Kuzel, A.J. (1992) ‘Sampling in qualitative inquiry’, in Crabtree, B.F and Miller, W.L. (eds) *Doing qualitative research.* Newbury Park, CA: SAGE, pp. 31-44.
- Latif, A. (2018) ‘Community pharmacy medicines use review: current challenges’, *Integrated Pharmacy Research and Practice*, 7, pp. 83-92.
- Lewington, S., Clarke, R., Qizilbash, N., Peto, R., Collins, R. and Collaboration PS. (2002) ‘Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies’, *Lancet*, 360, pp.1903-1913.
- Ley, P. and Llewellyn, S. (1995) ‘Improving patients’ understanding, recall, satisfaction and compliance’, in Broome, A. and Llewellyn, S., (eds) *Health psychology: processes and applications*. 2nd edn. London: Chapman & Hall, pp. 75–98.
- Lincoln, Y.S. and Guba, E.G. (1985) *Naturalistic Inquiry*. Newbury Park, CA: SAGE.
- Linnan, L.A. and Steckler, A.B. (2002) ‘Process evaluation for public health interventions and research. An overview’, in Steckler, A. and Linnan, L. (eds) *Process evaluation for public health interventions and research*. Josset-Bass: San Francisco, pp. 1-23.
- LoBiondo-Wood, G. and Haber, J. (2014) *Nursing research, methods and critical appraisal for evidence-based practice.* 8th edn. St. Louis, MI: Mosby.
- Mach, F., Baigent, C., Catapano, A.L., Koskinas, K.C., Casula, M., Badimon, L., Chapman, M. J., De Backer, G.G., Delgado, V., Ference, B.A., M Graham, I., Halliday, A., Landmesser, U., Mihaylova, B., Pedersen, T.R., Riccardi, G., Richter, D.J., Sabatine, M.S., Taskinen, M., Tokgozoglu, L., Wiklund, O. and ESC Scientific Document Group (2020) ‘2019 ESC/EAS Guidelines for the Management of Dyslipidemias: Lipid Modification to Reduce Cardiovascular Risk', *European Heart Journal,* 41(1), pp, 111–188
- Majchrowska, A., Bogusz, R., Nowakowska, L., Pawlikowsk, J., Pia˛tkowski, W. and Wiechetek, M. (2019) ‘Public perception of the range of roles played by professional pharmacists’, *International Journal of Environmental Research and Public Health*, 16(15), p. 2787. Doi:10.3390/ijerph16152787.

- Malterud, K., Siersma, V.D and Guassora, A.D. (2015) 'Sample size in qualitative interview studies: Guided by information power', *Qualitative Health Research*, 26, pp. 1753–1760.
- Manfrin, A., Thomas, T. and Krska, J. (2015) 'Randomised evaluation of the Italian medicines use review provided by community pharmacists using asthma as a model (RE I-MUR)', *BMC Health Services Research*, 15, p. 171. doi:10.1186/s12913-015-0791-6.
- Manfrin, A., Tinelli, M., Thomas, T. and Krska, J. (2017) 'A cluster randomised control trial to evaluate the effectiveness and cost-effectiveness of the Italian medicines use review (I-MUR) for asthma patients', *BMC Health Services Research,* 17, p. 300. doi:10.1186/s12913-017-2245-9
- Marshall, S. and Barth, J. (2000) 'Standardization of HbA1c measurements: a consensus statement', *Annals of clinical biochemistry,* 37(1), pp. 45-46.
- Mason, J. (2002) *Qualitative researching*. 2nd edn. London: SAGE
- McAdam-Marx, C., Bellows, B.K., Unni, S., Mukherjee, J., Wygant, G., Iloeje, U., Liberman, J.N., Ye, X., Bloom, F.J. and Brixner, D.I. (2014) 'Determinants of glycaemic control in a practice setting: the role of weight loss and treatment adherence (The DELTA Study)', *The International Journal of Clinical Practice*, 68 (11), pp. 1309–1317
- McDonough, R.P., Doucette, W.R., Kumbera, P. and Klepser, D.G. (2005) 'An evaluation of managing and educating patients on the risk of glucocorticoid-induced osteoporosis', *Value Health*, 8, pp. 24-31.
- McGivney, M.S., Meyer, S.M., Duncan–Hewitt, W., Hall, D.L., Goode, J.-V.R. and Smith, R.B. (2007) 'Medication therapy management: its relationship to patient counseling, disease management, and pharmaceutical care', *Journal of the American Pharmaceutical Association*, 47, pp. 620-628.
- Mclean, W., Gillis, J. and Waller, R. (2003) 'The BC community pharmacy asthma study: a study of clinical, economic and holistic outcomes influenced by an asthma care protocol provided by specially trained community pharmacists in British Columbia', *Canadian Respiratory Journal,* 10, pp. 195-202.
- *Medicare prescription drug, improvement, and modernization act* (pub. L. no. 108-173, 117 stat. 2066) (2003). Available at: https://www.gpo.gov/fdsys/pkg/PLAW-108publ173/html/PLAW-108publ173.htm (Accessed: 15 August 2021).
- Merriam, S.B. (1998) *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.
- Ministry of Health (2016a) *Pharmacy Action Plan 2016 to 2020*. Available at: www.health.govt.nz (Accessed: 15 January 2020).
- Ministry of Health (2016b) *New Zealand health strategy: future direction*. Available at: https://www.health.govt.nz/new-zealand-health-system/new-zealand-health-strategy-future-direction (Accessed: 6 February 2020).
- Ministry of health (2019a) *Healthcare Licensing Services.* Available at: www.moh.gov.sa/en/eServices/Licences/Pages/Licences.aspx (Accessed: 2 March 2020).
- Ministry of health (2019b) *World Health Survey Saudi Arabia (KSAWHS).* Available at: https://www.moh.gov.sa/en/Ministry/Statistics/Population-Health-Indicators/Documents/World-Health-Survey-Saudi-Arabia.pdf (Accessed: 8 January 2023).
- Ministry of Health (2021) *Statistical Yearbook*, Available at: https://www.moh.gov.sa/en/Ministry/Statistics/book/Pages/default.aspx (Accessed: 5 January 2023).
- Ministry of Health (2022) *Budget*, Available at: https://www.moh.gov.sa/en/Ministry/About/Pages/Budget.aspx (Accessed: 5 January 2023).
- Ministry of Health Malaysia (2007) *National medicines policy of Malaysia*. Putrajaya: Ministry of Health Malaysia.

- Mira, J.J. and Aranaz, J. (2000) 'Patient satisfaction as an outcome measure in health care', *Clinical Medicine (BARCELONA)',* 114(3), pp. 26–33
- Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., Stewart, L.A. and PRISMA-P Group (2015) 'Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement', *Systematic Review*, 4 (1), pp.1. doi: 10.1186/2046-4053-4-1.
- Mohler, R., Kopke, S. and Meyer, G. (2015) 'Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare: revised guideline (CReDECI 2)', *Trials*, 16, pp.204. doi:10.1186/s13063-015-0709-y
- Moles, R.J. and Stehlik, P. (2015) 'Pharmacy practice in Australia', *The Canadian Journal of Hospital Pharmacy*, 68 (5), p. 418–426.
- Moore, G., Audrey, S., Barker, M., Bond, L., Bonell, C., Cooper, C., Hardeman, W., Moore, L., O'Cathain, A., Tinati, T., Wight, D. and Baird, J. (2014) 'Process evaluation in complex public health intervention studies: the need for guidance', *Journal of epidemiology and community health,* 68(2), pp. 101–102.
- Moore, G.F., Audrey, S., Barker, M., Bond, L., Bonell, C., Hardeman, W., Moore, L., O'Cathain, A., Tinati, T., Wight, D. and Baird, j. (2015) 'Process evaluation of complex interventions: Medical Research Council guidance', *British medical journal*, 350:h1258. doi:10.1136/bmj.h1258
- Morisky, E.E., Green, L.W. and Levine, D.M. (1986) 'Concurrent and predictive validity of a self-reported measure of medication adherence', *Medical Care,* 24, pp. 67–74
- Morse, J.M. (1994). 'Designing funded qualitative research', in. Denzin, N.K. and Lincoln, Y.S. (eds) *Handbook of qualitative research* (pp.). Thousand Oaks, CA: SAGE, pp. 220-235
- Morse, J.M. and Niehaus, L. (2009) *Mixed method design: Principles and procedures.* Walnut Creek, CA: Left Coast Press.
- Mott, D.A., Martin, B., Breslow, R., Michaels, B., Kirchner, J., Mahoney, J. and Margolis, A. (2003) 'Impact of a medication therapy management intervention targeting medications associated with falling: results of a pilot study', *The Journal of the American Pharmacists Association*. 56 (1), pp. 22-28.
- Murray, E., Treweek, S., Pope, C., MacFarlane, A., Ballini, L., Dowrick, C., Finch, T., Kennedy, A., Mair, F., O'Donnell, C., Ong, B.N., Rapley, T., Rogers, A. and May, C. (2010) 'Normalisation process theory: a framework for developing, evaluating and implementing complex interventions', *BMC medicine*, 8(1), pp. 1-11.
- Nabhani-Gebara, S., Fletcher, S., Shamim, A., May, L., Butt, N., Chagger, S., Mason, T., Patel, K., Royle, F. and Reeves, S. (2020) 'General practice pharmacists in England: integration, mediation and professional dynamics', *Research in Social and Administrative Pharmacy*, 16(1), pp. 17-24.
- Nahid, A. (2016) 'Knowledge attitude and practice towards pharmaceutical care in community pharmacy in Saudi Arabia', *British Journal of Medicine and Medical Research*, 15, pp. 1-9.
- National Health Strategy (2011) *Doha: Supreme Council of Health*. Available at: http://www.nhsq.info/ (Accessed: 1 May 2023)
- National Institute for Health and Care Excellence (2015) *Type 2 diabetes in adults: management. NICE guidelines*. Available at: https://pubmed.ncbi.nlm.nih.gov/26741015 (Accessed: 20 March 2022).
- National Institute for Health and Care Excellence (2022) *Type 1 diabetes in adults: diagnosis and management. NICE guidelines.* Available at: https://pubmed.ncbi.nlm.nih.gov/32017485 (Accessed: 20 March 2022).

- Neergaard, M.A., Olesen, F., Andersen, R.S. and Sondergaard, J. (2009) 'Qualitative description – the poor cousin of health research? ', *BMC Medical Research Methodology*, 9, pp. 52. doi:10.1186/1471-2288-9-52
- Nielsen, K. and Randall, R. (2013) 'Opening the black box: presenting a model for evaluating organizational-level interventions', *European Journal of Work and Organisational Psychology*, 22, pp. 601 - 617.
- Nola, K.M., Gourley, D.R., Portner, T.S., Gourley, G.K., Solomon, D.K., Elam, M. and Regel, B. (2000) 'Clinical and humanistic outcomes of a lipid management program in the community pharmacy setting', *The Journal of the American Pharmacists Association,* 40, pp. 166-173.
- Nordström, A., Hadrévi, J., Olsson, T., Franks, P.W. and Nordström, P. (2016) 'Higher Prevalence of Type 2 Diabetes in Men Than in Women Is Associated With Differences in Visceral Fat Mass', *The Journal of clinical endocrinology and metabolism*, 101(10), pp. 3740-3746.
- Nowak, S.N., Singh, R., Clarke, A., Campbell, E. and Jaber, L.A. (2002) 'Metabolic control and adherence to American Diabetes Association practice guidelines in a pharmacist-managed diabetes clinic', *Diabetes Care*, 25(8), pp.1479-1479.
- Nurunnabi, M. (2017) 'Transformation from an oil-based economy to a knowledge-based economy in Saudi Arabia: the direction of Saudi Vision 2030', *The Journal of the Knowledge Economy*, 8, pp. 536-564.
- O'Cathain, A., Murphy, E. and Nicholl, J. (2008) 'The quality of mixed methods studies in health services research', *The Journal of Health Services Research & Policy*, 13(2), pp. 92-98.
- Oakley, A., Strange, V., Bonell, C., Allen, E., Stephenson, J. and RIPPLE Study Team (2006). 'Process evaluation in randomised controlled trials of complex interventions', *British medical journal*, 332, pp. 413–6
- Odegard, P.S., Goo, A., Hummel, J., Williams, K.L. and Gray, S.L. (2005) 'Caring for poorly controlled diabetes mellitus: a randomized pharmacist intervention', *Annals of Pharmacotherapy*, 39(3), pp. 433-440.
- Ogden, J., Bavalia, K., Bull, M., Frankum, S., Goldie, C., Gosslau, M., Jones, A., Kumar, S. and Vasant, K. (2004) ' "I want more time with my doctor": a quantitative study of time and the consultation', *Family Practice*, 21(5), pp. 479-83.
- Opdenakker, R. (2006) 'Advantages and Disadvantages of Four Interview Techniques in Qualitative Research', *Forum: Qualitative Social Research,* 7(4), Art. 11. doi:10.17169/fqs-7.4.175
- Oppenheim, A.N. (1992) *Questionnaire design, interviewing and attitude measurement*. London: Pinter.
- Organization of the Petroleum Exporting Countries (2022) *Saudi Arabia facts and figures*. Available at: https://www.opec.org/opec_web/en/about_us/169.htm (Accessed: 5 January 2023).
- Osborn, C.Y., Amico, K.R., Cruz, N., Perez-Escamilla, R., Kalichman, S.C., O'Connell, A.A., Wolf, S.A. and Fisher, J.D. (2011) 'Development and Implementation of a Culturally Tailored Diabetes Intervention in Primary Care', *Translational behavioral medicine,* 1(3): pp. 568-479.
- Osterberg, L. and Blaschke, T. (2005) 'Adherence to medication', *The New England Journal of Medicine,* 353, pp. 487-497.
- Otufowora, A., Liu, Y., Young, H., 2nd, Egan, K.L., Varma, D.S., Striley, C.W. and Cottler, L.B. (2021) 'Sex Differences in Willingness to Participate in Research Based on Study Risk Level Among a Community Sample of African Americans in North Central Florida', *Journal of immigrant and minority health*, *23*(1), pp. 19-25.

- Owiredua, C., Quarshie, EN-B. and Atorkey. P. (2018) 'Living with diabetes: an exploratory study of illness representation and medication adherence in Ghana', *Cogent Medicine*, 5(1), pp.1463599. doi:10.1080/2331205X.2018.1463599
- Parahoo, K. (2014) *Nursing research principles, process and issues*. 3rd edn. Basingstoke, UK: Palgrave Macmillan.
- Pascoe, G.C. (1983) 'Patient satisfaction in primary health care: a literature review and analysis', *Evaluation and Program Planning*, 6, pp. 185–210.
- Patel, H., Bell, D., Molokhia, M., Srishanmuganathan, J., Pate, M., Car, J. and Majeed, A. (2007) 'Trends in hospital admissions for adverse drug reactions in England: analysis of national hospital episode statistics', *Clinical Pharmacology*, 7(9). doi:10.1186/1472-6904-7-9.
- Patton, M.Q. (1990) *Qualitative evaluation and research methods*. 2nd edn. Newbury Park, CA: SAGE.
- Patton, M.Q. (2002) *Qualitative research and evaluation methods.* 3rd edn. Thousand Oaks, CA: SAGE.
- Patton, M.Q. (2015) *Qualitative research & evaluation methods: Integrating theory and practice.* 4th edn. Thousand Oaks, CA: SAGE.
- Paudyal, V., Hansford, D., Cunningham, S. and Stewart, D. (2011) 'Pharmacy assisted patient self-care of minor ailments: a chronological review of UK health policy documents and key events 1997– 2010', *Health Policy*, 101 (3), pp. 253-259.
- Paulo, P.T.C., Medeiros, P.A.D., Azevedo, P.R.M., Diniz, R.D.S., Egito, E.S.T. and Araujo, I.B. (2016) 'A Randomized Clinical Trial Of The Impact Of Pharmaceutical Care On The Health Of Type 2 Diabetic Patients', *Latin American Journal Of Pharmacy*, 35, pp. 1361-1368
- Pawson, R., Tilley, N. and Tilley, N. (1997) *Realistic evaluation*: London: Sage.
- Pechlivanoglou, P., Abrahamyan, L., MacKeigan, L., Consiglio, G.P., Dolovich, L., Li, P., Cadarette, S.M., Rac, V.E., Shin, J. and Krahn, M. (2016) 'Factors affecting the delivery of community pharmacist-led medication reviews: evidence from the MedsCheck annual service in Ontario', *BMC Health Services Research*, 16, p. 666. doi:10.1186/s12913-016-1888-2
- Pharmaceutical Services Negotiating Committee (2022a) *Community Pharmacy Contractual Framework.* Available at: https://psnc.org.uk/contract-it/the-pharmacy-contract/ (Accessed: 16 February 2020).
- Pharmaceutical services negotiating committee (2022b) *Advanced Services*. Available at: https://psnc.org.uk/national-pharmacy-services/advanced-services/ (Accessed: 1 January 2023)
- Pharmacy profession in Jordan (2023) *Jordan Pharmacists Association*. Available at: https://jpa.org.jo/ (Accessed: 1 May 2023)
- Pintaudi, B., Lucisano, G., Gentile, S., Bulotta, A., Skovlund, S.E., Vespasiani, G., Rossi, M.C., Nicolucci, A. and BENCH-D Study Group (2015) 'BENCH-D Study Group. Correlates of diabetesrelated distress in type 2 diabetes: findings from the benchmarking network for clinical and humanistic outcomes in diabetes (BENCH-D) study', *The Journal of Psychosomatic Research,*79, pp. 348–354
- Pirmohamed, M., James, S., Meakin, S., Meakin, S., Green, C., Scott, A.K., Walley, T.J., Farrar, K., Park, B.K. and Breckenridge, A.M. (2004) 'Adverse drug reactions as cause of admission to hospital: prospective analysis of 18, 820 patients', *British Medical Journal*, 329, pp. 15-19.
- Planas, L.G., Crosby, K.M., Farmer, K.C. and Harrison, D.L. (2012) 'Evaluation of a diabetes management program using selected HEDIS measures', *The Journal of the American Pharmacists Association*, 52, pp. e130-e138.
- Planas, L.G., Crosby, K.M., Mitchell, K.D. and Farmer, K.C. (2009) 'Evaluation of a hypertension medication therapy management program in patients with diabetes', *The Journal of the American Pharmacists Association,* 49, pp. 164-170.

- Plano Clark, V.L and Ivankova, N.V. (2016) *Why use Mixed Methods Research?: Identifying Rationales for Mixing Methods In: Mixed Methods Research: A Guide to the Field.* Thousand Oaks, CA: SAGE.
- Plano Clark, V.L., Schumacher, K., West, C., Edrington, J., Dunn, L.B., Harzstark, A., Melisko, M., Rabow, M.W., Swift, P.S. and Miaskowski, C. (2013) 'Practices for Embedding an Interpretive Qualitative Approach Within a Randomized Clinical Trial', *The Journal of Mixed Methods Research,* 7(3), pp. 219–242
- Polonsky, W.H., Fisher, L., Earles, J., Dudl, R.J., Lees, J., Mullan, J. and Jackson, R.A. (2005) 'Assessing psychosocial distress in diabetes: Development of the diabetes distress scale', *Diabetes Care*, 28, pp. 626-631.
- Pope, C., Royen, P.V. and Baker, R. (2002) 'Qualitative methods in research on healthcare quality', *Quality and Safety in Health Care,* 11, pp. 148-152
- Public Health England (2017) *Pharmacy: a way forward for public health, opportunities for action through pharmacy for public health*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643520/Pharmacy_a_way_forward_for_public_health.pdf (Accessed: 5 June 2020).
- Rallis, S.F. and Rossman, G.B (2003) 'Mixed methods in evaluation context: a pragmatic framework', in Tashakkori, A. and Teddlie, C. (eds) *Handbook of Mixed Methods in Social and Behavioral Research.* Thousand Oaks, CA: SAGE, pp. 491– 512.
- Rapport, F., Hogden, A., Faris, M., Bierbaum, M., Clay-Williams, R., Long, J., Shih, P., Seah, R. and Braithwaite, J. (2018) *Qualitative Research in Healthcare – Modern Methods, Clear Translation: A White Paper.* Australian Institute of Health Innovation, Macquarie University: Sydney, Australia.
- Rasheed, M.K., Hasan, S.S. and Babar, Z.-U.-D (2019) 'Community pharmacist's knowledge, attitude, roles and practices towards patient-centred care in Saudi Arabia: a systematic review of the literature', *Journal of Pharmaceutical Health Services Research*, 10, pp. 101-115.
- Rhee, M.K., Slocum, W., Ziemer, D.C., Culler, S.D., Cook, C.B., El-Kebbi, I.M., Gallina, D.L., Barnes, C. and Phillips, L.S. (2005) 'Patient adherence improves glycemic control', *Diabetes Educator,* 31(2), pp. 240-50.
- Richmond, S., Morton, V., Cross, B., Chi Kei Wong, I., Russell, I., Philips, Z., Miles, J., Hilton, A., Hill, G., Farrin, A., Coulton, S., Chrystyn, H. and Campion, P. (2010) 'Effectiveness of shared pharmaceutical care for older patients: RESPECT trial findings', *British Journal of General Practice*, 60, pp. 14-20.
- Rickles, N.M., Svarstad, B.L., Statz-paynter, J.L., Taylor, L.V. and Kobak. K.A. (2005) 'Pharmacist telemonitoring of antidepressant use: effects on pharmacist-patient collaboration', *The Journal of the American Pharmacists Association,* 45, pp. 344-353.
- Riekert, K.A. and Rand, C.S. (2002) 'Electronic monitoring of medication adherence: when is hightech best?', *Journal of Clinical Psychology in Medical Settings*, 9, pp. 25-34.
- Ritchie, J., Jewis, J. and Elam, G. (2003) 'Designing and selecting samples', in: Ritchie, J. and Lewis, J. (eds) *Qualitative Research Practice: A guide for Social Science Students and Researchers.* London: SAGE.
- Rogvi, S., Tapager, I., Almdal, T., Schiøtz, M. and Willaing, I. (2012) 'Patient factors and glycaemic control: Associations and explanatory power', *Diabetic Medicine,* 29, pp. 382-389.
- Rollason, V. and Vogt, N. (2003) 'Reduction of polypharmacy in the elderly: a systematic review of the role of the pharmacist', *Drugs & Aging*, 20, pp. 817-832.
- Rothman, R., Malone, R., Bryant, B., Horlen, C. and Pignone, M. (2003) 'Pharmacist Led, Primary Care-Based Disease Management Improves Hemoglobin Aic in High-Risk Patients With Diabetes', *American Journal of Medical Quality*, 18(2), pp. 51-58.

- Rubin, R.R. and Peyrot, M. (1999) 'Quality of life and diabetes', *Diabetes/Metabolism Research and Reviews*,15, pp. 205– 218
- Rudd, P. (1993) 'The measurement of compliance: medication taking', in Krasnegor, N.A., Epstein, L.H., Johnson, S.B. and Yaffe, S.J. (eds) *Developmental aspects of health compliance behavior*. Hillsdale, New Jersey: Lawrence Erlbaum, pp. 185–213.
- Sadek, M.A., Elnour, A.A., Al Kalbani, N.A.S., Bhagavathula, A.S., Baraka, M.A., Abdul Aziz, A.M. and Shehab, A. (2016) 'Community pharmacy and the extended community pharmacist practice roles: The UAE experiences', *Saudi Pharmaceutical Journal*, 24 (5), pp. 563-570.
- Sakharkar, P., Bounthavong, M., Hirsch, J.D., Morello, C.M., Chen, T.C. and Law, A.V. (2015) 'Development and validation of PSPSQ 2.0 measuring patient satisfaction with pharmacist services', *Research in Social and Administrative Pharmacy Journal*, 11, pp. 487-98.
- Saldana, J. (2009) *The Coding Manual for Qualitative Researchers*. Thousand Oaks, California: SAGE.
- Sandelowski, M. (1995) 'Focus on qualitative methods: sample size in qualitative research', *Research in Nursing & Health*, 18, pp. 179-183.
- Sandelowski, M. (2000) 'Focus on Research Methods Whatever Happened to Qualitative Description?', *Research in Nursing and Health*, 23, pp. 334-340
- Sandelowski, M. (2003) 'Tables or tableaux? The challenges of writing and reading mixed methods studies', in Tashakkori, A. and Teddlie, C. (eds) *Handbook of Mixed Methods in Social and Behavioral Research.* Thousand Oaks, CA: SAGE, pp. 321-350.
- Sapkota, S., Brien, J. A., Greenfield, J. and Aslani, P. (2015) 'A systematic review of interventions addressing adherence to anti-diabetic medications in patients with type 2 diabetes - Impact on adherence', *The Public Library of Science ONE*, 10, p. e0118296. doi:10.1371/journal.pone.0118296.
- Sarriff, A., Nordin, N. and Hassali, M.A.A. (2012) 'Extending the roles of community pharmacists: views from general medical practitioners', *Medical Journal of Malaysia,* 67, pp. 574-578.
- Saudi Vision 2030 (2016). Available at: http://www.vision2030.gov.sa (Accessed: 1 February 2020).
- Savin-Baden, M. and Major, C.H. (2013) *Qualitative research: The essential guide to theory and practice.* Oxon, UK: Routledge.
- Schoenmakers, T.W.A., Wensing, M., De Smet, P. and Teichert, M. (2018) 'Patient-reported common symptoms as an assessment of interventions in medication reviews: a randomised, controlled trial', *International Journal of Clinical Pharmacy*, 40, pp. 126-134.
- Schulz, M., Griese-Mammen, N., Anker, S.D., Koehler, F., Ihle, P., Ruckes, C., Schumacher, P.M., Trenk, D., Böhm, M. and Laufs, U. (2019) 'Pharmacy-based interdisciplinary intervention for patients with chronic heart failure: results of the PHARM-CHF randomized controlled trial', *European Journal of Heart Failure,* 21, pp. 1012-21.
- Schulza, K.F., Altmanb, D.G., Moherc, D. and the CONSORT Group (2010) 'CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials', *The Journal of Clinical Epidemiology*, 8, p. 18. doi: 10.1186/1741-7015-8-18
- Shrestha, S., Sapkota, B., Thapa, S., K.C, B. and Khanal, S. (2020) 'Translation, cross-cultural adaptation and validation of Patient Satisfaction with Pharmacist Services Questionnaire (PSPSQ 2.0) into the Nepalese version in a community settings', *Public Library of Science medicine ONE*, 15(10): e0240488.
- Sibbald, B. and Roland, M. (1998) 'Understanding controlled trials: Why are randomised controlled trials important?', *The British Medical Journal,* 316 (7126), pp. 201. doi:10.1136/bmj.316.7126.201.

- Simmons, H. (2022) *Diabetes in Men versus Women.* News-Medical, Available at: https://www.news-medical.net/health/Diabetes-in-Men-versus-Women.aspx (Accessed: 10 December 2022).
- Simpson, S.H., Eurich, D.T., Majumdar, S.R., Padwal, R.S., Tsuyuki, R.T., Varney, J. and Johnson J.A. (2006) 'A meta-analysis of the association between adherence to drug therapy and mortality', *British Medical Journal,* 333, pp. 15. doi:10.1136/bmj.38875.675486.55
- Skivington, K., Matthews, L., Simpson, S.A., Craig, P., Baird, J., Blazeby, J.M., Boyd, K.N., Craig, N., French, D.P., McIntosh, E., Petticrew, M., Rycroft-Malone, J., White, M. and Moore, L. (2021) 'A new framework for developing and evaluating complex interventions: update of Medical Research Council guidance', *British Medical Journal, 374, pp. n2061.*
- Smith, H.A. and Coons, S.J. (1990) 'Patronage factors and consumer satisfaction with sources of prescription purchases', *Journal of Pharmaceutical Marketing & Management*, 4, pp. 61-81.
- Smith, J. and Firth, J. (2011) 'Qualitative data analysis: the framework approach', *Nurse Researcher,* 18, pp. 52-62.
- Smith, M., Giuliano, M.R. and Starkowski, M.P. (2011) 'In Connecticut: improving patient medication management in primary care', *Health Affairs*, 30 (4), pp. 646-654.
- Smith, M.L. (2007) 'Multiple methodology in education', in Green, J., Camilli, G. and Elmore, P. (eds) *Complementary methods for research in education*. Washington, DC: AERA.
- Speight, J. (2005) 'Assessing patient satisfaction: concepts, applications, and measurement', *Value Health*, 8, pp. S6-S8. doi:10.1111/j.1524-4733.2005.00071.x.
- Steckler, A. and Linnan, L. (eds) (2002) *Process evaluation for public health interventions and research.* San Francisco: Jossey-Bass.
- Steel, B.J. and Wharton, C. (2011) 'Pharmacy counter assistants and oral health promotion: an exploratory study', *British Dental Journal*, 211, p. E19. doi:10.1038/sj.bdj.2011.938.
- Stevens, W., Hillsdon, M., Thorogood, M. and McArdle, D. (1998) 'Cost-effectiveness of a primary care based physical activity intervention in 45-74 year old men and women: a randomised controlled trial', British Journal of Sports Medicine, 32, pp. 236-241.
- Stewart, K., George, J., Mc namara, K.P., Jackson, S.L., Peterson, G.M., Bereznicki, L.R., Gee, P.R., Hughes, J.D., Bailey, M.J., Hsueh, Y.A., McDowell, J.M., Bortoletto, D.A. and Lau, R. (2014) 'A multifaceted pharmacist intervention to improve antihypertensive adherence: a cluster-randomized, controlled trial (HAPPy trial)', *Journal of Clinical Pharmacy and Therapeutics*, 39, pp. 527-534.
- Stirratt, M.J., Dunbar-Jacob, J., Crane, H.M., Simoni, J.M., Czajkowski, S., Hilliard, M.E., James E Aikens, J.E., Hunter, C.M., Velligan, D.L., Huntley, K., Ogedegbe, G., Rand, C.S., Schron, E. and Nilsen, W.J (2015) 'Self-report measures of medication adherence behavior: recommendations on optimal use', *Translational Behavioral Medicine,* 5, pp. 470-82.
- Strandberg, R.B., Graue, M., Wentzel-Larsen, T., Peyrot, M., Thordarson, H.B. and Rokne, B. (2015) 'Longitudinal relationship between diabetes-specific emotional distress and follow-up HbA1c in adults with type 1 diabetes mellitus', *Diabetic Medicine,* 32, pp. 1304-1310.
- Stratton, I.M., Adler, A.I., Neil, H.A.W., Matthews, D.R., Manley, S.E., Cull, C.A., Hadden, D., Turner, R.C. and Holman, R.R. (2000) 'Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study', *British medical journal,* 321, pp. 405-412.
- Strauss, A. and Corbin, J. (1990) *Basics of qualitative research: Grounded theory procedures and techniques.* Newbury Park, CA: SAGE.
- Sullivan-Bolyai, S., Bova, C. and Harper, D. (2005) 'Developing and refining interventions in persons with health disparities: The use of qualitative description', *Nursing Outlook,* 53, pp. 127–133.

- Sutton, J. and Austin, Z. (2015) 'Qualitative Research: Data Collection, Analysis, and Management', *The Journal of Clinical Pharmacology*, 68 (3), pp. 226-231
- Tang, T.S., Funnell, M.M., Brown, M.B. and Kurlander, J.E. (2010) 'Self-management support in "real-world" settings: an empowerment-based intervention', *Patient education and counseling*, 79(2), pp.178-184.
- Tasai, S., Kumpat, N., Dilokthornsakul, P., Chaiyakunapruk, N., Saini, B. and Dhippayom, T. (2021) 'Impact of medication reviews delivered by community pharmacists to elderly patients on polypharmacy: a meta-analysis of randomized controlled trials', *Journal of Patient Safety,* 17(4), pp. 290-298.
- Tashakkori, A. and Creswell, J.W. (2007) 'Editorial: the new era of mixed methods', *The Journal of Mixed Methods Research*, 1, pp. 3–7.
- Teddlie, C. and Tashakkori, A. (2009) *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. Thousand Oaks, CA: Sage.
- Teddlie, C. and Yu, F. (2007) **'**Mixed Methods Sampling: A Typology with Examples**',** *The Journal of Mixed Methods Research*, 1 (1), pp. 77-100.
- The General Authority for Statistics (2023) *General Information about The Kingdom of Saudi Arabia*. Available at: https://www.stats.gov.sa/en/page/259 (Accessed: 9 January 2023).
- Thier, S.L., Yu-Isenberg, K.S., Leas, B.F., Cantrell, C.R., DeBussey, S., Goldfarb, N.L. and Nash, D.B. (2008) 'In chronic disease, nationwide data show poor adherence by patients to medication and by physicians to guidelines', *Managed Care.*17(2), pp. 48–52
- Thomas, R.M. (2003) *Blending qualitative and quantitative research methods in theses and dissertations. Mix Methods Res*. Thousand Oaks, CA: SAGE.
- Thompson, K., Kulkarni, J. and Sergejew, A.A. (2000) 'Reliability and validity of a new Medication Adherence Rating Scale (MARS) for the psychoses', *Schizophrenia Research,* 42, pp. 241-247.
- Thorne, S., Kirkham, S.R. and MacDonald-Emes, J. (1997) 'Focus on qualitative methods. Interpretive description: A noncategorical qualitative alternative for developing nursing knowledge', *The Research in Nursing & Health*, 20, pp. 169–177
- Tinelli, M., Bond, C., Blenkinsopp, A., Jaffray, M., Watson, M. and Hannaford, P. (2007) 'Patient evaluation of a community pharmacy medications management service', *Annals of Pharmacotherapy*, 41, pp. 1962-1970.
- Tsuyuki, R.T., AL Hamarneh, Y.N., Jones, C.A. and Hemmelgarn, B.R. (2016) 'The effectiveness of pharmacist interventions on cardiovascular risk: the multicenter randomized controlled RxEACH trial', *Journals of the American College of Cardiology*, 67, pp. 2846-2854.
- Tuffaha, L.H. (2017) 'Health Care and Pharmacy Practice in Jordan', *The Journal of Clinical Pharmacology,* 70(2), pp. 150-155
- Twinn, S. (2003) 'Status of mixed methods research in nursing', in Tashakkori, A. and Teddlie, C. (eds) *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, CA: SAGE, pp. 541–556.
- U.L.T.P Gunasekare. (2015) 'Mixed Research Method as the Third Research Paradigm: A Literature Review', *International Journal of Science and Research,* 4 (8) pp. 361-367
- United Nations Interagency Task Force on the Prevention and Control of Noncommunicable Diseases (2018) *The investment case for noncommunicable disease prevention and control in the Kingdom of Saudi Arabia: return on investment analysis & institutional and context analysis.* Available at: https://www.undp.org/sites/g/files/zskgke326/files/migration/sa/180326-MOH-KSA-NCDs-2017.pdf (Accessed: 5 January 2022).
- United Nations, Department of Economic and Social Affairs, Population Division (2020) *World population ageing 2019*. Available at:

https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Report.pdf. (Accessed: 5 June 2021).

- Van der meer, H.G., Wouters, H., Pont, L.G. and Taxis, K. (2018) 'Reducing the anticholinergic and sedative load in older patients on polypharmacy by pharmacist-led medication review: a randomised controlled trial', *British Medical Journal*, 8, pp. e019042. doi:10.1136/bmjopen-2017-019042.
- Van Mil, J.W.F, Westerlund, L.O.T, Hersberger, K.E. and Schaefer, M.A. (2004) 'Drug-related problem classification systems', *Ann Pharmacotherapy,* 38(5), pp. 859-67.
- Verdoorn, S., Kwint, H.F., Blom, J.W., Gussekloo, J. and Bouvy, M.L. (2019) 'Effects of a clinical medication review focused on personal goals, quality of life, and health problems in older persons with polypharmacy: a randomised controlled trial (DREAMeR-study)', *Public Library of Science Medicine,* 16 (5), pp. e1002798. doi:10.1371/journal.pmed.1002798.
- Verma, A., Harrison, A., Torun, P., Vestbo, J., Edwards, R. and Thornton, J. (2012) 'Are pharmacists reducing COPD's impact though smoking cessation and assessing inhaled steroid use?', *Respiratory Medicine*, 106 (2), pp. 230-234.
- Villeneuve, J., Genest, J., Blais, L., Vanier, M.C., Lamarre, D., Fredette, M., Lussier, M.T., Perreault, S., Hudon, E., Berbiche, D. and Lalonde, L. (2010) 'A cluster randomized controlled trial to evaluate an ambulatory primary care management program for patients with dyslipidemia: the TEAM study', *The Canadian Medical Association Journal,* 182, pp. 447-455.
- Vinks, T.H., Egberts, T.C., De Lange, T.M. and De Koning, F.H. (2009) 'Pharmacist-based medication review reduces potential drug-related problems in the elderly: the SMOG controlled trial', *Drugs & Aging*, 26, pp. 123-133.
- Vision 2030 (2016) *National Transformation Program 2020*. Available at: https://www.vision2030.gov.sa/v2030/vrps/ntp/ (Accessed: 20 June 2021).
- Viswanathan, M., Kahwati, L.C., Golin, C.E., Blalock, S.J., Coker-Schwimmer, E., Posey, R. and Lohr, K.N. (2015) 'Medication therapy management interventions in outpatient settings: a systematic review and meta-analysis', *Journal of the American Medical Association Internal Medicine,* 175, pp. 76-87.
- Volume, C.I., Farris, K.B., Kassam, R., Cox, C.E. and Cave, A. (2001) 'Pharmaceutical care research and education project: patient outcomes', *The Journal of the American Pharmacists Association,* 41, pp. 411-420.
- Wajid, S., Al-Arif,i M., Al Nomay, H., Al Mousa, Y. and Babelghaith, S. (2015) 'Knowledge and perception of community pharmacists' towards generic medicines in Saudi Arabia', *Biomedical Research*, 26 (4), pp. 800-806.
- Waszak, C. and Sines, M.C. (2003) 'Mixed methods in psychological research', in Tashakkori, A. Teddlie, C. (eds) *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, CA: SAGE, pp. 557–576.
- Wei, L., Champman, S., Li, X., Li, X., Li, S., Chen, R., Bo, N., Chater, A. and Horne1, R. (2017) 'Beliefs about medicines and nonadherence in patients with stroke, diabetes mellitus and rheumatoid arthritis: a cross-sectional study in China', *British Medical Journal Open*, 7(10), pp. e017293. doi:10.1136/bmjopen-2017-017293
- White, H., Sabarwal, S. and de Hoop, T. (2014) *Randomized Controlled Trials (RCTs): Methodological Briefs - Impact Evaluation No. 7*. Available at: https://www.unicef-irc.org/publications/pdf/brief_7_randomized_controlled_trials_eng.pdf (Accessed: 1 April 2021).
- Wild, D., Grove, A., Martin, M., Eremenco, S., McElroy, S., Verjee-Lorenz, A. and Erikson, P. (2005) 'Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes (PRO) Measures: Report of the ISPOR Task Force for Translation and Cultural Adaptation', *Value in Health*, 8(2), pp. 94–104.
- Williams, C. (2007) 'Research Methods', *Journal of Business Economics*, 5 (3), pp. 65-72.

- Williams, K.A., Emmerton, L.M., Taylor, R., Werner, J. and Benrimoj, S.I. (2011) 'Nonprescription medicines and Australian community pharmacy interventions: rates and clinical significance', *International Journal of Pharmacy Practice*, 19, pp. 156-165.
- Williams, N.H., Hendry, M., France, B., Lewis, R. and Wilkinson, C. (2007) 'Effectiveness of exercise-referral schemes to promote physical activity in adults: systematic review', *British Journal of General Practice*, 57, pp. 979-986.
- Wolcott, H.F. (1994) *Transforming qualitative data: Description, analysis, and interpretation.* Thousand Oaks, CA: SAGE.
- World Health Organization. Regional Office for the Eastern Mediterranean (2013) *Country cooperation strategy for WHO and Saudi Arabia 2012 – 2016*. Available at: https://apps.who.int/iris/bitstream/handle/10665/113227/CCS_Saudia_2013_EN_14914.pdf?sequence=1&isAllowed=y . (Accessed: 1 October 2022).
- Wright, J.M. and Musini, V.M. (2009) 'First-line drugs for hypertension', *Cochrane Database of Systematic Reviews*, (3),CD001841. doi:10.1002/14651858.CD001841.pub2
- Wu, T.Y., Jen, M.H., Bottle, A., Molokhia, M., Aylin, p., Bell, D. and Majeed, A. (2010) 'Ten-year trends in hospital admissions for adverse drug reactions in England 1999-2009', *Journal of the Royal Society of Medicine,*103(6), pp, 239-50.
- Wubben, D.P. and Vivian, E.M. (2008) 'Effects of pharmacist outpatient interventions on adults with diabetes mellitus: a systematic review', *Pharmacotherapy*, 28, pp. 421-436.
- Yan Chana, A.H., Horne, R., Hankinsc, M. and Chisari. C. (2020) 'The Medication Adherence Report Scale A measurement tool for eliciting patients' reports of nonadherence', *The British Journal of Clinical Pharmacology*, 86, pp. 1281–1288.
- Zulman, D.M., Rosland, A.M., Choi, H., Langa, K.M. and Heisler, M. (2012) 'The influence of diabetes psychosocial attributes and self-management practices on change in diabetes status', *Patient Education and Counseling,* 87, pp. 74-8.

Appendices

Appendix II (Chapter 2)

A. SEARCH TERMS FOR EACH DATABASE

Bibliographic databases	**Key search terms**
Cochrane library	#1 MeSH descriptor: [Pharmaceutical Services] explode all trees #2 MeSH descriptor: [Community Pharmacy Services] explode all trees #3 MeSH descriptor: [Drug Utilisation Review] explode all trees #4 MeSH descriptor: [Medication Therapy Management] explode all trees #5 Clinical pharmacy service #6 Medication review #7 Drug review #8 Medscheck #9 Home medicines review #10 Medicines use review #11 Medicines therapy assessment #12 Netcare #13 Drug therapy management #14 Medication management #15 Drug management #16 Drug regimen review #17 Medication regimen review #18 MeSH descriptor: [Pharmacists] explode all trees #19 MeSH descriptor: [Pharmacies] explode all trees #20 #18 OR #19 #21 #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #14 OR #15 OR #16 OR #17 #22 #20 AND #21
Embase **Embase**	1. exp pharmaceutical care/ 2. Pharmaceutical care.mp. 3. Community Pharmacy Services.mp.

	4. exp clinical pharmacy/ 5. Clinical pharmacy service.mp. 6. Medication review.mp. 7. Drug review.mp. 8. exp "drug utilisation review"/ 9. Drug Utilisation Review.mp. 10. "utilisation review"/ 11. exp medication therapy management/ 12. Medication Therapy Management.mp. 13. Medscheck.mp. 14. Home medicines review.mp. 15. Medicines therapy assessment.mp. 16. Netcare.mp. 17. Drug therapy management.mp. 18. Medication management.mp. 19. Drug management.mp. 20. Drug regimen review.mp. 21. Medication regimen review.mp. 22. exp pharmacist/ 23. Pharmacist.mp. 24. Pharmacists.mp. 25. exp community pharmacist/ 26. exp "pharmacy (shop)"/ 27. Pharmacy.mp. 28. Pharmacies.mp. 29. community pharmacy.mp. 30. community pharmacies.mp. 31. 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 32. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 33. 31 and 32 34. limit 33 to randomized controlled trial
Medline **Ovid MEDLINE(R) and In-Process & Other Non-Indexed Citations**	1. exp Pharmaceutical Services/ 2. Pharmaceutical care.mp. 3. exp Community Pharmacy Services/ 4. community pharmacy services.mp. 5. Clinical pharmacy service.mp. 6. Medication review.mp. 7. exp "Drug Utilisation Review"/ 8. Drug review.mp. 9. exp Drug Utilisation/ 10. Drug Utilisation Review.mp. 11. exp Medication Therapy Management/ 12. Medication Therapy Management.mp. 13. Medscheck.mp. 14. Home medicines review.mp. 15. Medicines therapy assessment.mp. 16. Netcare.mp. 17. Drug therapy management.mp. 18. Medication management.mp. 19. Drug management.mp. 20. Drug regimen review.mp. 21. Medication regimen review.mp. 22. exp Pharmacy/ 23. Pharmacy.mp. 24. exp Pharmacists/ 25. Pharmacist.mp.

	26. community pharmacy.mp. 27. exp Pharmacies/ 28. community pharmacist.mp. 29. retail pharmacy.mp. 30. 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 31. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 32. 30 and 31 33. limit 32 to randomized controlled trial

B. STUDY CHARACTERISTIC TABLE

Study	Study design	Country	Aim	Population	Intervention, duration of intervention	Comparator	Outcomes measured
Bouvy *et al.*, 2003	RCT	Netherlands	Determined the effect of a community-pharmacist-led intervention on medication compliance	Heart failure (HF) patients (admitted to hospitals or attended a specialist HF outpatient clinic) and treated with loop diuretics	Pharmacist led intervention, six-month.	Usual care	-Medication compliance with medication event monitoring systems data -Death - QoL -No. of hospitalizations -Planned readmission -Other hospital admission
McDonough *et al.*, 2005	RCT	USA	Assess the impact of pharmacists' risk management activities on patient risk of	Adult patients on the equivalent of at least 7.5 mg of prednisone for at least six-month	Pharmacists' risk management	Usual care	-Drug therapy problems

			glucocorticoid-induced osteoporosis		activities, nine-month		
Hoffmann *et al.*, 2008	prospective, RCT	Germany	Evaluate the effects of Pharmaceutical Care (PC)	Patients who purchased OTC headache and migraine medication from pharmacies	Pharmaceutical Care (PC), four-month	Control	- QoL
Vinks *et al.*, 2009	A controlled follow-up study	Netherlands	Investigate whether a community-pharmacist-led intervention scheme reduces the number of potential DRPs	Patients aged ≥65 years and using ≥ 6 medications concomitantly.	Community-pharmacist-led medication review, four-month	Usual care	- Number DRPs - DRPs/patient
Villeneuve *et al.*, 2010	open cluster RCT	Canada	Compared a collaborative model involving physicians and pharmacists with usual care for patients with DLD	Adult patients' candidate for statin monotherapy or on statin monotherapy with inadequate control	Collaborative care (Ambulatory primary care Management programme), twelve-month	Usual care	-LDL, TC, HDL, TG, BP and FBG - Adherence to lipid-lowering medication (≥ 80%)
Jahangard-Rafsanjani *et al.*, 2015	parallel group, RCT	Iran	Evaluate the effect of a community pharmacist's diabetes support programme in a middle-income country	Diabetic patients on oral hypoglycemic medications with a history of A1C >7% within the preceding month	Community pharmacist's diabetes support programm	Usual care	-A1C and BP - Medication adherence

					e, five-month		
Basheti, Tadros and Aburuz, 2016	prospective RCT	Jordan	Assess the impact of a MMR service on TRPs and certain clinical outcomes	Adult outpatients' patients who visited two CPs with ≥1 chronic medical condition, and ≥three medications.	MMR, three-month	Control	-BP, blood glucose level, and TG
Elliott *et al.*, 2016	patient-level multicentre, pragmatic RCT involving a parallel group design	England	Evaluate the effectiveness of the New Medication Service (NMS) compared with normal practice in changing medicines-taking behaviour	Adult patients, identified in the pharmacy on presentation of a prescription for asthma/chronic obstructive pulmonary disease, HTN, type 2 diabetes or an anticoagulant/antiplatelet agent	New Medicine Service (NMS), ten-week	Normal practice	-Self-reported adherence
Falamić *et al.*, 2018	double-blind RCT	Croatia	Evaluate the pharmacist's impact on the quality of anticoagulation expressed as Time in Therapeutic Range (TTR) in a specific population	Elderly, rural patients on warfarin, in primary care	pharmacist's intervention, six-month	Usual care	- Adherence
Schoenmakers *et al.*, 2018	non-blinded, RCT	Netherlands	Determine changes in patient reported DASs collected by PROMISE before and after community-pharmacist-led CMR compared with usual care	Patients eligible for a CMR according to the guidelines	CMR, three-month	Usual care	- DASs - No. of patients reporting at least one DAS
Beaucage *et al.*, 2006	A multicenter, randomised, controlled, open-label CP study	Canada	Evaluate the impact of a community pharmacist telephone follow-up intervention (PTFI) on clinical outcomes, pharmaceutical care, and costs for patients undergoing antibiotic treatment was studied	Adult patients coming to a participating pharmacy with a new prescription for oral antibiotic treatment	Community pharmacist telephone follow-up intervention (PTFI), depend on duration of antibiotics	usual pharmacist intervention (UPI)	- DRPs - ADR - Adherence - pt with < 80% adherence

Amariles *et al.*, 2012	RCT	Spain	Assess the effectiveness of the Dader Method for pharmaceutical care on the achievement of therapeutic goals for BP, TC, and both BP and TC (BP/TC)	Patients aged 25 to 74 years with cardiovascular disease and/or high or intermediate CVR attending a CP with a prescription for ≥1 drug indicated for cardiovascular disease or CVR factors	Dader Method for Pharmaceutical Care, eight-month	Usual Care	- Patients achieving BP therapeutic goals - Patients achieving SBP therapeutic goals - Patients achieving DBP therapeutic goals -Patients achieving TC therapeutic goals -BP and TC
Jodar-Sanchez *et al.*, 2015	cluster RCT	Spain	Estimate the incremental cost-effectiveness ratio (ICER) of a Medication Review with Follow-Up (MRF) service	Elderly patients (≥65 years) with polypharmacy, defined as individuals taking ≥5 medicines/day. These five medicines are only prescription and OTC medicines (officially registered medications)	medication review with follow-up (MRF) service, six-month	Usual dispensing	- HR-QoL - Participants who at least visited the A&E department once -Visits to the A&E

							department - Participants with at least one hospital admission -Hospital admissions
Al-Tameemi and Al-Tukmagi, 2017	prospective clinical RCT	Iraq	Apply a pharmaceutical care programme for patients with DLD within a CP setting and examine its effects on patient's awareness about DLD, disease control, and QoL.	Adult patient with DLD	Comprehensive pharmaceutical care programme, sixteen-week	ordinary (usual counseling) care	- TC, LDL, TG and HDL -QoL
Schulz *et al.*, 2019	investigator-initiated, prospective multicentre, RCT	Germany	Investigated whether an interdisciplinary intervention consisting of regular contacts with the local pharmacy and weekly dosing aids improves medication adherence, QoL, hospitalizations and mortality	Elderly patients (≥60 years) with CHF defined by HF symptoms, currently treated with a diuretic, and a hospitalization for HF within the last twelve-month or increased B-type natriuretic peptide or N-terminal pro-B-type natriuretic peptide concentrations	Pharmacy-based interdisciplinary intervention, two-year	Usual care	- Medication adherence - QoL - All-cause deaths and unplanned CV hospitalizations

Verdoorn *et al.*, 2019	pragmatic RCT	Netherlands	Determine the impact of such a patient-centred approach in CMR on patients' lives, including HR-QoL and health problems	Elderly patients (≥70 years) and using≥7 long-term medications.	CMR, six-month	Usual care	- HR-QoL - Visits to the ED - Hospital admissions, acute and planned
Currie *et al.*,1997	A prospective, randomised study	USA	Examine the ability of patient oriented pharmacists to provide pharmaceutical care in a CP setting	Ambulatory, noninstitutionalized patients who had had ≥ 2 prescription orders filled at the study pharmacy during the preceding twelve-month	Pharmaceutical care, six-month	Usual care	-Total prescription-related problems -Total DRPs -ADR present - Patients with ≥ 1 Problem Detected
Nola *et al.*, 2000	randomised pretest-posttest control group design	USA	Evaluate specific clinical and humanistic outcomes of a lipid management programme in a CP setting.	Patients at risk for CAD based on a six-month history of use of specific medications indicative of HTN and diabetes, which are known to increase the risk of developing CAD and heart disease.	Pharmacist-directed lipid management programme, six-month	Control	-TC, LDL, HDL, TG -Risk factors for CAD -No. of patients who reached their cholesterol goal
Bernsten *et al.*, 2001	RCT longitudinal, clinical trial	Centres in 7 European	Investigate the impact of a coordinated CP-based pharmaceutical care programme	Elderly patients (≥65 years) taking ≥ 4 prescribed medications and orientated with respect to self, time and place. In	Pharmaceutical Care,	Control	- HR-QoL - Self reported

	with repeated measures	countries participated in the study: Denmark, Germany, The Netherlands, Northern Ireland (coordinating centre), Portugal, Republic of Ireland and Sweden	on a range of health and economic outcomes.	addition, they were community dwelling and regular visitors to a recruited CP.	eighteen-month		Compliance - Participants with at least one hospital admission
Cordina, Mcelnay and Hughes, 2001	longitudinal, prospective RCT	Malta	Examine the impact of a CP-based education and monitoring programme on a range of patient-specific asthma management outcomes	Community-dwelling patients with asthma.	CP-based education and monitoring programme, one-year	Control	- HR-QoL - Patients' asthma-specific QoL - Hospitalization Rates
Volume *et al.*, 2001	cluster RCT	Canada	Describe changes in patients' adherence to therapy regimens and patients' HRQoL after the provision of pharmaceutical care	Ambulatory elderly (~ 65 years) patients covered under Alberta Health & Well ness's senior drug benefit plan and who were concurrently using ≥3 medications according to pharmacy profiles	Pharmaceutical care research and education project, one-year	Usual care	- Self-reported medication adherence - HRQoL

Garcao and Cabrita, 2002	RCT	Portugal	Evaluate the community pharmacist' s capacity to positively influence the results of antihypertensive drug therapy through a pharmaceutical care programme and to determine what factors limit the programme	Patients with a diagnosis of essential HTN who had been on drug treatment for less than six-month	Pharmaceutical Care programme, six-month	Usual care	- BP - BP differences
Rickles *et al.*, 2005	unblinded, mixed experimental RCT	USA	Impact of telephone-based, pharmacist-guided education and monitoring (PGEM) on multiple outcomes of pharmacist–patient collaboration and monitoring in 8 CPs	Patients presenting new antidepressant prescriptions to their CPs.	Telephone-based pharmacist-guided education and monitoring (PGEM), three-month	Usual care	- Adherence
Armour *et al.*, 2007	multi-site randomised intervention versus control repeated measures study design	Australia	Implement the Pharmacy Asthma Care Programme (PACP) in three Australian states (New South Wales, Queensland and Victoria) and evaluate its effect on asthma control and other clinical and humanistic patient outcomes.	Adult patients, previous diagnosis of asthma and fulfilment of one or more of the following sub-criteria from the revised Jones' Morbidity Index: -Use of a reliever medication >3 times a week over the previous four-week. -Waking at night or morning with cough/chest tightness on at least one occasion over the previous four-week. -Time off work/study because of asthma over the previous four-week. -Symptoms of asthma (cough, breathlessness, wheeze, etc) at least once a week over the previous four-week. -No visit to a doctor for asthma within the last six-month	Pharmacy Asthma Care Programme (PACP), six-month	Usual care	- Risk of non-adherence - QoL

Doucette *et al.*, 2009	RCT	USA	Evaluate the effect of a community pharmacist–provided extended diabetes care service on primary clinical outcomes, including A1C, LDL-C, and BP.	Adults patients with type 2 diabetes who had completed at least 2 diabetes education sessions at a local diabetes education centre within the past two-year	Community pharmacist–provided extended diabetes care service, one-year	Usual care	- A1C and LDL - BP
Planas *et al.*, 2009	RCT	USA	Evaluate the effect of a CP–based HTN MTM service on quality of care in patients with both diabetes and HTN. Clinical outcomes of care were BP and antihypertensive medication adherence. This study was part of a larger study of patients with diabetes.	Patients with diabetes and HTN who were enrolled in a managed care organisation.	CP–based HTN MTM service, nine-month	Control	-SBP - Participants at goal BP - Adherence rates for antihypertensive medications
Ali *et al.*, 2012	prospective RCT	UK	Demonstrate the benefits of a community-pharmacist-led extended diabetes care model	DM patients	Pharmaceutical care package (community-pharmacist-led extended diabetes care model), one-year	Control	- BP, Blood glucose, HbA1c, LDL, HDL, TC and TG -Diabetes QoL

Planas *et al.*, 2012	RCT	USA	To evaluate the efficacy of a community-based, pharmacist-directed diabetes management programme among managed care organisation enrollees using National Committee for Quality Assurance (NCQA)–Healthcare Effectiveness Data and Information Set (HEDIS) performance measures	Patients with diabetes and HTN who were enrolled in a managed care organisation.	Pharmacist-directed diabetes management programme, nine-month	Control	- LDL, BP and HbA1c - Participants at goal LDL levels - Participants at goal BP levels - Participants at goal HbA1c levels
Tsuyuki *et al.*, 2016	multicentre, RCT	Canada	Develop and implement a broad-based, community, pharmacist-initiated vascular risk reduction case-finding and intervention programme and to evaluate its impact on risk for cardiovascular events	Adults patients who were at high risk for CV events	MTM consultation (in Alberta, called a Comprehensive Annual Care Plan or Standard Medication Management Assessme	Usual care	- Estimated CV risk - BP -LDL (mmol/L) -HbA1c % - Achievement of targets for BP - Achievement of

					nt), three-month		targets for LDL - Achievement of targets for HbA1c
Manfrin *et al.*, 2017	cluster, multicentre RCT	Italy	Deliver a novel CP intervention for asthma patients, adapted from the MUR service for chronic diseases in England, across the Italian territory and to evaluate its effectiveness and cost-effectiveness	Patients with an asthma diagnosis or at least six-month consecutive use of medicines indicating asthma	Italian medicines use review (I-MUR), nine-month	I-MUR start at three-month later, at three and six-month .Because the intervention starts at T3	- Adherence to asthma medication
Cheema *et al.*, 2018	Multicentre RCT	UK	To determine whether the structured information provided to patients verbally and in writing by community pharmacists about high BP will be associated with improved BP control and be better retained by patients	Patients started on a BP medication	Structured written and verbal advice by community pharmacists, six-month	Usual care	- BP

Van der Meer *et al.*, 2018	single blind RCT	Netherlands	Evaluate if a medication review is an effective strategy to reduce anticholinergic and sedative load as measured by the Drug Burden Index (DBI) and evaluate the effect of a medication review on patient outcomes including cognitive function, risk of falls, activities of daily living and QoL.	community-dwelling patients aged ≥65 years who used ≥5 medicines for ≥ three-month, including at least one psycholeptic/ psychoanaleptic medication and who had a DBI≥1.	pharmacist-led medication review, three-month	Control	- Sedative side effects measured - Anticholinergic side effects - QoL - Mortality - Hospital admission
Aslani *et al.*, 2010	A repeated-measures RCT	Australia	Develop, implement and evaluate a new service in CP for conducting therapeutic outcomes monitoring to promote adherence to medication therapy.	Patients on chronic lipid-lowering therapy	Adherence monitoring service, nine-month	Control	-TC -Patients adherence
Mott *et al.*, 2003	A randomised, cluster, controlled experimental design	USA	Examine preliminary effects of a MTM intervention focused on FRIDs provided by a community pharmacist to older adults	Elderly patients who completed a fall prevention workshop	MTM, six-month	Control	- Fall risk-increasing drug (FRID) related problems
Herborg, 2001	Prospective, controlled, multicentre study	Denmark	Evaluate the effects of a therapeutic outcomes monitoring (TOM) programme on selected process and outcome measures	Adult patients with asthma and treated in primary care	Therapeutic outcomes monitoring (TOM) programm	Normal practice	- HR-QoL - Patients' asthma-specific QoL

					e, one-year		- Hospital admission - ED visits
Armour *et al.*, 2013	cluster randomised design	Australia	Investigate the feasibility and effectiveness of a specialist management service in CP for patients identified as at risk of adverse outcomes. And assess whether similar clinical and humanistic outcomes could be achieved by three versus four consultations over six-month Assess the sustainability of outcomes after twelve-month	People with poorly controlled asthma or no recent asthma review were included	Evidence-based asthma service, six-month	Evidence-based asthma service four-visit intervention, 6-month.	- QoL - Risk of non-adherence
Stewart *et al.*, 2014	prospective, non-blinded, cluster- RCT	Australia	Assess the efficacy of a well-defined, multifaceted, community pharmacist-delivered intervention to improve adherence to antihypertensive therapy in patients suspected of being non-adherent	Adults with primary HTN who obtained antihypertensives in the previous six-month. Patients with poor refill adherence were preferentially identified with the help of a purpose-built software application.	Well-defined, multifaceted, community Pharmacist Care, six-month	Usual care	- BP - Self-reporting adherence
McLeanm Gillis and Waller 2003	Cluster RCT	Canada	Demonstrate a significant difference in clinical, economic and QoL outcomes in asthma patients who received enhanced pharmaceutical care (EC) versus those who received usual care (UC)	all members of the Health Outcome Pharmacies (HOP) cooperative in British Columbia (BC) which were Asthma patients, particularly those whose asthma was uncontrolled	Enhanced pharmaceutical care (EC), twelve-month with no less than nine	Usual care and control care	- Asthma QoL - Hospitalizations visits in previous month

					month as acceptable		- Emergency visits in previous month
Clifford *et al.*, 2005	RCT	Australian	Examine the effect of a twelve-month pharmaceutical care (PC) programme on vascular risk	Adults with type 2 diabetes from the Fremantle Diabetes Study (FDS)	pharmaceutical care programme, one-year	Control	- HbA1c, BP, HDL, TC and TG -Fasting serum glucose
Richmond *et al.*, 2010	randomised multiple interrupted time-series design	UK	Estimate the effect of pharmaceutical care on the appropriateness of prescribing; patients' knowledge, adherence, and QoL; and the incidence of adverse events	Elderly patients (≥75 years) taking ≥5 drugs on repeat prescription at the time of recruitment	pharmaceutical care, 12-month. Five primary care trusts (PCTs) implemented pharmaceutical care at two-month intervals. In this way, each PCT acted as a control for the other four. Within each PCT, participants, GPs, and pharmacists acted as their own controls		- QoL - ER admission per month.

C. PHARMACIST- LED MEDICATION REVIEW SERVICES

Study ID	Name of Intervention, duration	Components of intervention
Bouvy *et al.*, 2003	Pharmacist led intervention, six-month	• Aim to reinforce medication compliance • A structured interview on the patient's first visit in pharmacy • A computerized medication history was used to discuss drug use, reasons for noncompliance • A short report of this interview was forwarded to the GP • Pharmacists then contacted patients on a monthly basis
McDonough *et al.*, 2005	Pharmacists' risk management activities, nine-month	• The initial evaluation focused on the patient's glucocorticoid therapy and any medications being used to manage the risks of developing glucocorticoid-induced osteoporosis • Subsequent reviews by the pharmacists included evaluations of drug therapy being studied in addition to other medications the patients were taking. • Received education + an educational pamphlet about the risks of glucocorticoid-induced osteoporosis • Monitored the patients' drug therapy, using Outcomes Encounter Programme (Web-based claims system that pays pharmacists to identify and address five types of DRPs) • Any problems that were identified were discussed with the patient and/or the prescribing physician.
Hoffmann *et al.*, 2008	Pharmaceutical Care (PC), four-month	• First interview: data acquisition, patients were asked about disease- and patient-related aspects in a computer-aided, standardised, personal telephone interview (CATI). The interview covered the following modules: diagnostic, therapy, self-efficacy; QoL; knowledge about headaches and intervention • Prescheduled individual counseling with a defined extended time frame, usually provided in designated rooms, thus ensuring confidentiality. • All steps were documented by the pharmacist in semi standardised forms • Together with the patient, the intervention pharmacist prioritised problems, defined individual goals, and devised a plan to work toward them. • Checklist prepared contained patients' personal and disease-related data, as well as information about BP, blood glucose, body weight, and BMI. • During every consultation, pharmacists documented the number and duration of headache attacks between the consultations, as well as patient history regarding drugs prescribed and any additional drugs used because of headaches. • The counseling sessions ranged between 1 and 6 • After four-month, a standardised telephone interview was repeated. Using the same standardised questionnaire as in the first interview

Vinks *et al.*, 2009	Community-pharmacist-led medication review, four-month	• In the date of inclusion, the actual drug list of all patients was screened for potential DRPs. • The pharmacist composed a list of recommended changes to medications. • Within two-week after the date of inclusion, these recommendations were discussed with the GP according to a fixed format in which the DRPs and recommendations were classified. • Depending upon the health status of the patient and the nature of the DRPs the recommendation(s) were discussed with the patient. • This discussion usually lasted for about 5–15 minutes. • Four-month following the date of inclusion, the medication of each included patient was again reviewed and screened for potential DRPs.
Villeneuve *et al.*, 2010	Collaborative care (Ambulatory primary care Management programme), twelve- month	• During the patient's initial visit to the pharmacy (which lasted 30 minutes), the pharmacist provided counselling and used a patient decision aid to draw up a treatment plan, which included lifestyle changes and pharmacotherapy. • The pharmacist then scheduled so-called titration visits (lasting 15 minutes each) at two-month intervals. During the titration visits, the pharmacist evaluated lifestyle changes, the patient's tolerance of and adherence with the pharmacotherapy, and the drug's efficacy and then adjusted the statin dosage accordingly. • If necessary, the pharmacist scheduled an adherence visit (lasting 30 minutes) to discuss strategies to optimise treatment. • When target lipid levels were achieved, the pharmacist scheduled a follow-up visit (15 minutes) for three-month later. • After each visit, the pharmacist prepared an interim report and sent it to the physician by fax. • The intervention ended when any one of the following milestones occurred: target lipid levels were reached at the follow-up visit, the patient had not achieved target lipid levels at the maximum statin dosage prescribed, the patient experienced severe intolerance to the drug or the patient asked to end the intervention
Jahangard-Rafsanjani *et al.*, 2015	Community pharmacist's diabetes support programme, five-month	• The programme consisted of 5 follow-up visits with the community pharmacist (once a month). • The duration of each follow-up visit was estimated to be 30 minutes. • The community pharmacist made a telephone call between visits to reinforce treatment adherence and resolve any TRP. • A step-by-step protocol was designed to deliver education on diet management, physical activity, and diabetes complications during the intervention. • Each patient received individualised consultations based on individual needs. • The community pharmacist used a predefined checklist to document the education procedure for each patient during the study period. • At the recruitment visit, patients were provided with a blood glucose self-monitoring device and the required test strips were supplied for one-month. Patients were trained how to use the device and were requested to document blood glucose levels every other day in a rotating schedule. Each patient was provided with a special logbook and educational pamphlets for the diabetes medications. • At each follow-up visit, MRPs, self-care issues, and the logbook were discussed with the patient. • Patients were referred to the physician whenever the disease was not controlled after the first two-month of the intervention or a drug therapy modification was required.

		• The community pharmacist recorded the number of physician visits and the drug therapy modifications during the study period.
Basheti, Tadros and Aburuz, 2016	MMR, three-month	• Aim to maximizing patient benefit from their medication regimen and preventing TRPs through a team approach involving the patient's physician and the pharmacist through 2 visits (baseline and at 3-month.). • Patients in both groups were followed up • Phone calls were conducted by the clinical pharmacist to remind the patients of their second visit to the pharmacy • The impact of the MMR service for the intervention group was then assessed by evaluating the outcomes of the recommendations submitted to the physicians to resolve the identified TRPs, physicians' acceptance of the recommended interventions, and the effect of the intervention on certain clinical outcomes • Data collection required about six-month (recruitment plus a follow-up period of three-month) in each of the two participating pharmacies
Elliott *et al.*, 2016	New Medicine Service (NMS), ten-week	• Aim is the patient-centred identification of any problems with the treatment (including ADR) and support or action needed. Action may include referring the patient back their prescriber to review their medication Begins with the patient's initial presentation with a prescription for a new medicine • The intervention itself is relatively rapid and comprises two parts, named 'intervention' and 'follow-up' by the commissioners. • The pharmacist invites the patient to a one-to-one consultation 7– 14 days later (the 'intervention') with a 'follow-up' 14–21 days after that, meaning the whole episode should be complete within a maximum of five-week. • The pharmacist would ask about adherence and experiences with the medicine. • The intervention can be face-to-face or telephone-based, in this study, all follow-up was via telephone
Falamić *et al.*, 2018	pharmacist's intervention, six-month	• At the baseline: the investigator collected the sociodemographic, social, and patient's clinical data by interviewing the patients, using the data provided by the GPs and the pharmacy data. • The first visit: an approximately 45 min education considering all aspects of warfarin treatment. The participants were provided with a follow up plan as well as most important messages provided during the education. • The participants were provided a pillbox for warfarin therapy only and were instructed to fill the pillbox according to the dosing scheme. • A medication review was done to avoid drug interactions with warfarin, and, if necessary, the GP was contacted with a proposal for drug change or dose modification. • Acceptance of interventions made to the GPs was noted. • The participants were instructed to contact the investigator by telephone or to visit him every time a new drug was added to the therapy to scan for drug interactions and to contact the GP if necessary. • The frequency of INR monitoring for the whole course of the study was driven by the GPs, while the INR values were taken from the GP's electronic base. • All of the collected INR values were taken into account • The follow up visits (approximately 20 min) were scheduled monthly, when participants were taking their usual therapy at the pharmacy.

		• At the follow up visit, the investigator repeated the key education themes and measured adherence. The investigator checked the INR result and the dosing scheme if the INR was checked that day. The GP was contacted if need it
Schoenmakers *et al.,* 2018	CMR, three-month	• Comprises six steps for patient selection, patient interview, medication analysis, intervention plan, implementation of treatment changes, and evaluation after three-month of follow-up; the patient and the GP also contribute to these steps • The 'Patient-Reported Outcome Measure, Inquiry into Side Effects' PROMISE instrument was used during the steps
Beaucage *et al.,* 2006	Community pharmacist telephone follow-up intervention (PTFI), depend on duration of antibiotics	• **Initial evaluation:** A face-to-face interview was conducted at the pharmacy prior to randomisation. To evaluate the number of infectious symptoms and the infection severity score. The interviewing pharmacist did not have access to the initial evaluation and was unaware of the patient's diagnosis. • **Evaluation during treatment:** For each patient, DRPs, pharmacist oral recommendations, and written pharmaceutical advices to physicians were documented during the antibiotic treatment, excluding the initial and final evaluations. • **Final evaluation:** The final evaluation was conducted over the telephone by a pharmacist blinded to the patient's assignment group. The interview was scheduled for the expected last day of antibiotic treatment. If a DRPs was identified at the final evaluation, the patient was referred to his or her treating pharmacist.
Amariles *et al.,* 2012	Dader Method for Pharmaceutical Care, eight-month	• Aim to identify (a) any potential or actual patient health outcomes that are not consistent with the objectives of pharmacotherapy and are associated with the use of medicines (negative outcomes associated with medication (NOM) and (b) situations in which the use of medicines caused or may cause the appearance of an NOM (DRPs). Dader Method for Pharmaceutical Care was provided on a regular basis according to a systematic and documented method and carried out in collaboration with patients and physicians. • Patient-specific data were obtained by interviewing the patient and reviewing the drug and clinical records • Used the collected data to complete the assessment form, which was interpreted and evaluated once all the necessary information was added. • Valuated the patient's drug therapy outcomes • Conducted an intervention intended to directly prevent or resolve an NOM. Once the pharmacist identified concerns about the medical problems and current drug therapy, he or she interpreted and analysed this information in the context of the clinical condition illustrated by the assessment form. • Completed a new assessment form. • Patients provided with verbal and written counselling regarding cardiovascular disease prevention • To assess the results of interventions on BP and/or TC, patients had at least 5 appointments with the pharmacist on weeks 0. The timing of the intermediate appointments (weeks 4-6, 8-10, 14-16) was flexible, depending on the amount of time necessary to assess the results of interventions that had been performed
Jodar-Sanchez *et al.,* 2015	medication review with follow-up	• The aim of the Dader method for the MRF service is to detect DRPs and to prevent and resolve NOMs. • All sessions were conducted face to face. • **First interview,** first month, Patients took all the medication they were taking to the pharmacy and the pharmacist asked them a series of questions to obtain information

	(MRF) service, six-month	• **Situation assessment**, first month, the pharmacist processed the information obtained from patients during the interviews • **Study phase**, first month, the pharmacist searched for information in the knowledge database and in other sources of information to enable them to identify DRPs and NOMs • **Evaluation phase,** first month, the pharmacist identified DRPs and NOMs • **Definition of the action plan**, first month, the pharmacist agreed with patients on certain therapeutic objectives to be reached regarding their pharmacotherapy, and suggested interventions to patients and/or GP to prevent, resolve, or improve the identified DRPs and NOMs • **Intervention phase.** first month, the pharmacist went through with the interventions in the action plan • **Follow-up to ascertain the level of acceptance of the interventions and evaluate their results**, second to sixth month, the pharmacist obtained information about the acceptance or non-acceptance of the proposed interventions by those affected. After this, the pharmacist obtained clinical information about patients' health problems, about NOMs, and about the elements of the process of use of the drugs (DRPs), and repeated the process described for the MRF service • **Additional contacts**, Second to sixth month, Additional contacts with the patient outside the scheduled contacts
Al-Tameemi and Al-Tukmagi , 2017	Comprehensive pharmaceutical care programme, sixteen-week	• First interview, initial assessment data and laboratory analysis were collected • A stepwise approach was designed for each patient in order to: set priorities for patient care, assess patient's educational needs, and develop a comprehensive and achievable pharmaceutical care plan. • Patients were also educated on their illness and their medication in a structured manner and behavioural modifications • Patients were supplied with this information verbally and in a written manner through manuals organised specially for this study. • The monthly visits, lasted about 15 minutes each and additional on-demand phone calls and visits were performed if required by the patients • At each visit: lipid profile and body weight were measured for each patient in the intervention group. • At the first and last scheduled visit, patients in both groups received questionnaires to assess their QoL. Weight measurement and blood analysis for lipid profile determination were also performed.
Schulz *et al.,* 2019	Pharmacy-based interdisciplinary intervention, two-year	• **First, medication review** (**within two-week after randomisation)** at baseline with the aim of generating a consolidated medication plan. This included the following: • compilation of the patient's entire medication (based on the physician's medication list, documented drug dispensing in the pharmacy, and patient interview in the pharmacy) •check for DRPs using a standardised checklist •contact with the physician to discuss problems and risks if necessary •based on the subsequently consolidated medication plan, the patient received a weekly dosing aid together with a printout of the medication plan. • **Pharmacy care continued** by (bi-)weekly visits to the local pharmacy including: •updating the medication plan if necessary •receiving the supply of medicines in dosing aids filled by the pharmacist for one-week or two-week

		•counselling regarding medication, adherence, potential side effects, signs and symptoms of decompensation •measurement of BP and pulse rate •in case of newly detected DRPs and/or significant changes in vital signs, contact with the physician
Verdoorn *et al.,* 2019	CMR, six-month	Full drug-dispensing records from the pharmacy and clinical records from the GP were available at the start of the CMR. The process of CMR consisted of **5 different steps**: • A patient interview performed by the community pharmacist, consisting of an extensive discussion of the patient's health problems, patient's preferences, and all medications currently used, including OTC medication. At the end of the interview, all the problems were summarised, and one or more health-related goals were proposed. • After the patient interview, all potential DRPs were summarised by the pharmacist, and recommendations were proposed to attain goals and to solve DRPs. • The pharmacist had a face-to-face meeting with the patient's GP to discuss all health-related goals and other identified DRPs. They then proposed a pharmaceutical care plan, including which actions should be carried out, as well as when and by whom • The pharmaceutical care plan was then discussed with the patient to reach agreement about implementation. • Two follow up appointments were scheduled (within approximately three-month), in which the pharmacist evaluated the agreed actions and the attainment of goals with the patient and, if necessary, adjusted the treatment plan after discussion with the GP.
Currie *et al.,* 1997	Pharmaceutical care, six-month	• Before the patients were enrolled, the pharmacists began logging identified problems for all pharmacy patients on a Pharmacist Intervention Report Form (PIRF). The PIRF was used for all patients throughout the study period. • Study pharmacists completed a PIRF each time a problem was identified and whenever time was spent with an intervention patient • Intervention patients were interviewed by the pharmacist, and medication and medical information was collected and documented on a modification of the Pharmacist's Workup of Drug Therapy form • Pharmacists then used this information to develop a Problem-Oriented Pharmacy Record (POPR), or patient chart, in which all of the DRPs for that patient were recorded. • A one-page patient-specific list of DRPs was developed as a cover sheet and table of contents to the POPR. This sheet summarised the current medications, as well as medical and DRPs. • The Subjective Objective Assessment Plan (SOAP) format was used to summarise the problems identified and to record the thoughts and actions of the pharmacists. • The POPR served as the primary reference and documentation source for the pharmaceutical care of intervention patients by the pharmacist.
Nola *et al.,* 2000	Pharmacist-directed lipid management programme, six-month	• Baseline demographic information was collected at study enrollment. • The lipid management programme was a comprehensive disease management programme comprising diet and exercise evaluation and instruction, monitoring of cholesterol levels, monitoring of drug therapy, collaboration with physicians, education to increase patient knowledge, and education to improve compliance with diet and drug therapy.

		• Patients who were not at goal were referred to their physician with recommendations for diet, exercise, and drug therapy. When patients were at their individual cholesterol goals, they received reinforcement to continue their current efforts. • When a patient was started on pharmacotherapy, the pharmacist evaluated the appropriateness of the selection. Any suspected or potential problems with medications were shared with the patient's physician. • Patients were sent a card reminding them to make an appointment for their final laboratory screening.
Bernsten *et al.*, 2001	Pharmaceutical Care, eighteen-month	• Assess patients individually and identify actual and potential DRPs using a structured approach. Utilise the patient (via informal questioning), the patient's GP and pharmacy-held records. • Formulate an intervention and monitoring plan for each individual patient. • Educating the patient about their drug regimen and their medical condition(s) • Implementing compliance-improving strategies • Rationalizing and simplifying drug regimens in collaboration with the patient's GP • Formal links between the community pharmacists and GPs were established to encourage GP participation
Cordina, Mcelnay and Hughes,2001	CP-based education and monitoring programme, one-year	• The pharmaceutical care interventions implemented by intervention pharmacies focused on two issues: patient education and patient monitoring. • Verbal education and demonstration of inhaler technique were supported by written information and provision of a short videotape for home viewing. • Patients were monitored by supplying them with a peak flow meter and asking them to record on a diary card. • Patients were instructed to present their diary card to their community pharmacist for review monthly when the patients collected their asthma drugs. • pharmacists were provided with a patient profile. These data were retrieved from each patient's asthma clinic file. • When the patient returned to the pharmacy each month, the pharmacist inquired about asthma symptoms and problems encountered with treatment. • The pharmacist reviewed the patient's inhaler and PEF technique, and reviewed the patient's asthma status and drug therapy. • This information was recorded in the patient profile, together with any referral to the asthma clinic, suggested treatment changes that were relayed to the patient's physician, and time spent with the patient.
Volume *et al.*, 2001	Pharmaceutical care research and education project, one-year	• Conduct initial interview and frequent follow-up communication with the patient and other caregivers. • They used the Pharmacist's Management of Drug-Related Problems (PMDRPs) instrument to summarise the information collected during the patient interview and the subjective, objective, assessment, and plan record to document actions and follow-up.
Garcao and Cabrita, 2002	Pharmaceutical Care programme, six-month	• Conduct monthly scheduled interviews • The pharmacist interviewed patients, obtained laboratory and body measurements, and designed an individualized nonpharmacologic care plan on the basis of the results.

		• Each patient' s pharmacy record, obtained and updated monthly, contained sociodemographic data, clinical and therapeutic data, patient behaviours, lifestyle information, and BP records. • Educational leaflets were handed out during the first interview. Oral and written instructions were also given during the first interview and reinforced in the subsequent interviews. • The educational materials were distributed • The pharmacist' s recommendations for drug regimen changes in light of the DRPs detected were made to physicians mainly by letter but also verbally by telephone. Recommendations to patients focused mainly on nonpharmacologic measures and adherence reinforcement.
Rickles *et al.*, 2005	Telephone-based pharmacist-guided education and monitoring (PGEM), three-month	• Patients received 3 monthly telephone calls from the pharmacist. • The **first telephone call** last 19 minutes to complete and took place, on average, within the first three-week of the patient picking up their initial antidepressant prescription from the pharmacy. During the first call, the pharmacist assessed the patient's antidepressant knowledge and beliefs, adverse effects and other concerns, treatment goals or areas in which they hoped the medication would help, and how the medication was being used during the week before the telephone call. Study pharmacists probed and clarified or explained issues that were not understood by patients. They also asked patients to rate the severity of their concerns and made recommendations on how to handle any adverse effects, difficulties remembering or paying for medications, and other concerns. Pharmacists were expected to follow up on any indication of medication nonadherence using supportive probing to inquire why the doses were missed and making recommendations to help the patients better use the medication. • The **second and third telephone calls** last 12 and 11 minutes, respectively and took place approximately one-month and two-month after the initial call. During these patient calls, study pharmacists used the monitoring tool to guide their follow-up on any issues or concerns identified in earlier calls. Pharmacists also reviewed current adherence, whether any new adverse effects and concerns had developed, and whether the patient had seen any progress in his/her medication goals. The pharmacist made new recommendations to patients as needed.
Armour *et al.*, 2007	Pharmacy Asthma Care Programme (PACP), six-month	• PACP provided an ongoing cycle of assessment, management and review in collaboration with GPs. • The PACP included targeted counselling and education on the condition, medication and lifestyle issues; review of inhaler technique; adherence assessment; detection of DRPs; goal setting and review; and referral to a GP as appropriate. • In addition to the baseline and six-month visits, the patients visited the pharmacy one-month after the baseline visit and returned three-month after the baseline visit if there were outstanding issues. • At the beginning of the study, demographic details and asthma history were collected. • Pharmacists assessed asthma severity/control, conducted lung function testing and had patients complete questionnaires to collect baseline data on outcome measures. These were repeated six-month later. • All interventions were documented manually.
Doucette *et al.*, 2009	Community pharmacist–provided	• The pharmacist's role involved a 5step process of care: gathering information from patients and other sources, evaluating the information, formulating a plan, implementing the plan, monitoring the plan, and following up with the patient and physician to ensure optimal outcomes.

	extended diabetes care service, one-year	• Patients received up to 4 (quarterly) visits. • During the first visit, pharmacists take a patient history, create a medication list, assess clinical markers, review medications and self-care behaviours, and identify drug therapy problems. • Pharmacists were instructed to assess clinical parameters with flexibility to customize interventions to the needs of the patients. • Subsequent visits were intended to allow pharmacists to follow-up on previous problems, identify new problems, reassess clinical parameters • After the visits, pharmacists faxed a one-page progress note to patients' physicians describing the content of the visit. Progress notes followed a subjective-objective-assessment-plan (SOAP) format. • Study participants did not receive additional diabetes education sessions from the participating diabetes education centre during the study period • Patients presented to the diabetes centre at baseline and twelve-month for data collection.
Planas *et al.*, 2009	CP–based HTN MTM service, nine-month	• Participants received HTN MTM services on a monthly basis during the same visits in which they received diabetes management services. • During the visits, a detailed history was taken to identify current or potential medical problems. This history also included a comprehensive assessment of current prescription and nonprescription medications to identify drug therapy problems. • A brief physical examination was performed, during which the patient's BP was recorded. • Patients were educated on diet and lifestyle modifications to lower BP. • During visits, the role of medications was discussed with the patient and adherence to therapy was assessed. • Patients were encouraged to adhere to their therapies, and an individualised plan was developed for each patient to help them manage their therapies. • Patient visits were documented, and the patient's primary care provider was sent a copy of the visit note. • If drug therapy problems were identified, the pharmacist provider contacted the patient's PCP via fax or telephone to make recommendations • Patients' progress toward achieving a BP of lower than 130/80 mmHg was assessed during their next visit. • Previous recommendations made to the patient's PCP regarding changes to the hypertensive medication regimen were assessed for acknowledgement or implementation
Ali *et al.*, 2012	Pharmaceutical care package (community-pharmacist-led extended diabetes care model), one-year	• Patients received a pharmaceutical care package designed for patients with Type 2 diabetes, with regular monitoring and consultations • BMI, BP and blood glucose were measured at each visit; HbA1c and lipid profile were assessed at months 0, 5 and 12. • Pharmacists carried out a targeted medicine use review (if required) and lifestyle modification counselling with a referral to a GP or other healthcare professional where appropriate. • Patients were provided with diaries (diabetes record books) in which the outcomes of each appointment were recorded.

Planas *et al.*, 2012	Pharmacist-directed diabetes management programme, nine-month	• The study intervention, which consisted of patient education and diabetes management services. • Participants met individually with the pharmacist in the CP of their choice for a 1-hour visit. • At the baseline visit, participants were provided with a comprehensive packet of written patient education materials on diabetes and HTN and complications of these diseases • Participants received **diabetes education** and coaching on **self-management skills** • For **medication management services**, the pharmacist completed a comprehensive assessment of prescription and nonprescription medications to identify drug therapy problems at each visit. • The participants received A1C and fasting lipid panel testing in their selected CP during baseline and three-, six-, and nine-month visits. Written test results were provided to participants. • Participants were encouraged to discuss their results with their PCP. • The pharmacist subsequently contacted the participant's PCP via fax or telephone to recommend adjustments to therapy based on the assessment • Documentation of the participant's visit with the pharmacist was sent to the participant's PCP. • Participants were followed up at their next visit to monitor the status of drug therapy problem resolution (e.g., change in medication therapy by PCP) and clinical goal attainment.
Tsuyuki *et al.*, 2016	MTM consultation (in Alberta, called a Comprehensive Annual Care Plan or Standard Medication Management Assessment), three-month	• **Patient assessment** BP measurement, waist circumference, and weight and height measurements. • **Laboratory assessment**: HbA1c, fasting cholesterol profile, estimated glomerular filtration rate, and ACR • **Individualised assessment:** CVR and education about this risk • Providing treatment recommendations • Prescription adaptation(s) • Regular communication with the patient's family physician after each contact with the patient. • **Regular follow-up with all patients** a minimum of every three-week to four-week for three-month
Manfrin *et al.*, 2017	Italian medicines use review (I-MUR), nine-month	• The I-MUR consisted of a systematic, structured interview, which covered asthma symptoms, medicines used, attitudes towards medicines and adherence. • The pharmacists were trained to identify pharmaceutical care issues (PCIs) which could impact on optimal medicines use or asthma control and provide advice to the patients and recommendations to their GP, as necessary.
Cheema *et al.*, 2018	Structured written and verbal advice	• Participants were asked to continue to take their prescribed anti-hypertensive medications during the study. • Participants received individually tailored information sheets containing structured advice on BP and their anti-hypertensive medication, provided by a trained pharmacist during three face to face sessions (week 0, 2 and 4) over a period of six-month

	by community pharmacists, six-month	
Van der Meer *et al.,* 2018	pharmacist-led medication review, three-month	• Medication review conducted by the community pharmacist in close collaboration with the patients' GP and, if needed, other medical specialists. In the Netherlands, medication review consisted of **five steps** • **Step one** was a face-to-face consultation between the pharmacist and patient to discuss medication use. • **Second**, the pharmacist undertook a pharmacotherapeutic medication review, identified potential pharmacotherapeutic problems taking into account the patient's medical records, including latest recorded episodes and lab-values. Accordingly, the pharmacist drafted written recommendations for medication optimisation to discuss with the patients' GP. medication review took place within days after the baseline measurement for the intervention patients • **Third**, a multidisciplinary meeting between pharmacist and GP was held. At this meeting, the potential medication problems of the patient were discussed and draft of a pharmacotherapeutic action plan was decided. • **Fourth** is a discussion of the draft pharmacotherapeutic action plan between patient and pharmacist and/or GP. The patients' expectations and wishes were key elements in the decision making process and were included in the final action plan. • **Fifth**, a follow-up of the final pharmacotherapeutic action plan was undertaken.
Aslani *et al.,* 2010	Adherence monitoring service, nine-month	• Pharmacists were required to assess each consumer individually, and develop a targeted strategy to address their barriers to adherence. • At each visit, total blood cholesterol levels (non-fasting) were measured. After lipid levels were taken and results provided to the patient, the patient completed the multi-part questionnaire. • The pharmacist and patient discussed any adherence and medicine related issues identified from the questionnaire. • Appropriate interventions were devised and recorded on data sheets. • Copies were provided to the patient, kept by the pharmacist, and sent to researchers. • Follow-up of the patient by Subjects were followed up three times over a period of nine-month, and all measurable study outcomes were monitored
Mott *et al.,* 2003	MTM, six-month	• Baseline data related to demographics, health status, health services utilisation, and medication use were collected during the pre-intervention telephone survey • Subjects received six-monthly, 30-minute, follow-up telephone interviews. • During the monthly follow-up telephone interviews, data were collected about the number of falls experienced using the falls calendars, any changes to medications mentioned in previous interviews, and information about medications started within the past 30 days. • After six-month, subjects participated in a post-intervention telephone survey designed to collect data about current and new medications and health status information • The 60-minute face-to-face targeted medication review and follow-up process was designed to follow the core elements of MTM, with the exception of a PMR.

		• Using information collected during the pre-intervention survey, the community pharmacist conducted a targeted MTR with the goal of identifying and modifying FRID use. • Based on the targeted MTR, the community pharmacist developed a MAP that included recommendations to modify FRID use. • The community pharmacist discussed the recommendations with the subject and provided the MAP to the subject. • If needed, the pharmacist communicated recommendations and supplemental information to corresponding prescribers via either fax or telephone. • The community pharmacist documented and followed up on all recommendations to determine whether they were accepted or rejected. • The initial and follow-up interactions between the community pharmacist and the study subjects were audio recorded.
Herborg, 2001	Therapeutic outcomes monitoring (TOM) programme, one-year	• **Aim to foster cooperation among pharmacists, patients, and physicians.** • **It uses a structured, cyclical outcome improvement process consisting of the seven steps present: Establish patient-pharmacist-physician relationship, Collects patient data (patient interview), Identify and analyse drug therapy problems, Outline therapeutic goals, Choose individual intervention and monitoring plan, implement monitoring and follow-up and Document and report to physician and patient** • **Patients in the TOM group were asked to visit their pharmacist once a month during the study year.** • **During each visit, pharmacists recorded the patient's inhalation technique, PEFR. and asthma symptoms.** • **Daily peak-flow measurements and symptoms experienced, which had been recorded in the patient's PEFR diary, were monitored at these encounters.** • **Patients discussed with pharmacists their daily experiences with the disease together with possible solutions to any subjective problems.**
Armour *et al.*, 2013	Evidence-based asthma service, six-month	• The asthma service protocol included interventions and counselling which focused on medication use and adherence, knowledge of disease and health beliefs, and triggers for asthma and use of an asthma action plan. • All patient data were recorded in a patient file. The patient file contained checklists to document assessments and record pharmacists' interventions, as well as a referral letter template for the patient's GP. • Asthma medication profiles were generated at the start and end of the service from a combination of the dispensed medication history and medication use reported by the patient using the BMQ. • The asthma assessment was repeated, interventions delivered as appropriate, and goals and strategies reviewed, at one-month • Pharmacists recorded their interventions in the patient file and then assisted patients to set goals and strategies. • For any referral, one copy was kept in the file and the other given to the patient to take to his/her GP. • At the final visit (six-month), the assessments/questionnaires used at the start of the service were repeated and any outstanding issues were addressed.
Stewart *et al.*, 2014	Well-defined, multifaceted, community	Baseline visit: • the pharmacist measured the patient's BP and Adherence • A home BP monitor

	Pharmacist Care, six-month	• Training by the pharmacist on self-monitoring of BP • Motivational interviewing and education by the pharmacist to help patients improve their medication adherence and achieve target BP • Pharmacy-based medicines review to identify and resolve, where necessary, possible medication-induced HTN • Pharmacist-initiated dose administration aid (DAA), home-based medicines review and/or patient medication list, where necessary • Referral to a GP at the pharmacist's discretion • Refill reminders Interim visit: • Participants returned to the pharmacy at three-month for review and action based on the downloaded home BP measures. Final visit: • Measures performed at baseline were repeated at their six-month visit to the pharmacy
McLeanm Gillis and Waller 2003	Enhanced pharmaceutical care (EC), twelve-month with no less than nine-month as acceptable	• Participants involved appointments of approximately 1 hour in length with a pharmacist in a private counselling area every two-week to three-week for at least 3 appointments • then follow-up appointments at least every three-month for the remainder of the study. • Patients could request additional appointments or could see the pharmacist intermittently for short sessions without an appointment. • An initial assessment of 'readiness for change' was completed using the Transtheoretical Model of Change and patients were reassessed at each appointment. • Education did not begin until the patient was in 'contemplation' stage, and the new strategies were not begun until the patient was in 'preparation' stage. • pharmacist assesses readiness to change and adjusts initiation date • pharmacist provides education on disease, helps identify triggers and works with patient to develop action plan • patient participates in all decisions • patient monitors own therapy (PEFRs, using calendar/diary) • pharmacist takes responsibility for outcomes • pharmacist promotes evidence-based care • physician informed or consulted regarding all results and interventions
Clifford *et al.*, 2005	pharmaceutical care programme, one-year	• patients were assessed at baseline, at six-weekly intervals by telephone, and at face-to-face meetings at 6 and twelve-month. • The 9 steps of good PC practice were followed in each case, specifically, developing a pharmacist-patient relationship; collecting, analysing, and interpreting relevant information; listing and ranking DRPs; establishing pharmacotherapeutic outcomes with the patient; determining feasible pharmacotherapeutic alternatives; selecting the best pharmacotherapeutic solution; designing a therapeutic monitoring plan; implementing the individual regimen and monitoring plan; and follow-up.

		• Patient-specific goals, current medication lists, and clinical and biochemical data were sent to the PCP and other involved health care professionals after each visit. • Attention to diet, exercise, and compliance with home blood glucose monitoring and treatment were encouraged initially by the pharmacist, who subsequently advised the patient to consult their doctor for consideration of intensification of pharmacotherapy if there had been insufficient progress at follow-up. • Telephone interviews and the PC-related aspects of face-to-face meetings took 5–30 min (average 15 min).
Richmond *et al.*, 2010	pharmaceutical care, twelve-month	• Pharmaceutical care was undertaken by community pharmacists who interviewed patients, developed and implemented pharmaceutical care plans together with patients' GPs, and thereafter undertook monthly medication reviews. • Researchers collected data from participants using questionnaires completed by post, telephone interview, or home visit, depending on the characteristics of each responder. • During home visits, researchers also collected data on participants' adherence using pill counts, and their knowledge of the drugs they had been prescribed. • Researchers collected four-year retrospectively from participants' GP

Appendix IV (Chapter 4)

A. PRINCESS NOURAH BENT ABDULRAHMAN UNIVERSITY ETHICAL APPROVAL

Kingdom of Saudi Arabia
Ministry of Education
Princess Nourah bint
Abdulrahman University
(048)
Graduate Studies and Scientific
Research Vice- Rectorate

المملكة العربية السعودية
وزارة التعليم
جامعة الأميرة
نورة بنت عبدالرحمن
(٠٤٨)
وكالة الجامعة للدراسات العليا والبحث العلمي

IRB Registration Number with KACST, KSA: H-01-R-059

June 21, 2020
IRB Log Number: 20-0240
Project Title: Evaluation of Medication Therapy Management Programme in Saudi Community Pharmacy: Mixed Methods Study
Category of Approval: EXEMPT

Dear Basmah Albabtain and Dr. Ghadah Bawazeer,

Thank you for submitting your proposal to the PNU Institutional Review Board. Your proposal was evaluated considering the national regulations that govern the protection of human subjects. The IRB has determined that your proposed project poses no more than minimal risk to the participants. Therefore, your proposal has been deemed ***EXEMPT*** from IRB review. Please note that this approval is from the research ethics perspective only. You will still need to get permission from the head of the department in PNU or an external institution to commence data collection.

Please note that the research must be conducted according to the proposal submitted to the PNU IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For ***any*** proposed changes in your research protocol, please submit a Request for Modification form to the PNU IRB. Please be aware that changes to the research protocol may prevent the research from qualifying for exempt review and require submission of a new IRB application or other materials to the PNU IRB. In addition, if an unexpected situation or adverse event happens during your investigation, please notify the PNU IRB as soon as possible. If notified, we will ask for a complete explanation of the event and your response.

Please be advised that regulations require that you submit a progress report on your research every 6 months. Please refer to the protocol number denoted above in all communication or correspondence related to your application and this approval. You are also required to submit any manuscript resulting from this research for approval by IRB before submission to journals for publication.

For statistical services you are advised to contact the Data Clinic at the Health Sciences Research Center (hsrc-DC@pnu.edu.sa) or the Scientific Research Center at the Deanship of Scientific Research (dsr-rsc@pnu.edu.sa) extension 30711.

We wish you well as you proceed with the study. Should you have additional questions or require clarification of the contents of this letter, please contact me.

Sincerely Yours,

[redacted]

Prof. Omar H. Kasule Sr.
Chairman, Institutional Review Board (IRB)
Princess Nourah bin Abdulrahman University, Riyadh, KSA
Tel: [redacted]
E-mail: [redacted]

جامعة الأميرة نورة بنت عبدالرحمن
مجلس المراجعة المؤسسي
Institutional Review
Board (IRB)
21 JUN 2020

الرقم ____ التاريخ ____/____/____هـ المشفوعات ____

B. KING FAHAD MEDICAL CITY ETHICAL APPROVAL

Kingdom of Saudi Arabia
Ministry of Health
King Fahad Medical City
(162)

المملكة العربية السعودية
وزارة الصحة
مدينة الملك فهد الطبية
(١٦٢)

IRB Registration Number with KACST, KSA: H-01-R-012
IRB Registration Number with OHRP/NIH, USA: IRB00010471
Approval Number Federal Wide Assurance NIH, USA: FWA00018774

June 21, 2020
IRB Log Number: 20-388E
Department: External - PNU
Category of Approval: EXEMPT

Dear Basmah Albabtain and Dr. Ghada Bawazeer,

I am pleased to inform you that your submission dated June 16, 2020 for the study titled '**Evaluation of Medication Therapy Management Programme in Saudi Community Pharmacy: Mixed Methods Study**' was reviewed and was approved according to Good Clinical Practice guidelines. Please note that this approval is from the research ethics perspective only. You will still need to get permission from the head of department or unit in KFMC or an external institution to commence data collection.

We wish you well as you proceed with the study and request you to keep the IRB informed of the progress on a regular basis, using the IRB log number shown above.

Please be advised that regulations require that you submit a progress report on your research every 6 months. You are also required to submit any manuscript resulting from this research for approval by IRB before submission to journals for publication.
As a researcher you are required to have current and valid certification on protection human
As a researcher you are required to have current and valid certification on protection human research subjects that can be obtained by taking a short online course at the US NIH site or the Saudi NCBE site followed by a multiple choice test. Please submit your current and valid certificate for our records. Failure to submit this certificate shall a reason for suspension of your research project.

If you have any further questions feel free to contact me.

Sincerely yours,

[redacted]

Institutional Review Board
Approved
Date: 21 JUN 2020

Prof. Omar H. Kasule
Chairman, Institutional Review Board (IRB)
King Fahad Medical City, Riyadh, KSA
Tel: + [redacted]
E-mail: [redacted]

C. BIRMINGHAM UNIVERSITY ETHICAL APPROVAL

Dear Dr Ejaz Cheema,

Re: "Assessing the impact of Medication therapy management service on patient's clinical outcomes in Saudi Arabia: a mixed methods pilot randomised controlled trial"
Application for Ethical Review ERN_20-0768

Thank you for your application for ethical review for the above project, which was reviewed by the Science, Technology, Engineering and Mathematics Ethical Review Committee.

On behalf of the Committee, I confirm that this study now has full ethical approval.

I would like to remind you that any substantive changes to the nature of the study as described in the Application for Ethical Review, and/or any adverse events occurring during the study should be promptly brought to the Committee's attention by the Principal Investigator and may necessitate further ethical review.

Please also ensure that the relevant requirements within the University's Code of Practice for Research and the information and guidance provided on the University's ethics webpages (available at https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Links-and-Resources.aspx) are adhered to and referred to in any future applications for ethical review. It is now a requirement on the revised application form (https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx) to confirm that this guidance has been consulted and is understood, and that it has been taken into account when completing your application for ethical review.

Please be aware that whilst Health and Safety (H&S) issues may be considered during the ethical review process, you are still required to follow the University's guidance on H&S and to ensure that H&S risk assessments have been carried out as appropriate. For further information about this, please contact your School H&S representative or the University's H&S Unit at healthandsafety@contacts.bham.ac.uk.

Kind regards,

Ms Sam Waldron
Research Ethics Officer
Research Support Group
C Block Dome (room 137)
Aston Webb Building
University of Birmingham
Edgbaston B15 2TT
Tel: [redacted] (if you leave a voicemail message and number I will get back to you)
Email: [redacted] (also available on Skype for Business)

D. LETTER OF APPROVAL

شركة إنوفا السعودية للرعاية الصحية
Innova Saudi Health Care Company

انوفا
Innova

To: Princess Nourah bint Abdurrahman University

"College of Pharmacy "

Greetings,

In reference to your letter dated on 18th of April regard giving the permission to Ms. Basmah Abdulaziz Albabtain to conduct her study in one of our pharmacies.

We hereby grant the permission to Ms. Basmah Albabtain to conduct her study in our pharmacy *"Health Kingdom 30"* conditioned upon finishing all required approvals from scientific and formal authorities.

Regards,

Chief Executive Officer

[redacted]

E. PRINCESS NOURAH BENT ABDULRAHMAN UNIVERSITY FIRST AMENDMENT ETHICAL APPROVAL

Kingdom of Saudi Arabia
Ministry of Education
Princess Nourah bint Abdulrahman University
(048)
Graduate Studies and Scientific Research Vice- Rectorate

المملكة العربية السعودية
وزارة التعليم
جامعة الأميرة نورة بنت عبدالرحمن
(٤٨)
وكالة الجامعة للدراسات العليا والبحث العلمي

IRB Registration Number with KACST, KSA: H-01-R-059

July 13, 2020
IRB Log Number: 20-0240
Project Title: Evaluation of Medication Therapy Management Programme in Saudi Community Pharmacy: Mixed Methods Study
Category of Approval: EXEMPT

Dear Basmah Albabtain and Dr. Ghadah Bawazeer,

We have received and recorded the amendment as per details below:

1. Delete two secondary outcomes that related to assessing diabetes-related psychosocial parameters: depression and health literacy (measured by questionnaires.
2. To remove two questionnaires (Short-Version of Functional Health Literacy in Adults (S-TOFHLA) and Patient Health Questionaire-9 (PHQ-9)).

Should you have additional questions or require clarification of the contents of this letter, please contact me.

Sincerely Yours,

مجلس المراجعة المؤسسي
Institutional Review Board (IRB)
13 JUL 2020

Prof. Omar H. Kasule Sr.
Chairman, Institutional Review Board (IRB)
Princess Nourah bin Abdulrahman University, Riyadh, KSA
Tel: [redacted]
E-mail [redacted]

F. KING FAHAD MEDICAL CITY FIRST AMENDMENT ETHICAL APPROVAL

Kingdom of Saudi Arabia
Ministry of Health
King Fahad Medical City
(162)

المملكة العربية السعودية
وزارة الصحة
مدينة الملك فهد الطبية
(١٦٢)

مدينة الملك فهد الطبية
King Fahad Medical City

IRB Registration Number with KACST, KSA: H-01-R-012
IRB Registration Number with OHRP/NIH, USA: IRB00010471
Approval Number Federal Wide Assurance NIH, USA: FWA00018774

July 15, 2020
IRB Log Number: 20-388E
Category of Approval: EXEMPT

Dear Basmah Albabtain and Dr. Ghada Bawazeer,

We have received, reviewed and approved the amendment submitted on July 8, 2020 for the study titled '**Evaluation of Medication Therapy Management Programme in Saudi Community Pharmacy: Mixed Methods Study**' as per details below:

1. Delete two secondary outcomes which related to assess diabetes-related psychosocial parameters: depression and health literacy (measured by questionnaires).
2. Remove two questionnaires (Short-Version of Functional Health Literacy in Adults (S-TOFHLA) and Patient Health Questionaire-9 (PHQ-9)).

If you have any further questions feel free to contact me.

Sincerely yours,

[redacted]

Institutional Review Board
Approved
Date: 19 JUL 2020

Prof. Omar H. Kasule
Chairman, Institutional Review Board (IRB)
King Fahad Medical City, Riyadh, KSA
Tel: + [redacted]
E-mail: [redacted]

G. THE MEDICATION ADHERENCE REPORT SCALE (MARS-5) QUESTIONNAIRE

(English version)

Medication Adherence Reported Scale-5 (MARS-5)

QUESTIONS ABOUT USING YOUR MEDICINES

- Many people find a way of using their medicines which suits them.
- This may differ from the instructions on the label or from what their doctor has said.
- We would like to ask you a few questions about how you use your medicines

Here are some ways in which people have said that they use their medicines

For each of the statements, please tick the box which best applies to you

	Your own way of using your medicines	Always 1	Often 2	Sometimes 3	Rarely 4	Never 5
M1	I forget to take them					
M2	I alter the dose					
M3	I stop taking them for a while					
M4	I decide to miss out a dose					
M5	I take less than instructed					

THE MEDICATION ADHERENCE REPORT SCALE (MARS-5) QUESTIONNAIRE

(Arabic version)

أسئلة حول استخدام للأدوية الخاصة بك (الإلتزام الدوائي)

- يوجد الكثير من الناس طريقة تناسبهم لاستخدام أدويتهم.
- هذه الطريقة تختلف عن الارشادات المكتوبة او التوجيهات التي يقولها الطبيب.
- نحن نرغب بطرح بعض الاسئلة عليك بخصوص الطريقة التي تتبعها في استخدام الأدوية الخاصة بك.

هنا بعض الطرق التي قال الناس بأنهم يتبعونها في استخدام الأدوية الخاصة بهم.

الرجاء اختيار خيار واحد فقط من الخيارات لكل عبارة من العبارات التالية.

	الطريقة الخاصة بك في استخدام الأدوية	دائما 1	غالبا 2	بعض الأحيان 3	نادرا 4	مطلقا 5
1	أنا أنسى أخذ الأدوية الخاصة بي.					
2	أنا أقوم بالتعديل على جرعة الأدوية.					
3	أنا أتوقف عن استخدام الأدوية لمدة من الزمن.					
4	أنا أقرر عدم أخذ جرعة معينة.					
5	أنا أخذ أقل من العلاجات الموصى بها.					

H. DIABETES DISTRESS SCALE (DDS) QUESTIONNAIRE (English version)

DIRECTIONS: Living with diabetes can sometimes be tough. There may be many problems and hassles concerning diabetes and they can vary greatly in severity. Problems may range from minor hassles to major life difficulties. Listed below are 17 potential problem areas that people with diabetes may experience. Consider the degree to which each of the 17 items may have distressed or bothered you DURING THE PAST MONTH and circle the appropriate number.

Please note that we are asking you to indicate the degree to which each item may be bothering you in your life, NOT whether the item is merely true for you. If you feel that a particular item is not a bother or a problem for you, you would circle "1". If it is very troublesome to you, you might circle "6".

	Not a problem	A slight problem	A moderate problem	A somewhat serious problem	A serious problem	A very serious problem
1. Feeling that diabetes is taking up too much of my mental and physical energy every day.	1	2	3	4	5	6
2. Feeling that my doctor doesn't know enough about diabetes and diabetes care.	1	2	3	4	5	6
3. Not feeling confident in my day-to-day ability to manage diabetes.	1	2	3	4	5	6
4. Feeling angry, scared and/or depressed when I think about living with diabetes.	1	2	3	4	5	6
5. Feeling that my doctor doesn't give me clear enough directions on how to manage my diabetes.	1	2	3	4	5	6
6. Feeling that I am not testing my blood sugars frequently enough.	1	2	3	4	5	6
7. Feeling that I will end up with serious long-term complications, no matter what I do.	1	2	3	4	5	6
8. Feeling that I am often failing with my diabetes routine.	1	2	3	4	5	6
9. Feeling that friends or family are not supportive enough of self-care efforts (e.g. planning activities that conflict with my schedule, encouraging me to eat the "wrong" foods).	1	2	3	4	5	6
10. Feeling that diabetes controls my life.	1	2	3	4	5	6
11. Feeling that my doctor doesn't take my concerns seriously enough.	1	2	3	4	5	6
12. Feeling that I am not sticking closely enough to a good meal plan.	1	2	3	4	5	6
13. Feeling that friends or family don't appreciate how difficult living with diabetes can be.	1	2	3	4	5	6
14. Feeling overwhelmed by the demands of living with diabetes.	1	2	3	4	5	6
15. Feeling that I don't have a doctor who I can see regularly enough about my diabetes.	1	2	3	4	5	6
16. Not feeling motivated to keep up my diabetes self management.	1	2	3	4	5	6
17. Feeling that friends or family don't give me the emotional support that I would like.	1	2	3	4	5	6

DIABETES DISTRESS SCALE (DDS) QUESTIONNAIRE (Arabic version)

ان العيش مع مرض السكري قد يكون صعبا أحيانا، وقد يكون هناك العديد من المشكلات والمتاعب المصاحبة لمرض السكري والتي تختلف شدتها ما بين مريض واخر، فتكون خفيفة لدى البعض، وتصير لدى البعض الاخر بمثابة معوقات شديدة للحياة. فيما يلي 17 مشكلة محتملة قد يتعرض لها المصابون بمرض السكري. واضعا في الاعتبار درجة معاناتك أو انزعاجك من جميع هذه المشكلات أو بعضها خلال الشهر الماضي، اختر الرقم المناسب.

يرجى ملاحظة أننا نطلب منك تقدير درجة معاناتك أو انزعاجك من كل مشكلة من المشكلات المذكورة، وليس مجرد تحديد إذا كنت عانيت من هذه المشكلات من عدمه. إذا رأيت ان أحد العناصر المذكورة لم يسبب لك مشكلة، فعليك اختيار رقم "1"، و اذا كان قد سبب لك الكثير من المشكلات، فيمكنك اختيار رقم "6".

	لا تُوجدُ مشكلة	مشكلة طفيفة	مشكلة متوسطة	مشكلة كبيرة إلى حد ما	مشكلة كبيرة	مشكلة كبيرة جدا
1.الشعور بان مرض السكري يستهلك الكثير جدا من طاقتي الذهنية والبدنية كل يوم	1	2	3	4	5	6
2.الشعور بان طبيبي المعالج ليس لدية القدر الكافي من العلم بمرض السكري ورعايته	1	2	3	4	5	6
3. عدم الشعور بالثقة في قدرتي على العناية بمرض السكري لدي يوميا	1	2	3	4	5	6
4. الشعور بالغضب، الخوف، و/أو الاكتئاب عندما أفكر في كيفية العيش مع مرض السكري	1	2	3	4	5	6
5. الشعور بان طبيبي المعالج لا يعطيني توجيهات واضحة بما يكفي لأن اتمكن من العناية بمرض السكري لدي	1	2	3	4	5	6
6. الشعور بأنني لا أقوم بإجراء تحاليل السكر في الدم بالشكل الكافي	1	2	3	4	5	6
7. الشعور بأن مرض السكري سيصيبني بمضاعفات كبيرة طويلة المدى، مهما اتخذت من تدابير	1	2	3	4	5	6
8. الشعور بأنني غالبا أفشل في الالتزام باتباع التعليمات المقررة لي نظرا لمرض السكري لدي	1	2	3	4	5	6
9. الشعور بأن الأصدقاء أو العائلة لايقدمون الدعم الكافي لجهودي الشخصية في رعايتي لنفسي (على سبيل المثال: عدم مراعاة جدولي عند التخطيط للأنشطة المختلفة، أو تشجيعي على تناول أطعمة "مضرة" لحالتي)	1	2	3	4	5	6
10. الشعور بأن مرض السكري يتحكم في حياتي	1	2	3	4	5	6
11. الشعور بأن طبيبي المعالج لا يأخذ مخاوفي على محمل الجد بما يكفي	1	2	3	4	5	6
12.الشعور بأني لا ألتزم بما فيه الكفاية باتباع برنامج غذائي صحي	1	2	3	4	5	6
13.الشعور بأن الأصدقاء أو العائلة لا يقدرون مدى مشقة العيش مع مرض السكري	1	2	3	4	5	6
14.الشعور بأن المتطلبات اللازمة للعيش مع السكري كثيرة للغاية	1	2	3	4	5	6
15.الشعور بأنني ليس لدي طبيب يمكنني زيارته بانتظام بشأن مرض السكري لدي	1	2	3	4	5	6
16.عدم شعوري بالحماسة للحفاظ على عنايتي الشخصية بمرض السكري لدي	1	2	3	4	5	6
17.الشعور بعدم حصولي على الدعم العاطفي الذي أرغب فيه من الأهل والأصدقاء	1	2	3	4	5	6

I. PATIENT SATISFACTION WITH PHARMACIST SERVICES 2.0 (PSPS 2.0)

QUESTIONNAIRE (English version)

Please complete this survey by checking the option that best describes your opinion:

	Quality of Care	Strongly Agree	Agree	Disagree	Strongly Disagree
1	The pharmacist fully addressed the main health reason/concerns/issues during my visit.	4	3	2	1
2	The pharmacist was professional in all of our interactions.	4	3	2	1
3	The pharmacist explained information to me in a manner that I could understand.	4	3	2	1
4	The pharmacist checked to see if I understood all the information.	4	3	2	1
5	The pharmacist spent as much time necessary to help me with my questions and concerns.	4	3	2	1
6	The pharmacist made sure I understood how important it is to follow the drug regimen.	4	3	2	1
7	The pharmacist provided useful recommendations on how to take my medications.	4	3	2	1
8	The pharmacist provided useful recommendations about managing my overall health (e.g. diet, exercise).	4	3	2	1
9	The pharmacist worked with me to manage my medication related issues (e.g. cost, side effects of drugs).	4	3	2	1
10	The pharmacist followed up on my progress in a timely manner.	4	3	2	1

	Interpersonal Relationship (pharmacist/patient)	Strongly Agree	Agree	Disagree	Strongly Disagree
11	The pharmacist was caring and kind in dealing with my health issues.	4	3	2	1
12	The pharmacist encouraged me to achieve my treatment goals.	4	3	2	1
13	I felt comfortable in my interactions with the pharmacist.	4	3	2	1
14	The pharmacist was respectful to me during our interactions.	4	3	2	1
15	The pharmacist was committed to improving my health.	4	3	2	1
16	I could trust the information that the pharmacist provided.	4	3	2	1

	Overall	Strongly Agree	Agree	Disagree	Strongly Disagree
17	I was satisfied with the overall care provided by my pharmacist.	4	3	2	1
18	I would recommend my pharmacist to people I know.	4	3	2	1
19	If needed, I would continue seeing this pharmacist for my healthcare needs.	4	3	2	1

20	The overall care provided by the pharmacist.	Exceeded my expectations 4	Met my expectations 3	Did not meet my expectations 2	Had no expectations 1

THE PATIENT SATISFACTION WITH PHARMACIST SERVICES (PSPS 2.0)

QUESTIONNAIRE (Arabic version)

استبيان رضا المريض عن الخدمات الصيدلية

يرجى إكمال هذا الاستبيان عن طريق تحديد الخيار المناسب لرأيك.

	جودة الرعاية الصحية	أوافق بشدة	أوافق	لا اوافق	لا أوافق بشدة
1	تطرق الصيدلي بشكل كامل للأسباب / المخاوف / المشاكل الصحية خلال الزيارة	4	3	2	1
2	كان الصيدلي على قدر عالي من المهنية في التعامل معي	4	3	2	1
3	شرح الصيدلي جميع المعلومات بأسلوب أستطيع فهمه	4	3	2	1
4	تأكد الصيدلي من فهمي للمعلومات	4	3	2	1
5	قضى الصيدلي الوقت الكافي لمساعدتي في أسئلتي ومخاوفي	4	3	2	1
6	تأكد الصيدلي من فهمي لطريقة أخذ الدواء	4	3	2	1
7	قدم الصيدلي توصيات مفيدة لكيفية أخذ أدويتي.	4	3	2	1
8	قدم الصيدلي توصيات مفيدة عن صحتي (مثل النظام الغذائي والتمارين الرياضية)	4	3	2	1
9	عمل الصيدلي معي لحل المشاكل المتعلقة بأدويتي (مثل التكلفة والآثار الجانبية للأدوية)	4	3	2	1
10	تابع الصيدلي تطور حالتي الصحية في أوقات مناسبة	4	3	2	1

	العلاقة الشخصية (بين الصيدلي / المريض)	أوافق بشدة	أوافق	لا اوافق	لا أوافق بشدة
11	كان الصيدلي مهتم ولطيف في التعامل مع مشاكلي الصحية	4	3	2	1
12	شجعني الصيدلي على تحقيق أهدافي العلاجية	4	3	2	1
13	شعرت بالراحة أثناء تعاملي مع الصيدلي	4	3	2	1
14	كان الصيدلي محترما أثناء التعامل معي	4	3	2	1
15	كان الصيدلي ملتزمًا بتحسين صحتي	4	3	2	1
16	أثق بالمعلومات التي قدمها الصيدلي.	4	3	2	1

	الكل	أوافق بشدة	أوافق	لا اوافق	لا أوافق بشدة
17	كنت راضيًا عن الرعاية الشاملة التي قدمها الصيدلي	4	3	2	1
18	سأنصح غيري بالتعامل مع هذا الصيدلي	4	3	2	1
19	إن دعت الحاجة سأستمر في المتابعة مع هذا الصيدلي في ما يخص احتياجاتي الصحية	4	3	2	1

20	الرعاية الشاملة التي قدمها الصيدلي	فاقت توقعاتي 4	مثل توقعاتي 3	لم تلب توقعاتي 2	لم يكن لدي توقعات 1

J. PRINCESS NOURAH BENT ABDULRAHMAN UNIVERSITY SECOND AMENDMENT ETHICAL APPROVAL

Kingdom of Saudi Arabia
Ministry of Education
Princess Nourah bint
Abdulrahman University
(048)
Graduate Studies and Scientific
Research Vice- Rectorate

المملكة العربية السعودية
وزارة التعليم
جامعة الأميرة
نورة بنت عبدالرحمن
(٠٤٨)
وكالة الجامعة للدراسات العليا
والبحث العلمي

IRB Registration Number with KACST, KSA: HAP-01-R-059

October 12, 2021

IRB Log Number: 20-0240
Project Title: "Evaluation of Medication Therapy Management Programme in Saudi Community Pharmacy: Mixed Methods Study."
Category of Approval: EXEMPT

Dear Basmah Albabtain and Dr. Ghadah Bawazeer,

We have received and recorded an amendment as per detail below:

1. To add *process evaluation that will include interviewing additional key stakeholders.*

The researcher is personally liable for plagiarism and any violations of intellectual property rights.

Should you have additional questions or require clarification of the contents of this letter, please contact me.

Sincerely Yours,

[redacted]

جامعة الأميرة نورة بنت عبدالرحمن
مجلس المراجعة المؤسسي
Institutional Review
Board (IRB) 12 OCT 2021

Prof. Omar H. Kasule Sr.
Chairman, Institutional Review Board (IRB)
Princess Nourah bin Abdulrahman University, Riyadh, KSA
Tel: [redacted]
E-mail: [redacted]

الرقم: التاريخ: / / هـ المشفوعات:

K. KING FAHAD MEDICAL CITY SECOND AMENDMENT ETHICAL APPROVAL

مدينة الملك فهد الطبية
King Fahad Medical City

IRB Registration Number with KACST, KSA: H-01-R-012
IRB Registration Number with OHRP/NIH, USA: IRB00010471
Approval Number Federal Wide Assurance NIH, USA: FWA00018774

October 5, 2021
IRB Log Number: 20-388E
Category of Approval: EXEMPT

Dear Basmah Albabtain and Dr. Ghada Bawazeer,

We have received, reviewed and approved the amendment submitted on September 26, 2021 for the study titled '**Evaluation of Medication Therapy Management Programme in Saudi Community Pharmacy: Mixed Methods Study**' as per details below:

Page# / Section /Title	Changes from	Changes to
Page 3/ Consent form	one specifically for the qualitative phase	two specifically for the qualitative phase
Page 3/ Consent form	Add APPENDIX 4: PARTICIPANT INFORMATION SHEETS AND CONSENT FORM- PHASE 2	
Page 3/ Consent form	were developed to provide patients with	were developed to provide participants with
Page 13/ Objectives	to explore patients' views around	to explore participants' views around
Page 14/ Study design	Add and key stakeholders (clinical pharmacist providing the service, pharmacists working in the community pharmacy, physicians who refer patients to the services and pharmacy owner)	
Page 14/ Participants recruitment and eligibility criteria	Add Notably, the process of stakeholder recruitment will incorporate all accessible stakeholders involved in developing MTM programme, including the two clinical pharmacists providing the service, 4 pharmacists working	

Saudi Arabia - Riyadh
King Fahad Medical City
Faculty of Medicine
Phone: 0112889999

المملكة العربية السعودية - الرياض
مدينة الملك فهد الطبية

Institutional Review Board
Approved
Date: 0 - OCT 2021

	in the community pharmacy, the two physicians referring patients to the services and the pharmacy owner	
Page 14/ Participants recruitment and eligibility criteria	However, patients will be allowed to withdraw	However, Participants will be allowed to withdraw
Page 14/ Participants recruitment and eligibility criteria	based on the patients' preference	based on the participants' preference
Page 15/ Inclusion criteria	Add and willing stakeholders.	
Page 15/ Description and delivery of the interview:	aim to interview patients within two	aim to interview participants within two
Page 15/ Description and delivery of the interview:	Patient information sheet was developed (APPENDIX 13: INTERVIEWS' PATIENTS INFORMATION SHEET).	Participant information sheet was developed (APPENDIX 13: INTERVIEWS' PARTICIPANTS INFORMATION SHEET).
Page 15/ Description and delivery of the interview:	patients will be asked to sign the consent form	participants will be asked to sign the consent form
Page 15/ Description and delivery of the interview:	(APPENDIX 14: TOPIC GUIDE FOR PATIENTS'),	(APPENDIX 14: TOPIC GUIDE FOR PATIENTS' AND STAKEHOLDERS' INTERVIEWS),
Page 15/ Description and delivery of the interview:	Delete Topic guide will be designed to cover the following areas: expectations from the service; efficacy of the service (did it help? How?); quality of the service; interaction with pharmacist (time given for consultation, engaging patient in discussion and designing of therapeutic plan, listening to and understanding the problem); their opinion in the role of pharmacist in MTM programme; and overall satisfaction (experience compared to other services in past, aspects of the service which need improvement etc.) with the service.	

Saudi Arabia - Riyadh
King Fahad Medical City
Faculty of Medicine
Phone: 0112889999

مدينة الملك فهد الطبية
King Fahad Medical City

Page 16/ Sample size:	Add in addition to the nine stakeholders	
Page 16/ Sample size:	continue to interview patients until	continue to interview participants until
Page 26/ APPENDIX 3	the study will not take place	the MTM services will not take place
Page 27/ APPENDIX 3 Page 32-37/ APPENDIX 4 Page 50/ APPENDIX 13 Page 52-54/ APPENDIX 14	Add It is highly unlikely to be injured as a result of taking part in this study. Add APPENDIX 4 Add APPENDIX 13 Add topic guide for FOR STAKEHOLDERS, For the physicians and community pharmacists and for the pharmacy owner	

Sincerely yours,

Institutional Review Board
Approved
Date: 0 - OCT 2021

[redacted]

Dr. Hussam Sakkijha, FCCP, FACP, Diplomat, ABSIM
Chairman Institutional Review Board--IRB
Consultant, Critical Care, Pulmonary & Sleep Medicine
Adult ICU Department
Critical Care Services Administration
King Fahad Medical City
P.O. Box. 59046, Riyadh 11525
Kingdom of Saudi Arabia
[redacted]
Mobile #: [redacted]
E-mail: [redacted]

L. BIRMINGHAM UNIVERSITY SECOND AMENDMENT ETHICAL APPROVAL

Samantha Waldron (Research Support Services)

Tue 10/19/2021 10:30 AM

To:Muhammad Hadi (Pharmacy) <M.A.Hadi@bham.ac.uk>;

Cc:Vibhu Paudyal (Pharmacy) <V.Paudyal@bham.ac.uk>; Basmah Albabtain (PhD Pharmacy FT Non-Lab (B230)) <BAA985@student.bham.ac.uk>;

Dear Muhammad,

I'm pleased to confirm that the chair has agreed to accept the external review in lieu of a full application here. This has been assigned ERN_20-0768A.

If you need anything else or make any further changes please do get in touch.

Best wishes
Sam

Ms Sam Waldron (she/her)
Research Ethics Officer
Research Support Group
University of Birmingham
Email: [redacted]
Video/phone: If you would like to arrange a Teams/Zoom/telephone call, please email me and I will get in touch with you as soon as possible.
Postal address: Ms Sam Waldron, Finance Office, University of Birmingham, c/o Room 106 Aston Webb, B Block, Edgbaston, Birmingham, B15 2TT.

M. PATIENT INFORMATION SHEETS AND CONSENT FORM- GENERAL

Patient information sheet

Evaluation of Medication Therapy Management Service in Saudi Community Pharmacy: Mixed-Methods Study

Principal Investigator: Basmah Albabtain, Dr. Ghada Bawazeer and Dr. Abdulaziz Alqahtani

We would like to invite you to take part in a research study. Before you decide, you need to understand the purpose of research and what it would involve for you. Please take time to read the following information carefully. Should you need any further information, please feel free to contact us

WHAT IS THE PURPOSE OF THE STUDY?

The study will evaluate the effectiveness of a community pharmacist intervention, focusing on pharmacist led MTM service in Kingdom of Saudi Arabia (KSA). This study is agreement between Ministry of Health and King Saud University to implement new services in community pharmacies.

WHY HAVE I BEEN INVITED?

You have been approached because your General practitioner (GP) has referred you to the MTM service. We aim to include 160 adult patients who have diabetes and have been referred to the service.

DO I HAVE TO TAKE PART?

It is totally up to you to decide. We will provide you with all the necessary information and answer all your questions related to this study. We will then ask you to sign a consent form to show that you have agreed to take part. You can withdraw from the study at any time without giving a reason. This would not affect the care you receive.

WHAT WILL HAPPEN IF I TAKE PART IN THIS STUDY?

It will require continuous and periodic follow up for six-month by your pharmacist. As your doctor will follow you directly to continue your health care plan. There are two phases of the study. Participation in both phases is not compulsory and you can choose to participate only in one phase of the study if you wish. If you will enroll in this study (both arms) you need to have fill the questionnaires and answer for any follow up questions

Phase 1: In the first phase, two services will be offered, and your name will be randomly included in one of the services, whether an educational service to answer your questions regarding your medications or MTM service. The MTM service for your drug treatment contains multiple and periodic services. In addition to three questionnaires at the beginning and end of service which will take about 10 minutes each to complete.

Phase 2: The second phase consists of a face to face interview. This will be conducted at the clinic. We would like to interview you within two-week of end the phase 1. The interview will be about your experience and view with the care provided by the pharmacist. There are no right or wrong answers; we just want to hear about your experience of the MTM service. The interview is expected to last for 20-30 minutes and if you agree, it will be audio taped. You will be asked to sign a separate consent form for the interview. You can choose to stop the interview at any time without giving any reason. We will still include the information you have already given us, unless you ask us not to. Your decision to participate in the interview will not affect the care you receive.

WHAT IS EXPECTED OF ME DURING THE STUDY (What are my responsibilities)?

1. Read the information sheet to understand this study

2. Asking questions that you have and understanding your rights
3. Compliance with the instructions regarding the study
4. Fill the questionnaires and answer for any follow up questions
5. Inform your doctor or emergency doctor that you are participating in the study
6. Inform the study officials of any apparent negative reaction
7. Give us a phone number to call, answer our call and also answer questions clearly and frankly

HOW LONG WILL I BE IN THE STUDY?
Around seven-month

CAN I STOP BEING IN THE STUDY?
Yes. You can decide to stop at any time. Tell the study pharmacist if you are thinking about stopping or you've decided to stop. She will tell you how to stop your participation safely. No one will try to get you to change your mind.

ARE THERE RISKS IF I STOP BEING IN THE STUDY?
There are no risks, but the desired benefit from the study will not take place.

WHAT SIDE EFFECTS OR RISKS CAN I EXPECT FROM BEING IN THE STUDY?
There are no side effects or risks specifically associated with participation in the study. The only possible disadvantage is the time taken to complete the questionnaires and interview (optional).

ARE THERE BENEFITS TO TAKING PART IN THE STUDY?
Taking part in this study may make your health better. While pharmacists hope the service will be more effective than the usual care, there is no proof of this yet. But the information we get from this study should help improve the care provided by the pharmacists for other people with diabetes. It will help us understand the working of the MTM service and patient expectation with the care provided.

WHAT OTHER OPTIONS ARE THERE?
Instead of being in this study, you have the option to continue your management plan with your physician.

WHAT HAPPENS IF I AM INJURED BECAUSE I TOOK PART IN THIS STUDY?
It is important that you tell Dr. Ghada [redacted] or Mrs.Basmah [redacted] if you feel that you have been injured because of taking part in this study. You can tell the doctor in person or call him. If you are injured as a result of being in this study, treatment will be available.

WHAT ARE THE COSTS OF TAKING PART IN THE STUDY?
You will not be charged for any study activities. As for communication, we will initiate the call.

WILL I BE PAID FOR MY TAKING PART IN THIS STUDY?
You will not be paid for taking part in this study.

WILL MY MEDICAL INFORMATION BE KEPT PRIVATE?
Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. All data obtained will be anonymised and kept in a password protected personal computer. Only the research staff will have access to your data. However, if you tell us something that gives us cause of concern about your health or care, with your permission, we will share this information with relevant healthcare professionals. Your identity will not be revealed in any report and publication. Your GP will be informed about your participation in the research.

WHAT ARE MY RIGHTS IF I TAKE PART IN THIS STUDY?
Taking part in this study is your choice. You may choose either to take part or not to take part in the study. If you decide to take part in this study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your regular benefits. Leaving the study will not affect your medical care. You can still get your medical care. Dr. Ghada Bawazeer and Basmah Albabtain may use information that was collected prior to your leaving the study.

We will tell you about new information or changes in the study that may affect your health or your willingness to continue in the study.
We will tell you about any anticipated circumstances under which your participation may be terminated by the investigator without regard to your consent.

WHO DO I CALL IF I HAVE QUESTIONS OR PROBLEMS?
Before you agree to be in this study, you will talk to a study team member qualified to tell you about this study. You can ask questions about any aspect of the research. If you have further questions about the study, you may ask them at any time. You may call investigator, Basmah Albabtain on [redacted]

Patient Consent Form - Phase 1

Project title: Evaluation of Medication Therapy Management Service in Saudi Community Pharmacy: Mixed-Methods Study

Research Team: Basmah Albabtain, Dr. Ghada Bawazeer and Dr. Abdulaziz Alqahtani

1. I confirm that I have read and understood the information sheet. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. In this case my medical care or legal rights will not be affected in any way. ☐
3. I give permission for my GP to be informed of my participation in the study. ☐
4. I agree to take part in the above study. ☐
5. I agree to fill the questionnaires and answer any follow up questions ☐
6. I give permission to regulatory authorities to access the research data for auditing purposes. ☐
7. I would like to be considered for interview as well. ☐

Name of patient	Date	Signature
Researcher	Date	Signature

PATIENT INFORMATION SHEETS AND CONSENT FORM- General

(Arabic version)

نشرة معلومات المريض ونموذج الموافقة – عامة

نشرة معلومات المريض

تقييم برنامج إدارة العلاج الدوائي في الصيدلية المجتمعية السعودية: دراسة متعددة الأساليب.

الباحثتان الرئيسيتان: بسمة البابطين , الدكتورة غادة باوزير و الدكتور عبدالعزيز القحطاني

نود دعوتك للمشاركة في دراسة بحثية. لكن قبل أن تقرر، يجب أن تفهم الغرض من البحث وفوائده العائدة إليك. نرجو أن تأخذ وقتك في قراءة المعلومات التالية بعناية ولا تتردد في الاتصال بنا في حال كنت بحاجة إلى أي مساعدة.

ما الغرض من الدراسة؟
تهدف هذه الدراسة إلى معرفة فاعلية دور الصيدلي في الصيدليات المجتمعية في تقديم إدارة العلاج الدوائي وتأثير ذلك على فعالية الرعاية الصحية المقدمة لمريض يعاني من الأمراض المزمنة مثل داء السكري. وهذه الدراسة هي ضمن اتفاقية بين وزارة الصحة وجامعة الملك سعود لتطبيق خدمات صحية مباشرة للمريض تضاف إلى مهام صرف الأدوية في الصيدليات المجتمعية.

لماذا تمت دعوتي؟
لقد تم الاتصال بك لأن طبيبك العام أحالك إلى برنامج إدارة العلاج الدوائي، حيث نهدف إلى إدراج ١٦٠ من المرضى البالغين المصابين بداء السكري والذين قد أحيلوا إلى البرنامج.

هل يجب علي المشاركة؟
قرار المشاركة عائد إليك. سنقدم لك جميع المعلومات الضرورية ونرد على جميع أسئلتك المرتبطة بالدراسة، ثم سنطلب منك التوقيع على نموذج الموافقة لضمان مشاركتك. علماً بأنه يمكنك الانسحاب من الدراسة في أي وقت دون إبداء الأسباب ولن يؤثر ذلك على الرعاية التي تتلقاها.

ماذا سيحدث إذا اشتركت في الدراسة؟
سيتطلب الأمر متابعة مستمرة لستة أشهر من قبل الصيدلاني الإكلينيكي المتخصص (بالإضافة إلى متابعة حالتك من قبل طبيبك مباشرة) لمواصلة خطة الرعاية الصحية الخاصة بك و تحقيق تحسن في وضعك الصحي. تتكون هذه الدراسة من مرحلتين، ولست ملزماً بأن تشارك في كلا المرحلتين بل يمكنك المشاركة في مرحلة واحدة فقط إن كانت تلك رغبتك. في كل الأحوال ستحتاج إلى ملء الاستبيانات والإجابة عن أي أسئلة إضافية كما سيتم شرحه أدناه.

المرحلة الأولى: سوف يتم توزيع أسمك بشكل عشوائي في إحدى المجموعتين:

مجموعة (أ) وهي مجموعة الرعاية الصيدلانية المعتادة حيث سيتم:

- أخذ معلوماتك الشخصية (العمر، الحالة الإجتماعية، التعليم، طبيعة العمل، الدخل الشهري بشكل عام) و تاريخك الصحي (طبيعة الأكل، ممارسة الرياضة، التدخين) و المرضي و الدوائي و
- الدخول لملفك الطبي لمعرفة التحاليل المختبرية الخاصة بك (في بداية الدراسة، بعد 3 شهور و بعد 6 شهور)
- اعطائك تثقيف عن أدويتك و الإجابة عن أي استفسارات لديك خاصة بالأدوية.

- الاتصال بك تلفونيا بعد 3 و 6 شهور لمعرفة اذا ما حصل لك تنويم في المستشفى أو إذا احتجت للذهاب إلى الطوارئ مع ذكر السبب. المكالمة قد تستغرق 5 دقائق
- سيطلب منك تعبئة الإستبانات التالية في الزيارة الأولى ونهاية الدراسة (تستغرق كل منها حوالي ١٠ دقيقة لإكمالها)
  - إستبانة الإلتزام الدوائي (medication adherence)
  - أستبانة المعاناة مع السكري (diabetes distress)

<u>مجموعة (ب)</u> وهي مجموعة برنامج إدارة العلاج الدوائي المقدم من الصيدلي حيث سيتم:
- أخذ معلوماتك الشخصية (العمر، الحالة الإجتماعية، التعليم، طبيعة العمل، الدخل الشهري بشكل عام) و تاريخك الصحي (طبيعة الأكل، ممارسة الرياضة، التدخين) و المرضي و الدوائي و التحاليل المختبرية الخاصة بك
- الدخول لملفك الطبي لمعرفة التحاليل المختبرية الخاصة بك (في بداية الدراسة، بعد 3 شهور و بعد 6 شهور)
- مراجعة شاملة لكل أدويتك الوصفية و اللاوصفية و المكملات الغذائية و العشبية و أي أدوية أخذتها سابقا و بناء على المراجعة سيتم إعطائك قائمة مفصلة بأدويتك، كما سيتم إعطائك الخطة الدوائية و التي سيتم وضعها من قبلك و بمساعدة الصيدلاني المختص للتأكد من حصولك على أفضل النتائج المرجوة من العلاج
- سيتم متابعتك بعد ذلك بالتلفون أو إذا رغبت (بزيارة العيادة) مرة شهريا للرد على أي إستفسار لديك عن أدويتك و حل أي مشاكل قد تكون واجهتها عند أخذ الأدوية و إعطاء التثقيف اللازم (كل متابعة قد تستمر من 5 إلى 15 دقيقة)
- في حال وجود مشكلة دوائية سيقوم الصيدلاني المختص بالتواصل مع طبيبك العام و استشارته لوضع الحل الأمثل و من ثم التواصل معك للتعديل.
- سيطلب منك تعبئة الإستبانات التالية في الزيارة الأولى و نهاية الدراسة (تستغرق كل منها حوالي ١٠ دقيقة لإكمالها)
  - إستبانة الإلتزام الدوائي (medication adherence)
  - أستبانة المعاناة مع السكري (diabetes distress)
- كما سيطلب منك تعبئة استبانة رضى المريض على برنامج إدارة العلاج الدوائي المقدم من الصيدلي

المرحلة الثانية:
تتكون هذه المرحلة من مقابلة شخصية في العيادة، حيث نود مقابلتك خلال أسبوعين من نهاية المرحلة الأولى. ستتمحور المقابلة حول تجربتك ووجهة نظرك بشأن الرعاية التي يقدمها الصيدلاني. علماً بأنه لا يوجد إجابات صحيحة أو خاطئة، فنحن نريد فقط الاستماع لتجربتك مع برنامج إدارة العلاج الدوائي. ومن المتوقع أن تستمر المقابلة لمدة ٢٠-٣٠ دقيقة، وسيتم تسجيلها بالصوت إذا وافقت على ذلك. سيُطلب منك التوقيع على نموذج موافقة مختلفة خاصة بالمقابلة، وباستطاعتك إيقاف المقابلة في أي وقت دون الإبداء بالسبب. سنواصل تضمين المعلومات التي قدمتها لنا مالم تطلب منا عدم القيام بذلك، ولن يؤثر قرارك بالمشاركة في المقابلة على الرعاية التي تتلقاها من الطبيب أو الصيدلي.

ما المتوقع مني أثناء الدراسة (ماهي مسؤولياتي)؟
١-قراءة نشرة معلومات المريض هذه للتأكد من فهم الدراسة.
٢-طرح الأسئلة التي تراودك وفهم حقوقك.
٣-الامتثال للتعليمات المتعلقة بالدراسة.
٤- ملء الاستبيانات والإجابة عن أي أسئلة إضافية.
٥-إبلاغ طبيبك أو طبيب الطوارئ باشتراكك في الدراسة.
٦-إبلاغ مسؤولي الدراسة عن أي ردة فعل واضحة وسلبية.
٧-تزويدنا برقم هاتف للتواصل والحرص على الرد على اتصالاتنا والإجابة على أسئلتنا بوضوح وصدق.

كم مدة الدراسة؟
ما يقارب سبعة أشهر.

هل يمكنني الانسحاب من الدراسة؟
نعم، يمكنك الانسحاب في أي وقت. كل ما عليك فعله هو إخبار صيدلانية الدراسة عن رغبتك بالانسحاب وستقوم بإخبارك بطريقة الانسحاب بشكل آمن، ولن يحاول أحد تغيير رأيك.

هل سأتعرض للمخاطر إن قررت الانسحاب من الدراسة؟
لا يوجد أي مخاطرو سيتم الإستمار بمتابعة حالتك من قبل طبيبك.

ما الآثار الجانبية أو المخاطر التي يمكن أن أتوقعها من الدراسة؟
لا توجد آثار جانبية أو مخاطر مرتبطة بالمشاركة في الدراسة على وجه التحديد. لكن العيب الوحيد الممكن هو الوقت الذي يستغرقه إكمال الاستبيانات والمقابلة (اختيارية). أيضا قد يتم الإتصال بك في وقت غير مناسب، لذا من المهم أن تخبر الصيدلي بمواعيد الإتصال المناسبة لك.

ما فوائد المشاركة في الدراسة؟

المشاركة في هذه الدراسة قد تحسن من صحتك أو قد لا تحسنها، وبينما يأمل الصيادلة بأن يكون البرنامج أكثر فعالية من الرعاية المعتادة، إلا أنه لا يوجد دليل على ذلك حتى الآن. ولكن قد تساعد المعلومات التي ستستنتجها هذه الدراسة في تحسين الرعاية التي يقدمها الصيادلة في الصيدليات المجتمعية لأشخاص آخرين يعانون من مرض السكري، و أضا ستسهم في فهم و تحسين برامج إدارة العلاج الدوائي وفهم توقعات المريض مع الرعاية المقدمة.

ماهي الخيارات الأخرى المتاحة؟
لديك خيار الاستمرار بالخطة العلاجية الخاصة بك مع طبيبك بدلاً من الاشتراك في هذه الدراسة.

ما الذي يحدث إذا تعرضت لإصابة جراء اشتراكي في الدراسة؟
جميع التدخلات الدوائية ستكون بموافقة طبيبك المباشر و لكن من المهم إخبار الدكتورة غادة (جوال [redacted]) أو السيدة بسمة (جوال [redacted]) إذا شعرت بأنك أُصبت بسبب مشاركتك في هذه الدراسة، ويمكنك إخبار الطبيب شخصياً أو الاتصال به. علماً بأن العلاج سيكون متاحاً إن أصبت نتيجة لهذه الدراسة.

ماهي تكاليف الاشتراك في الدراسة؟
لن يتم محاسبتك على أي أنشطة تابعة للدراسة. أما بالنسبة للتواصل، فستتم المكالمة عن طريقنا.

هل سأحصل على مقابل مادي بعد الاشتراك في الدراسة؟
لن يُدفع لك مقابل اشتراكك في هذه الدراسة.

هل سيتم الحفاظ على سرية معلوماتي الطبية؟
نعم، سوف نتبع الممارسة الأخلاقية والقانونية وسيتم التعامل مع جميع المعلومات المتعلقة بك بسرية، بالإضافة إلى إخفاء هوية جميع البيانات التي يتم الحصول عليها وحفظها في جهاز كمبيوتر شخصي محمي بكلمة مرور، ففريق البحث هو فقط من يمكنه الوصول إلى بياناتك. ومع ذلك، إن قررت إخبارنا بأي شيء يثير القلق بشأن صحتك أو رعايتك، فسوف نشارك هذه المعلومات مع متخصصي الرعاية الصحية ذوي الصلة بعد الحصول على إذن منك. لن يتم الكشف عن هويتك في أي تقرير أو منشور. وأخيرا، سيتم إبلاغ طبيبك العام عن مشاركتك في البحث.

ما هي حقوقي في هذه الدراسة؟
المشاركة في هذه الدراسة هي اختيارك، لك الحق في المشاركة أو عدم المشاركة. وإذا قررت الاشتراك فلك الحق أن تنسحب منها في أي وقت، ولن تتعرض لعقوبة ولن تفقد أياً من استحقاقاتك العادية بغض النظر عن القرار الذي اتخذته. بالإضافة إلى أن تركك للدراسة لن يؤثر على رعايتك الطبية، فلا يزال بإمكانك الحصول على الرعاية الطبية الخاصة بك. قد تستخدم الدكتورة غادة باوزير وبسمة البابطين المعلومات التي قد تم جمعها قبل انسحابك من الدراسة.
سيتم إخبارك بأي معلومات أو تغييرات جديدة في الدراسة قد تؤثر على صحتك أو استعدادك للاستمرار في الدراسة.

سيتم إخبارك بأي ظروف متوقعة قد يتم بموجبها إنهاء مشاركتك من قبل الباحث دون النظر إلى موافقتك.

بمن اتصل إذا راودتني بعض الأسئلة أو واجهت بعض المشاكل؟
قبل الموافقة على المشاركة في هذه الدراسة، ستتحدث إلى أحد أعضاء فريق الدراسة المؤهلين ليحدثك عن الدراسة، ويمكنك حينها طرح أي أسئلة حول أي جانب من جوانب البحث. وإذا راودتك أسئلة أخرى عن الدراسة فيمكنك طرحها في أي وقت بالاتصال بالباحثة بسمة بابطين على الرقم [redacted]

نموذج موافقة المريض – المرحلة الأولى

عنوان المشروع: تقييم برنامج إدارة العلاج الدوائي في الصيدلية المجتمعية السعودية: دراسة متعددة الأساليب.

فريق البحث: بسمة البابطين , الدكتورة غادة باوزير والدكتور عبدالعزيز القحطاني

١-أؤكد أنني قرأت وفهمت ورقة المعلومات. ☐

٢-أفهم أن مشاركتي طوعية وأن لي الحرية في الانسحاب في أي وقت دون إبداء أي سبب، وفي هذه الحالة لن تتأثر رعايتي الطبية أو حقوقي القانونية بأي شكل من الأشكال. ☐

٣-أعطي الأذن لطبيبي العام ليتم إعلامه بمشاركتي في الدراسة. ☐

٤-أوافق على المشاركة في الدراسة أعلاه. ☐

٥- الموافقة على ملء الاستبيانات والإجابة عن أي أسئلة إضافية. ☐

٦-أعطي الأذن للسلطات التنظيمية للوصول إلى بيانات البحث لأغراض المراجعة. ☐

٧-أود أن يتعين النظر في مقابلتي أيضا (المرحلة الثانية) ☐

التوقيع	التاريخ	اسم المريض
الباحث	التاريخ	التوقيع

N. PATIENT INFORMATION SHEETS AND CONSENT FORM- PHASE 2

Patient information sheet

Evaluation of Medication Therapy Management Service in Saudi Community Pharmacy: Mixed-Methods Study

Principal Investigator: Basmah Albabtain, Dr. Ghada Bawazeer and Dr. Abdulaziz Alqahtani

Thank you very much for your participation in Phase 1 of the study. We would like to invite you to take part in the Phase 2 of the study. Before you decide, you need to understand the purpose of research and what it would involve for you. Please take time to read the following information carefully. Should you need any further information, please feel free to contact us. Thank you for taking the time to read this

WHAT IS THE PURPOSE OF THE STUDY?
The purpose of phase 2 is to evaluate patient experience with the service provided by the MTM service.

WHY HAVE I BEEN INVITED?
You have been approached because you indicated earlier in your consent form that you were interested in participating in an interview as well. We aim to include 15-25 adult patients referred to the MTM service

DO I HAVE TO TAKE PART?
It is totally up to you to decide. We will provide you with all the necessary information and answer all your questions related to this study. We will then ask you to sign a consent form to show that you have agreed to take part.

WHAT WILL HAPPEN IF I TAKE PART IN THIS STUDY?
You will be asked to participate in a face-to-face interview. This will take about 20-30 minutes. The interview will take place at the clinic. We would like to interview you within two-week of end the phase 1 and you will be contacted by telephone to arrange a time and venue. You will be interviewed by Mrs. Basmah Albabtain (lead researcher, PhD student) who will audio-record the conversation. You will be asked to sign a separate consent form for the interview. Your decision to participate in the interview will neither affect the standard of care nor the participation in the research

WHAT IS EXPECTED OF ME DURING THE STUDY (What are my responsibilities)?
You will be asked to participate in the interview as explained above. You will be asked about your expectations of the MTM service; 2) things that you liked and disliked; 3) satisfaction with the service provided; 4) impact (positive or negative) of the service on your health. At the end of the interview, there will be additional time to discuss any other aspects of the service, if they have not been covered during the interview

CAN I STOP BEING IN THE STUDY?
Yes. You can decide to stop at any time. Tell the study pharmacist if you are thinking about stopping or you've decided to stop. She will tell you how to stop your participation safely. No one will try to get you to change your mind.

ARE THERE RISKS IF I STOP BEING IN THE STUDY?
There are no risks, but the desired benefit from the MTM services will not take place.

WHAT SIDE EFFECTS OR RISKS CAN I EXPECT FROM BEING IN THE STUDY?
There are no side effects or risks specifically associated with participation in the study. The only possible disadvantage is that it will take 20-30 minutes of your time.

ARE THERE BENEFITS TO TAKING PART IN THE STUDY?
We cannot promise the study will help you, but we hope that the information we get from this study will help improve the service provided by the pharmacists for future patients. It will help us understand the working of the MTM service from the patient's point of view.

WHAT OTHER OPTIONS ARE THERE?
Instead of being in this study, you have the option to continue your management plan with your physician.

WHAT HAPPENS IF I AM INJURED BECAUSE I TOOK PART IN THIS STUDY?
It is highly unlikely to be injured as a result of taking part in this study. It is important that you tell Mrs Basmah (0504335566) if you feel that you have been injured because of taking part in this study. You can tell the doctor in person or call him. If you are injured as a result of being in this study, treatment will be available.

WHAT ARE THE COSTS OF TAKING PART IN THE STUDY?
You will not be charged for any study activities. As for communication, we will initiate the call.

WILL I BE PAID FOR MY TAKING PART IN THIS STUDY?
You will not be paid for taking part in this study.

WILL MY MEDICAL INFORMATION BE KEPT PRIVATE?
Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. The interview will be audio recorded and then transcribed onto a computer. All data obtained will be anonymised and kept in a password protected computer. Your response will be treated with full confidentiality and anyone who takes part in the research will be identified only by code numbers. Only the research staff will have access to your data. However, if you tell us something that gives us cause of concern about your health or care, with your permission, we will share this information with relevant healthcare professionals. Your identity will not be revealed in any report or publication. Your GP will be informed about your participation in the research. If the interview upsets you and you feel you would like some additional help after the interview I will be able to advise you who to contact. You can choose to stop the interview at any time without giving any reason. We will still include the part of the interview you have already completed, unless you ask us not to.

WHAT ARE MY RIGHTS IF I TAKE PART IN THIS STUDY?
Taking part in this study is your choice. You may choose either to take part or not to take part in the study. If you decide to take part in this study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your regular benefits. Leaving the study will not affect your medical care. You can still get your medical care. Dr . Ghada Bawazeer and Basmah Albabtain may use information that was collected prior to your leaving the study.
We will tell you about new information or changes in the study that may affect your health or your willingness to continue in the study.
We will tell you about any anticipated circumstances under which your participation may be terminated by the investigator without regard to your consent.

WHO DO I CALL IF I HAVE QUESTIONS OR PROBLEMS?
Before you agree to be in this study, you will talk to a study team member qualified to tell you about this study. You can ask questions about any aspect of the research. If you have further questions about the study, you may ask them at any time. You may call investigator, Basmah Albabtain on [redacted]

Patient Consent Form - Phase 2

Project title: Evaluation of Medication Therapy Management Service in Saudi Community Pharmacy: Mixed-Methods Study

Research Team: Basmah Albabtain, Dr. Ghada Bawazeer and Dr. Abdulaziz Alqahtani

1. I confirm that I have read and understood the information sheet. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. In this case my medical care or legal rights will not be affected in any way. ☐

3. I agree to take part in the interview. ☐

4. I give permission to use anonymised quotes from my interview in relevant publications, and I understand that my identity will not be revealed and such information will not be traced back to me ☐

5. I give permission to regulatory authorities to access the research data for auditing purposes. ☐

6. I give permission to audiotape my interview ☐

Name of patient	Date	Signature
Researcher	Date	Signature

PATIENT INFORMATION SHEETS AND CONSENT FORM- PHASE 2

(Arabic version)

نشرة معلومات المرضى ونموذج الموافقة – المرحلة الثانية

نشرة معلومات المرضى

تقييم برنامج إدارة العلاج الدوائي في الصيدلية المجتمعية السعودية: دراسة متعددة الأساليب.

الباحثتان الرئيسيتان: بسمة البابطين , الدكتورة غادة باوزير و الدكتور عبدالعزيز القحطاني

نشكر لك مشاركتك في المرحلة الأولى من الدراسة ونود دعوتك للمشاركة في المرحلة الثانية من الدراسة. لكن قبل أن تقرر، يجب أن تفهم الغرض من البحث وفوائده العائدة إليك. يرجى أخذ الوقت الكافي لقراءة المعلومات التالية بعناية، وإذا كنت بحاجة إلى مزيد من المعلومات لا تتردد بالاتصال بنا. شاكرين لك وقتك.

ما هو الغرض من الدراسة؟
الغرض من المرحلة لثانية هو تقييم تجربة المريض مع الخدمة التي يقدمها برنامج إدارة العلاج الدوائي.

لماذا تمت دعوتي؟
لقد تم اختيارك لأنك أشرت سابقاً في نموذج موافقتك إلى أنك مهتم بالانضمام إلى مرحلة المقابلة، ونحن نهدف إلى تضمين ١٥-٢٥ مريضاً بالغاً تمت إحالتهم إلى برنامج إدارة العلاج الدوائي.

هل تتوجب عليّ المشاركة؟
القرار عائد لك تماما، فنحن سنزودك بكل المعلومات الضرورية ونجيب على جميع أسئلتك المتعلقة بهذه الدراسة، ثم سنطلب منك التوقيع على نموذج الموافقة لضمان مشاركتك.

ماذا سيحدث إذا شاركت في هذه الدراسة؟
سيُطلب منك المشاركة في مقابلة شخصية قد تستغرق ٢٠-٣٠ دقيقة، وستجرى المقابلة في العيادة. نود إجراء المقابلة في غضون أسبوعين من نهاية المرحلة الأولى، وسنتواصل معك عبر الهاتف لترتيب الموعد والمكان. ستتم مقابلتك من قِبل السيدة بسمة البابطين (الباحثة الرئيسية وطالبة دكتوراه) والتي ستسجل المحادثة صوتياً. سيُطلب منك التوقيع على نموذج موافقة مختلفة خاصة بالمقابلة، ولن يؤثر قرارك بإجراء المقابلة على مستوى الرعاية أو المشاركة في البحث.

ما المتوقع مني أثناء الدراسة (ماهي مسؤولياتي)؟
سيُطلب منك المشاركة في المقابلة كما هو موضح أعلاه. ١-سيتم سؤالك عن توقعاتك لبرنامج إدارة العلاج الدوائي. ٢-الأشياء التي أعجبتك ولم تعجبك. ٣-الرضا عن الخدمة المقدمة. ٤-تأثيرالبرنامج على صحتك (إيجابي أم سلبي). وفي نهاية المقابلة، سيتوفر لديك وقت إضافي لمناقشة أي جوانب أخرى من البرنامج لم يتم تغطيتها أثناء المقابلة.

هل يمكنني الانسحاب من الدراسة؟
نعم، يمكنك الانسحاب في أي وقت. كل ما عليك فعله هو إخبار صيدلانية الدراسة عن رغبتك بالانسحاب وستقوم بإخبارك بطريقة الانسحاب بشكل آمن ولن يحاول أحد تغيير رأيك.

هل سأتعرض للمخاطر إن قررت الانسحاب من الدراسة؟
لا يوجد أي مخاطر، لكن الفائدة المنشودة من الدراسة لن تتحقق.

ما الآثار الجانبية أو المخاطر التي يمكن أن أتوقعها من الدراسة؟
لا توجد آثار جانبية أو مخاطر مرتبطة بالمشاركة في الدراسة على وجه التحديد، لكن العيب الوحيد هو أن المقابلة ستستغرق ٢٠-٣٠ دقيقة من وقتك.

ما فوائد المشاركة في الدراسة؟
لا يمكننا أن نعدك بأن الدراسة ستساعدك، ولكننا نأمل أن تساعد المعلومات التي نحصل عليها من هذه الدراسة على تحسين الخدمة التي يقدمها الصيادلة للمرضى في المستقبل، وستساعدنا على فهم عمل برنامج إدارة العلاج الدوائي من وجهة نظر المريض.

ماهي الخيارات الأخرى المتاحة؟
لديك خيار الاستمرار بالخطة العلاجية الخاصة بك مع طبيبك بدلاً من الاشتراك في هذه الدراسة.

ما الذي يحدث إذا تعرضت لإصابة جراء اشتراكي في الدراسة؟
من غير المتوقع اصابتك عند المشاركة في الدراسة ولكن من المهم إخبار الدكتورة غادة أو السيدة بسمة إذا شعرت بأنك أُصبت بسبب مشاركتك في هذه الدراسة، ويمكنك إخبار الطبيب شخصياً أو الاتصال به. علماً بأن العلاج سيكون متاحاً إن أصبت نتيجة لهذه الدراسة.

ماهي تكاليف الاشتراك في الدراسة؟
لن يتم محاسبتك على أي أنشطة تابعة للدراسة. أما بالنسبة للتواصل، فستتم المكالمة عن طريقنا.

هل سأحصل على مقابل مادي بعد الاشتراك في الدراسة؟
لن يُدفع لك مقابل اشتراكك في هذه الدراسة.

هل سيتم الحفاظ على سرية معلوماتي الطبية؟
نعم. سوف نتبع الممارسة الأخلاقية والقانونية وسيتم التعامل مع جميع المعلومات المتعلقة بك بسرية. سيتم تسجيل المقابلة صوتياً ونسخها على جهاز كمبيوتر، إضافة إلى إخفاء هوية جميع البيانات التي تم الحصول عليها وحفظها في جهاز كمبيوتر محمي بكلمة مرور، وسيتم التعامل مع إجاباتك بسرية تامة، ولن يتم تحديد أي شخص يشارك في البحث إلا من خلال الأرقام الرمزية، فقط فريق البحث يمكنه الوصول إلى بياناتك. ومع ذلك، إن أخبرتنا بشيء يثير القلق بشأن صحتك أو رعايتك، فسوف نشارك هذه المعلومات مع متخصصي الرعاية الصحية ذوي الصلة بعد الحصول على إذن منك. لن يتم الكشف عن هويتك في أي تقرير أو منشور، وسيتم إبلاغ طبيبك العام عن مشاركتك في البحث. إذا شعرت بالانزعاج أثناء المقابلة وترغب في الحصول على بعض المساعدة الإضافية بعد المقابلة، يمكنني أن أزودك برقم لتتصل به، ولك الحق في إيقاف المقابلة في أي وقت دون إبداء أي سبب. علماً بأننا سنواصل تضمين جزء المقابلة الذي أجريته، مالم تطلب منا عدم القيام بذلك.

ما هي حقوقي إذا شاركت في هذه الدراسة؟
المشاركة في هذه الدراسة هي اختيارك، لك الحق في المشاركة أو عدم المشاركة. وإذا قررت الاشتراك فلك الحق أن تنسحب منها في أي وقت، ولن تتعرض لعقوبة ولن تفقد أياً من استحقاقاتك العادية بغض النظر عن القرار الذي اتخذته. بالإضافة إلى أن تركك للدراسة لن يؤثر على رعايتك الطبية، فلا يزال بإمكانك الحصول على الرعاية الطبية الخاصة بك. قد تستخدم الدكتورة غادة باوزير وبسمة البابطين المعلومات التي قد تم جمعها قبل انسحابك من الدراسة.
سيتم إخبارك بأي معلومات أو تغييرات جديدة في الدراسة قد تؤثر على صحتك أو استعدادك للاستمرار في الدراسة.

سيتم إخبارك بأي ظروف متوقعة قد يتم بموجبها إنهاء مشاركتك من قبل الباحث دون النظر إلى موافقتك.

بمن اتصل إذا واردتني بعض الأسئلة أو واجهت بعض المشاكل؟
قبل الموافقة على المشاركة في هذه الدراسة، ستتحدث إلى أحد أعضاء فريق الدراسة المؤهلين ليحدثك عن الدراسة، ويمكنك حينها طرح أي أسئلة حول أي جانب من جوانب البحث. وإذا راودتك أسئلة أخرى عن الدراسة فيمكنك طرحها في أي وقت بالاتصال بالباحثة بسمة البابطين على الرقم [redacted]

نموذج موافقة المريض – المرحلة الثانية

عنوان المشروع: تقييم برنامج إدارة العلاج الدوائي في الصيدلية المجتمعية السعودية: دراسة متعددة الأساليب.

فريق البحث: بسمة البابطين والدكتورة غادة باوزير و الدكتور عبدالعزيز القحطاني

١-أؤكد أنني قرأت وفهمت ورقة المعلومات. ☐

٢-أفهم أن مشاركتي طوعية وأن لي الحرية في الانسحاب في أي وقت دون إبداء أي سبب، وفي هذه الحالة لن تتأثر رعايتي الطبية أو حقوقي القانونية بأي شكل من الأشكال. ☐

٣-أوافق على المشاركة في الدراسة أعلاه. ☐

٤-أعطي الإذن لاستخدام اقتباسات مجهولة المصدر من المقابلة التي أجريتها مع المنشورات ذات الصلة، وأدرك أنه لن يتم الكشف عن هويتي ولن تستخدم للتوصل إلي. ☐

٥-أعطي الأذن للسلطات التنظيمية للوصول إلى بيانات البحث لغرض المراجعة. ☐

٦-أعطي الأذن لتسجيل صوتي في المقابلة. ☐

_____	_____	_____
اسم المريض	التاريخ	التوقيع
_____	_____	_____
الباحث	التاريخ	التوقيع

O. PARTICIPANT INFORMATION SHEETS AND CONSENT FORM

Participant information sheet

Evaluation of Medication Therapy Management Service in Saudi Community Pharmacy: Mixed-Methods Study

Principal Investigator: Basmah Albabtain, Dr. Ghada Bawazeer and Dr. Abdulaziz Alqahtani

We would like to invite you to take part in the Phase 2 of the study. Before you decide, you need to understand the purpose of research and what it would involve for you. Please take time to read the following information carefully. Should you need any further information, please feel free to contact us. Thank you for taking the time to read this

WHAT IS THE PURPOSE OF THE STUDY?
The purpose of this study is to evaluate key stake holders' views and experiences of developing and implementing community pharmacy based MTM service

WHY HAVE I BEEN INVITED?
You have been approached because you were involved in MTM service process. We aim to include all the nine stakeholders.

DO I HAVE TO TAKE PART?
It is totally up to you to decide. We will provide you with all the necessary information and answer all your questions related to this study. We will then ask you to sign a consent form to show that you have agreed to take part.

WHAT WILL HAPPEN IF I TAKE PART IN THIS STUDY?
You will be asked to participate in a face-to-face interview. This will take about 30-40 minutes. The interview will take place at the clinic. We would like to interview you within two-week of end the phase 1 and you will be contacted by telephone to arrange a time and venue. You will be interviewed by Mrs. Basmah Albabtain (lead researcher, PhD student) who will audio-record the conversation. You will be asked to sign a separate consent form for the interview. Your decision to participate in the interview will neither affect the standard of care nor the participation in the research

WHAT IS EXPECTED OF ME DURING THE STUDY (What are my responsibilities)?
You will be asked to participate in the interview as explained above. You will be asked about MTM service efficacy; your expectations of the MTM service; things that you liked and disliked; relationship with the MTM pharmacists; collaboration regarding medication issues. At the end of the interview, there will be additional time to discuss any other aspects of the service, if they have not been covered during the interview

CAN I STOP BEING IN THE STUDY?
Yes. You can decide to stop at any time. Tell the study pharmacist if you are thinking about stopping or you've decided to stop. She will tell you how to stop your participation safely. No one will try to get you to change your mind.

ARE THERE RISKS IF I STOP BEING IN THE STUDY?
There are no risks associated with your participation in this study.

WHAT SIDE EFFECTS OR RISKS CAN I EXPECT FROM BEING IN THE STUDY?
There are no side effects or risks specifically associated with participation in the study. The only possible disadvantage is that it will take 30-40 minutes of your time.

ARE THERE BENEFITS TO TAKING PART IN THE STUDY?

We cannot promise the study will help you, but we hope that the information we get from this study will help improve the service provided by the pharmacists for future patients. It will help us understand the working of the MTM service from the participants' point of view.

WHAT HAPPENS IF I AM INJURED BECAUSE I TOOK PART IN THIS STUDY?

It is highly unlikely to be injured as a result of taking part in this study. It is important that you tell Mrs. Basmah (0504335566) if you feel that you have been injured because of taking part in this study. You can tell the doctor in person or call him. If you are injured as a result of being in this study, treatment will be available.

WHAT ARE THE COSTS OF TAKING PART IN THE STUDY?

You will not be charged for any study activities. As for communication, we will initiate the call.

WILL I BE PAID FOR MY TAKING PART IN THIS STUDY?

You will not be paid for taking part in this study.

WILL MY MEDICAL INFORMATION BE KEPT PRIVATE?

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. The interview will be audio recorded and then transcribed onto a computer. All data obtained will be anonymised and kept in a password protected computer. Your response will be treated with full confidentiality and anyone who takes part in the research will be identified only by code numbers. Only the research staff will have access to your data. Your identity will not be revealed in any report or publication. If the interview upsets you and you feel you would like some additional help after the interview, I will be able to advise you who to contact. You can choose to stop the interview at any time without giving any reason. We will still include the part of the interview you have already completed, unless you ask us not to.

WHAT ARE MY RIGHTS IF I TAKE PART IN THIS STUDY?

Taking part in this study is your choice. You may choose either to take part or not to take part in the study. If you decide to take part in this study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your regular benefits. Dr. Ghada Bawazeer and Basmah Albabtain may use information that was collected prior to your leaving the study.

We will tell you about new information or changes in the study that may affect your health or your willingness to continue in the study.

We will tell you about any anticipated circumstances under which your participation may be terminated by the investigator without regard to your consent.

WHO DO I CALL IF I HAVE QUESTIONS OR PROBLEMS?

Before you agree to be in this study, you will talk to a study team member qualified to tell you about this study. You can ask questions about any aspect of the research. If you have further questions about the study, you may ask them at any time. You may call investigator, Basmah Albabtain on [redacted]

Participant Consent Form

Project title: Evaluation of Medication Therapy Management Service in Saudi Community Pharmacy: Mixed-Methods Study

Research Team: Basmah Albabtain, Dr. Ghada Bawazeer and Dr. Abdulaziz Alqahtani

1. I confirm that I have read and understood the information sheet. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. In this case my medical care or legal rights will not be affected in any way. ☐

3. I agree to take part in the interview. ☐

4. I give permission to use anonymised quotes from my interview in relevant publications, and I understand that my identity will not be revealed and such information will not be traced back to me ☐

5. I give permission to regulatory authorities to access the research data for auditing purposes. ☐

6. I give permission to audiotape my interview ☐

Name of patient	Date	Signature
Researcher	Date	Signature

PARTICIPANT INFORMATION SHEETS AND CONSENT FORM

(Arabic version)

نشرة معلومات المشاركين ونموذج الموافقة

نشرة معلومات المشاركين

تقييم برنامج إدارة العلاج الدوائي في الصيدلية المجتمعية السعودية: دراسة متعددة الأساليب.

الباحثتان الرئيسيتان: بسمة البابطين , الدكتورة غادة باوزير و الدكتور عبدالعزيز القحطاني

نود دعوتك للمشاركة في المرحلة الثانية من الدراسة. لكن قبل أن تقرر، يجب أن تفهم الغرض من البحث وفوائده العائدة إليك. يرجى أخذ الوقت الكافي لقراءة المعلومات التالية بعناية، وإذا كنت بحاجة إلى مزيد من المعلومات لا تتردد بالاتصال بنا. شاكرين لك وقتك.

ما هو الغرض من الدراسة؟
الغرض من هذه الدراسة هو تقييم آراء وتجارب أصحاب المصلحة الرئيسيين في تطوير وتنفيذ خدمة برنامج إدارة العلاج الدوائي القائمة في الصيدلة المجتمعية.

لماذا تمت دعوتي؟
لقد تم اختيارك لأنك من الجهات ذات العلاقة بشان انطلاق وتطور برنامج إدارة العلاج الدوائي. ونحن نهدف إلى تضمين 9 من المشاركين تمت دعوتهم للمشاركة في المقابلة.

هل تتوجب عليّ المشاركة؟
القرار عائد لك تماما، فنحن سنزودك بكل المعلومات الضرورية ونجيب على جميع أسئلتك المتعلقة بهذه الدراسة، ثم سنطلب منك التوقيع على نموذج الموافقة لضمان مشاركتك.

ماذا سيحدث إذا شاركت في هذه الدراسة؟
سيُطلب منك المشاركة في مقابلة شخصية قد تستغرق ٣٠ – ٤٠ دقيقة، وستجرى المقابلة في العيادة. نود إجراء المقابلة في غضون أسبوعين من نهاية المرحلة الأولى، وسنتواصل معك عبر الهاتف لترتيب الموعد والمكان. ستتم مقابلتك من قِبل السيدة بسمة البابطين (الباحثة الرئيسية وطالبة دكتوراه) والتي ستسجل المحادثة صوتياً. سيُطلب منك التوقيع على نموذج موافقة مختلفة خاصة بالمقابلة، ولن يؤثر قرارك بإجراء المقابلة على مستوى الرعاية أو المشاركة في البحث.

ما المتوقع مني أثناء الدراسة (ماهي مسؤولياتي)؟
سيُطلب منك المشاركة في المقابلة كما هو موضح أعلاه. سيتم سؤالك عن فعالية برنامج إدارة العلاج الدوائي, سيتم سؤالك عن توقعاتك لبرنامج إدارة العلاج الدوائي. الأشياء التي أعجبتك ولم تعجبك, علاقتك مع فريق البرنامج و كذلك ستم سؤالك عن مدى التعاون في مايخص مشاكل الخطط العلاجية.
وفي نهاية المقابلة، سيتوفر لديك وقت إضافي لمناقشة أي جوانب أخرى من البرنامج لم يتم تغطيتها أثناء المقابلة.

هل يمكنني الانسحاب من الدراسة؟
نعم، يمكنك الانسحاب في أي وقت. كل ما عليك فعله هو إخبار صيدلانية الدراسة عن رغبتك بالانسحاب وستقوم بإخبارك بطريقة الانسحاب بشكل آمن ولن يحاول أحد تغيير رأيك.

هل سأتعرض للمخاطر إن قررت الانسحاب من الدراسة؟
لا يوجد أي مخاطر، لكن الفائدة المنشودة من الدراسة لن تتحقق.

ما الآثار الجانبية أو المخاطر التي يمكن أن أتوقعها من الدراسة؟

لا توجد آثار جانبية أو مخاطر مرتبطة بالمشاركة في الدراسة على وجه التحديد، لكن العيب الوحيد هو أن المقابلة ستستغرق ٣٠ – ٤٠ دقيقة من وقتك.

ما فوائد المشاركة في الدراسة؟
لا يمكننا أن نعدك بأن الدراسة ستساعدك، ولكننا نأمل أن تساعد المعلومات التي نحصل عليها من هذه الدراسة على تحسين الخدمة التي يقدمها الصيادلة للمرضى في المستقبل، وستساعدنا على فهم عمل برنامج إدارة العلاج الدوائي من وجهة نظر المريض.

ما الذي يحدث إذا تعرضت لإصابة جراء اشتراكي في الدراسة؟
من غير المتوقع اصابتك عند المشاركة في الدراسة ولكن من المهم إخبار الدكتورة غادة أو السيدة بسمة إذا شعرت بأنك أُصبت بسبب مشاركتك في هذه الدراسة، ويمكنك إخبار الطبيب شخصياً أو الاتصال به. علماً بأن العلاج سيكون متاحاً إن أصبت نتيجة لهذه الدراسة.

ماهي تكاليف الاشتراك في الدراسة؟
لن يتم محاسبتك على أي أنشطة تابعة للدراسة. أما بالنسبة للتواصل، فستتم المكالمة عن طريقنا.

هل سأحصل على مقابل مادي بعد الاشتراك في الدراسة؟
لن يُدفع لك مقابل اشتراكك في هذه الدراسة.

هل سيتم الحفاظ على سرية معلوماتي الطبية؟
نعم. سوف نتبع الممارسة الأخلاقية والقانونية وسيتم التعامل مع جميع المعلومات المتعلقة بك بسرية. سيتم تسجيل المقابلة صوتياً ونسخها على جهاز كمبيوتر، إضافة إلى إخفاء هوية جميع البيانات التي تم الحصول عليها وحفظها في جهاز كمبيوتر محمي بكلمة مرور، وسيتم التعامل مع إجاباتك بسرية تامة، ولن يتم تحديد أي شخص يشارك في البحث إلا من خلال الأرقام الرمزية، فقط فريق البحث يمكنه الوصول إلى بياناتك. لن يتم الكشف عن هويتك في أي تقرير أو منشور. إذا شعرت بالانزعاج أثناء المقابلة وترغب في الحصول على بعض المساعدة الإضافية بعد المقابلة، يمكنني أن أزودك برقم لتتصل به، ولك الحق في إيقاف المقابلة في أي وقت دون إبداء أي سبب. علماً بأننا سنواصل تضمين جزء المقابلة الذي أجريته، مالم تطلب منا عدم القيام بذلك.

ما هي حقوقي إذا شاركت في هذه الدراسة؟
المشاركة في هذه الدراسة هي اختيارك، لك الحق في المشاركة أو عدم المشاركة. وإذا قررت الاشتراك فلك الحق أن تنسحب منها في أي وقت، ولن تتعرض لعقوبة ولن تفقد أياً من استحقاقاتك العادية بغض النظر عن القرار الذي اتخذته. بالإضافة إلى أن تركك للدراسة لن يؤثر على رعايتك الطبية، فلا يزال بإمكانك الحصول على الرعاية الطبية الخاصة بك. قد تستخدم الدكتورة غادة باوزير وبسمة البابطين المعلومات التي قد تم جمعها قبل انسحابك من الدراسة.
سيتم إخبارك بأي معلومات أو تغييرات جديدة في الدراسة قد تؤثر على صحتك أو استعدادك للاستمرار في الدراسة.

سيتم إخبارك بأي ظروف متوقعة قد يتم بموجبها إنهاء مشاركتك من قبل الباحث دون النظر إلى موافقتك.

بمن اتصل إذا واردتني بعض الأسئلة أو واجهت بعض المشاكل؟
قبل الموافقة على المشاركة في هذه الدراسة، ستتحدث إلى أحد أعضاء فريق الدراسة المؤهلين ليحدثك عن الدراسة، ويمكنك حينها طرح أي أسئلة حول أي جانب من جوانب البحث. وإذا راودتك أسئلة أخرى عن الدراسة فيمكنك طرحها في أي وقت بالاتصال بالباحثة بسمة البابطين على الرقم [redacted].

نموذج موافقة المشارك

عنوان المشروع: تقييم برنامج إدارة العلاج الدوائي في الصيدلية المجتمعية السعودية: دراسة متعددة الأساليب.

فريق البحث: بسمة البابطين والدكتورة غادة باوزير و الدكتور عبدالعزيز القحطاني

١-أؤكد أنني قرأت وفهمت ورقة المعلومات. ☐

٢-أفهم أن مشاركتي طوعية وأن لي الحرية في الانسحاب في أي وقت دون إبداء أي سبب، وفي هذه الحالة لن تتأثر رعايتي الطبية أو حقوقي القانونية بأي شكل من الأشكال. ☐

٣-أوافق على المشاركة في الدراسة أعلاه. ☐

٤-أعطي الإذن لاستخدام اقتباسات مجهولة المصدر من المقابلة التي أجريتها مع المنشورات ذات الصلة، وأدرك أنه لن يتم الكشف عن هويتي ولن تستخدم للتوصل إلي. ☐

٥-أعطي الأذن للسلطات التنظيمية للوصول إلى بيانات البحث لغرض المراجعة. ☐

٦-أعطي الأذن لتسجيل صوتي في المقابلة. ☐

اسم المريض	التاريخ	التوقيع
الباحث	التاريخ	التوقيع

P. INITIAL VISIT NOTE FOR INTERVENTION PATIENT

Interview Start Time: _____:_____ **Date: _____**
Name and MRN: _____ **Assignment No.: _____**

Duration of diabetes: _____
Last time saw a physician: _____

Hospitalization/ER in past year: □ No □ Yes, reason_____

Disabilities/restrictions: □ None □ Hearing □ Sight □ Cognition □ on wheelchair □ cane.

Social support and help with medication admin:
□ by Own self □ a family member/maid.

Receives meds from other hospitals: □ No □ Yes.

Other comorbid conditions: □ None □ HTN □ DLD □ CKD □ AFib □ IHD □ stroke □ HF □ DVT □ PE □ HyPOthyroid □ HypERthyroid □ asthma □ COPD □ Osteoarthritis □ glaucoma □ chronic pain □ Rheumatoid arthritis □ Gout □ BPH □ Urinary incontinence □ Allergic rhinitis □ Other, _____

Diet assessment: follow diet: □ No □ Yes
No. of meals: □ B @_____ □ L @___
□ D @ _____ □ snacks@ _____

Exercise assessment: □ House chores (no maid),
□ walking (frequency_____)
□ other, _____

Vitals:
Ht:_____ Weight: _____
BP: _____ Random BG: _____

Baseline Labs: □ HbA1c_____ □ LDL_____
□ TG_____ □ TC_____ □ ACR_____
□ SrCr _____ □ TSH_____ □ FBG_____

No. of Meds before and after intervention: _____ _____ **Pt knows their Meds?** □ Yes □ No □ Not sure

Medication List: *Rx, OTC, herbal, supplements, Inhalers, drops, creams, patches, discontinued medications and reason for discontinuation (write start date or duration on):*

……
……
……
……
……
……
……
……

Use of glucometer @ home: □ No □ Yes, readings run around: _____

Follow UP/date:

DRP:
□ No DRP identified at this time.
□ Need additional drug □Unnecessary drug.
□ ineffective drug □ High dose □Low dose
□Duration inappropriate □ Duplicate tx □ ADR/SE □ Drug interaction □ Lab value(s) warrant attention □ Nonadherence □ Needs referral
□ Education/counseling needed.
□ Polypharmacy □ Preventive therapy is required
□ Cannot afford drug cost □ Vaccination not up to date
Type of Meds related to DRP:

Intervention/Plan
□ Provide CMR and education
□ Optimize drug regimen (add/change/stop/adherence)
□ Referral: □ Ophtha □ PCP □ Dietitian □other _____
□ Write a consult to PCP
□ Request Lab
□ Device education
□ Medication counseling
□ Smoking cessation counseling
□ Other:_____

Interview End time: _____:_____

Q. FOLLOW VISIT NOTE @ THREE-MONTH AND SIX-MONTH FOR INTERVENTION PATIENT

Interview Start Time: _____:_____ **Date: _____:_____**
Name and MRN: _____ **Assignment No.:**
_____

Follow method:
☐ Phone call
☐ WhatssApp message
☐ Clinic visit

Updated labs (if any):
☐ HbA1c_____ ☐ LDL_____☐ TG_____
☐ TC_____ ☐ ACR_____ ☐ SrCr _____
☐ TSH_____ ☐ FBG_____ ☐ Wt_____

Hospitalization/ER in past three-month: ☐ No ☐ Yes, reason_____

RBG : _____ **BP**:_____

Assessment:
☐ Medication Adherence: ☐ Improved ☐ need additional education
☐ Started the new medication regimen/or successful implementation of care plan:
☐ Yes ☐ No, reason:
_____
☐ Side effects: _____
☐ Referral Successful: ☐ Yes ☐ No, reason: _____
☐ New issue:

DRP:
☐ No DRP identified at this time ☐ Need additional drug ☐ Drug without indication ☐ Adverse drug reaction
☐ ineffective drug ☐ High dose ☐ Low dose ☐ Noncompliance ☐ New issues

Medications involved in DRP:

Questionnaires @ six-month

MARS-5 _____

DDS _____

PSPSQ 2.0 _____

No. of medication: _____

Referral:
☐ **No need** ☐ **Ophtha** ☐ **PCP** ☐ **Dietitian** ☐ **other** _____

Follow up date: _____:_____

Interview End time: _____:_____

R. MONTHLY FOLLOWUP NOTE FOR INTERVENTION PATIENT

Interview Start Time: _____:_____ **Date: _____:_____**
Name and MRN: _____ **Assignment No.: _____**

Follow method:
☐ Phone call
☐ WhatssApp message
☐ Clinic visit

Updated labs (if any):
☐ HbA1c_____ ☐ LDL_____ ☐ TG_____
☐ TC_____ ☐ ACR_____ ☐ SrCr _____
☐ TSH_____ ☐ FBG _____ ☐ RBG _____
☐ Weight:_____

DRP:
☐ No DRP identified at this time ☐ Need additional drug ☐ Drug without indication ☐ Adverse drug reaction
☐ ineffective drug ☐ High dose ☐ Low dose ☐ Noncompliance

Medications involved in DRP:

Assessment:
☐ Medication Adherence: ☐ Improved ☐ need additional education
☐ Started the new medication regimen/or successful implementation of care plan:
☐ Yes ☐ No, reason:
_____
☐ Side effects: _____
☐ Referral Successful: ☐ Yes ☐ No, reason: _____
☐ New issue: _____

Improvement in diet and physical activity

HBGM (if done):

Home BP (if done):

Follow UP Plan:

Interview End time: _____:_____

S. INITIAL VISIT NOTE FOR CONTROL PATIENT

Name: _____ **Date:** _____
MRN: _____ **Assignment No.:** _____

Duration of diabetes: _____
Hospitalization/ER in past year: □ No □ Yes, reason_____

Other comorbid conditions: □ None □ HTN □ DLD □ CKD □ AFib □ IHD □ stroke □ HF □ DVT □ PE □ HyPOthyroid □ HypERthyroid □ asthma □ COPD □ Osteoarthritis □ glaucoma □ chronic pain □ Rheumatoid arthritis □ Gout □ BPH □ Urinary incontinence □ Allergic rhinitis □ Other, _____

Vitals:
BP: _____

Baseline Labs: □ HbA1c_____ □ LDL_____
□ TG_____ □ TC_____ □ ACR_____
□ SrCr _____ □ TSH_____ □ FBG

No. of Meds: _____

List of medications: ----------

Pt knows their Meds? □ Yes □ No □ Not sure

Use of glucometer @ home: □ No □ Yes, readings run around: _____

Follow UP Date:

T. FOLLOW VISIT NOTE @ THREE-MONTH AND SIX-MONTH FOR CONTROL PATIENT

Interview Start Time: _____:_____ **Date: _____:_____**
Name and MRN: _____ **Assignment No.: _____**

Follow method:
□ Phone call
□ WhatssApp message
□ Clinic visit

Updated labs (if any):
□ HbA1c_____ □ LDL_____□ TG_____
□ TC_____ □ ACR_____ □ SrCr _____
□ TSH_____ □ FBG_____ □ Wt_____

Hospitalization/ER in past three-month: □ No □ Yes, reason_____

HBGM (if done): _____ **Home BP (if done):_____**

No. of medication: _____

Referral:
□ **No need** □ **Ophtha** □ **PCP** □ **Dietitian** □ **other _____**

Questionnaires @ six-month

MARS-5 _____

DDS _____

PSPSQ 2.0 _____

Interview End time: _____:_____

Follow up date: _____:_____

U. AGREEMENT TO USE MEDICATION ADHERENCE REPORT SCALE (MARS-5)

Conditions for use and/or translation of the
Medication Adherence Report Scale (MARS)

1. The copyright of the translated MARS and all adaptations remains with the originator (Professor Robert Horne). (NOTE: Subsequent permission to use the translated questionnaire must be agreed by him).
2. The translated MARS is used ethically.
3. The MARS is translated and used completely intact. Items or phrases may not be removed or used in other contexts.
4. The back-translation of the MARS is approved by Professor Rob Horne.
5. All copies of the MARS will have the legend: '**© Professor Rob Horne'** clearly indicated on them.
6. The MARS is analysed and reported in accordance with the instructions of the originator.
7. The MARS may not be used in studies developing other assessment tools without specific permission of the originator.
8. At the conclusion of the study, the principal researcher(s) or the sponsoring institution agrees to share, with Professor Rob Horne, the entire de-identified data set, including MARS data and other variables evaluated relative to MARS scores, and any related materials including codebooks. This data will contribute to the collection of normative values across different populations. Please specify which data you are willing to share and what form the data will come in. Professor Rob Horne reserves the right to publish amalgamated data sets, but will not publish your individual data or share your data with another party.

Publication rights of the MARS

1. The MARS itself may not be published except by its constructors.
2. Permitted users are free to publish reported adherence rates obtained with the MARS without collaborating with the originator.
3. Publications, which include psychometric data of the MARS, should include Professor Rob Horne as a co-author.

I agree to the above conditions for use and/or translation of the MARS:

Name of user	Basmah AlBabtain
Signature of user	[redacted]
Address for correspondence	Riyadh, KSA

E-mail	[redacted]
Telephone	[redacted]
Date	11/5/2020

V. AGREEMENT TO USE PATIENT SATISFACTION WITH PHARMACIST SERVICES 2.0 (PSPS 2.0) QUESTIONNAIRE

Western University
OF HEALTH SCIENCES
College of Pharmacy

Permission is being requested to adapt the copyrighted PSPSQ 2.0 survey recently developed and validated in the following work: Sakharkar P, Bounthavong M, Hirsch JD, Morello CM, Chen TC, Law AV. Development and validation of PSPSQ 2.0 measuring patient satisfaction with pharmacist services. Res Social Adm Pharm. 2015;11(4):487-98, to utilize in our research project titled, "Assessing the Effectiveness of Community Pharmacy-led Medication Therapy Management Program in Kingdom of Saudi Arabia: a Pilot Randomized Controlled Trial"

Being the copyright holder, I (we) hereby grant permission for use of the material specified above.

Signature: Anandi V. Law

Name and Title: _Anandi V. Law, Professor and Associate Dean for Assessment_____

Company/Affiliation: __Western University of Health Sciences, College of Pharmacy Pomona, CA

Date: __5/13/2020_____

I(We) vouch that this request is for non-exclusive, irrevocable, and royalty-free permission and it is not intended to interfere with other uses of the same work. We commit to including a full citation to the published work and any other acknowledgement as Drs. Law and Bounthavong may request. We also state that we have read and agreed to the instructions for use and analysis included with the survey.

Signature: _____[redacted]_____

Name and Title: _____Basmah Albabtain _____

Company/Affiliation: Birmingham University / Princess Nourah Bent Abdulrahman University

Date: _____14/5/2020_____

W. INTERVIEWS' PARTICIPANTS INFORMATION SHEET

Participants Information		
Date		
Time tracking	From ---------- to ----------	
Serial Number		
Participant name		
Age	year	
Nationality	Saudi/ non-Saudi	
Gender	Male / female	
If stakeholders		
Position (Area of practice)		
Years of practice		
If patients		
Duration of diabetes		
HbA1c %	at baseline and after six-month	
BP	at baseline and after six-month	
LDL	at baseline and after six-month	
TC	at baseline and after six-month	
TG	at baseline and after six-month	
ACR	at baseline and after six-month	
SrCr	at baseline and after six-month	
Number of DRPs	at baseline and after six-month	
MARS-5 Score	at baseline and after six-month	
DDS Score	at baseline and after six-month	
PSPSQ2.0 Score	At six-month	

X. TOPIC GUIDE FOR PATIENTS' AND STAKEHOLDERS' INTERVIEWS

FOR PATIENTS:

Expectations
What were your expectations from the MTM clinic?
Have these changed now?
Has the care provided by MTM clinic met your expectations? Disappointed?

Expectations of prognosis
Is this different from before?

Efficacy
Did it help?
What was the most helpful part?
How did it help?
Did they help you to manage problems with your medications?

Understanding and Self-management
Did it help you to understand your problem?
Was the information provided adequate?
Do you feel you have control over problem?
Do you think you can now manage your problem better on your own?

Interaction with Pharmacist
Did they communicate well? Listened to your problem?
Did they encourage you to be active and self manage?
Did they give you enough time?
Have you had any problems in following their instructions?
Could they have done any better?
Anything particularly good or bad about the service?
Do you agree with their medication management approach?

Overall Satisfaction
Any other issues?
How do you think care could have been improved?
How do you compare it with other treatments?

Note: In the beginning of each interview, patients were also asked about their history of chronic disease, its impact on their lives and their experiences of dealing with various healthcare professionals in relation with its management

FOR STAKEHOLDERS:

For the MTM team:

Efficacy
What do you think about MTM service with regards to its impact?
Did it help your patients? If yes/ How did it help? And What was the most helpful part?
How is the effectiveness and usefulness of the MTM service determined?

Expectations
What sort of benefits did you expect from implementing the MTM service in comparison to the traditional care?
Have they been realised?
What sort of challenges did you expect from implementing the MTM service in comparison to the traditional care?
Have they been realised? If so how were they overcome? How do you feel they can be prevented?
What would your dream outcome for it?
What would be a reason why we would not be able to get this outcome?

MTM service
Do you feel there was a rationale for implementing the MTM service?
To what extent was it implemented as planned?
To what extent were all components within the MTM service implemented?
How is MTM service currently managed?
Anything particularly good or bad about it?
What aspects of it do you feel need improvement? How do you think it could have been improved?
In your view, what organisational changes/ redesign may be required?
Who do you see as the key partners and decision makers in the redesign it?
What resources are needed for implement MTM service?
How did MTM team get to where you are today?
What facilitators were encountered and actions taken in relation to implementation?
What was your largest barrier/challenges to deliver the MTM service in the CP?
Would you know what would be your role in implementing MTM service?
What do you think about taking on this role?
Are there any protocols or policies on the roles and responsibilities of pharmacists in running the MTM service?
If yes/ How are these protocols or policies implemented locally?
What training have you received in order to run the MTM service?
Will pharmacists require additional training to run MTM service?
Did you have to make significant changes to your work practices in order to implement the MTM service? If so
What impact has MTM service implementation had on other work tasks?
What would need pharmacists to drive this forward?
What other services in CP do you think do an excellent job?
How the MTM service differs from existing practice?
Based on your experiences, can you highlight what difference the MTM service has made to the practice?
Do you feel patients understand the aims and expected benefits of the MTM service?
How patients found/ valued MTM service?
Do you feel patients engage with the MTM service willingly?
Have patients been given an opportunity to provide feedback about the MTM service? If so in what manner?
Do you think that MTM service should be implemented more widely? If yes/What would need to change? If not
Why not?
How can we sustain the MTM service?
How is competence in running the MTM service assured?
What advice would you give to other CP thinking of implementing the MTM service? Or What are the specific key ingredients which could be included?

Relationship with the physicians in private sector

Descript your working relationship with private GPs?
What about their communication? Have you had any problems in communication?
To what extend do you agree with their medication management approach?
Would GPs know what would be required of them?
Would GPs value the MTM service?
How do you work together in order to embed this MTM service into routine practice?

Collaboration regarding medication issues

Have you ever collaborated with another health professional to address your patients' medication issues?
Describe that collaboration or, if no, why not?

For the physicians and community pharmacists:

Efficacy
What do you think about MTM service with regards to its impact?
Did it help your patients? If yes/ How did it help? And What was the most helpful part?
How is the effectiveness and usefulness of the MTM service determined?

Expectations
What were your general feelings about it, before and after implementation?
What sort of benefits did you expect from implementing the MTM service in comparison to the traditional care? Have they been realised?
What sort of challenges did you expect from implementing the MTM service in comparison to the traditional care? Have they been realised? If so how were they overcome? How do you feel they can be prevented?

MTM service
Do you feel there was a rationale for implementing the MTM service?
Do you understand MTM service framework?
Anything particularly good or bad about it?
What aspects of it do you feel need improvement? How do you think it could have been improved?
In your view, what organisational changes/ redesign may be required?
Who do you see as the key partners and decision makers in the redesign it?
What resources are needed for implement MTM service?
Would you know what would be required from you?
What impact has MTM service implementation had on your day-to-day and your overall job?
What other services in CP do you think do an excellent job?
How the MTM service differs from existing practice?
Based on your experiences, can you highlight what difference the MTM service has made to the practice?
Do you feel patients understand the aims and expected benefits of the MTM service?
What was your patient perception of the MTM service?
How patients found/valued MTM service?
Do you feel patients engage with the MTM service willingly?
Do you think that MTM service should be implemented more widely? If yes/What would need to change? If not Why not?
What advice would you give to other CP thinking of implementing the MTM service? Or What are the specific key ingredients which could be included?

Relationship with the MTM pharmacists
Descript your working relationship with MTM pharmacists?
What about their communication? Have you had any problems in communication?
How would you like a MTM pharmacist to communicate with you about your patients?
What is your perspective to pharmacist run the MTM service?
What is your point of view for pharmacist's competency to run MTM service?
What would need pharmacists to drive this forward?
Could MTM pharmacists have done any better?
What are your thoughts on working with a MTM pharmacist?
What is your view regarding utilise CDTM arrangements?
If your patient came with an MTM recommendations, would you accept it, why?
To what extend do you agree with MTM pharmacists' medication management approach?
Did you have to make significant changes to your work practices in order to refer patients to the MTM service? If so what were they?
How do you work together in order to embed this MTM service into routine practice?

For the pharmacy owner

Efficacy
What do you think about MTM service with regards to its impact?
Did it help patients? If yes/ How did it help? And What was the most helpful part?
How is the effectiveness and usefulness of the MTM service determined?

Expectation
What sort of benefits did you expect from implementing the MTM service in comparison to the traditional care? Have they been realised?
What sort of challenges did you expect from implementing the MTM service in comparison to the traditional care? Have they been realised? If so how were they overcome? How do you feel they can be prevented?
What would your dream outcome for it?
What would be a reason why we would not be able to get this outcome?

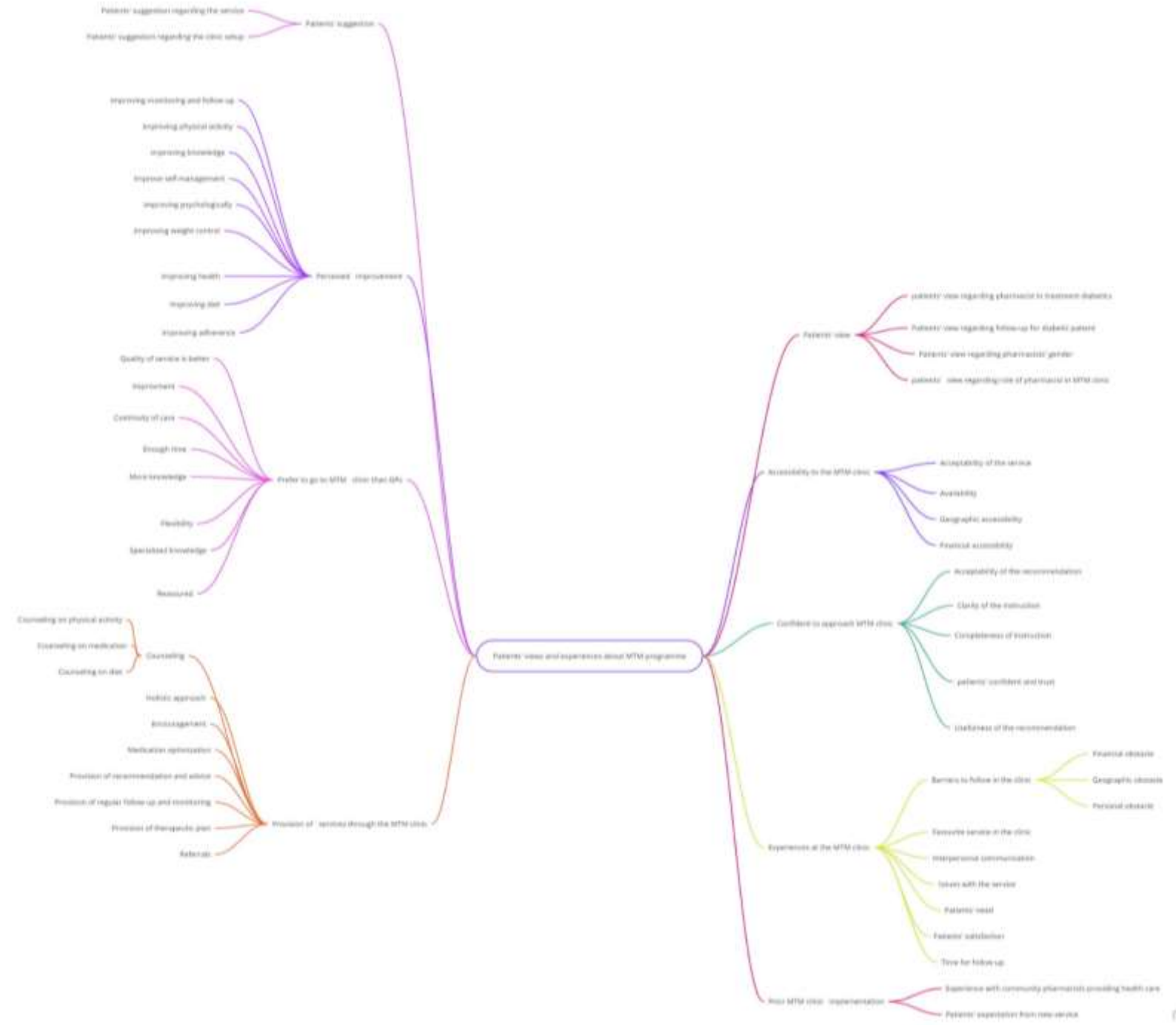
MTM service
Do you feel there was a rationale for implementing the MTM service?
How is MTM service currently managed?
Anything particularly good or bad about it?
What aspects of it do you feel need improvement? How do you think it could have been improved?
In your view, what organisational changes/ redesign may be required?
Who do you see as the key partners and decision makers in the redesign service?
What resources are needed for implement MTM service?
How did MTM team get to where we are today?
What facilitators were encountered and actions taken in relation to implementation?
What was your largest barrier/challenges to implement the MTM service in the CP?
Are there any protocols or policies on the roles and responsibilities of pharmacists in running the MTM service?
How are these protocols or policies implemented locally?
Will pharmacists require additional training to run MTM service?
Did you have to make significant changes to the practices in order to implement the MTM service? If so what were they?
What would need pharmacists to drive this forward?
What other services in CP do you think do an excellent job?
How the MTM service differs from existing practice?
Based on your experiences, can you highlight what difference the MTM service has made to the practice?
What kind of relationship or experiences do you want to create?
Do you feel patients understand the aims and expected benefits of the MTM service?
Do you think that MTM service should be implemented more widely? If yes/What would need to change? If not Why not?
How can we sustain the MTM service?
How is competence in running the MTM service assured?
What advice would you give to other CP thinking of implementing the MTM service? Or What are the specific key ingredients which could be included?
Why is this project important?
What its impact on the current business, do you see any potential profit, if not, would you still do it?
What is a reasonable risk you are willing to take by hiring and funding such service?
How much pharmacy should invest in such services?

To be used for all key stakeholders
Wrap up question
Can you provide any words of advice?
What do I need to know that you don't think other stakeholders have said?
Is there anyone else, in particular, you think we would benefit from interviewing? Who?
What questions do you have for us?

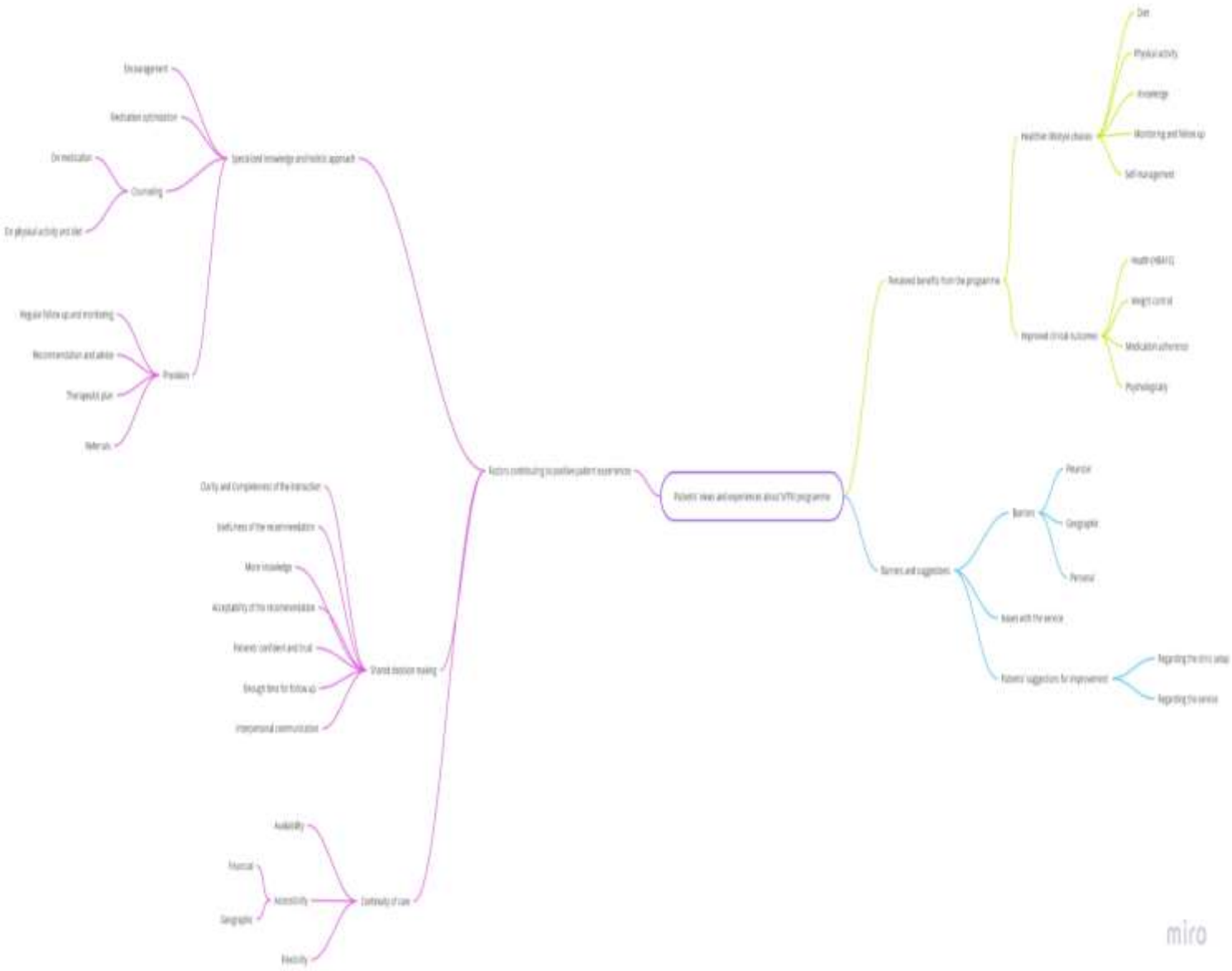
Probing Questions
Anything else? Any other thoughts? Anything else to add?

Appendix VI (Chapter 6)

A. MIND MAP (FIRST DRAFT)

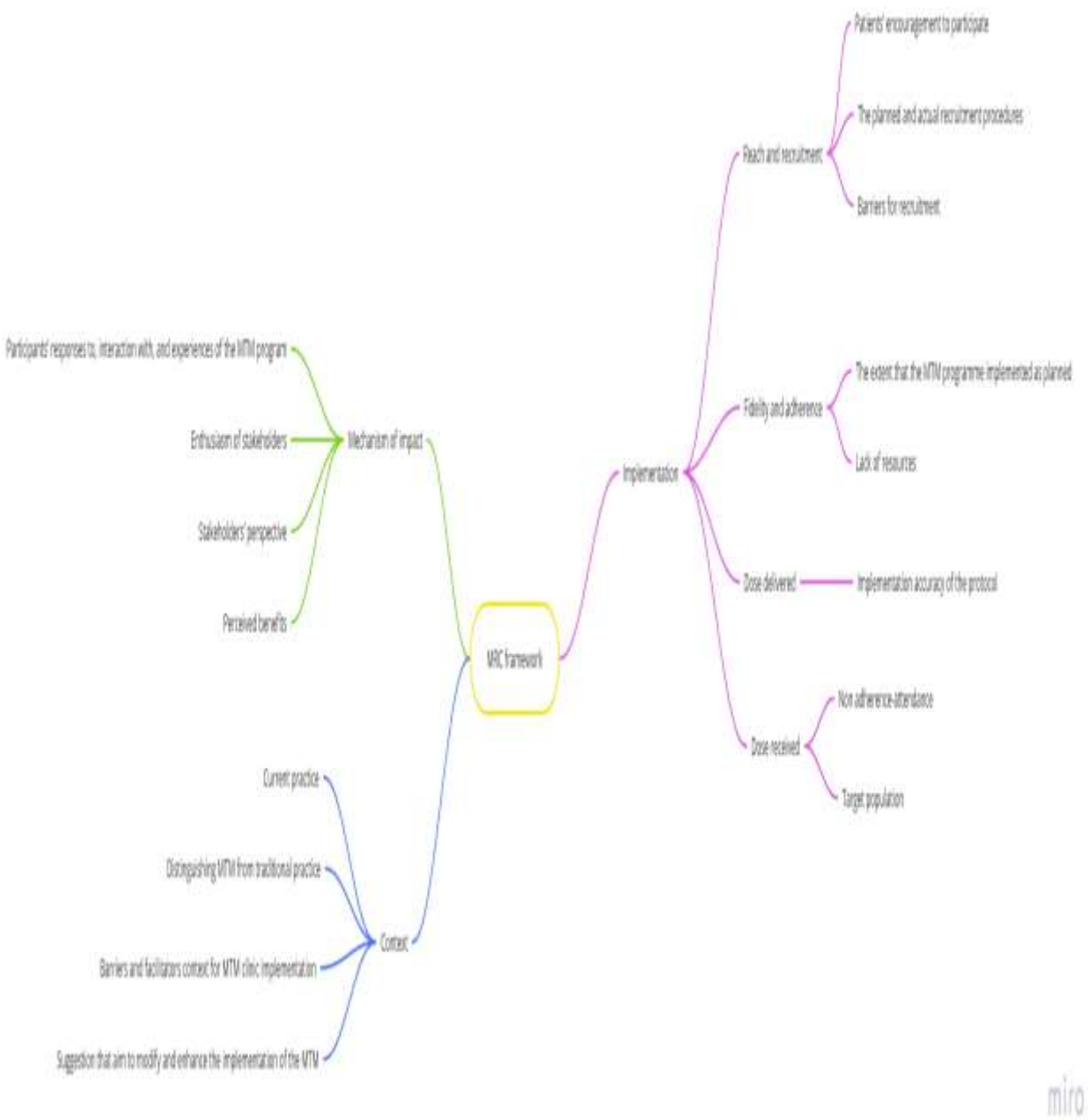


B. MIND MAP (FINAL DRAFT)



Appendix VII (Chapter 7)

A. PROCESS EVALUATION MIND MAP



Appendix VIII (Chapter 8)

A. Key summary from the three sections of the thesis

Review	**Mixed-methods study**		**Process evaluation**
	Quantitative phase	**Qualitative phase**	
Systematic review (SR) and meta-analysis (MA)	Study set up as a six-month, 2-arm, open-label, parallel-group, pilot RCT.	A descriptive qualitative study using individual face-to-face semi-structured interviews.	The design and structure of the process evaluation was according to the MRC framework for process evaluation of complex interventions. This was done by assessing the following process elements, namely: implementation which include reach and recruitment, fidelity and adherence, dose delivered/ received; mechanism of impact and context **(Moore *et al.,* 2015)**.
Reporting of the review conforms to Preferred Reporting Items for Systematic Reviews and Met-Analysis (PRISMA) guidelines **(Moher *et al*., 2015).**	Reporting of the mixed-methods study follows the A Good Reporting of a Mixed-Methods Study (GRAMMS) **(O'Cathain, Murphy and Nicholl, 2008).**		Reporting of the process evaluation conforms to the Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare: revised guideline (CReDECI 2) **(Moher, Kopke and Meyer, 2015).**
Aiming to evaluate the effectiveness of community-pharmacist-led medication review services with a wide range of targeted outcomes among different patient population groups.	Aiming to investigate the effectivness of community-pharmacy based MTM service alongside the assessment of the service feasibility.	Aiming to explore patients' views around their experiences with the community-pharmacist-led MTM service.	Aiming to clarify under which conditions the MTM service has been implemented and maintained while still being effective.
The systematic review included 40 studies. There was heterogeneity among studies for interventions, outcomes, population characteristics, study duration, methods for measuring outcomes and origin of study.	One hundred sixty **patients** were enrolled in the study and completed by 129 patients. Patients' mean **age** was around 50 years old. Approximately two thirds of the patients were **male**. Most of the patients had **diabetes for more** than eight-year.	Interviews conducted with a sample from patients who were randomised to the intervention arm. Sixteen patients participating in the interview.	Participants in this process evaluation were patients and key stakeholders. Patients' data were taken from the mixed-methods study, which consist of 80 intervention patients from quantitative RCTs phase including 16 patients from the qualitative interview phase.

Meta-analysis was performed including 12 RCTs. In total, 4,815 patients with chronic diseases completed these studies. Community-pharmacist-led medication review was useful for patients with different types of chronic conditions, involved patients with various chronic diseases: HTN, diabetes, DLD, asthma and elderly patients.		By using purposeful sampling, patients sample was fairly representative for the patient population with diabetes in terms of gender, age, prognosis of HbA1c and time since diagnosis with diabetes. Patients' mean **age** was around 52 years old. Nine (56.3%) were **male.** The mean number of years spent since they were diagnosed with diabetes was 11 years.	Stakeholders' data were taken from interviews with 9 key stakeholders involved in implementation and developing process of MTM service. All stakeholders took part in the semi-structured interviews were **males** except three **females** with a mean **age** of 39-year with a mean of 12 **years' experience** in their field.
For the **HbA1c**, data from six studies, community-pharmacist-led medication review services have a clinical effect with a 0.6% MD reduction in 591 diabetic patients.	For **HbA1c**, after adjusting for baseline, the mean HbA1c level was 0.21% lower in the intervention arm compared to the control arm at six-month.	**Theme one (Perceived benefits from the service)** **Healthier lifestyle choices** - The MTM pharmacist highlighted the importance of changing poor diet habits and engaging in physical activity in controlling blood sugar. -Patients talked positively about being provided with more information regarding their diagnosis and	**Implementation:** - High acceptance rate of 44.8% - Recruitment process took 19-week, - Inclusion criteria were rigorously applied. - No statistically significant differences between the characteristics of patients who completed the service and those who were lost to follow up. - **Patients cited multiple motivations for participation**, included o possibility for additional education, follow-up and encouragement opportunity o physiological improvement needs o accessibility to the MTM service o trust and goodwill toward the pharmacists **-Encouragement to continue attending follow-up appointments:** o the quality of service was high o discounts on laboratory tests

		clearer instructions about their medicines use. -Patients feel empowered or having greater responsibility for promoting their own health. **Improved clinical outcomes** -HbA1c, medication adherence, weight control and psychological condition were perceived to improve by patients with implementation of MTM service. -Patients mentioned the consequences involved in understanding tests and their results.	○ prompt availability of test results. -Most of the patients were self-referral. **-Hindered referring patients to MTM service** ○ workload ○ unaware of clinic schedule. **-Barriers for recruitment** ○ participants were overwhelmed with extra visit ○ confused in understand of clinic name and unsured about the purpose of the clinic. ○ low physicians' knowledge and confidence about pharmacists' role in the MTM service. -Majority of patients received assessment follow up in the clinic, some patients chose to conduct the follow up by telephone - High retention-participation rate 0.81. -The service was achieved as initially planned in the study protocol, no major changes were made in design, model, components, and method of delivery. Except the PMR, monthly follow up and referral were challenge in implementing these components. -Most healthcare stakeholders reported understanding what was required of them, shared its aims with other healthcare professionals. -**Three dimensions of lack of resources that required for a successful and quality delivery of MTM service.** ○ infrastructure ○ skilled human resource ○ logistics -The mean time elapsed between service entry and exit was approximately 7.5 months. -The median length for baseline assessment was 35, 15 and 20 minutes for the first, second and third appointments respectively. -Number of monthly follow up and referral was lower. -18.8% of patients did not complete the service.

			The median number of monthly follow up per patients was 1 [IQR, 0, 1]. **-Strategies to reduce drop-out consisted** o contacting the participant after no show via telephone or WhatsApp o offered the MTM service free of charge. **-The target population they believed will benefits from CP based MTM service:** o patients taking multiple medications o patients with multiple comorbidities o patients from the community who were have difficulties in accessing specialised hospital services.
For **BP,** data from 9 studies, overall MD for **SBP** and **DBP** in 833 diabetic and hypertensive patients was significantly reduced by 6.6 mmHg and 1.7 mmHg, respectively.	For **BP**, after adjustment for baseline, mean SBP and DBP are 5.8 mmHg and 4.8 mmHg, respectively, lower in the intervention arm than the control arm at six-month.	**Theme two (Factors contributing to positive patient experiences-)** **Specialised knowledge and holistic approach:** -The in-depth specialised knowledge of the pharmacist in terms of medication optimisation was quickly recognised by the patients as well. -The MTM service offered a holistic approach includes medication safety and efficacy, encouragement, medication adherence, organise daily patient's doses, regular follow up and monitoring,	**Mechanism of impact:** **-**The number of adherent patients were more compared to before starting the service. **-**The number of distressed patients reduced dramatically after they had completed the service **-**Overall level of satisfaction with patients' experience was higher compared to patients who did not receive the MTM service. -Initially, patients have minimal expectations from the service. -The quality of MTM service was high and in line with the service theory -Positive interprofessional relationships but limited. -Pharmacists' recommendation was useful and helped patients to bring the recommended changes in their health and lifestyle. -Participants were generally very positive about having advance service in CP practice and enthusiastic about potential benefit in improving the practice and the quality of healthcare services and facilities in KSA.

		recommendation, advice, therapeutic plan and referral. **Shared decision making:** -Patients regarded the MTM service as having provided an opportunity to obtain a clear and sufficient information about their problems and medicines from the pharmacist. -Patients felt confident to approach pharmacists in MTM service and accepted pharmacist's recommendations. -Patients felt that they were given full time in the clinic to express their views. -Patients felt that the MTM pharmacists have good interpersonal communication skills. **Continuity of care:** The factors accountable for the continuity of care in the MTM service included availability, accessibility and flexibility of the service.	-The MTM pharmacists welcomed opportunities to utilise their professional expertise and education. -Stakeholders expressed a clear and positive viewpoint about the future of MTM service. -Stakeholders had different perspective regarding the location of MTM clinic. -Stakeholders provided dissimilar viewpoints regarding best way to communicate with pharmacists in MTM clinic. -Stakeholders welcomed the utilisation of CDTM arrangements. **-Steps to facilitate incorporation of the service in routine practice** o using automatic referral for target patients to the clinic. o employ pharmacists as coordinator o to let the MTM pharmacists provide the service from the pharmacy counter. **-Number of factors to ensure continuity of the service** o empowerment of MTM pharmacists o cooperation of doctors and medical centre o strong marketing o robust legislation o financial return on the pharmacy in terms of investment. **-Patients' benefits from viewpoint of stakeholders' perspective** o preventing drug interaction o increase awareness and education o understands their health problem o reduce expenses and medication use. o enhanced the feeling of patients' control and patients' confidence **-Stakeholders' benefits from viewpoint of stakeholders' perspective**

			○ helps GPs work. ○ increase MTM pharmacists' expertise and satisfaction **-MTM service was important for CP sector** ○ the medical centre benefits from presence of clinic ○ the clinic affects the quality of the medical services that provided in the pharmacy. ○ enhance patient's loyalty to the CP which reflected in the patient's return to the pharmacy and putting his trust in the pharmacy which increases purchasing medicines.
For **TC,** data from 3 studies, MD in 184 DLD patients was significantly reduced by 0.2 mmol/l (6.9 mg/dl) For the other outcomes (**LDL, TG**), they were deemed clinically heterogeneous and were not combined statistically.	For **LDL,** after adjusting for baseline, the mean LDL level was 4.2 mg/dl higher in the intervention arm compared to the control arm at six-month. However, results should be addressed with caution due to the missing data. **For TC**, after adjusting for baseline, the mean TC level was 11.1 mg/dl lower in the intervention arm compared to the control arm at six-month. **For TG,** data shows that after adjusting for baseline, the TG mg/dl in the intervention arm was 1.2% lower than the control arm at six-month.	**Theme three (barriers of implementation and suggestions for improvement)** **Issues with the service:** -Long waiting time. -Short time spent with the MTM pharmacists. **Barriers:** Financial: MTM service does not afford free lab tests. Geographic: accessing the clinic involved substantial long time. Personal: uncommitted, random, and non-adhering behaviour either to the diet, physical	**Context:** -Saudi CPs are still predominantly commercial ventures, and unfortunately, the current practice is business oriented. -The scope of services being offered by community pharmacist wouldn't entering into clinical evaluation of the patient's medicines list. -Recent changes in legislation by MOH paved the way for establishing the MTM service. -Pharmacists saw the introduction of MTM as a significant change in direction for pharmacy as a profession. -MTM pharmacists provided more information; more time was given to patients and did follow up with patients. -The MTM service was not covered by the basic health insurance scheme. -In term of GP practice, interviewee stated that doctors' treatment was cruel. -The MTM service was deemed to be a 'pioneer' and serve the patient considerably and connected all health practitioners with all specialties in one clinic. **-Difference between MTM clinic and GPs clinic**

		activities, or treatment plan. **Patients' suggestion for improvement:** -Expanding the clinic space and include waiting area. -Having more than one MTM pharmacists operating the clinic at the same time. -Clinic's location inside the pharmacy should be more accessible, clear and in front of patients. -Moving the MTM clinic from the CP to inside the medical centre. -Increasing number of clinics. -Increasing the communication to be every month instead of every three-month. -Activating the educational and follow up messages.	○ the MTM clinic's perspective is looks at the patient from the side of medicine and then turns to the side of chronic diseases, while the services provided in GPs' clinic start from the diagnostic side to dispense the medicine. -There is no similar service to MTM clinic in CPs. **-Difference between MTM service and other services implemented in CPs**. ○ The MTM service goal is improve patients' health, not increase financial return. ○ the MTM service is more comprehensive in providing pharmaceutical care, not dedicated to specific work parts as in other services. **-Potential barriers to implementation** ○ clinical and logistical issues ○ lack of manpower and interprofessional setup ○ financial challenges ○ internal organisation ○ patients' factors ○ resistance from some physicians. **-Facilitating factors provided to implement the MTM service.** ○ **For macro-organisational level**: support from the Inova Saudi Health Care Company and health centre management, choice of the pharmacy location, availability of qualified and enthusiastic pharmacists to run MTM clinic and new legislation supported the role of the pharmacist in the MTM clinic. ○ **For micro-organisational level**, utilisation of CDTM and presence of research coordinator. **-The suggestions relate to the setup.** ○ Clinic must be well prepared, and the setup must be more comfortable. ○ Expanding the clinic to include waiting and vital sign room

		-Activating more the referral and cooperating with other specialists as required. -Including clinic under insurance coverage. -Dispensing medication from the MTM clinic or at least connect the clinic system to MOH system or 'WASFATY' programme.	○ Occupying the clinic with certain devices or tools and educational material. ○ Need for a computer software. ○ Providing a phone **-The suggestions relate to the MTM service** ○ Provide MTM service directly from pharmacy counter. ○ Increasing the number of the clinic working days to be daily. ○ Expanding the MTM service to other comorbidities services. ○ Introducing MTM service to home health care service to reach patients at home. **-The organisational suggestions** ○ There should be periodic meetings with MTM pharmacists ○ Conducting monthly medical lectures or journal club between pharmacists and the doctors ○ Improving the compensation and recognition for the pharmacists ○ Supporting staff ○ Good marketing ○ Including the service under insurance umbrella ○ legislation should be clear, accurate and complete ○ Training courses for pharmacists
	For **ACR,** data shows that after adjusting for baseline ACR, the mean ACR level was 21 mg/g higher in the intervention arm compared to the control arm at six-month. However, results should be addressed with caution due to the missing data.		
	For **SCr,** data shows that after adjusting for baseline, the SCr mg/dl in the intervention arm was 9.2 % lower than the control arm at six-month.		

	For **feasibility of the MTM service**, number of monthly follow up was low and the median number of monthly follow up per patients was only 1 [IQR, 0, 1]. Moreover, 45% of patient did not have any monthly follow up. The percentage of referrals to the other health care practitioners at baseline, three-month and six-month were 65%, 15% and 9% referrals, respectively. Ophthalmology (n = 41) followed by physician (n= 19) and dietitian (n = 4) were the most frequently made referrals. Finally, median minutes of pharmacist consultation time per patient at baseline, three-month and six-month were 35, 15 and 20 minutes, respectively.		
For **DRPs**, three studies showed that the service had a positive effect on DRPs throughout the study. However, one study reported an increase in the number of DRPs in the intervention group compared to the control group.	For **DRPs,** MTM service can optimize use of medications among diabetes patients by identifying and resolving DRPs. Number of DRPs were reduced from 191 at baseline to 69 at three-month and 60 at six-month follow-up. As well as mean number of DRPs per patient decreased from 2.4 (1.1) in the first visit to 0.96 (1) at second visit and 0.9 (0.9) at last visit. Moreover, 43% and 35% of patients had no DRPs at three-month and six-month of follow-up visits, respectively. Finally, the most reported DRPs over the follow up visits included additional drug		

	therapy needed, drug dose too low and noncompliance.		
For healthcare utilisation, a substantial improvement in ER visits and hospital admissions/readmissions.	For **healthcare utilisation,** 14 patients in standard group hospitalized or ED visited while none of the intervention patient utilise healthcare service during the MTM service. Thus, the MTM service significantly reduces the odds of healthcare utilisation by 93.1% at six-month compared to standard care.		
For **medication adherence**, 15 studies revealed that medication review services had a positive effect on medication adherence outcomes in patients with chronic diseases and in elderly patients. Only one study reported fluctuation in the result, where the mean adherence score increased at the six-month follow-up (0.48 ± SD 0.7) and decreased at the one-year follow-up (0.53 ± SD 0.8).	For **patients' medication adherence**, at the end of the intervention, participants in the intervention group were 8 times more likely to be adherent compared to the participants in the standard group. At the end of the study, adherent patients were significantly more in the intervention-group (50 (76.9%)) compared to the control group (19 (29.7%)).		
For **ADEs,** one study showed that there was reduction in the mean of DASs after three-month, along with a reduction in the percentage of patients reporting at least one DAS Another study, the patients in the intervention reported felt fewer sedative and anticholinergic side effects at the three-month follow-up compared to the baseline. For the last two studies, the follow-up revealed that the percentage of	For **DD**, at the end of the study MTM service significantly reduces the odds of patients' distress by 93.4% compared to standard care. At the end of the study, majority of MTM service patients 47 (72.3%) likely not to suffer from any distress compared to standard care patients where the majority of them 50 (78.2%) had moderate and high distress.		

patients who suffered from ADR was higher in the medication review service group compared to the usual care group.			
	For **patient satisfaction with pharmacist services,** at the end of the study, MTM service group had a significantly higher median satisfaction score 4 [IQR 4, 4] than the standard care group 1.4 [IQR 1.3, 1.9]		