PROCESS EVALUATION AND COST ANALYSIS OF THE TEAM APPROACH IN DIABETES MANAGEMENT IN A PRIMARY CARE SETTING

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UNIVERSITI SAINS MALAYSIA

2023

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ACKNOWLEDGMENTS

I would first like to thank my thesis supervisor, Dr Surianti Binti Sukeri from the Department of Community Medicine at the Universiti Sains Malaysia. She is always there whenever I face difficulties in my research or during the writing process. She allowed this research to be my own work and steered me in the right direction whenever she thought I needed it.

I would also like to thank the experts who were involved in this research project: Dr Ong Siew Chin who is my thesis co-supervisor, Dr Shareh Azizan Bin Shareh Ali, Public Health Physician, Kota Setar District, Kedah and Dr Sri Wahyu Binti Taher, Family Medical Specialist, Kota Setar District, Kedah. Without their passionate participation and input, the study could not have been successfully completed.

I further extend my gratitude to the Kedah State Health Department for allowing me to conduct this study. Not to be forgotten the Kota Setar Health Office and their staff who not only assisted me, but also provided me with the needed documents in order to obtain the necessary data for my study.

Finally, I must express my very profound gratitude to my parents and my wife, Dr Nurulsyuhadah Binti Mohd Ramli for providing me with the unwavering support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

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LIST OF ABBREVIATIONS

CPG	Clinical practice guideline
NDR	National Diabetes Registry
MOH	Ministry of Health Malaysia
TADM	Team Approach in diabetes management
JKNK	Jabatan Kesihatan Negeri Kedah
PKDKS	Pejabat Kesihatan Daerah Kota Setar
PWD	Public Works Department
OPD	Outpatient Department
DPPF	Diabetes Patient Process Flow Chart
ICPDM	Integrated Care Pathway of Diabetes Management
BPMN	Business Process Model and Notation
VSM	Value Based Management
UML	Unified Modelling Language
DRG	Diagnosis related group.
ISO	International Organization for Standardization
iDeal	Insight for Diabetes Excellence, Access, and Learning group.
KPI	Key performance indicators
SMBG	Self-blood glucose monitoring
HbA1c	Haemoglobin A1c
HCS	Home Care Service
JEPeM	*Jawatankuasa Etika Peyelidikan Manusia*
MREC	Medical Research and Ethics Committee

ABSTRAK

Latar Belakang: *Pendekatan Berpasukan* adalah pendekatan melibatkan pekerja kesihatan professional dari pelbagai bidang yang mengutamakan pesakit dalam rawatan penyakit kencing manis. Pendekatan ini bertujuan memperkasa pesakit ke arah pengurusan kendiri supaya penyakit kencing manis dapat dikawal. Kajian ini bermula dengan penghasilan carta alir dan carta klinikal *Pendekatan Berpasukan* yang kemudiannya digunakan sebagai panduan kepada penilaian proses dan analisa kos untuk pendekatan tersebut, dan pada masa yang sama mengenalpasti kos tambahan diperlukan dalam menambahbaik program tersebut.

Metodologi: Kajian ini merangkumi tiga bahagian. Bahagian pertama kajian ini melibatkan reka bentuk dan penghasilan carta alir dan carta klinikal melalui pemerhatian proses kerja dan aktiviti *Pendekatan Berpasukan* yang dijalankan di Klinik Kesihatan Simpang Kuala. Penghasilan carta alir dan carta klinikal tersebut menggunakan panduan *'10-step framework for developing and disseminating clinical pathway'* yang dihasilkan oleh Centre of Evidence-based Practice, University of Pennsylvania Health System, Philadelphia. Bahagian kedua merupakan penilaian proses ke atas *Pendekatan Berpasukan* di mana penilaian tersebut merangkumi aspek *konteks, kadar pesakit menyertai program, jumlah perkhidmatan diberikan, kualiti rawatan* dan *kadar pelaksanaan* pendekatan tersebut. Bahagian ketiga pula menggunakan analisa kos ke atas *Pendekatan Berpasukan*, menggunakan gabungan pendekatan atas ke bawah bersama-sama pendekatan bawah ke atas dalam menentukan kos yang ditanggung oleh pihak Kementerian Kesihatan untuk seorang pesakit kencing manis. Kajian ini turut meramal sumber dan kos diperlukan dalam penambahbaikan program tersebut untuk memperoleh keputusan darah HbA1c of $\leq 6.5\%$ sebanyak 50% dan 70% dari jumlah pesakit kencing manis di klinik tersebut.

Keputusan: Carta alir dan carta klinikal untuk process *Pendekatan Berpasukan* tersebut divisualisasikan dan dirumuskan dalam *'Diabetes Patient Process Flow Chart (DPPF)'* dan '*Integrated Care Pathway of Diabetes Management (ICPDM)'*. Penilaian proses yang dijalankan mendapati faktor mempengaruhi *Pendekatan Berpasukan* adalah *kepimpinan ketua klinik, sumber manusia, fasiliti dan peralatan kesihatan, pengurusan maklumat pesakit, variasi dalam penyampaian konsultasi, komitmen pesakit, penerimaan terhadap ilmu baru, stigma penggunaan insulin* dan *kesan pandemik Covid-19.* Markah yang diperoleh dalam penilaian aspek k*adar pesakit menyertai program, jumlah perkhidmatan diberikan* dan *kualiti rawatan* merangkumi dari 0% hingga 100%. *Kadar pelaksanaan Pendekatan Berpasukan* tersebut memperoleh markah sebanyak 57%. Kos untuk merawat seorang pesakit kencing manis pada tahun 2020 adalah sebanyak RM1,330.05. Untuk memperoleh keputusan HbA1C of ≤ 6.5% untuk 50% dan 70% dari jumlah keseluruhan pesakit kencing manis di klinik tersebut pada tahun yang sama, kos rawatan adalah RM1,659.34 dan RM 2,117.68.

Kesimpulan: Kajian ini melakukan penilaian yang menyeluruh terhadap pelaksanaan *Pendekatan Berpasukan* dalam rawatan penyakit kencing manis di peringkat klinik kesihatan. Carta alir dan carta klinikal dapat memastikan piawaian dalam pelaksanaan rawatan kencing manis adalah konsisten dan pada masa yang sama memudahkan perkongsian maklumat pelaksanaan *Pendekatan Berpasukan* untuk kegunaan klinik lain. Penilaian proses ke atas program tersebut telah pengenalpasti kelemahan dan kekuatan sedia ada. Maklumat-maklumat ini akan membantu pihak Kementerian Kesihatan dalam perancangan kewangan dan keperluan lain bagi penambahbaikan *Pendekatan Berpasukan* dalam rawatan kencing manis di peringkat kesihatan awam.

Kata Kunci: Pendekatan Berpasukan, rawatan kencing manis, penilaian proses, penilaian kos, carta klinikal rawatan kencing manis, carta alir rawatan kencing manis

ABSTRACT

Introduction: The Team Approach is a patient-centred multidisciplinary approach in the management of diabetes that aims to empower patients in the self-care towards achieving good diabetes control. This study began with the development of the flow chart and clinical pathway of the Team Approach that guided the process evaluation and cost analysis of the program and the additional costs that required to improve the program.

Methodology: This study consisted of three parts. Part 1 of the study is the design and development of a flow chart and clinical pathway that was developed from observing the work processes and activities of the Team Approach at the Simpang Kuala health clinic. The development of the flow chart and clinical pathway was based on the 10-step framework for developing and disseminating clinical pathway by the Centre of Evidence-based Practice, University of Pennsylvania Health System, Philadelphia. Part 2 was a process evaluation of the Team Approach on the program's *context, reach, dose delivered, fidelity,* and *implementation*. Part 3 of the research was a cost analysis of the Team Approach using the top-down and bottom-up costing approach to determine the cost per patient from providers' perspective. Additional resources and costs required to expand the program to achieve 50% and 70% of patients with HbA1c level ≤6.5% was also forecasted.

Result: The Diabetes Patient Process Flow Chart (DPPF) and the Integrated Care Pathway of Diabetes Management (ICPDM) of the Team Approach work processes were visualized using the Business Process Model and Notation tool and the time-task matrix format of a chain model. The process evaluation discovered factors that influenced the implementation of Team Approach was the leadership of the clinic's manager, human resource, facilities and equipment, health informatics, variations in

consultation practices, commitments of patients, acceptance of new knowledge, stigma on insulin use and the effect of Covid-19 pandemic. The scores obtained in the evaluation of *reach, dose delivered and fidelity* of the services and consultations in the Team Approach ranged from 0% to 100%. The overall score for the *implementation* of the Team Approach in diabetes management and care was 57%. The cost of treatment for diabetes patient in 2020 was RM1,330.05 per patient. To achieve 50% and 70% of the total diabetes patients with HbA1c of ≤6.5% in the same year, the cost per patient will be RM1,659.34 and RM2,117.68 respectively.

Conclusion: The research is a comprehensive study of the Team Approach in diabetes management in a primary care setting. The flow chart and clinical pathway will be useful in standardizing the delivery of care and sharing of practices among other clinics. Whilst the process evaluation enabled the weaknesses of the program to be identified, thus aiding future improvements and guiding the Ministry of Health in the planning resources and funding for the management and care of diabetes mellitus in Malaysia.

Keywords: Team Approach in diabetes management, multidisciplinary approach in diabetes management, process evaluation, cost analysis, clinical pathway, flow chart

CHAPTER 1

INTRODUCTION

The current study examined the process evaluation of the Team Approach in diabetes management at the Simpang Kuala health clinic, followed by a cost analysis of the program to determine the resources required to improve the target in diabetes care at the clinic. Since process evaluation requires comparison to a standard and cost analysis requires a clinical pathway to guide its data collection, the study began with the development of a process flow chart and clinical pathway that illustrates the work processes and activities of the Team Approach in diabetes management at the clinic.

This chapter begins with an introduction of diabetes mellitus and its complications, prevalence, and primary care management. For further comprehension, an introduction to the concepts of process flow chart, clinical pathway, process evaluation, and cost analysis were provided. The chapter concludes with the research questions and objectives.

1.1 Diabetes Mellitus

Diabetes mellitus is a group of disorders that are characterized as having hyperglycaemia in the absence of treatment (WHO, 2019). The pathology of diabetes mellitus is due to either defect in insulin secretion or insulin action, or because of disturbance of the body's carbohydrate, fat and protein metabolism. To date, diabetes mellitus can be categorized into six main types of diagnosis with many other specific subtypes. However, the two major types of diabetes remain type 1 diabetes and type 2 diabetes whereby the latter accounts for 90%-95% of total diabetes population. Type 2 diabetes remains the highest proportion in both low- and middle-income country. Globally, the increase of diabetes mellitus is associated with rapid change in social, culture and economic, ageing populations, increasing and unplanned urbanization,

increasing consumption of highly processed foods and sugar sweetened beverages, obesity, reduced physical activity, and practicing unhealthy lifestyle and behavioural patterns.

The cause of diabetes complications was mainly due to the body's prolonged hyperglycaemic state, which triggers various metabolic derangements that lead to various macrovascular and microvascular complications (Sato *et al.*, 2006). Diabetes complications are classified as either acute or chronic. Acute complications for diabetes include hypoglycaemia, hyperglycaemic state (diabetes ketoacidosis and hyperosmolar hypoketotic state) and microbial infection. Chronic diabetes complications include microvascular (retinopathy, nephropathy and neuropathy) and macrovascular (cardiovascular disease, cerebrovascular events and peripheral vascular disease) (MOH, 2020a). Microvascular and macrovascular disorders were 10 to 20 times higher among diabetes patients as compared to individual without diabetes (Gregg *et al.*, 2016).

Diabetes mellitus is a widely known noncommunicable disease that affects not only high-income countries, but increased prevalence was also reported mainly in the low and middle-income countries over the past decade (Roglic, 2016). Globally, it was estimated that 422 million adults developed diabetes in 2014 as compared to 108 million in 1980. It was also estimated that the number of adults with diabetes will surpass 700 million worldwide by the year 2025 (Zhou *et al.*, 2016).

Globally, the World Health Organization (2019) reported that almost 4 million deaths occur annually due to high blood glucose level that led to increased risk of developing cardiovascular events, cerebrovascular events, and other diabetes-related complications (Roglic, 2016). From the economic perspective, the global health

spending for diabetes mellitus for adults cost a staggering USD 850 billion for the year 2017 (IDF, 2017).

1.2 Diabetes Mellitus in Malaysia

There is an increasing trend of diabetes mellitus in Malaysia. The prevalence of diabetes mellitus was 11.2% in 2011, which increased to 18.3% in the year 2019. In the same year, Kedah ranked the 4th highest in the prevalence of diabetes mellitus at 24.9%, exceeding that of Malaysia (IPH, 2020a). Figure 1.1 shows the prevalence of diabetes mellitus in Malaysia based on the Malaysian National Health and Morbidity Survey 2019 (IPH, 2020a).

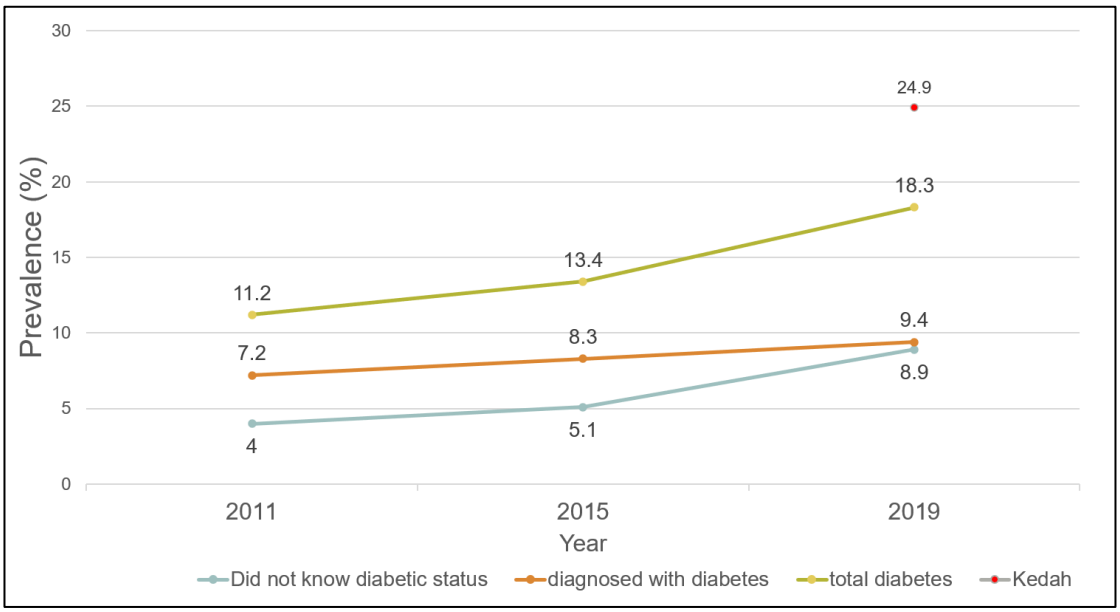

Figure 1.1. Prevalence of diabetes in Malaysia (IPH, 2020a)

The National Diabetes Registry (NDR) in Malaysia documents the sociodemographic information, clinical findings, investigations, and complications of diabetes patients. Retinopathy, nephropathy, erectile dysfunction, diabetes foot ulcer, ischemic heart disease, and cerebrovascular disease were the complications of diabetes that were recorded in the registry..

Table 1.1 shows the prevalence of diabetes complication in 2019 from the NDR report (MOH, 2020b). Treatment of these complications was costly. Based on the

finding by Mustapha *et al.* (2017a), it was estimated that the total cost of care for diabetes mellitus and its complications in Malaysia for the 2011 was RM 2.04 billion, with the Malaysian government spending RM 1.4 billion of the total cost.

Table 1.1 Prevalence of diabetes complication for diabetes in Malaysia based on NDR.

Complication	**Prevalence (2019)**
Retinopathy	10.6%
Nephropathy	14.6%
Erectile Dysfunction	14.5%
Diabetes foot Ulcer	1.2%
Ischemic Heart Disease	5.9%
Cerebrovascular disease	1.8%

Adapted from the National Diabetes Registry report 2013-2019 (MOH, 2020b)

1.3 The World Health Organization recommendations in managing diabetes.

Advances in medical knowledge have not yet resulted in the prevention of type 1 diabetes mellitus. However, current knowledge has been able to identify effective approaches in preventing type 2 diabetes mellitus and lowering the risk of developing complications and dying from diabetes. The World Health Organization (Roglic, 2016) emphasised that similar to many other diseases, the prevention of diabetes mellitus requires not only the government, but involves the whole society to take a life-course perspective that includes practising healthy lifestyle such as healthy eating and physical activities at an early age and mitigating the risk of type 2 diabetes at a later stage of life.

The World Health Organization has proposed two strategies to effectively prevent diabetes and its complications. The first strategy focuses on designing population-wide interventions that promote healthy eating and physical activity. The

second strategy was to diagnose diabetes mellitus as early as possible, utilising a mechanism that facilitates easy access to diabetes diagnostics and a referral system for further evaluation and treatment. The second strategy entails the implementation of cost-effective and holistic interventions aimed at reducing cardiovascular risk and diabetes complications. To comply with the recommendations of the World Health Organization, national policies in managing diabetes need to include interventions that promotes and support healthy lifestyle for the entire population while ensuring adequate medication for blood sugar control and medication that reduces the risk of developing cardiovascular disease. It is equally important for a national policy to ensure the provision of service delivered that enabled early detection of diabetes complications, timely referral from primary care to secondary or tertiary care and access to person-centred care by a multidisciplinary team.

1.4 The Team Approach in diabetes management in Malaysia

The Team Approach in diabetes management (TADM) was first introduced in the clinical practice guideline (CPG) 'Management of Type 2 Diabetes Mellitus 4th edition' (MOH, 2009a). It is a multidisciplinary approach for diabetes management in which the patient is the core member of the team and supported by five healthcare professionals: primary care practitioner, diabetes educator, dietitian, physician/endocrinologist/diabetologist, ophthalmologist/optometrist and oral health professional. The goal of TADM is to provide early treatment for blood sugar control and to enable early detection of diabetes complications for early referral. The TADM also serves as a holistic intervention to empower patients for self-care by increasing their understanding of the disease, its impact on health, and the importance of management (MOH, 2020a). In the latest CPG 'Management of Type II Diabetes

Mellitus 6th edition', pharmacist, registered nurses, and assistant medical officers were added to the team (Figure 1.2).

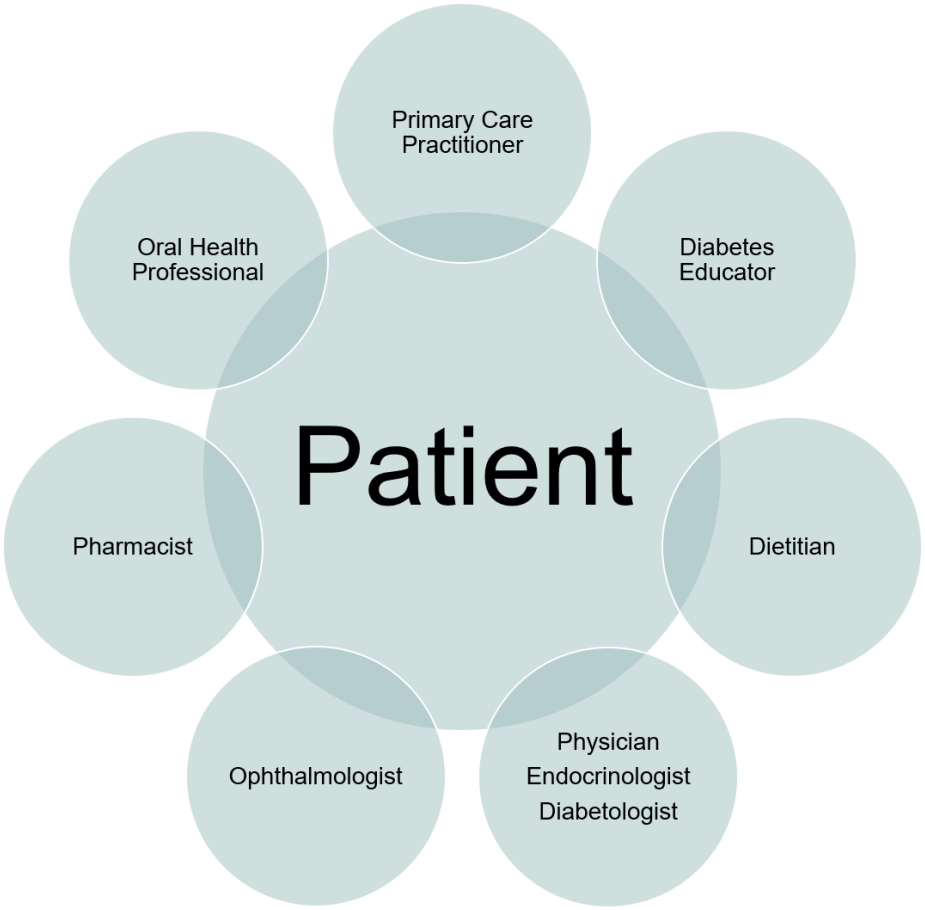

Figure 1.2. Multidisciplinary healthcare workers involved in the Team Approach

Table 1.2 depicts the detailed job descriptions for primary care practitioners, diabetes educators, dietitians, registered nurses, assistant medical officers, physician/endocrinologist/diabetologist, ophthalmologist/optometrist, pharmacist, and oral health professionals in the TADM. Apart from the introduction of the team members and their job descriptions, the CPG did not provide any guidance for the TADM. Hence, the content, duration, and frequency of service delivery of the TADM depended on patients' need and resources available at each health clinic.

Table 1.2. Task descriptions of the Team Approach members

Professionals	Task descriptions
Primary Care practitioner	• Initial assessment of patient (physical examination, blood investigation and pharmacological treatment) • Coordinating treatment management • Education and counselling session • Overall patient manager
Diabetes Educator	Facilitating knowledge and skills on: • healthy eating • physical activity • self-monitoring • medication usage • setting goals • problem solving • risk reduction practice • smoking cessation • keeping medical appointment
Pharmacist	• Ensuring adherence to medication • Giving information about medication • Training on insulin administration and adjustment
Dietitian	• Dietary education • Individualized diet plan • Identify and address problems related to diet
Registered nurse and assistant medical officer	• Early assessment prior seeing primary care practitioner. • Medical administration counselling • Assessment of medication adherence, medication tolerability, and other diabetes related issue
Physician Endocrinologist Diabetologist	• Facilitate the managements of patients with complicated problem related to diabetes
Pharmacist	• Ensuring adherence to medication • Provide information on mode of action and side effect of medications. • Train patients for administration and dose adjustment of insulin
Ophthalmologist Optometrist	• Further assessment and managements of retinopathy and other eye problems
Oral health professionals	• Routine oral health examination • Oral health education • Treatment of oral health diseases

1.5 Process Flow Chart and Clinical Pathway

A flow chart is a diagrammatic representation of a process or workflow (Chapin, 2003). Sterneckert (2003) explained that flow charts are performed for three purposes which are for 1) comprehension, where the construction of flow chart highlights areas that the user do not have a thorough understanding of the system, 2) evaluation, in which the user creates flow chart to recognize patterns that visualized a program's strength and limitations, and 3) communication, where the user construct flow chart for the purpose to communicate their understanding of the system of a program or intervention to other parties. The Object Management Group (OMG, 1989) was able to acquire ratifications from the International Organization for Standardization (ISO) on a number of their flow chart tools. One of the flow charts tools that can be used for process mapping is the Business Process Modelling and Notation. The tool converts internal business procedures into graphical notation to communicate these procedures in a standard manner and facilitate collaborations and business transactions between organizations (OMG, 2022).

A clinical pathway is a structured multidisciplinary treatment care plan translated from guidelines or scientific evidence into a pathway, algorithm, or protocol with the aim to standardize care for an episode of healthcare management in a specific population (Lawal *et al.*, 2016). There are three types of clinical pathway model that are commonly used and were based on the level of certainty of treatment for disease and level of cooperation in the multidisciplinary team (Ismail *et al.*, 2015). Out of the three model, this research utilizes the "chain model", which is used when the treatment plan for a disease is clear and concise with good multidisciplinary cooperation. The other two model is the "hub model", used when the treatment plan is vague due to the

complexity of the disease, and the “web model”, used when treatment could provide a coherent expected outcome for a disease.

1.6 Process Evaluation

Process evaluation is the assessment of the methods or course of action that allow for an intervention in achieving its success or failure (Linnan and Steckler, 2002). Process evaluation aims to gain detailed insight into how a program or intervention is being implemented and identify its strengths and weaknesses, provide an outline as to how a program needs to be implemented within its target population, compare its actual implementation to the proposed intervention, and at the same time perform documentation of the program's implementation as well as its strengths and weaknesses to allow others to replicate and improve them (Hulscher *et al.*, 2003). Process evaluation helps its users understand the relationship between programs, processes, and their outcomes by monitoring and documenting program implementation. As its importance and utilisation have grown, so have its scope and implementation in public health interventions (Linnan and Steckler, 2002). Aside from assessing public health interventions, process evaluation was also used for quality improvement planning and implementation, resulting in improved public health program’s quality (Patel *et al.*, 2014). The function of process evaluation varies according to the stage in which a program or intervention is currently implemented (Moore *et al.*, 2015). For programs that are still in the pilot phase, process evaluation provides comprehension of the intervention to optimise its design and outcome. However, for programs that are already being implemented, process evaluation may provide insights on the elements that support or deter the overall effectiveness of the program, while ensuring positive elements that support its success can be continued and practised in other settings and the negative elements can be improved.

Process evaluation has undergone a great deal of advancement over the past few decades as more researchers have understood the importance of identifying the elements that contribute to the success or failure of an intervention. Process evaluation in different settings can be guided by several frameworks and models. Due to the nature of public health programs that are in abundance, but lack proper evaluation framework, Linnan and Steckler (2002) introduced the 'Process Evaluation for Public Health Intervention and Research'. The framework not only provided clear and consistent definition for the evaluation of key processes, but also introduced systematic processes in the planning and development of the process evaluation. According to Linnan and Steckler (2002), process evaluation can be assessed based on seven components which are *context* that assessed the program's or intervention's environment that affects it, *reach* that measures the degree of which the intended audience participates in the intervention, *dose delivered* that calculates the proportion of the intended intervention that was delivered to the program participants, *dose receive* that evaluates outcome of the intervention on the participants, *fidelity* that evaluates the quality of the intervention, *implementation* that appraised the overall execution of the intervention, and *recruitment* that examine the resources and approach that were adopted to attract programs participants.

Sawtell *et al.* (2015), Fotu *et al.* (2011), Baranowski and Stables (2000), Glasgow *et al.* (1999) and many others conducted evaluations of health programs differently, using various measures of assessment. The Medical Research Council Population Health Sciences Research Network (Campbell *et al.*, 2000; Craig *et al.*, 2008; Moore *et al.*, 2015) also introduced a series of guidelines for process evaluation of complex interventions. Nevertheless, since the guideline only measures fidelity, dose and outcome, only new public health intervention can be evaluated.

It can be argued that the ‘Process Evaluation of Public Health Interventions and Research’ by Linnan and Steckler (2002) is more relevant for the evaluation of public health interventions and programs as it is more specific, well defined and provide sufficient insight on the purpose of each component. Saunders *et al.* (2005) developed a process evaluation framework for assessing health promotion program and intervention that was adopted from Linnan and Steckler (2002), but with the addition of the eightth component; *resource*.

Process evaluation when paired with the use of a flow chart creates a synergistic outcome (Martin, 1982) due to the ability of the flow chart to capture and visualize the entire process involved in a program. During the mapping of the flow chart, Dos Santos *et al.* (2020) in their study were able to identify key areas that needed improvements and, at the same time, directly implement improvements in the quality of care for diabetes foot ulcer management.

Clinical pathways, as explained by Kitchiner *et al.* (1996), can be used for both the establishment of treatment protocols within an institution and as an evaluation tool within the context of its clinical practise. This is because the clinical pathway was developed after careful evaluation of the organization's best clinical practises, a thorough examination of the relevant literature, and the incorporation of national guidelines for the treatment of specific diseases. Any deviation or alteration from the clinical pathway can be considered a breech of the standard clinical practise. Rotter *et al.* (2019) describe similar usage of clinical pathways for evaluation reasons, stating that they translate recommendations and evidence into local contexts, give detailed treatment steps, and standardise care for a specific disease.

1.7 Cost Analysis

Cost analysis is a partial economic evaluation; it measures only the cost component of a single program without comparison against the cost of an alternative program (Drummond *et al.*, 2015). The Joint Learning Network developed the 'Costing of Health Services for Provider Payment' to guide resource identification, measurement and valuation of health services (Özaltın and Cashin, 2014). The manual describes the costing exercise into three parts: part 1 involves determining the purpose of the costing, part 2 involves developing a plan for data collection, processing and data analysis, and part 3 involves communicating the costing results to the target audience through a written report.

Research by Lee *et al.* (2003) and Porter and Rayner (1992) used flow chart in their cost exercise as a guide for the identification of resources used in their organization. The use of flow charts in identifying organisational resources was made possible because the development of a flow chart requires the user to have a comprehensive understanding of the inputs, processes, and outputs of a particular intervention or program.

Often time costing exercise in the healthcare setting uses Diagnosis Related Group (DRG) system. However in the Malaysian MOH, such a system were only applicable in the hospital setting. Feyrer *et al.* (2005) explains they use clinical pathway for their cost exercise. Since each healthcare facility's clinical pathways will be unique to itself and will incorporate the facility's own resources and treatment plan, this method will be most useful in the primary care context.

1.8 Problem Statement

The Simpang Kuala health clinic is one of the numerous government health clinics in the Kota Setar District. Despite having a gazetted capability of providing healthcare services to 70 000 people in a community, it has managed to serve more than 100 000 patients. In terms of TADM, the clinic adheres to most of healthcare professionals recommended by the diabetes management CPG, in addition to providing additional services to their diabetes patients. Despite, heavy workload the clinic was still able to achieve the MOH goal of obtaining HbA1c of ≤ 6.5% for 30% of the clinic's diabetes patients over the past four years (2019- 2022). Consequently, the clinic was chosen for this research.

The implementation of the TADM at primary health clinics in Malaysia began in 2009. However, the evaluation of TADM on its implementation were limited. There was no evidence to support planning or better manage TADM's limited resources without any evaluation of the program. The scarcity of resources, as well as the rising cost of healthcare, will have an impact on the delivery of services to patients. Without a process flow chart and clinical pathway to guide delivery of treatment and care, conflict among disciplines may occur, and standardisation of the TADM cannot be achieved. Standardization of practise is important in maintaining the quality of care. The implementation of the TADM also tends to differ between clinics due to the variation in resources available at each clinic.

The increasing prevalence of diabetes in Malaysia will require the expansion of the TADM. However, the TADM is time consuming and expensive. Previous cost analyses and economic evaluations of diabetes management in primary care settings have never used a team approach to diabetes management. Without evidence of the program cost, budget application leads to inconsistent and non-targeted funding

allocations for this program, leading to sub-optimal implementation. Efforts to expand the TADM are also hindered since there is no available data on the projected cost needed to offer the service to more patients.

1.9 Study Rationale

The presence and utilisation of flow chart and clinical pathway may reduce miscommunication between disciplines and provide an optimal standard of care to diabetes patients. Process evaluation of the Team Approach will aid in identifying elements that influence the performance of the program, whereas obtaining the costs of the Team Approach in diabetes management will provide valuable data for stakeholders in planning and managing available resources to expand the service to more patients. With the availability of both types of information, policymakers may improve the Team Approach in diabetes management while ensuring resources are used at their peak efficiency in achieving the best outcome.

1.10 Research Questions

1. What is the flow chart and clinical pathway of the Team Approach in diabetes management at the Simpang Kuala health clinic?
2. How is the implementation of Team Approach in diabetes management at the Simpang Kuala health clinic?
3. How much is the cost of the Team Approach in diabetes management at the Simpang Kuala health clinic from the provider's perspective?
4. How much cost are required to enhance the Team Approach in diabetes management at the Simpang Kuala health clinic to achieve 50% and 70% of patients with HbA1c of $\leq$ 6.5%?

1.11 Objective

1.11.1 General Objective

To conduct a process evaluation and cost analysis of the Team Approach in diabetes management at the Simpang Kuala health clinic, Kota Setar.

1.11.2 Specific Objectives

1. To develop a process flow chart and clinical pathway for Team Approach in Diabetes Management in Simpang Kuala health clinic
2. To evaluate the process of the Team Approach in diabetes management at the Simpang Kuala health clinic.
3. To calculate the provider's cost of the Team Approach in diabetes management program at the Simpang Kuala health clinic.
4. To estimate the cost required to enhance the Team Approach in diabetes management at the Simpang Kuala health clinic to achieve 50% and 70% of patients with HbA1c of $\leq 6.5\%$

CHAPTER 2

LITERATURE REVIEW

The search of papers in this study was done using an online search engine and database that includes Springer Link, Taylor & Francis Online, Google Scholar, Science Direct, Cambridge University Press, The Lancet, BMC, SAGE journals, Europe PMC, Wiley Online Library, American Diabetes Association, National Library of Medicine, Frontiers, Indian Journal of Public Health, British Journal of General Practice, IEEE Explore, Sabinet African Journal, Malaysian Medical Repository, Scientific Electronic Library Online, Journal of American Board of Family Medicine, and Annals of Family Medicine. Several searching strategies were applied including the use of Boolean operators, "AND", "OR" and "NOT". The keywords used were multidisciplinary approach in diabetes management, diabetes management in primary care, clinical pathway, flow charts, process evaluation in primary care, cost analysis in primary care and cost for diabetes management. The papers cover the time period from 1983 all the way up to 2020. All of the papers were either written or translated in the English language.

2.1 Diabetes Management in Primary Care Setting

Diabetes management and care in Australia, like in Malaysia, falls under the purview of primary health care services (Health and Welfare, 2016). A review paper by Tan *et al.* (2020) reported that diabetes management and care were placed under the responsibility of general practitioners who were tasked to develop multidisciplinary care plan for their diabetes patients. Their policy highlights the importance of partnership between private and governmental sectors in delivering optimal diabetes management and care to diabetes patients. In the private sector, the healthcare professionals who were involved include general practitioners, medical specialists,

dietitians, practise nurses, optometrists, pharmacists, physiotherapists, and podiatrists. On the other hand, in the public sector, the healthcare professionals who were involved include aboriginal health education officers and aboriginal community workers, diabetes educators, and dietitians. In essence, a partnership of this kind does lessen the burden of economic responsibility that was borne by the government. However, the disadvantage of depending solely on the private sector to manage and deliver care for diabetes in Australia was that general practitioners, in their capacity as case managers for patients, provided minimal collaboration with other healthcare providers. Another issue that was discovered was that public health providers who had been delegated to a particular region for the purpose of managing the health of a community made very few referrals to general practitioners as a result of their restricted competence and function.

According to Noor Abdulhadi *et al.* (2013), in Oman, the Ministry of Health was the primary healthcare provider for the country, and the government fully subsidises the costs of medical care. Concerning the delivery of their diabetes management and care, diabetes patients initially sought treatment at primary healthcare centres before being referred to secondary or tertiary facilities for more specialised care. General practitioners, practise nurses, pharmacists, laboratory technicians, dietitians, and health educators were members of the multidisciplinary teams. However, their diabetes management and care suffer from substandard care due to the excessive workload of general practitioners and practise nurses, the shortage of diabetes nurses, dietitians, and health educators, and the absence of podiatrists in their multidisciplinary team (Abdulhadi *et al.*, 2006).

Insurance-based payments make up the majority of the budget for Indonesia's healthcare system (Soewondo *et al.*, 2013a). In terms of their diabetes management

and care, a meta-analysis conducted by Ligita *et al.* (2018) describes that the entry point of diabetes patients, which involved screening and early treatments, were through public health centres, while referral to secondary and tertiary centre were made when there were indications. The members of their multidisciplinary team for the management and care of diabetes include general practitioners, specialists such as internists, endocrinologists, infectious disease specialists, vascular surgeons, plastic surgeons, cardiologists, and orthopaedic surgeons, as well as nurses, pharmacists, dietitians, and diabetes educators. Ligita *et al.* (2018) further elaborated that one of the prominent issues arises for their diabetes management and care was due to insufficient funding, as 37% of the population does not have any sort of insurance coverage. As a result of insufficient funding, the provision of medication was restricted, particularly in the more remote locations, and dietitians could only be found working in hospital settings. Meanwhile, Malini *et al.* (2017) discovered that their healthcare workers lack adequate knowledge and skill for the delivery of diabetes education, and Soewondo *et al.* (2013b) discovered that the distribution of healthcare professionals were more weighted to urban regions.

The United Kingdom health care expenses were funded by their government (Connolly *et al.*, 2010). As in other countries, Bain *et al.* (2019) describe the structure of the United Kingdom's diabetes management and care starts at the primary care setting as early screening and treatment were provided to diabetes patients where their multidisciplinary teams consist of primary care physicians that acts as the case manager, working together with podiatrist, nurses, dietitians. Complex diabetes cases will then be referred to an outpatient hospital setting and managed by their interdisciplinary care service, which includes endocrinologists as case managers, as well as ophthalmologists, cardiologists, nephrologists, a diabetes foot team, and the primary care practitioner if their services are

required. Bain *et al.* (2019) also describe the presence of an extended team consisting of a practise nurse, specialist medical practitioners such as an ophthalmologist and an obstetrician, exercise physiology, optometrist, psychologist, and social worker that aids in diabetes management and care; however, their involvement in either the primary care or hospital settings was not explicitly mentioned. The iDeal (Insight for Diabetes Excellence, Access, and Learning) group, whose members were experts from a variety of professions, in an article called 'Tackling The Biggest Challenge in Diabetes Care' (Kneschke, 2019), has identified difficulties that the United Kingdom's National Health Service needs to address in order to improve the nation's diabetes management and care program. The diabetes care program needs to introduce key performance indicators (KPI) that provide the standard of care that are required to be fulfilled for each patient, the need for healthcare facilities that achieved desirable treatment outcome to share their diabetes management and care process in the hope that it will allow the desired outcome to be achieved, the need to revamp the diabetes education curriculum and approach as only less than 8 percent uptake of the current health education program, and expanding the usage of self-blood glucose monitoring (SMBG) and offering enough knowledge to diabetes patients along with it to ensure they are able to use the information gained from SMBG for self-monitoring and self-management of their condition.

The primary source of funding for health care costs in the United States of America was covered by health insurance (Mainous III *et al.*, 2006) where Medicare and Medicaid provide coverage for the population that does not have private health insurance. According to their Centre of Disease Control and Prevention Agency (2022), their multidisciplinary team, also referred to as the diabetes care team, comprised of a primary care practitioner who primarily manages diabetes in the

primary care setting and refers patients to an endocrinologist when dealing with complex diabetes cases, manages diabetes patients with the support of registered dietitian, ophthalmologist or optometrist, podiatrist, audiologist, pharmacist, dentist, nephrologist and exercise specialist. However, other health care centres such as in one of a primary care residency teaching practice that was under Carolinas Healthcare System (Tapp *et al.*, 2012) define their multidisciplinary team consisting of physicians and nurses, behavioural medicine interns, pharmacists, social workers, and information technology specialists and office schedulers whereas the multidisciplinary team approach being practice in the state of Oklahoma (Codispoti *et al.*, 2004) consist of physicians, nurses, pharmacists, dietitians, and health educators as its team members. Despite the fact that United states of America has one of the strongest economies, according to Boddiger (2006), the high cost of health care has forced many employer and insurance company to offer insurance plans and healthcare policies that fail to cover even the most basic needs of diabetes treatments. Since diabetes epidemics disproportionately affect low-income, urban, and minority populations, and since comprehensive health insurance that serves patients of all socioeconomic backgrounds is difficult to come by (and even more so for those in the middle class), the situation has only worsened. As a result, many people with diabetes lacked access to adequate medical care. In addition, Lutfiyya *et al.* (2017) noticed a continuing shortage of primary care physicians, resulting in the disruption of their primary healthcare delivery.

Table 2.1 provides a summary of the multidisciplinary team members for their diabetes management and care for the respective nations.

Table 2.1. Members in multidisciplinary team for diabetes care.

Country	**Members in the Multidisciplinary Team**	**Issues in Diabetes Management and Care**
Australia	*Private Health Sector:* General practitioner, medical specialist, dietitian, practice nurse, optometrist, pharmacist, physiotherapist, and podiatrist *Public sectors:* Aboriginal health education officer and aboriginal community worker, diabetes educator and dietitian	• Minimal collaboration between general practitioners and allied health professionals • Public sector referrals to general practitioner were minimal.
Omen	General practitioner, practice nurse, pharmacist, lab technician, dietitian, and health educators	• High patient load • Insufficient dietitian, health educators and diabetes educators • Absence of podiatrist
Indonesia	General practitioner, specialized doctors, nurse, pharmacist, dietitian, and diabetes educators	• Insufficient insurance coverage • Limited diabetes medication supply • Unbalance workforce distribution between urban and rural • Dietitian only at hospital setting. • Lack adequate knowledge for diabetes management and care

Table 2.1. Continued

Country	Members in the Multidisciplinary Team	Issues in diabetes management and care
United Kingdom	Primary care physician's podiatrist, nurses, dietitians, endocrinologists, ophthalmologists, cardiologists, nephrologists, and diabetes foot team,	• No target key performance indicators • No sharing of knowledge between health facility • Low diabetes education uptake • Underutilize of SMBG
United States of America	Primary care practitioner, Endocrinologist, registered dietitian, ophthalmologist or optometrist, podiatrist, audiologist, pharmacist, dentist, nephrologist, and exercise specialist	• Lack of insurance coverage • Low number of primary care practitioner • Diverse member compositions in the multidisciplinary team.

2.2 Process Evaluation in Healthcare Programs

Basa and McLeod (1995) performed a comprehensive evaluation on the education program of non-insulin dependent diabetes patients at the Diabetes Specialist Centre, Vancouver, Canada. The education program involves a multidisciplinary team consisting of medical diabetes specialist, two nurses, and a dietitian with the addition of physiotherapist, social workers, and pharmacist. The evaluation places a strong emphasis on the appropriateness of the centre's facility and personnel in the provision of education and treatment (structural evaluation), the activities carried out during the education program (process evaluation), and the impact of the program on participants' blood sugar levels (outcome evaluation). Four parameters were identified and measures pre and post programs which were diabetes knowledge using a knowledge

test developed by the Michigan Diabetes Research and Training Centre (Hess and Davis, 1983) with a scoring system of 0 to 100, emotional adjustments by using the ATT39 attitude scale (Dunn *et al.*, 1986) that scores from -72 to 72, quality of life by using 5-point Likert scale questioner that focuses on patients perception of diabetes affecting their lives , and metabolic control by using HbA1c level as its proxy. In terms of the structured evaluation, there was a lack of distinct parameters that were specified and evaluated. Due to the fact that the objective of the structured evaluation is to determine whether or not there was adequate amount of manpower and facilities, the research could have used their patient load as an indicator for human resource and the number of patients who used the facilities and equipment as an indicator for facilities evaluation. Similarly, the process evaluation performed in their research was merely making subjective assessments without establishing appropriate indicator. The process evaluation should include quantitative evaluation in assessing the activities involving the health education program. In terms of their outcome evaluation, the parameters for the evaluation were properly defined and appropriate to identify the effects of the diabetes education program. The researcher did, however, emphasise that the majority of interventions performed on diabetes patients in the centre focused on diabetes treatment rather than diabetes education. Thus, it was difficult to discriminate between the outcome measures allocated were the result of the diabetes treatment counselling session or the diabetes education program.

Pakistan has been practicing an integrated diabetes care, where its services being provided by medical and allied health in both community health centres and sub-districts hospitals. The diabetes management and care were primarily public funded where diabetes patients receive free treatments. Although treatment for diabetes patients for Pakistan were free, Khan *et al.* (2018) describe in his research that their

diabetes management and care provided in Pakistan lacks contextual guideline, leading to inadequate levels of care being provided. The discovery was based on their process evaluation, which assessed the program's fidelity, program's implementation from both the patient and provider perspectives, and identified elements that require improvement. The process evaluation included the gathering of both quantitative and qualitative evaluation from four primary care institutions, two rural health centres, and two urban sub-district hospitals. Five essential aspects of diabetes management and care were evaluated: screening and diagnosing diabetes patients, providing medications, providing lifestyle modification counselling, follow ups and referral, and resources used for diabetes and management care. The research established precise definitions for both the quantitative and qualitative variables that were being measured and evaluated. The mixed-method approach used to interpret the findings allowed the author obtain insight into diabetes management and care practises in the country from the perspectives of both providers and patients. In conclusion, this research focuses on the evaluation of the process ad execution of their diabetes management and care while also identifying the program's strengths and weaknesses that require attention.

Process evaluation could be carried out at any point in a program's development. Carroll *et al.* (2015) evaluated their Diabetes Prevention Program and Healthy Living Program, which were a diabetes prevention program, while they were in their pilot phase. The study focuses on the feasibility evaluation of both recruitment and early program implementation in four primary care practises in New York, United States of America. The evaluation's findings for both program's recruiting suffer from the program's rigorous eligibility requirements, a lack of standardised methodologies for diagnosing prediabetes disorders, labour and time-intensive enrolment procedures, and a lack of on-site diagnostic testing. In the meantime, feasibility analysis on both