REVIEW ARTICLE

Scoping Review of Community-Based Interventions to Improve Diabetes Control in Malaysian Adults

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ABSTRACT

Type 2 diabetes mellitus (T2DM) is a major non-communicable disease globally including Malaysia. Despite a huge amounts of funds spent for the management of T2DM including community-based interventions (CBIs), the national statistics on the prevalence, treatment outcomes and summary measures of these population health have not improved. Thus we conducted a scoping review to map the details of CBI used for diabetes control among adult T2DM in Malaysia. A scoping review that followed the standard PRISMA guideline in conducting and reporting a scoping review was conducted. A search for relevant journal articles were conducted on four electronic databases (PubMed, SCOPUS, Cochrane Library, and Google Scholar). The titles and abstract of the search results were screened to select eligible papers for full text retrieval. Eligible papers were those reporting CBI studies of adults diagnosed with Type 2 diabetes mellitus in Malaysia. Only studies using intervention designs were included. Thirteen studies were reviewed and had individually-oriented or group-based interventions, or a combination of both. There was limited adoption of behavioural theories in guiding these diabetes interventions. Outcomes of the interventions were inconsistent. Most studies yielded significant positive results on HbA1c, diabetes knowledge, blood pressure, blood sugar, and foot care practices; few demonstrated positive outcomes on self-efficacy, body mass index, physical activity; self-monitoring of blood glucose, medication adherence, smoking and alcohol consumption. Studies varied in their approaches and yield mixed effects on diabetes control. Nevertheless, most interventions demonstrated reductions of HbA1c, which is the main clinical outcome measured following the CBIs.

Keywords
diabetes education, diabetes mellitus, diabetes control, health promotion, self-management

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Received: 28 March 2024; Accepted: 4th July 2024

Doi: https://doi.org/10.31436/imjm.v24i01.2577

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a major public health concern across the globe including in Malaysia. National Health and Morbidity Survey 2019 (NHMS 2019) reported that approximately 3.9 million Malaysians are living with diabetes and the prevalence rate of diabetes has risen from 13.4% in 2015 to 18.3% in 2019.[1] Study has shown that obesity, advancing age, family history of diabetes, and living in a rural area are the important factors that drive the escalating prevalence of T2DM in Malaysia.[2]

Community-based interventions (CBIs) is a programs that target the entire population living within a specific location outside clinical or healthcare settings.[3] CBIs constitute a strategy employed to promote self-management among individuals living with diabetes, aligning with the overarching approach of strengthening community actions outlined in the Ottawa Charter for Health Promotion, endorsed in 1986. Despite a significant number of reviews assessing the effectiveness of community-based strategies in enhancing diabetes control among adults, the evidence concerning clinical parameters, knowledge transfer, and behaviour change remains inconclusive [3-5]

In view of insufficient evidence supporting specific approaches of CBIs in diabetes control and the impact of cultural influences on health behaviour modelling among Malaysian population, an analysis of the data via a scoping review on this subject shall provide an insight on the way forward for diabetes control among affected Malaysian populations. A scoping review seeks to examine the evidence found in relevant literature to present an overview and map key concepts underlying a particular research topic. Hence the use of a scoping review to investigate this topic is appropriate as the scope of studies may include heterogeneous studies in terms of design, methodology, and outcomes.

The objective of our scoping review is to map the CBIs which had been done to improve diabetes control among Malaysian adults. The following are the review questions:

I. What are the types of study designs used in published studies investigating CBIs to improve diabetes control among Malaysian adults?
II. What are the characteristics and types of these interventions that have been developed and implemented within Malaysian communities to improve their diabetes control?
III. What are the outcomes of these CBIs?

MATERIALS AND METHODS

Study design

The study was conducted in accordance with the JBI methodology for scoping reviews.[6] The study protocol has been registered with Open Science Framework (OSF registration number: osf-registrations-jmw6s-v1) and is accessible at this link: https://archive.org/details/osf-registrations-jmw6s-v1.

Eligibility criteria

We had only included community-based interventional (CBI) studies investigating adults in Malaysia who have been diagnosed with 2DM and excluded studies involving Type 1 Diabetes Mellitus (T1DM), prediabetes, and gestational diabetes. The CBIs which were reviewed and included were educational programmes, lectures, videos, hands-on activities, community projects, digital platforms and devices. Then, the relevance of the intervention in improving T2DM outcomes step was scrutinised and any intervention studies that were not related to improvement of health outcomes were excluded. In order to ensure that all reported efforts were accounted in the study, no timeframe was imposed as the eligibility criteria.

Data Extraction

Data were extracted from the eligible papers by three independent reviewers using a data extraction tool developed by the team. The extracted data were the specific details about the study participants, concept, context, study methods, and key findings relevant to the review questions. A drafted template of the extraction form was developed using Microsoft Word to collect data for analysis. The drafted data extraction tool was modified and revised necessarily during the data extraction process from each included evidence source. Any disagreements that arisen between the reviewers were resolved through discussion, or with the additional reviewers.

Assessment of Quality

The Effective Public Health Practice Project Quality Assessment Tool (EPHPP) (https://www.ephpp.ca/quality-assessment-tool-for-quantitative-studies/) was adopted to assess the methodological quality of the studies included in the review.[7] The quality assessment were performed by three independent reviewers. Each article was rated on the EPHPP six domains as strong (3 points), moderate (2 points) or weak (1 point). Domain scores were averaged to produce total scores with the maximum total score per study being 3.00. Based on the total scores, the studies were assigned an overall quality rating of strong (2.51–3.00), moderate (1.51–2.50) or weak (1.00–1.50) as recommended by the EPHPP guidelines. Studies with poor methodological quality were not excluded.

Data Analysis and Presentation

The extracted data were summarised and reported in a tabular form (numerical summary, using tables and charts), and as descriptive format. Quantitative analysis

(eg, frequency analysis) indicates the design and background of the targeted population (age); mode of educational delivery; duration; theoretical models used; and domain of the interventions. This provides a summary of the common intervention characteristics, coded and classified into overall categories, and main outcomes related to diabetes control. We reported the full review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). [8]

Literature Search

A total of 382 articles were imported for screening from the selected electronic database search in which 28 duplicate studies were removed and 354 articles were remained. Further screening on abstracts and titles resulted in the exclusion of 287 articles, leaving 67 articles for full-text screening. After a full-article screening performed, 13 articles were included into the final analysis (Figure I).

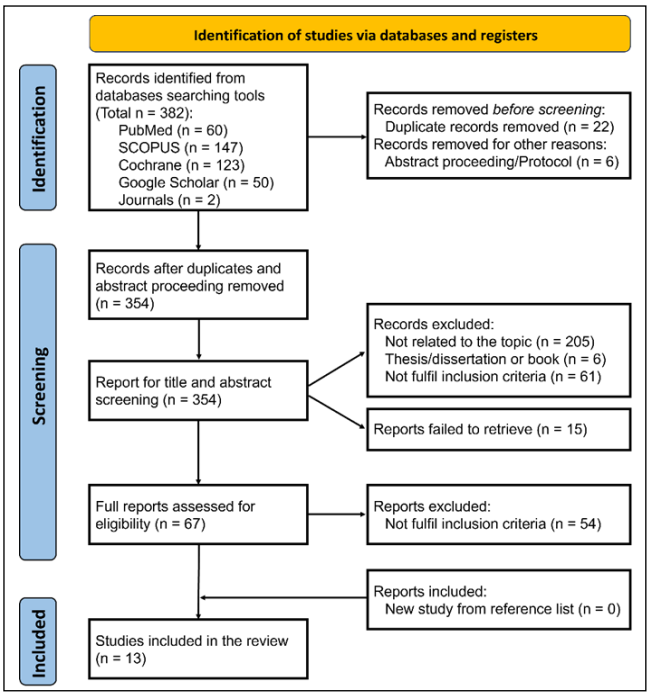

Figure 1: Selection of sources of evidence

Characteristic of the Identified Studies

The studies included in the final analysis were studies conducted between 2015 to July 2023. Although no timeframe was imposed on the study eligibility, the fact that all analyzed studies were between 2015-2023 indicated that CBIs have only recently taken hold in Malaysia. The types of study design, intervention, and behavioural theories employed are summarised in Table I. Majority of the studies employed randomised controlled trials (RCT) while two studies were of quasi-experimental design.

Out of the 13 studies analysed, four studies focused on improving the participants' medication adherence,[9-12] while another four aimed to improve on the participants' dietary habit or nutrition.[13-16] Conversely, the study by Sharoni *et al* had focused only on foot care among diabetes patients.[17] However, out of all studies analysed, only one study included oral health in their diabetes intervention programme.[18]

The use of tele-health approaches was reported by more recent studies, started from year 2018. The use of telecommunication was employed in two studies. Chan *et al* conducted personalised care reminder via phone call every three months while Zainordin *et a*l resorted to making phone call follow-ups due to the movement restriction during the pandemic.[16,19] A web-based health education programmes were reported by two studies[14,18] and Lee *et al* utilised digital technology to monitor patients' glycemic control via a gluco-telemeter that uploads patient's glucose readings to an online portal, and automated feedback is provided based-on the reading.[20]

In the analysis of theories behind these interventions, we found out that only four out of 13 studies documented the use of specific behaviour theories to guide their programs.[11,14,15,21] Our review revealed that the theories used for the interventions were the Chronic Care Model (CCM), Participatory Research Action (PAR), Transtheoretical Model (TTM), Stages of Change Model (SOC), A Hierarchical Model for Self-Efficacy, Extended Theory of Planned Behaviour (TPB), and Information-Motivation-Behavioural Skills Model (IMB).

Table I: Study design, intervention, and underpinning behavioural theory

Author, Year	Study design	Intervention	Underpinning Behavioural Theory
Butt M et al, 2015	RCT	Patient Education by Pharmacist Programme (PEPP)	None
Ramli AS et al, 2016	Cluster-RCT	EMPOWER-PAR (PAR=Participatory research action),	Chronic Care Model (CCM), Participatory Research Action (PAR)
Chee WSS et al, 2017	RCT	Malaysian customized Transcultural Diabetes Nutrition Algorithm (tDNA)	None
Sharoni SKA et al, 2017	Prequsi-experimental and Postquasi -experimental	Self-efficacy education programme on improving foot self-care behaviour	None
Ramadas A et al, 2018	RCT	Web-based dietary intervention programme	Transtheoretical Model (TTM), Stages of Change Model (SOC)
Gilcharan Singh HK et al, 2020	RCT	Malaysian customized Transcultural Diabetes Nutrition Algorithm (tDNA)	A Hierarchical Model for Self-Efficacy
Lee JY et al, 2020	RCT	Telemonitoring with gluco -telemeter	None
Rosli MR et al, 2021	RCT	Home medication review	None
Ting CY et al, 2021	RCT	Group-based intervention (MEDIHEALTH) to improve medication adherence	Extended Theory of Planned Behaviour (TPB), Information-Motivation-Behavioural Skills Model (IMB)
Zainordin NA et al, 2021	RCT	Meal replacement plan of low carbohydrate diet	None
Atoglable ET et al, 2023	RCT	Electronic educational materials on diabetes knowledge and medication adherence	None
Chan JCN et al, 2022	RCT	JADE Web-Based Management Guide on Risk Factors	None
Rusly NFS et al, 2022	Quasi-experimental	Online Diabetes Wellness Programme	None

Study outcomes

Table II summarises the key findings of the clinical outcomes as well as learning and behavioural outcomes. For clinical outcomes findings, ten studies reported HbA1c as an outcome measure. Out of these ten studies, nine studies reported significant improvements in HbA1c[9-11,13,15,16,19,21-20] while one study showed no change.[14] There were four studies reported on the fasting-blood glucose (FBG) level in which three studies[10,16,17] demonstrated a significant improvement in FBG whereas one study showed no improvement.[14] The other relevant clinical parameters that showed improvement include BMI,[13,16,18] body weight,[15,16,18-19] waist circumference,[13,16] LDL,[16] systolic blood pressure,[13] and inflammatory marker interleukin (IL)-6.[16]

For learning and behavioural outcomes, the measures that were reported include self-efficacy, diabetes-related knowledge, and behaviour. Self-efficacy improvements were noted in studies by Ting[11] and Gilcharan,[15] however, no changes were observed in Lee's study.[26] Improved diabetes-related knowledge was demonstrated by two studies.[14,18] Most studies reported on the behavioural change of their patients; namely improved medication adherence[9-10,12] foot care[17] information-seeking behaviour,[12] dietary intake, and longer duration of exercise.[13]

Table II: Outcomes of the community-based intervention

Author/ Year	Key Findings Post-intervention	
	Clinical outcomes	Learning & behavioural outcomes
Butt M et al, 2015	Improved HbA1c	Improved medication adherence
Ramli AS et al, 2016	Improved HbA1c	-
Chee WSS et al, 2017	Improved HbA1c, BMI, body weight, waist circumference and systolic blood pressure	Reduced calorie intake and longer exercise duration
Sharoni SKA et al, 2017	Improved FBG	Improved foot care
Ramadas A et al, 2018	No improvement in HbA1c and FBG	Improved Dietary Knowledge, Attitude and Behaviour
Gilcharan Singh HK et al, 2020	Improved HbA1c and reduced body weight	Improved self-efficacy
Lee JY et al, 2020	Improved HbA1c at 24 weeks but not sustained at 52 weeks	No improvement in self-efficacy
Rosli MR et al, 2021	Improved HbA1c and FBG	Improved medication adherence
Ting CY et al, 2021	Improved HbA1c	Improved self-efficacy
Zainordin NA et al, 2021	Improved HbA1c, FBG, increased LDL, BMI, body weight, waist & hip circumference and IL-6	Reduced calorie intake, higher protein intake
Atoglabe et al 2023	-	Improved medication adherence and information-seeking behaviour
Chan JCN et al, 2022	Improved HbA1c and LDL	-
Rusly NFS et al, 2022	Improved body weight and BMI	Improved knowledge and dietary intake

Study Quality

The overall quality of the studies in this review is weak, as measured by the EPHPP Tool (Table III). Only three studies scored strong[19] and moderate [10,11] respectively in the global rating, while the majority obtained a weak score. Of all the items used to assess the study quality, flaws were seen especially in selection bias, and the lack of blinding.

Table III: Study Quality

No	Author	Selection Bias	Design	Con-founders	Blinding	Data Collection Method	Withdrawal and drop-outs	Global rating
1	Butt, M.	Strong	Strong	Strong	Moderate	Strong	Strong	Strong
2	Chee, W. S. S.	Weak	Strong	Weak	Weak	Strong	Strong	Weak
3	Gil-charan Singh, H. K.	Weak	Strong	Weak	Weak	Strong	Strong	Weak
4	Lee, J. Y.	Weak	Strong	Strong	Weak	Strong	Strong	Weak
5	Ramadas, A.	Weak	Strong	Strong	Moderate	Strong	Weak	Weak
6	Ramli, A. S.	Weak	Strong	Strong	Weak	Strong	Strong	Weak
7	Rosli, M. R.	Weak	Strong	Strong	Moderate	Strong	Strong	Moderate
8	Sharoni, S.K.A.	Weak	Strong	Strong	Weak	Moderate	Strong	Weak
9	Ting, C.Y.	Weak	Strong	Strong	Strong	Strong	Strong	Moderate
10	Zainord in, N. A.	Weak	Strong	Strong	Weak	Strong	Strong	Weak
11	Atoglabe	Weak	Strong	Strong	Weak	Strong	Strong	Weak
12	Chan	Strong	Strong	Strong	Moderate	Strong	Moderate	Strong
13	Rusly	Weak	Moderate	Weak	Weak	Weak	Strong	Weak
	Sum weak n (%)	11 (84.6)	0 (0.0)	3 (23.1)	8 (61.5)	1 (7.7)	1 (7.7)	9 (69.2)
	Sum moderate n (%)	0 (0.0)	1 (7.7)	0 (0.0)	4 (30.8)	1 (7.7)	1 (7.7)	2 (15.4)
	Sum strong n (%)	1 (9.1)	12 (92.3)	10 (76.9)	1 (7.7)	11 (84.6)	11 (84.6)	(15.4)

DISCUSSION

Effective self-management of diabetes is essential for reducing complications, improving health status, and enhancing the quality of life for individuals living with the disease. In order to support this goal, many countries, including Malaysia, have adopted the approach of community-based interventions.[22-24] Considering limited evidence on the scope, extent, and outcomes of such interventions, we conducted a scoping review to identify the features of these interventions employed in Malaysia so that the findings may be used as a reference to establish future interventions and research directions.

Need for more collaborative work

The need for collaborative approaches in diabetes care had been emphasised in a recent systematic review and meta-analysis by Siaw and Lee which stated that "*multidisciplinary collaborative care will have a positive impact on the clinical, humanistic, and economic outcomes of patients with uncontrolled diabetes*".[25] However, many of the reviewed studies did not deliberate on the multidisciplinary aspects of diabetes care. Mostly focused on a single factor and only one out of all studies involved oral health. Involvement of dental intervention as part of diabetes patient care has been suggested to increase the likelihood to improved health, wellbeing, and quality of life in people with diabetes as has been established by previous studies.[26-27] Studies undertaking interventions that investigate multiple facets associated with diabetes would offer a comprehensive approach to managing the condition.

Limited adoption of behavioural framework

The limited adoption of specific behavioural framework in guiding diabetes management interventions deserves further reflection. A theoretical framework is needed to incorporate the factors and processes that influence behaviour change into the intervention. Theory helps in organising and applying the existing knowledge about what causes (mediators) and affects (moderators) behaviour change, as well as the basic assumptions about human behaviour and its determinants. The incorporation of these theories in the design and execution of self-management and behaviour change interventions has shown promise in enhancing their effectiveness. [28]

Evolving uptake of telemedicine

The evolving landscape of healthcare has seen a significant shift towards telemedicine, and this trend is evident in our findings where five studies utilised telemedicine as a part of the CBIs. Telemedicine is a "*subset of e-health that involves the use of communication networks to offer healthcare services and medical education remotely*".[29] The use of telemedicine is particularly beneficial in improving access to healthcare in that it may help provide continuous patient care and manage chronic health conditions like diabetes and ultimately helps reduce healthcare cost.[30]

Clinical and non-clinical study outcomes

The clinical outcomes assessed in the studies reviewed in this scoping analysis were diverse in which not all studies reported on HbA1c despite its prominence as a key marker in diabetes control. The omission of HbA1c parameters could be attributed to resource constraints or a limited study duration. As expected, in most of the studies, a change in the behaviour was seen to be parallel with the HbA1c reduction. This observation emphasises the importance of behaviour interventions, notwithstanding the need of proper alignment with a behavioural framework, as an effective strategy in tackling

self-management of the HbA1c level in T2DM patients.[31] Two behavioural aspects that many T2DM patients struggle with are the eating disorder and inactivity, which are related to worse glycaemic control and a higher risk for various complications.[32]

Implementation of carbohydrate (CHO) counting, calorie restrictions, pre- and post-meal blood glucose monitoring, evaluating blood glucose trends in between meals, and exercise have proved to be able to reduce the HbA1c level.[33] A domino effect on the reduction of other clinical manifestations such as FBG,[34-35] blood pressure,[34] and LDL[36] were also observed alongside these lifestyle changes. Since these behavioural changes are essential to ensure the important clinical parameters are at an optimum level, incorporation of disease self-management[37] such as self-efficacy and self-care measurements and the involvement of caregivers[38] are to be considered as effective strategies in encouraging behaviour change in people with diabetes.

Quality of community-based intervention studies

While the overall study quality assessment revealed weaknesses in selection bias and blinding, it is essential to recognize the strengths observed in other aspects of the studies such as study design, data collection methods, and management of withdrawals and drop-outs. Strong study design contributes to the credibility of the findings, providing a solid foundation for the research.

Future research in this area should aim to address the identified limitations, particularly in the areas of selection bias and blinding, to enhance the overall quality and validity of studies focused on diabetes management within the Malaysian context. Additionally, improved reporting and transparency in methodology can aid in the critical evaluation of study quality and contribute to more robust and reliable evidence in the field of diabetes management. Countries that share similar socio-demographic and cultural backgrounds, as well as health systems' resources and constraints may also gain perspectives from our findings to improve their diabetes control initiatives.

CONCLUSION

This comprehensive review provides useful insights on diabetes management interventions in Malaysia which are multi-faceted in nature. The studies exhibited diverse approaches and produced inconsistent effects on diabetes control. Nonetheless, most interventions demonstrated reductions of HbA1c, which is the main clinical outcome measured following interventions. Learning and behavioural outcomes highlight improvements in self-efficacy, knowledge, and patient behaviour, thus acknowledging the role of behavioural interventions in equipping individuals for self-management. These findings, though promising, reveal a need for enhancements in study quality, particularly addressing issues related to selection bias and blinding.

ACKNOWLEDGEMENTS

The authors would like to thank Universiti Kebangsaan Malaysia for providing infrastructural facilities to carry out this study. This study was funded by the Ministry of Higher Education, Malaysia, through the Malaysian Research University Network Grant (MRUN-RAKAN RU-2019-002/1).

CONFLICTS OF INTEREST

None of the authors have any conflicts of interest related to this project.

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