

The Role of Self-Efficacy and Self-Care Management in Mediation Analysis of Glycaemic Control in Type 2 Diabetes Mellitus: A Systematic Review

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ABSTRACT

Objective: The primary purpose of this review was to investigate the role of self-efficacy as a mediating factor towards effective diabetes self-care management in Type 2 Diabetes Mellitus.

Method: This is systematic review from scientific databases such as Web of Science, SCOPUS, and PubMed between the years 2010 until 2021. Three investigators cross-checked all articles assigned.

Results: A total of 18 articles were included. These studies showed perhaps a critical factor is self-efficacy that acts as mediators between various other components and diabetes self-management. Self-efficacy was also associated with improved glycemic control, dietary adherence and perceived autonomy support.

Conclusion: In general, self-efficacy has an extensive role in diabetes self-management. From this review we have come to an understanding of how general and diabetes-specific self-efficacy can contribute to successful diabetes self-care management.

KEY WORDS

self-efficacy, self-management, Type 2 Diabetes Mellitus, mediators

INTRODUCTION

The prevalence of Type 2 Diabetes Mellitus (T2DM) has risen steadily in recent decades. Additionally, the total number of people with diabetes is projected to rise from 9.3% (463 million people), rising to 10.2% (578 million) by 2030 and 10.9% (700 million) by 2045¹⁾. This prevalence exceeds Type 1 Diabetes, which account for up to 90% of all diabetes cases¹⁾. In 2019, diabetes was the ninth leading cause of death with an estimated 1.5 million deaths directly caused by diabetes²⁾. Patients with diabetes can develop macrovascular and microvascular complications, which are collectively known as diabetic vascular complications³⁾. When compared with the general non-diabetic population, people with diabetes have approximately seven years shorter in life expectancy, an effect which is directly related to these complications^{4,5)}.

The most important aspect of the optimal management of patients with diabetes is preventing severe complications of hyperglycaemia. Glycaemic control is thus considered the main therapeutic goal for preventing these consequences. Many overlapping factors such as the healthcare system, healthcare team, and patient-related factors contribute to glycaemic control⁶⁾. When taking into consideration the patient-related factors, self-efficacy and self-care are crucial for improving glycaemic control⁷⁾. A person's sense of self-efficacy is their conviction

that they have some degree of control over their motivation, behaviour, and surroundings⁸⁾. Self-efficacy also refers to "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives"⁸⁾.

On the other hand, self-care or self-management is an individual's capacity to act and make choices to stay physically, rationally, and profoundly fit and healthy⁹⁾. Self care management among others which include healthy eating, being physically active, monitoring of blood sugar, compliant with medications, good problem-solving skills, healthy coping skills and risk-reduction behaviours which may predict good outcomes among T2DM patients¹⁰⁾.

Much of the literature uses traditional regression models to understand the independent direct effect of covariates, including self-efficacy and self-care management, on glycaemic control¹⁰⁻¹²⁾. Due to the complexity of various factors that are associated with glycaemic control in T2DM, recent studies have been examining these factors simultaneously as a network of multiple pathways¹³⁻¹⁵⁾. For example, a positive relationship between self-efficacy and self-care management has been proven¹⁶⁾ and at the same time self-efficacy has also been proven to act as a mediating effect between other predicting factors and self-care management¹⁷⁾. However, attempts to integrate these factors in complex modeling have been methodologically heterogenous. Hence, a robust review of similar literatures is warranted to explore how self-efficacy and self-

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care or self-management can be addressed to promote good glycaemic control in patients with diabetes and to identify research gaps for further studies.

Self-efficacy has been utilized for predicting behaviours and planning interventions but more information is needed on the role of self-efficacy in self-management behaviours such as dietary choices and nutrient consumption and their impact on clinical outcomes (i.e., glycaemic and weight control). Self-efficacy has also been used in experimental studies to improve health behaviour among diabetic patient such as diabetes self-care¹⁸). Furthermore, self-efficacy acts as a theoretical construct that has proven to be very useful when translated into health behaviour interventions¹⁹). A better perception of its role would better prepare clinicians to encourage patient understanding to improve diabetes-related self-management behaviours and outcomes¹⁶).

The current systematic study aims better understand the function of self-efficacy as a mediating factor in the self-care management of Type 2 Diabetes Mellitus.

METHODS

Search strategy

This study was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for systematic reviews²⁰). The following databases were searched for relevant articles in English between 2010 and December 2021 i.e. Web of Science, SCOPUS, and PubMed. The search strategy included the combined terms "diabetes type 2", "self-management", and/or "self-care" and "self-efficacy", which were linked using the Boolean operators "AND" and "OR". The keywords were also combined with "mediation" and "arbitration". The search results were imported to EndNote and duplicates were removed. Two reviewers screened the titles and abstracts. Then, all articles selected were again identified by all authors for further agreement.

Eligibility

Inclusion criteria. Articles were included if they fulfils these criteria: i) Articles were written in English Language; ii) Observation and experimental studies published from January 2010 until December 2021; iii) Studies with respondents who were diagnosed with T2DM; iv) Studies that used quantitative measures; v) Studies that discussed role of self-efficacy in the management of T2DM and self-care management in diabetes. There were no limitations on the study population's age or the types of healthcare facilities (hospital or primary care).

Exclusion criteria. Studies were excluded if: i) They were not mediation analyses of self-efficacy or self-care or self-management; ii) The term "self-efficacy" was not properly defined; iii) The method or methodology was inadequately described; iv) The majority of the papers were talks, reviews, or theoretical articles; v) Articles included Type 1 Diabetes Mellitus patients.

Data extraction tool

All researchers extracted the information for each article independently with a standardised Excel spreadsheet, which was then revised by a second reviewer. The information extracted included authors, year, settings, countries, study designs, outcome measures, and the key findings.

Quality assessment tool

Two reviewers critically appraised the quality of the included articles independently using Mixed Methods Appraisal Tool (MMAT) version 2018. This tool is useful in systematic reviews involving different study designs²¹). All studies were subjected to the screening criteria, and the kind of design was chosen for each pertinent study. The corresponding criteria was used to appraise the study's quality. All data were collected using a standard, pre-designed data extraction table for evaluation by the two reviewers, who also talked about publications with ambiguous information before evaluating the overall quality. Any disagreement on the quality of the studies was reviewed by a third person.

RESULTS

Search outcomes

The initial search strategy identified 60 articles across the three databases i.e., Web of Science, n = 20; SCOPUS, n = 36; and PubMed, n = 4. After reviewing the titles, 23 duplicates were removed. Another nine articles were excluded, when the abstracts had been screened and reviewed. We retrieved the full text of the remaining 28 articles. The full text of four articles were only review articles and thus the remaining 24 articles were assessed for eligibility. Finally, 18 articles were included in the review after six articles had been excluded due to non-eligibility. Fig 1 shows the study selection process.

Study characteristics

Overall, a total of 18 studies involving 5716 participants were selected after undergoing critical appraisal using the MMAT checklist. The sample size in each study was 77-1318, the mean age was 51.5-69 years, and mean duration of disease was 5.06-16.7 years. All selected studies included both men and women. Most of the studies were cross-sectional (n = 14), two were randomised controlled trials (RCTs), and two were mixed-methods studies. Almost half of the studies had been conducted in the US (n = 7), while five were from China and one each was from Canada, Germany, Nepal, the United Kingdom, Jordan and Korea.

Description of studies integrating the roles of self-efficacy in diabetes self-management

Self-efficacy

Self-efficacy has been examined through distinctive settings i.e. i) in intervention study and included it as the main outcome; ii) in cross-sectional study that examined their role. The studies in our review contained an array of study designs (such as cross sectional studies, randomized control trials, mixed methods study designs), several independent and outcome measures, and different measurements of self-efficacy (among others are Multidimensional Diabetes Questionnaire, Diabetes Self-management Questionnaire, Diabetes Self-efficacy Scale, Self-Efficacy for Diabetes and Diabetes-specific Self-efficacy, Diabetes Self-care Activities Measure, Insulin Management Diabetes Self-care, and Cardiac Self-Efficacy Scale) as well as self efficacy roles as mediators or outcome (Table 1).

Variable measures

The way the self-efficacy construct was used has significant differences. It has been expressed as a wide-ranging or general variables (i.e., belief in one's ability to adhere to diabetes treatment regimens involving diet, exercise, medication use, and blood glucose monitoring) or more specific variables (i.e., confidence in managing diabetes, measuring psychosocial aspects of individuals with diabetes).

Two RCT studies that incorporated self-efficacy in improvements of self-management were among respondents from a diabetic clinic¹⁸) and a community centre²²). Study by Steed et al. (2014) tested the constructs from two theoretical models (i.e. self-regulatory theory and social cognitive theory) that could have mediated changes in outcomes i.e. illness beliefs and self-efficacy. This intervention study focused on the participants' evaluation of beliefs, goal-settings with feedback, problem-solving, skills training, as well as modelling approach. Self-efficacy was measured using the self-efficacy subscale of the Multidimensional Diabetes Questionnaire²³) where participants rated their self-efficacy based on diet, exercise, and blood glucose monitoring on a scale of 0 (low) to 100 (high). The results indicated that self-efficacy had a mediator effect on exercise behaviour and self-monitoring blood glucose but not on self-management behaviours. This conclude that self-efficacy acted as effective mediator in improving self-care management among Type 2 Diabetes Mellitus.

In another RCT study, two models of community health worker (CHW)-led diabetes medication decision supports were compared. This study was among 176 low-income Latino and African American adults with diabetes recruited from a community health centre in Detroit, USA²²). Participants were randomised to one of two groups receiving a

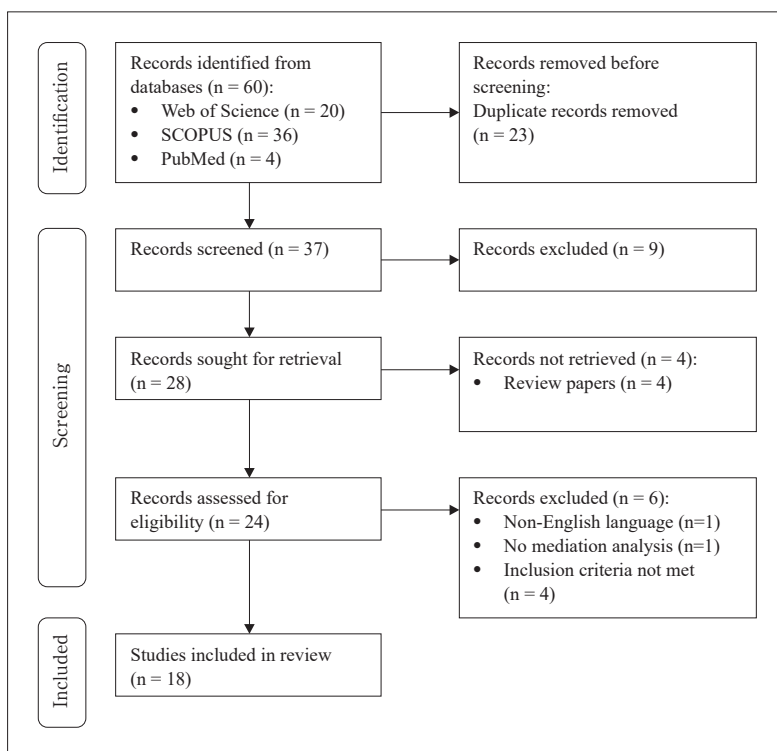


Figure 1: Study selection according to PRISMA flowchart

This is the PRISMA flowchart depicting the process of articles selection. A total of 60 articles were screened and assessed for eligibility according to the inclusion and exclusion criteria in which, a total of 18 articles were included in the final review process

brief CHW-led intervention consisting of an initial home visit and two follow-up calls. Self-efficacy was measured using a 5-item scale focusing on how confident the participant felt in five key areas related to managing diabetes²⁹. However, the findings did not support self-efficacy as a significant mediator, as there is no change in satisfaction with medication information or adherence.

We included in our review two mixed-method studies that associated greater self-efficacy and better self-management in diabetes^{17,25}. Robinson *et al.* (2020) used provider-patient secure messaging (SM) through the My HealthVet patient portal. The surveys were mailed to veterans, where diabetes self-efficacy (SED) and self-management were measured with Diabetes Self-Efficacy Scale (DSES) and Diabetes Self-Management Questionnaire (DSMQ), respectively. The DSES contains eight items with a response scale of 1 to 10 (not at all to totally confident), while the DSMQ comprises 16 items for assessing activities related to glycaemic control, in which a higher score indicate better self-management. The study also highlighted that patients who felt more autonomous of their health are more likely to feel confident and engage in self-management. The other mixed-method study involved participants (n = 230) 13 individuals were interviewed from the outpatient divisions of private clinics and tertiary (government) institutions in Nepal¹⁷. This particular study looked into the possible role of self-efficacy and perceived social support as mediators. A 5-point Likert scale was used to evaluate self-efficacy ranging from 1 to 5 and was found that relationship between diabetes duration and self-care that is only partially mediated. Meanwhile, perceived social support was measured by the Multidimensional Scale of Perceived Social Support²⁶ and was defined as the estimation of the sufficiency of subjective social support from friends, family, and close friends. The conclusion suggests that the association between education level and diabetic self-care was considerably mediated by perceived social support.

Fourteen cross-sectional studies which looked into the roles of self-efficacy in diabetes self-management have also been identified. Eleven studies used primary data, where information was collected using instruments²⁷⁻³⁷ while another three studies used secondary data to examine the associations of self-efficacy and diabetes self-management^{13,38,39}. Patients from the two main hospitals in Guangzhou City, China's endocrine clinics were used in this study to determine whether self-efficacy and adherence were mediators of the sequential impact of social support on glycaemic control¹³. Self-efficacy was measured using Lorig *et al.* (1996)'s self-efficacy scale, comprising five aspects: emo-

tional control, communication with doctors, symptom management, role function and perceived adaptability. Each item is scored from 0 to 9 (no confidence at all to full confidence). The results demonstrated that self-efficacy and adherence mediated the effects of social support on glycaemic control.

Meanwhile, a cross-sectional study including attendees of diabetic clinics in four hospitals in three cities in China³⁰ revealed that self-efficacy partially mediated self-management. SED was measured by nine items using a 5-point Likert scale. Similar study was also performed involving participants from an online survey³² and self-efficacy was measured using Diabetes Management Self-Efficacy Scale (DMSES)⁴⁰. The findings demonstrated that glycated haemoglobin (HbA1c) and self-management had an impact that was moderated by self-efficacy on impulsivity and the need for cognition. In addition, a study by Huang *et al.* (2020) showed that perceived treatment control mediated the association between diabetes distress and self-efficacy. The study considered diabetes management self-efficacy as the main outcome and the participants were recruited through Chinese community service agencies in three major cities in Texas. The participants' confidence in managing aspects of their diabetes was measured via the 20-item DMSES on a 10-point response scale from "cannot do at all" (0) to "certain can do" (10) that had been translated to Chinese⁴¹.

Similarly to Huang *et al.* (2020), Al-Dwaikat *et al.* (2020) assessed self-efficacy using the DMSES scale among outpatient clinic attendees in northern Jordan. The DMSES was developed by Van der Bijl *et al.* (1999) to measure people's belief in their capabilities for performing diabetes self-care activities⁴². The study showed that self-efficacy had a successful mediation role in the relationship between social support and psychological outcome of type 2 diabetes.

Gonzalez *et al.* (2015) had conducted a cross-sectional study to patients with Type 2 Diabetes who suffered with major depression or dysthymia or clinically had depressive symptoms. The study aimed to look into the link between emotional distress, medication adherence, and glycaemic control, and the potential mediating effects of self-efficacy and perceived illness control. Self-efficacy was assessed using an 8-item scale⁴³, with responses scored from 1 (not at all) to 4 (very sure). The findings showed that self-efficacy did not significantly mediate the change between diabetes distress and medication adherence and glycaemic control. Hahn *et al.* (2015) performed a cross-sectional study involving Type 2 Diabetic patients, where self-efficacy was deemed a proximal factor. The authors used a multimedia (text, audio, images)

Table 1. Characteristics of selected studies on role of self-efficacy

No	Study	Design	Population	Proximal factor	Measurement of self-efficacy and self-care management	Role of self-efficacy and self-care management
1	Hofer R. <i>et al</i> 2017	RCT	N=176 Type 2 diabetic patients recruited from community health centre in Detroit serving a Latino and African American low-income population. Mean age 51.5 years. Mean duration diabetes 9.26 years	Satisfaction with Medical Information (SMI), Medication Knowledge (MK), Decisional Conflict (DC)	Diabetes self-efficacy: 5 item scale Diabetes distress: 2-item scale	Self-efficacy and diabetes distress as mediators
2	Steed <i>et al</i> 2013	RCT	N = 124 Type 2 diabetes patients recruited through contact with a diabetologist and were drawn from two inner city London hospitals. Mean age 59.2 years Mean diabetes duration 10 years	Diabetes Self-Management Programme (UCL-DSMP) e.g. : examination of beliefs, goal setting with feedback, problem solving, skills training and modelling.	Self-efficacy was measured using the self-efficacy sub-scale of the Multidimensional Diabetes Questionnaire	Diabetes self-efficacy and Diabetes Illness Cognitions (mediators)
3	Robinson <i>et al.</i>	Mixed method	N = 446 Veterans with Type 2 diabetes with uncontrolled blood glucose who were sustained users of My Health eVet app. Mean age 66.4 years	Secure messages initiated by healthcare team	Diabetes self-management Questionnaire (DSMQ16). Diabetes self-efficacy was measured with the Diabetes Self-efficacy Scale (DSES)	Diabetes self-management and Diabetes self-efficacy as main outcome. Mediates by perceived autonomy support
4	Bhandar & Kim 2016	Mixed method	N = 230 Type 2 diabetes patients recruited from outpatient department of private clinics and tertiary level hospitals in Nepal. Mean age (year) 56.9. Mean diabetes duration 8.7 years	Patient's characteristics and Expectation regarding age (ERA) – expectation regarding age-associated decline in physical and mental health	DMSE scale: 5-point Likert scale Multidimensional Scale of Perceived Social Support	Self-Efficacy and Perceived social support as mediators
5	Xie <i>et al.</i> 2020	Cross-sectional	n = 148 Type 2 diabetic patients attended two diabetic clinics in Hong Kong. Mean age 63.72. Mean diabetes duration 16.60 years	Sociodemographic characteristics	Self-efficacy: 5 items scale (e.g., "How confident are you in your ability to follow a low salt and low-fat diet?"), with responses ranging from 1 (not at all confident) to 10 (totally confident) Health attitude: 5 items with 7-point scale	self-efficacy and health attitude as mediators
6	Gonzalez <i>et al</i> 2015	Cross-sectional	N = 142 Adult with Type 2 diabetes recruited from the Diabetes Centre and primary care clinics at Massachusetts General Hospital Mean age 55.95 years Mean duration diabetes 10.95 years	Diabetes Distress (DDS)	Self-efficacy for diabetes self-management: 8 items with 4-response scale	Perceived control and self-efficacy as mediators

7	Shao <i>et al.</i> 2017	Cross-sectional	n = 532 Type 2 diabetes inpatients and outpatients visited endocrine clinics of two largest hospitals in Guangzhou City. Mean Age 63.27 years	Social Support	Self-efficacy for diabetes Lorig <i>et al</i> 's 5-item measure. Scored from 0 to 9.	Self-efficacy mediates glycaemic control
8	Jiang <i>et al.</i> 2019	Cross-sectional	N = 265 Type 2 diabetes patients attended diabetic clinics in four hospitals in China. Mean age 56.91 years. Mean diabetes duration 6.03 years	Knowledge, diabetes distress, education level	Self-Efficacy for Diabetes (SED): 9 items with 5 points Likert scale	Self-efficacy as mediators
9	Houle <i>et al.</i> 2016	Cross-sectional	N = 284 Type 2 diabetes patients attended diabetic clinics at four hospitals and four health and social service centre in Montreal and Laval, Canada. Mean age (year) 59.3. Mean diabetes duration 7.4 years	Education level and living in poverty	DMSES: 20 items	Self-management self-efficacy mediates glycaemic control
10	Hadj-Abo <i>et al.</i> 2020	Cross-sectional	N = 77 Type 2 diabetes patients recruited from online survey link distributed by flyers to diabetic centre and from personalized messages Mean age (year) 62.3	Impulsivity and need for cognition (NOC)	DMSES: 15 items on 10-step numeric scale	self-efficacy as mediators
11	Cheng <i>et al.</i> 2016	Cross-sectional	N = 346 Type 2 diabetes patients recruited from four tertiary university-affiliated hospitals in Xi'an, China. Mean age (year) 59.43. Mean duration Diabetes 9.52 years	Self-management barrier	Diabetes Empowerment Scale-Short Form (DES-SF) 8 items with 5-point Likert scale	Self-efficacy as the main outcome
12	Huang <i>et al.</i> 2020	Cross-sectional	N = 155 Chinese Americans with Type 2 diabetes recruited through Chinese Community service agencies in three major cities in Texas. Mean age 69 years. Mean duration diabetes 13 years	Diabetes distress (DDS) and Depressive symptom (CES-D)	The Diabetes management self-efficacy (DMSE): 20 items with 10-point response scale.	Diabetes management self-efficacy as the main outcome
13	Hahn <i>et al.</i> 2015	Cross-sectional	N = 295 Type 2 diabetes patients receiving care in the general medicine clinic of one of the hospitals in Illinois. Mean age 54.5 years	Health literacy, health beliefs, and self-efficacy	Diabetes-specific self-efficacy: eight-item scale	health literacy, health beliefs, and self-efficacy as proximal factors
14	Wardian <i>et al.</i> 2013	Cross-sectional	N = 266 Adult with Type 2 diabetes recruited from three separate organizations located in San Diego. Mean age 57 years. Mean diabetes duration average 5.06 years	The Thinking About Diabetes Scale (TADS)	Self-efficacy: was measured by one question: "At this time, how confident are you that YOU can take good care of your diabetes?" Responses were recorded on a five-point Likert scale ranging from 1 = not at all confident to 5 = very confident	Self-efficacy, Healthcare Provider and "Significant others blames me" as mediators

15	Al-dwaikat <i>et al</i> 2020	Cross-sectional	N = 339 Type 2 diabetes patients recruited from outpatient clinic in the northern Jordan Mean age 59.6 years	Social Support Function (Function, Quality, Structure)	Diabetes Management Self-Efficacy Scale (DMSES) Diabetes Self-Care Activities Measure (SDSCA)	Self-efficacy and Self-management as mediators
16	Yang <i>et al</i> 2021	Cross-sectional	N = 380 Type 2 diabetic patients from five community health centre in China Mean age 66.27 years Mean diabetic duration 10.41 years	Social Support	Cardiac Diet Self-efficacy Scale (CDSE) Diabetes Self-management Behavior Scale	Self-efficacy as mediators
17	Juarez <i>et al</i> 2021	Cross-sectional	N = 1318 Low-income population with Type 2 diabetes form one of teaching hospitals in Alabama, USA. Mean age 52.9 years. Mean diabetes duration 12.1 years	Diabetes education Care coordination	Perceived Diabetes Self-Management Scale (PDSMS): 8 items with 5 point response scale	Self-efficacy as mediators
18	Lee <i>et al</i> 2021	Cross-sectional	N = 193 Type 2 diabetes patients form one of teaching hospitals in Korea Mean age 60.2 years Meang duration diabetes 16.7 years	Diabetes knowledge, psychological insulin resistance, family support for DM	Insulin Management Diabetes Self-Efficacy Scale Diabetes Self-Care Activities Measure (SDSCA)	Self-efficacy and diabetes self-management activities as mediators

which has received significant validation for use with self-administrating surveys in both English and Spanish^{44,45}. The participants were among those receiving care at a general medicine clinic in Illinois, USA. In the study, oral medication and insulin treatment were the main topics of a patient education program. SED (self efficacy diabetes) was measured with an 8-item scale⁴³ and was a proximal factor with other independent variable. SED was significantly associated with better diabetes self-care and outcomes. Houle *et al.* (2016) measured self-efficacy as a mediator in patients living in poverty. SED was quantified using the 20-item DMSES⁴². They found that self-care management and self-efficacy mediated glycaemic control.

Three recent studies regarding SED by Yang, Juarez and Lee *et al.* 2021 stated that diabetes knowledge as a proximal factors and SED mediates health outcomes such as HBA1c and self-care diabetes activities (36,37,46). Yang *et al.* (2021) patients from five Chinese community health centres participated in studies. SED was measured using Cardiac Diet Self-Efficacy Scale (CDSE) This included a 16-item assessment tool to gauge four components of diet self-efficacy: diet in a social setting, healthy eating abilities, behaviour related to food control, and weight management with 5-point Likert scale. Yang claimed that higher diet self-efficacy levels result in increased diet self-care levels. Another latest cross-sectional study participated by low-income population of diabetes patients in Alabama, USA³⁷. SED was quantify by eight item using a 5-point Likert scale. The outcome exhibit that SED mediates the effect of diabetes education of self-care management in a disadvantaged population. In their cross-sectional study, Lee *et al.* (2021) included patients with insulin-treated T2DM from one of the teaching hospitals in Korea. SED was assessed using the Korean version of Diabetes Self-Efficacy Scale comprises of 18 items; each item is rated using a five-point Likert scale. Self-efficacy significantly mediates the change between diabetes knowledge, family support and psychological insulin resistance.

Three cross-sectional studies were conducted using secondary data. One made use of a 24-week RCT's secondary data analysis²⁸. The patients were from two diabetic clinics of two public hospitals. A 5-item scale was used to measure self-efficacy in performing self-management, with responses ranging from 1 (not at all confident) to 10 (totally confident)²⁹. The authors showed that the relationship between getting older and having better adherence to diet therapy was mediated by self-efficacy. Another study using secondary data involved data was gathered as part of a pilot project to look at persons with diabetes' perceptions, emo-

tions, and experiences both at the time of diagnosis and now³⁵. Participants were recruited from three separate organisations in San Diego, USA. Self-efficacy was measured by one question: "At this time, how confident are you that you can take good care of your diabetes?" The responses were recorded on a 5-point Likert scale ranging from 1 (not at all confident) to 5 (very confident). Self-efficacy showed a significant partial mediation effect in the multivariate model. Lastly, Cheng *et al.* (2016) presented secondary data analyses of a multicentre cross-sectional study that recruited participants from four tertiary university-affiliated hospitals in Xi'an, China³³. The psychosocial self-efficacy of people with diabetes was measured with the 8-item Diabetes Empowerment Scale-Short Form (DES-SF)⁴⁷. In that study, self-efficacy played a role as the main outcome whereas diabetes appraisal was highlighted as the mediator between barriers and self-efficacy.

DISCUSSION

Although the literature on the roles of self-efficacy in diabetic self-management is by no means widespread, it is evident that self-efficacy is a key factor that mediates a number of diabetes self-management factors. These variables include perceived autonomy support, perceived social support, diabetes distress, diabetes knowledge and health literacy including diverse diabetes self-management behaviours and some metabolic parameters. The majority of the included studies used measures of self-efficacy that took into account self-management strategies like exercise, medicine, and blood sugar regulation^{13,28,30,32,34,39} while some used only one specific question³⁵, examined specific psychosocial self-efficacy³³ and healthy eating behaviours³⁶. Significant mediation was found in all studies that looked at the roles of self-efficacy and diabetic self-management^{13,25,28,32,36,37,39,46} and partial mediation^{17,30,35}, except three studies: one on a Chinese population³³, one intervention study in London¹⁸ and another of a Latino population²². One study reported that self-efficacy roles are crucial as the main outcome³⁴ and another identified self-efficacy as the proximal factor and reported that it was significantly associated with diabetes self-management²⁷.

Self-efficacy and diabetes self-management were incorporated into the curricula of the included intervention or RCT trials in a variety of ways. In one programme, there were group meetings¹⁸, while another

used an e-health tool²²). The programmes ranged in length, with follow-ups lasting anywhere from a few weeks to three months. As a result, it is impossible to say how much of programme effectiveness can be due to diabetes self-management self-efficacy. Since it has not been established which specific therapies' individual components are the most beneficial, more research is required.

Some of the included studies integrated self-efficacy in mixed-method formats. One employed a sequential, quantitatively driven mixed-method approach, where the quantitative element served as the main component and the gathering and analysis of qualitative data will come next¹⁷). Another similar study design relied on surveys, health record information, and SM coding to quantify the relationship between clinical team-initiated SM and patient-reported measures (perceived autonomy, diabetes self-management, SED) and examine the qualitative content²⁵). Both studies reported that self-efficacy mediates diabetes self-management outcomes. This is consistent with previous studies that used the same design^{48,49}).

Based on Bandura (1994), self-efficacy is the strongest construct in predicting a person's behaviour change. Typically, people who show the highest behaviour change have higher self-efficacy for performing a certain behaviour. Self-efficacy affects a person's motivation and pushes them to try and continue the behaviour. Self-efficacy is defined as the person's trust in their abilities to explore a behaviour. In other words, self-efficacy consists of people's trust in themselves to perform a special act. The feeling of self-efficacy is a prerequisite to behaviour change which will influence the self-motivation and performance level⁵⁰). Self-efficacy actually empowers people to use their abilities to overcome challenges and take praiseworthy actions. As a result, self-efficacy is a key component of effective performances and the human abilities required for them.

Efficient performance requires either competence or the capacity to use judgement to put those skills into practise. Self-efficacy, on the other hand, influences how many times a person tries to execute a task. Self-efficacy believers work twice as hard to overcome challenges and issues⁵⁰). Self-efficacy is the belief that one is capable of carrying out an action. It is influenced by a variety of factors, including successes, failures, other people's successes or failures, and verbal support. People who have greater personal self-efficacy are more resilient, luckier, and less fearful⁵¹).

There are few limitations in this study. Only three studies specifically focused on self-efficacy in Type 2 Diabetes: one on psychosocial self-efficacy in diabetes, another that used only one specific question and one focused on healthy eating behaviours. Inter-study comparisons were difficult because it is well known that diabetes treatment plans are multifaceted⁵²). The various facets of diabetic self-management and behaviour control throughout time are not adequately captured by the questions used in generic self-efficacy tests. Apart from that, different measuring tools may result in a variety or different measurements of self efficacy. Inter-study comparison is thus made difficult by a high level of heterogeneity among included studies. It is an issue that would likely affect the quality assessment of studies and consequently have an impact on the reporting and interpretation of results in this current review. The lack of comprehensive clinical evaluation and the studies' dependence on self-reported behaviour assessments are two further drawbacks. Additionally, only a small number of the measures found in the current review provided a description of the self-efficacy psychometric features. The development of standardised diabetes self-efficacy questionnaires for facilitating inter-study comparisons are thus needed.

CONCLUSION

In general, there is some proof that self-efficacy affects how well diabetes is managed, and there is some assistance for diabetes-specific self-management therapies. Although these results are helpful, policy-makers and doctors may find it difficult to use them in practical practise. Initiatives to increase SED could require a person to take chances and experiment with various self-management techniques. This field of study needs to be pursued, considering how many persons with Type 2 Diabetes Mellitus disregard their medication regimens. It is challenging to incorporate their treatment plans in a physiologically, socially, behaviourally, and culturally appropriate manner, where self efficacy could play a major factor for effective self care management of Type 2 Diabetes Mellitus. In short, in this review we found that several studies showed that self efficacy act as mediator between proximal variables and successful self-care management outcomes, though some studies revealed that self efficacy may not act as such. Self efficacy also has an

important role in experimental studies such as RCTs and can monitor diabetes self management over time.

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CONFLICTS OF INTEREST

The author declares that there is no conflict of interest. The views expressed are solely those of the authors and do not reflect the official policy or position of the National University of Malaysia, Ministry of Health Malaysia, or Malaysian Government.

REFERENCES

1. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, *et al.* Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9(th) edition. *Diabetes Res Clin Pract.* 2019 Nov; 157: 107843.
2. WHO. Diabetes [Internet]. 2018. [cited 2022 Dec 27]. Available from: https://www.who.int/health-topics/diabetes#tab=tab_1
3. Association AD. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes-2019. *Diabetes Care.* 2019 Jan; 42(Suppl 1): S13-28.
4. Morgan CL, Currie CJ, Peters JR. Relationship between diabetes and mortality: A population study using record linkage. *Diabetes Care.* 2000; 23(8): 1103-7.
5. Raghavan S, Vassy JL, Ho YL, Song RJ, Gagnon DR, Cho K, *et al.* Diabetes mellitus-related all-cause and cardiovascular mortality in a national cohort of adults. *J Am Heart Assoc.* 2019; 8(4).
6. Romakin P, Mohammadnezhad M. Patient-related factors associated with poor glycaemic control among patients with type 2 diabetes mellitus. *Aust J Gen Pract.* 2019; 48(8): 557-63.
7. Cheng LJ, Wang W, Lim ST, Wu VX. Factors associated with glycaemic control in patients with diabetes mellitus: A systematic literature review. *J Clin Nurs.* 2019 May; 28(9-10): 1433-50.
8. Bandura A. Self Efficacy; The Exercis of Control [Internet]. 1997. p. 5-174. Available from: https://www.academia.edu/28274869/Albert_Bandura_Self_Efficacy_The_Exercis_of_Control_W_H_Freeman_and_Co_1997_pdf
9. Wilkinson A, Whitehead L. Evolution of the concept of self-care and implications for nurses: a literature review. *Int J Nurs Stud.* 2009 Aug; 46(8): 1143-7.
10. Shrivastava SR, Shrivastava PS, Ramasamy J. Role of self-care in management of diabetes mellitus. *J Diabetes Metab Disord [Internet].* 2013 Mar 5; 12(1): 14. Available from: <https://pubmed.ncbi.nlm.nih.gov/23497559>
11. Sham SYZ, Thambiah SC, Samsudin IN, Chuan NO, Wei YS, Razmin NI. Practice of self-monitoring blood glucose among insulin-treated diabetic patients in Hospital Serdang. *Malaysian J Med Heal Sci.* 2016; 12(2): 38-44.
12. Kalkura MP, Umakanth S, Maiya AG, Mayya SS, Vasudeva KNPR, Pai MS, *et al.* Evolving a structural model in type 2 diabetes mellitus: Influence of knowledge, attitudes, and self-management practices on glycaemic control. *J Clin Diagnostic Res.* 2018; 12(9): LC01-5.
13. Shao Y, Liang L, Shi L, Wan C, Yu S. The Effect of Social Support on Glycemic Control in Patients with Type 2 Diabetes Mellitus: The Mediating Roles of Self-Efficacy and Adherence. *J Diabetes Res.* 2017; 2017.
14. Tripathy JP, Thakur JS, Jeet G, Jain S. Structural equation modeling to identify the risk factors of diabetes in the adult population of North India. *Trop Med Health [Internet].* 2018; 46(1): 23. Available from: <https://doi.org/10.1186/s41182-018-0104-y>
15. Reisi M, Mostafavi F, Javadzade H, Mahaki B, Tavassoli E, Sharifirad G. Impact of health literacy, self-efficacy, and outcome expectations on adherence to self-care behaviors in iranians with type 2 diabetes. *Oman Med J.* 2016; 31(1): 52-9.
16. Tharek Z, Ramli AS, Whitford DL, Ismail Z, Mohd Zulkifli M, Ahmad Sharoni SK, *et al.* Relationship between self-efficacy, self-care behaviour and glycaemic control among patients with type 2 diabetes mellitus in the Malaysian primary care setting. *BMC Fam Pract.* 2018 Mar; 19(1): 39.
17. Bhandari P, Kim M. Self-Care Behaviors of Nepalese Adults With Type 2 Diabetes: A Mixed Methods Analysis. *Nurs Res.* 2016; 65(3): 202-14.
18. Steed L, Barnard M, Hurel S, Jenkins C, Newman S. How does change occur following a theoretically based self-management intervention for type 2 diabetes. *Psychol Health Med.* 2014; 19(5): 536-46.
19. Schwarzer R, Fuchs R. Self-Efficacy and Health Behaviours [Internet]. 2012 [cited 2022 Dec 27]. Available from: <https://userpage.fu-berlin.de/gesund/publicat/conner9>

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20. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, *et al.* The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*. 2021; 372.
 21. Hong QN, Pluye P, F?bregues S, Bartlett G, Boardman F, Cargo M, *et al.* Mixed Methods Appraisal Tool (MMAT), Version 2018. User guide. McGill. 2018; 1-11.
 22. Hofer R, Choi H, Mase R, Fagerlin A, Spencer M, Heisler M. Mediators and Moderators of Improvements in Medication Adherence. *Heal Educ Behav Off Publ Soc Public Heal Educ*. 2017 Apr; 44(2): 285-96.
 23. Talbot F, Nouwen A, Gingras J, Gosselin M, Audet J. The assessment of diabetes-related cognitive and social factors: the Multidimensional Diabetes Questionnaire. *J Behav Med*. 1997 Jun; 20(3): 291-312.
 24. Lorig KR, Sobel DS, Ritter PL, Laurent D, Hobbs M. Effect of a self-management program on patients with chronic disease. *Eff Clin Pract*. 2001; 4(6): 256-62.
 25. Robinson SA, Zocchi MS, Netherton D, Ash A, Purington CM, Connolly SL, *et al.* Secure Messaging, Diabetes Self-management, and the Importance of Patient Autonomy: a Mixed Methods Study. *J Gen Intern Med*. 2020 Oct; 35(10): 2955-62.
 26. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The Multidimensional Scale of Perceived Social Support. *J Pers Assess*. 1988; 52(1): 30-41.
 27. Hahn EA, Burns JL, Jacobs EA, Ganschow PS, Garcia SF, Rutsohn JP, *et al.* Health literacy and patient-reported outcomes: A cross-sectional study of underserved English- and Spanish-speaking patients with Type 2 diabetes. Vol. 20, *Journal of Health Communication*. Hahn, Elizabeth A.: Department of Medical Social Sciences, Northwestern University Feinberg School of Medicine, 633 North St. Clair Street, Suite 1900, Chicago, IL, US, 60611, e-hahn@northwestern.edu: Taylor & Francis; 2015. p. 4-15.
 28. Xie Z, Liu K, Or C, Chen J, Yan M, Wang H. An examination of the socio-demographic correlates of patient adherence to self-management behaviors and the mediating roles of health attitudes and self-efficacy among patients with coexisting type 2 diabetes and hypertension. *BMC Public Health [Internet]*. 2020; 20(1): 1227. Available from: <https://doi.org/10.1186/s12889-020-09274-4>
 29. Lee, Liu KT, Lu HT, Mohd Ali R, Fong AYY, Wan Ahmad WA. Sex and gender differences in presentation, treatment and outcomes in acute coronary syndrome, a 10 year study from a multi-ethnic Asian population: The Malaysian National Cardiovascular Disease Database-Acute Coronary Syndrome (NCVD-ACS) registry. *PLoS One*. 2021; 16(2): e0246474.
 30. Jiang X, Jiang H, Li M, Lu Y, Liu K, Sun X. The Mediating Role of Self-Efficacy in Shaping Self-Management Behaviors Among Adults With Type 2 Diabetes. *Worldviews evidence-based Nurs*. 2019 Apr; 16(2): 151-60.
 31. Houle J, Lauzier-Jobin F, Beaulieu M-D, Meunier S, Coulombe S, Côté J, *et al.* Socioeconomic status and glycemic control in adult patients with type 2 diabetes: a mediation analysis. *BMJ open diabetes Res care*. 2016; 4(1): e000184.
 32. Hadj-Abo A, Enge S, Rose J, Kunte H, Fleischhauer M. Individual differences in impulsivity and need for cognition as potential risk or resilience factors of diabetes self-management and glycemic control. *PLoS One*. 2020; 15(1): 1-16.
 33. Cheng L, Sit JWH, Leung DYP, Li X. The Association Between Self-Management Barriers and Self-Efficacy in Chinese Patients with Type 2 Diabetes: The Mediating Role of Appraisal. *Worldviews evidence-based Nurs*. 2016 Oct; 13(5): 356-62.
 34. Huang Y-C, Zuñiga J, García A. Illness perceptions as a mediator between emotional distress and management self-efficacy among Chinese Americans with type 2 diabetes. *Ethn Health*. 2022 Apr; 27(3): 672-86.
 35. Wardian J, Sun F. Removing barriers to promote more positive thinking for people with diabetes: implications for social work. *Soc Work*. 2015 Apr; 60(2): 175-82.
 36. Yang, Li K, Liang Y, Zhao Q, Cui D, Zhu X. Mediating role diet self-efficacy plays in the relationship between social support and diet self-management for patients with type 2 diabetes. *Arch Public Heal [Internet]*. 2021; 79(1): 14. Available from: <https://doi.org/10.1186/s13690-021-00533-3>
 37. Juarez LD, Presley CA, Howell CR, Agne AA, Cherrington AL. The Mediating Role of Self-Efficacy in the Association Between Diabetes Education and Support and Self-Care Management. *Heal Educ Behav Off Publ Soc Public Heal Educ*. 2022 Aug; 49(4): 689-96.
 38. Gonzalez JS, Shreck E, Psaros C, Safren SA. Distress and type 2 diabetes-treatment adherence: A mediating role for perceived control. *Heal Psychol Off J Div Heal Psychol Am Psychol Assoc*. 2015 May; 34(5): 505-13.
 39. Al-Dwaikat TN, Chlebowy DO, Hall LA, Crawford TN, Yankeelov PA. Self-Management as a Mediator of the Relationship between Social Support Dimensions and Health Outcomes of African American Adults with Type 2 Diabetes. *West J Nurs Res*. 2020 Jul; 42(7): 485-94.
 40. Toobert DJ, Hampson SE, Glasgow RE. The summary of diabetes self-care activities measure: Results from 7 studies and a revised scale. *Diabetes Care*. 2000; 23(7): 943-50.
 41. Vivienne Wu S-F, Courtney M, Edwards H, McDowell J, Shortridge-Baggett LM, Chang P-J. Development and validation of the Chinese version of the Diabetes Management Self-efficacy Scale. *Int J Nurs Stud*. 2008 Apr; 45(4): 534-42.
 42. Bijl VDJJ, Van Poelgeest-Eclink A, Shortridge-Baggett L. The psychometric properties of the diabetes management self-efficacy scale for patients with type 2 diabetes mellitus. *J Adv Nurs*. 1999; 30(2): 352-9.
 43. Sarkar U, Fisher L, Schillinger D. Is self-efficacy associated with diabetes self-management across race/ethnicity and health literacy? *Diabetes Care*. 2006 Apr; 29(4): 823-9.
 44. Garcia SF, Hahn EA, Jacobs EA. Addressing low literacy and health literacy in clinical oncology practice. *J Support Oncol*. 2010; 8(2): 64-9.
 45. Yost KJ, Webster K, Baker DW, Jacobs EA, Anderson A, Hahn EA. Acceptability of the talking touchscreen for health literacy assessment. *J Health Commun [Internet]*. 2010; 15 Suppl 2(Suppl 2): 80-92. Available from: <https://pubmed.ncbi.nlm.nih.gov/20845195>
 46. Lee KS, Kim HY, Jin HY. Factors affecting the health status of patients with type 2 diabetes mellitus receiving insulin treatments: A multi-mediation path analysis: Influences on insulin-treated diabetes: Influences on insulin-treated diabetes. *J Clin Nurs*. 2022 May; 31(9-10): 1285-97.
 47. Anderson RM, Fitzgerald JT, Gruppen LD, Funnell MM, Oh MS. The Diabetes Empowerment Scale-Short Form (DES-SF). Vol. 26, *Diabetes care*. United States; 2003. p. 1641-2.
 48. Aloudah NM, Scott NW, Aljadhey HS, Araujo-Soares V, Alrubeaan KA, Watson MC. Medication adherence among patients with Type 2 diabetes: A mixed methods study. *PLoS One*. 2018; 13(12): e0207583.
 49. Shiyabola OO, Unni E, Huang YM, Lanier C. The association of health literacy with illness perceptions, medication beliefs, and medication adherence among individuals with type 2 diabetes. *Res Soc Adm Pharm [Internet]*. 2017; 14(9): 824-30. Available from: <https://doi.org/10.1016/j.sapharm.2017.12.005>
 50. Williams DM, Rhodes RE. The confounded self-efficacy construct: conceptual analysis and recommendations for future research. *Health Psychol Rev [Internet]*. 2014/08/12. 2016 Jun; 10(2): 113-28. Available from: <https://pubmed.ncbi.nlm.nih.gov/25117692>
 51. Schinekus L, Dangoisse F, Van den Broucke S, Mikolajczak M. When knowing is not enough: Emotional distress and depression reduce the positive effects of health literacy on diabetes self-management. *Patient Educ Couns*. 2018 Feb; 101(2): 324-30.
 52. Gao Y, Peterson E, Pagidipati N. Opportunities for improving use of evidence-based therapy in patients with type 2 diabetes and cardiovascular disease. *Clin Cardiol [Internet]*. 2019/08/26. 2019 Nov; 42(11): 1063-70. Available from: <https://pubmed.ncbi.nlm.nih.gov/31448852>