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Review Article

Cadre Interventions on Health Outcomes of Diabetes Mellitus Patients: Systematic Review of Randomized Control Trial

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ABSTRACT

Background: Diabetes mellitus is a disease that can cause complications in various organs of the body. There needs to be a strategic effort to improve the health outcomes of diabetes mellitus patients. Research studies show that cadres are able to become liaisons between patients and health care providers and make a positive contribution to the surrounding community. This systematic study aimed to review studies on cadre interventions on health outcomes of diabetes mellitus patients. **Methods:** The literature search was carried out on the online databases of PubMed, Proquest, and Google Scholar journals published in the range of 2015 – 2021. The keywords used included community health worker, intervention, health outcomes, and diabetes mellitus. Meanwhile, the literature criteria used included journal articles, peer-reviewed, written in English, and research studies with the Randomized Control Trial (RCT) design. **Result:** Based on the results of a review of 15 selected articles, it was found that the overall interventions carried out were providing education, counseling, and group classes. Other activities include home visits, goal setting and action plans, diabetes mellitus diaries, and follow-up phone calls. There were interventions carried out by cadres, in partnership with health care providers and academic partners, involving peers of diabetes mellitus patients and culturally relevant community resources. **Conclusion:** The results of the review showed that almost all articles found changes in metabolic control, behavior, and psychosocial of diabetes mellitus patients as a result of the interventions. Therefore, there needs to conduct subsequent studies on the effect of cadre interventions on the prevention of disease complications both macrovascular and microvascular.

Key words: Diabetes mellitus, Intervention, Cadres, Roles, Health outcomes.

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INTRODUCTION

Diabetes mellitus is a non-communicable disease that needs serious attention and caution. The incidence of this disease continues to increase from year to year and is a risk of complications in various organs of the body.[1] The prevalence of diabetes mellitus in the world reached 463 million in 2019. This case is expected to increase to 700 million by 2045.[2] These data also show that 4 out of 5 people with diabetes mellitus live in low or middle-income countries.

In addition, diabetes mellitus is said to be a prolonged and incurable disease. However, it can be controlled to avoid further complications. Effort for diabetes mellitus patients to prevent or delay the occurrence of complications is to perform self-care management properly.[3] Self-care is defined as a way for diabetes mellitus patients to survive their illness through learning to increase knowledge and awareness in a social context.[4]

Self-care plays an important role in the management of diabetes mellitus to improve health outcomes.[5] A systematic study and meta-analysis conducted by Sherifali, *et al* found that there was a decrease in HbA1C levels, fat, and blood pressure in diabetes mellitus patients who took good care of themselves.[6] Good self-care practices have a relationship with blood sugar control and the prevention of both macrovascular and microvascular complications.[7]

Several studies have found that diabetes mellitus patients' adherence to self-care is still low. A systematic study conducted by Luo, *et al* found that personal and environmental factors are factors that can affect the behavior of diabetes mellitus patients in self-care management, one of which is communication problems between health care providers and patients.[8] This is further confirmed in a study conducted by Sohal, *et al* that there was a mismatch of communication and language between health care providers and patients which made it difficult for patients to understand diabetes education.[9]

Therefore, it is necessary to have an alternative approach that aims to overcome obstacles in health services for diabetes mellitus patients in order to prevent complications. One of the partners and liaisons between primary health services and the community is cadres.[10] Cadre is a member of the community who is trusted to be a public health officer on the front line who is able to make a positive contribution to the surrounding community.[11] However, currently, the role of cadres has not been much focused on the area of non-communicable diseases in the community.

A systematic review conducted by Olaniran, *et al* describes cadres as ordinary people who have a deep understanding of the culture and language of the community; they are said to be professionals who receive shorter training periods than health professionals.[12] The existence of cadres has the main goal of providing health services that are in accordance with the culture of the community. Furthermore, a systematic review conducted by Hill, *et al* adds the role of cadres as educators, supporters of care provision, and coordinators of care and

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Table 1: Research studies synthesis table.

Authors (Year)	Study Quality	Cadre		Intervention Form		Measurement Time	Outcomes
		Roles & Activities	Preparation	Intervention Group	Control Group		
Lutes *et al.* (2017)[19]	Good	Educator, Consultation	Extensive training (50 hours), Quarterly refresher training	Empowering 16 weeks (N=100) and weekly supervision by psychologists and post-doctoral students.	Letter on educational materials (N=100)	Baseline-6-12 months	HbA1C, Blood pressure, Body weight
Murayama *et al.* (2016)[20]	Good	Educator, Coordination *Home visit*	Self-care management promotion empowerment training	Direct group: Receiving intervention directly by community-health system-academic partners collaboration)	Delayed group: Given intervention after 6 months of enrolment	Direct group: Baseline-6 months Delayed group: 6-12 months	HbA1C, Self-efficacy
Carrasquillo *et al.* (2017)[21]	Good	Educator, Coordination *Home visit*	Training (75 hours)	Usual care and 4 home visits, 12 phone calls, education and monthly training groups by cadres for 12 months (N=150)	Usual care and educational materials sent every 3 months as well as phone calls for follow-ups (N=150)	Baseline-12 months	HbA1C, Blood pressure, LDLC,
Campos *et al.* (2018)[22]	Good	Educator, Coordination *Home visit*	Core competency training, group process, empowerment, interview, and motivation	Usual care and 11 group class meetings for 2 hours every 2 weeks, 2 home visits for 60 minutes every month, facilitation of visits and phone calls by cadres (N=149).	Usual care and 2 hour classes from graduate students and phone calls.	Baseline-6 months	HbA1C, Diabetic distress, Self-management, Symptoms of depression
Jain *et al.* (2018)[23]	Good	Educator, Coordination	Intensive training and workshops (7 days)	Educational booklets by cadres, phone calls every 16 days and inspection target diaries (N=153)	Usual care	Baseline-6 months	Fasting blood glucose, HbA1C, Total cholesterol, Blood pressure, Body weight
Spencer *et al.* (2018)[24]	Good	Educator, Coordination *Home visit*	Training (80 hours)	Follow-up after 6 months of intervention was randomized into 2 groups, led by peer-leader + cadres and cadres only for 12 months. *Peer leader* trained by cadres (46 hours for 12 weeks). Cadres + PL: Weekly group sessions. Goal setting, call supports for 3 weeks (N=60) Cadres: Monthly *phone call* from cadres (N=89).	2 hour class by research assistant and phone call every month.	Baseline-6-12-18 months	HbA1C, Diabetic disorders, Symptoms of depression
Perez *et al.* (2015)[25]	Good	Educator, Healthcare provider team	DM care and treatment training (65 hours) Interview, motivation, and communication skills trainings (25 hours)	Counseling and home visits every week in the first month, every 2 weeks in the 2nd and 3rd months, and every month in the 4th until 12th months (N=103).	Standard care (N=104)	Baseline-3-6-12-18 months	HbA1C Blood sugar, Anthropometry, Blood pressure
McDermott (2015)[26]	Good	Educator, Coordination Healthcare provider team	Intensive training (3 weeks) Refresher training (workshop) for reporting & problem solving	Home visits and counseling from cadres (N=100, 6 clusters).	Usual care (N=113, 6 clusters).	Baseline-18 months	HbA1C, Cholesterol
Rodriguez *et al.* (2018)[27]	Good	Educator, Counseling	Patient health coaching training and modules (3 face-to-face sessions for 6 hours)	Education, goal setting, action planning and routine monitoring in Cadre groups and medical assistant groups (@ 3 CHC sites)	Usual care (10 CHC sites)	Baseline-2 years	HbA1C, Cholesterol, Chronic care experience

Islam *et al.* (2018)[28]	Good	Educator, *Home visit*	Not recorded	5 monthly 2 hour group education sessions and 2 home visits (90 minutes)	One 1st session of educational group	Baseline-6 months	HbA1C, Cholesterol, BMI, Blood pressure, Behavior, Knowledge
Gray *et al.* (2021)[29]	Good	Educator, *Home visit*	Comprehensive training (40 hours), Health training and coaching	6 home visits and education	Usual care	Baseline-12 months	Physical activity, Diet behaviour, Self-efficacy, Social support, Frequency of eating
Vaughan *et al.* (2017)[30]	Good	Educator	Ongoing orientation and training (14 hours)	3 hours of monthly diabetes group visits.	Usual care	Baseline-6 months	HbA1C, Eye retina examination, Diabetic foot check, Mammogram examination, Urine microalbumin, Body weight
Lim *et al.* (2021)[31]	Good	Educator, *Home visit Phone Call*	5 sessions training on health education in groups (60-90 minutes monthly) by paid and trained cadres.	HER registry, cadre interventions and HIT-enable linkage to community resources.	Not recorded	Baseline-6-12-18	HbA1C
Jung Hsu *et al.* (2021)[32]	Good	Educator	4 hours training	NSPT and periodontal curriculum by cadres face to face for 30 minutes (4 weeks)	NSPT	Baseline-1-3-6 months	Oral care behaviour, Periodontal status, Quality of life
Kim *et al.* (2016)[33]	Good	Educators and counselors	12 hours initial training and 12 hours diabetes specific training	6 education and training sessions (@ 2 hours) for 4 weeks, monthly phone counseling (10-60 minutes), 2 times daily blood sugar measurement and diabetes diary.	Standard care	Baseline-3-6-9 months	HbA1C

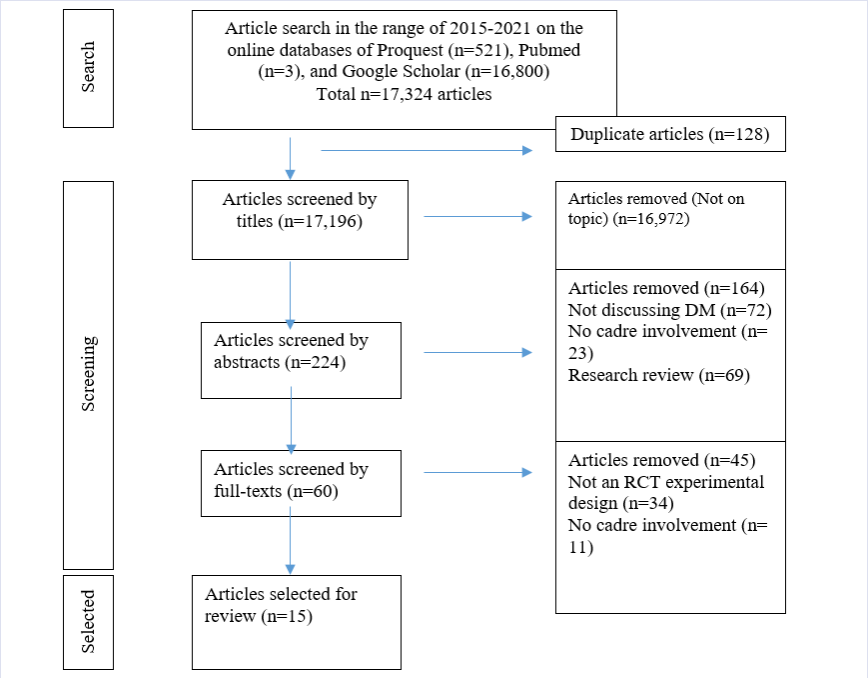

Figure 1: PRISMA 2015-based article selection flowchart

social support.[13] A study conducted by Balagopal, *et al* also explains that cadres play an important role as educators, support providers, and advocates as well as potential agents of change.[14] The concept of coordinator in the delivery of care includes a role in patient advocacy, for example assisting patients in communicating with health care providers and accessing health resources.[15]

The current issue in the development of health care for developing countries is to involve local lay people in disease prevention. In addition, the lack of resources in health services in providing basic intervention and prevention also supports the existence of cadres.[16] There is no clear consensus regarding the pattern of cadre intervention programs on the health outcomes of diabetes mellitus patients. This systematic review paper aimed to synthesize research studies on cadre interventions on health outcomes of diabetes mellitus patients.

METHODS

Data sources

The literature search was carried out on the online databases of PubMed, Proquest, and Google Scholar journals with a span of the last 7 years, namely in the range of 2015-2021. However, to strengthen the background and discussion, the literature used is not only in that time frame. Meanwhile, the keywords used to identify relevant research studies included community health worker, intervention, health outcomes, and diabetes mellitus.

Study selection

The search process was carried out systematically by setting literature criteria which included journal articles tested a diabetes mellitus patients intervention led by community health worker, peer-reviewed, written in English, and in the form of research studies with a Randomized Control Trial (RCT) design.

Data abstraction

The data abstracted from the selected articles included the characteristics of cadres as seen from their roles and activities as well as the form of cadre preparation in the intervention programs. Other data abstracted were the form of interventions, measurement time, and outcomes obtained from each research article.

Quality assessment

The quality of health research in the form of randomized interventions can use a checklist with 27 items.[17] Measurements were made on reporting, external validity, internal validity (bias), internal validity (confounding) and power. The measurement results are determined based on the value in the range 0-28 which is divided by the total score and then multiplied by 100. Furthermore, the total value of each article will refer to the category of quality assessment in the form of poor (0-25%), low (26-50%), fair (51-75%) or good (76-100%).[18]

RESULTS

Research description

Chart 1 describes the flow of the literature search process using the PRISMA model. Based on the identification of articles on the online databases of PubMed, Proquest and Google Scholar, 17,324 articles were obtained, 128 of which were duplicates, resulting in a total of 17,196 articles screened. The first screening was carried out from the title of the article, the results of the screening resulted in 16,972 articles. Furthermore, 224 articles were screened again by reading their abstracts and 60 articles deemed relevant to be screened in full-text. The results of the screening of 60 full-text articles obtained 15 articles that were selected for further systematic review.

Characteristics of cadres

One particular characteristic of a cadre is someone who lives in the area where the community is studied with a length of residence of 5 years.[19] Other characteristics are based on their language skills according to local culture[15,17,23,25] and in terms of education, is someone with a high school degree.[24,29] Not all articles explain the characteristics and recruitment criteria of cadres. In this intervention program, the cadres as a whole have a role in providing education and counseling.[14,15,16-28] Another role is to facilitate patients in making visits to health services,[15,16,19,21] and to make home visits.[15-17,19,24,26] In addition, 2 articles explain that cadres also play a role in the health care provider team.[20,21]

Before participating in the intervention program, all articles reviewed describe how cadres were prepared through various forms of training. The training provided was based on an empowerment approach.[15,17,19] Besides being given core competencies regarding health development for diabetes mellitus patients, cadres are also given training in motivational interviews and communication.[16,17,20,24,27] Other activities carried out by cadres are participating in workshops[18,21] and refresher training.[14,21] There were 12 articles that explained the length of the training carried out, both in terms of hours[14,16,19,20,22,24-28] or day[23] and week.[26]

Intervention characteristics

The intervention programs carried out included providing education and counseling both in group class meetings,[16,17,19,23,25] monthly phone counseling,[33] individual face-to-face meetings,[32] as well as home visits.[16,17,20,21,23,24] These interventions were carried out whether by cadres,[14,16-18,20-23,25,27,28] cadres in partnership with health care providers and academic partners,[20] or cadres and other parties such as peer-leaders in the patient group[24] and culturally relevant community resources.[31] The activities carried out in the intervention included helping patients with behavioral consistency by setting goals and planning actions,[14,19,22,23] keeping a diabetes diary[33] as well as doing phone calls.[14,16-19] In addition, there is 1 article that described the weekly supervision carried out in the intervention[19] as well as follow-up visit assessment.[29]

Impact of intervention

The measurement time reported in this study is relatively varied, ranging up to 6 months,[15,17,18,23,25] 9 months,[33] 12 months,[14,16,24] 18 months[24-26,31] and 24 months.[27] Overall, the health outcomes measured included metabolic control outcomes and behavioral components of diabetes management,[14-16,18,20-26,28] oral health status,[32] symptoms of depression or stress status[17,19] and quality of life of diabetic patients.[32] Out of 5 articles that assessed metabolic control for 6 months, all found that there was a difference in HbA1C between the intervention group and the control group. There were 2 articles that found no difference in HbA1C values at 12 months follow-up[19] and 18 months follow-up.[25]

Other metabolic controls for blood pressure and cholesterol levels, 1 article found that there was no difference in cholesterol levels between the intervention group and the control group at 12- and 18-months follow-up.[14-19] and blood pressure at 6 months follow-up.[23] As for anthropometric measurements, 2 articles found that there was no change in body weight[18,20] namely at 6 months and 18 months follow-up. Out of 2 articles, 1 article found that there was no effect of the intervention on diabetic distress and depressive symptoms at the 6 months follow-up.[22] However, this cadre intervention has been able to improve the behavior of diabetes mellitus patients in carrying out self-care at 6 months[23,27] and 12 months of measurement.[29]

DISCUSSION

This study aimed to review studies on cadre interventions on health outcomes of diabetes mellitus patients from a systematic search of

articles. This study described the characteristics, roles, and activities of cadres. In addition, it also explained the characteristics and impacts of the intervention. There were 15 research study articles with a randomized control trial design that were considered to have good methodological quality based on the PRISMA checklist instrument. These articles were further analyzed in order to provide conclusions in answering the study objectives.

Each article described the limitations in the study that were taken into account in reporting the results. In general, the existing limitations included the lack of ability to control confounding factors that can lead to bias in research results,[14,20-22-24,26,27] low sample size, data loss, and high loss of follow-up in the intervention group,[17,19,21] and short intervention time,[16,18,25] as well as no identification of further measurements on the identity of cadres.[20]

One of the outcomes measured in the articles selected was metabolic control. These metabolic markers included HbA1C, cholesterol levels, and blood pressure. HbA1C assessment is a biomarker sign in assessing the quality of glycemic control in diabetes mellitus patients.[29,30] The values of these HbA1C levels can also be a predictor of complications of diabetes mellitus.[36] There were 7 articles that reported a decrease in HbA1C levels in the intervention group compared to the control group. Meanwhile, there were also 2 articles that found no difference in HbA1C levels.

The differences in the findings from these articles can be assumed because of the difference in the form of intervention programs carried out and the duration of the interventions. All 4 articles with 6 months follow-up found a decrease in HbA1C levels. It is possible that short-term interventions can also change the glycemic control of diabetes mellitus patients.[37] However, interventions with short duration are less able to provide adequate psychosocial interventions for diabetes mellitus patients.[22]

In addition, the characteristics of the intervention also contributed to the improvement in health outcomes. Several studies have shown the magnitude of the effect of cadre involvement on diabetes mellitus patients.[31,32] However, the role of cadres will be very meaningful if followed by other interventions including involving peers of diabetes mellitus patients for consistency of outcome in each measurement.[24,40-45] Cadre and peer interventions are known to have a significant effect on patients' glycemic controls,[40] so if the two interventions are combined it will be better.

CONCLUSION

This systematic review provides evidence regarding the nature of the interventions and their impacts on improving the health outcomes of diabetes mellitus patients, given that diabetes mellitus is a disease that has a tendency to have complications. There is a need for further systematic studies of the effects of cadre involvement interventions in preventing both macrovascular and microvascular complications.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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