Impact of Health Education Interventions in People with Diabetes Mellitus in Africa: A Systematic Review and Narrative Synthesis

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ABSTRACT

Health education is important to promote good lifestyle behaviours and prevent/delay onset of type II diabetes mellitus. There is substantial evidence from developed countries supporting the importance of diabetes self-management education in promoting adherence to therapy and glycaemic control. The purpose of this systematic review (SR) was to identify the impact of educational interventions on glycaemic control and other related outcomes in African populations. Pubmed, CINAHL, EMBASE and Google Scholar data bases were searched. Search terms for diabetes were; diabetes, hyperglycaemia and diabetes mellitus. Search terms for educational interventions were; health education, health education model, health education programme, health education framework, health education intervention and patient education. Included were RCTs that had tested the effectiveness or impact of health education interventions on people with diabetes mellitus in Africa, had recruited concurrent controls, aimed to promote good glycaemic control in diabetic patients and focused on at least one area of lifestyle management. Studies were eliminated if they were not RCTs, were conducted on health professionals, had no accessible full text article, had recruited mixed populations (diabetic and non-diabetic) and if they did not have English titles and abstracts. The cut-off period for publications ensured inclusion of current evidence in the systematic review. Nine studies were included in the SR. Substantial heterogeneity existed among studies thus no head to head comparisons could be done, hence, there is no reliable evidence favouring superiority of one intervention over another.

Key words: Diabetes Mellitus; Patient-Education; Health-Education; Glycaemic-Control; Impact

INTRODUCTION

The burden of diabetes mellitus has risen sharply over the past 20 years International Diabetes Federation [1]. There is substantial evidence from developed countries supporting the importance of diabetes self-management education (DSME) in promoting adherence to therapy and glycaemic control [2-5]. However, DSME in Africa is generally limited in scope, content and consistency [6]. One study conducted in South Africa reported that 43% interventions have no cultural tailoring with only 39% being designed for low socio-economic status populations [6]. Most studies conducted in Zimbabwe have looked at epidemiology of diabetes, complications and adherence to therapy [7-18] with the psychosocial aspect being fairly neglected. Though a number of RCTs have been conducted in African countries, [19-26] none have been conducted in Zimbabwe to determine impact of health

education interventions. A number of RCTs have been conducted in Africa on educational interventions in people with diabetes mellitus [22,23,25-28]. The purpose of this systematic review was to identify educational interventions evaluated and their impact on glycaemic control and other related outcomes in people with DM. Findings of this systematic review will inform the development and adaptation of culture specific and family centered educational frameworks for people with diabetes to promote adherence to therapy.

METHODOLOGY

Information Sources

Pubmed, CINAHL, EMBASE and Google Scholar data bases were searched. Search terms for diabetes were; diabetes, hyperglycaemia

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and diabetes mellitus. Search terms for educational interventions were; health education, health education model, health education programme, health education framework, health education intervention and patient education.

Eligibility Criteria

Study types and participants: Search terms for diabetes were; diabetes, hyperglycaemia and diabetes mellitus. Search terms for educational interventions were; health education, health education model, health education programme, health education framework, health education intervention and patient education. Included were RCTs that had tested the effectiveness or impact of health education interventions on people with diabetes mellitus in Africa, had recruited concurrent controls, aimed to promote good glycaemic control in diabetic patients and focused on at least one area of lifestyle management. Studies were eliminated if they were not RCTs, were conducted on health care professionals, had no accessible full text article, had recruited mixed populations (diabetic and non-diabetic) and if they did not have English titles and abstracts. The cut-off period for publications ensured inclusion of current evidence in the systematic review.

Interventions: All interventions were eligible if they aimed to promote good glycaemic control in diabetic patients. They were eligible if they focused on at least one area of lifestyle management required in diabetic patients and these included diet, exercise, medication adherence, stress management and smoking cessation.

Outcomes: The primary outcome was glycated haemoglobin (HbA1C) as an objective measure of glycaemic control. Secondary outcomes were adherence to medications and other aspects of therapy, knowledge of the disease and other self-care practices. Generally, outcomes reflected the first three of the Kirkpatrick evaluation model for evaluating training effectiveness namely; i) reaction, ii learning and iii behaviour.

Study Selection

Two authors (DM and MZ) independently screened titles and abstracts to select potentially eligible reports. The abstracts were read followed by the full text if it was potentially eligible. Initially each reviewer screened a sample of 10 manuscripts to ensure interrater agreement. Both reviewers read full manuscripts to determine eligibility. Unresolved eligibility issues were clarified through consultation with a 3rd author (AN).

Data collection

Data were extracted and entered by 2 authors (DM and MZ) independently. Initially, they each extracted and entered 5 reports then compared them to ensure interrater agreement. Any disagreements were resolved with input from AN. Data items extracted are shown in Table 1 under results below.

Risk of bias in included studies

The nine studies were quality assessed using the Cochrane Collaborations tool for assessing risk of bias in RCTs. All nine studies contained at least two domains classified as at high risk of bias or no information. All studies contained performance bias (blinding of personnel and participants) while all but one had detection bias (blinding of outcome assessment). Table 2 below presents the summary of risk of bias assessment.

Table 1: Risk of bias.

Study	RSG	AC	B 1	B 2	IOD	SR	O
Olmen et al. (2017) DRC, Cambodia and Phillipines	+	?	?	?	+	+	+
Makki-Awouda et al. (2013	+	?	?	?	+	+	-
Muchiri et al. (2015) South Africa	+	+	-	+	+	+	-
Tawfik et al. (2017) Egypt	+	?	?	?	+	+	+
Abazz& Maschollek (2017) Egypt	+	+	?	?	+	+	+
Amendezo et al. (2017) Rwanda	+	-	-	-	+	+	-
Essien et al. (2017) Rwanda	+	+	?	?	+	+	+
Mash et al. (2014) South Africa	+	?	-	-	+	+	+
Debusche et al. (2018) Mali	-	?	-	-	+	+	-

Risk legend
+ Low risk - High Risk ? Unclear

Data synthesis

Because of the heterogeneity of the educational interventions, a narrative synthesis was done. The narrative synthesis was guided by Popay et al. (2007) guide for conducting narrative synthesis.

RESULTS

Figure 1 presents the flow of articles during the review process. The search identified 19 reports. After screening titles and abstracts, the full texts of 9 studies were examined. Nine eligible reports were then selected. No reports were identified from grey literature. Nine eligible studies were identified from literature. Only one study out of the eight looked at impact on pregnancy outcomes. The total sample size was 3335 with samples ranging from 71 to 1570. Below is a diagram illustrating selection of studies. The studies were from South Africa, Nigeria, Rwanda, Egypt, Malawi, Mali and Congo.
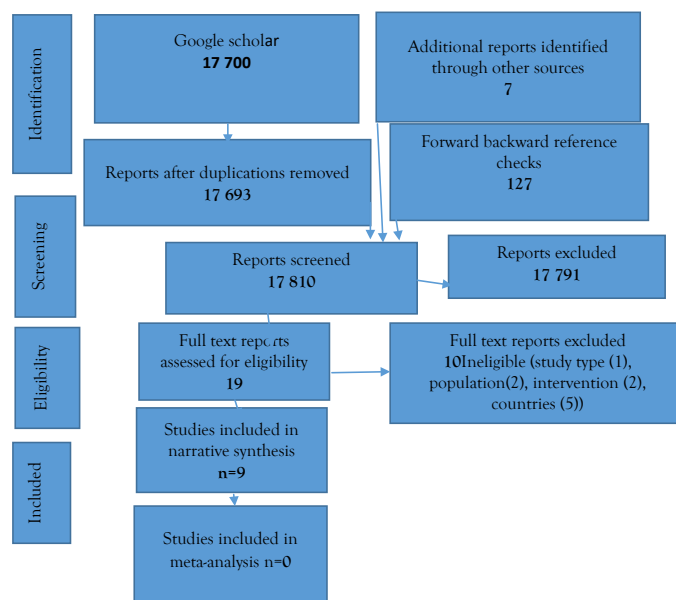

Figure 1: Selection of articles.

DISCUSSION

A total of 9 studies conducted in Africa were identified. Sample size ranged from 71 to 1570. Almost all studies were conducted in non-pregnant patients [19-24,26,29] and only one focussed

<div align="center">**Table 2:** Study Characteristics.</div>

Author	Participant characteristics	Sample size	Settings	Intervention details	Outcome measures	Impact
Van Olmen et al. (2017) DRC, Cambodia and Phillipines	Diabetic patients	781	HCC	Text message self-management support. Disease, diet, monitoring, foot care, smoking and alcohol, patient held records and problem solving	HbA1C after 2 years	No impact
Makki-Awouda et al. (2013) Sudan	Diabetic patients	152	HCC	Before and after comparison on knowledge of diabetes (Disease, diet, monitoring, foot care, smoking and alcohol, patient held records and problem solving)	Knowledge of diabetes mellitus.	Improved knowledge
Muchiri et al. (2015) South Africa	Type II Diabetic patients	82	HCC	Nutrition education programme consisting of: i. 8 weekly sessions lasting 2-2,5hours each (Disease, diet, monitoring, foot care, smoking and alcohol, patient held records and problem solving) ii. 4 monthly meetings and 2 bimonthly meetings lasting 1,5hours each iii. Vegetable gardening (demonstration of sowing/transplantation of vegetables)	HbA1C (primary) and BMI, BP and blood lipids (secondary)	No impact
Tawfik et al. (2017) Egypt	Women with GDM	201	HCC	Health belief model based educational intervention on knowledge, practice, gestational and post-partum weight gain at 6 weeks post-partum.	Knowledge, self-care practice, gestational weight gain, beliefs, post-partum weight gain	Improved outcomes in intervention group
Abaza 0& Maschollek (2017) Egypt	Diabetic patients	71	HCC	Daily SMS messages and weekly reminders addressing various diabetes categories (Disease, diet, monitoring, foot care, smoking and alcohol, patient held records and problem solving).	HbA1C (Primary). Blood glucose level, body weight, treatment and medication adherence, self-efficacy and diabetes knowledge	Reduction in HbA1c Improvement in treatment and medication adherence, self-efficacy and knowledge scores
Amendezo et al. (2017) Rwanda	Diabetic patients	223	HCC	Monthly lifestyle group education sessions lasting 45 minutes (Disease, diet, monitoring, foot care, smoking and alcohol, patient held records and problem solving)	HbA1C at 12 weeks	Reduction in HbA1c
Essien et al. (2017Nigeria	Diabetic patients	104	HCC	Intensive and systematic DSME programme, using structured guidelines adapted from the Health Educator Desk Guide of the COMDIS-HSD group in the United Kingdom, which reflects the core educational elements recommended by the International Diabetes Federation (IDF) (Disease, diet, monitoring, foot care, smoking and alcohol, patient held records and problem solving)	HbA1C at 6 months	Reduction in HbA1c
Mash et al. (2014) South Africa	Diabetic patients	1570	HCC	4 monthly sessions of group diabetes education lead by a health promoter (Disease, diet, monitoring, foot care, smoking and alcohol, patient held records and problem solving)	Diabetes self-care activities and 5% weight loss (Primary). Self-efficacy, locus of control, mean BP, mean weight loss, mean waist circumference, mean HBA1C, mean total cholesterol and quality of life (secondary).	No impact
Debusche et al. (2018) Mali	Diabetic patients	151	HCC and community	1 year of Peer-led culturally tailored patient education (3 courses of 4 sessions) delivered in the community by 5 trained peer-educators. (Disease, diet, monitoring, foot care, smoking and alcohol, patient held records and problem solving)	HbA1C at 12 months	Reduction in HbA1c

on gestational diabetes [25]. Of the 9 studies only one [25] was conducted in the community while the rest were done at health care facilities. Hospital based studies have an inherent limitation of participants reporting socially desirable responses on subjectively measured outcomes. Six of the studies reported HbA1C as the primary outcome though measured at different end points ranging from 12 weeks to 6 years. HbA1c is a reflection of 6 weeks' glycemic control in a diabetic patient. Longer end points might be subject to bias introduced by a number of factors that include contamination and comorbidities which might explain why in one study [26] the intervention had no impact. There were inconsistencies in the primary outcome (HbA1C) with 2 studies [24,26] reporting no impact. Some studies, however, reported statistically significant differences in HbA1C and other secondary outcomes favouring the intervention [19-22,25,29]. This underscores the importance of health education in the management of diabetes. There is need to conduct robust RCTs of educational interventions in order to yield reliable results that are generalizable and that reliably informs policy.

Across the studies, outcomes were measured at different points in time (ranging from 12 weeks to 2 years). This brings uncertainty whether the effects of the educational interventions will be sustained, especially considering that one study that measured outcome at 2 years reported no impact.

None of the studies evaluated the same educational intervention as the other included studies. Despite majority of the studies being conducted at health care institutions, variations arose in intensity and duration of educational intervention, educational format and educational intervention provider. Majority studies measures HbA1C as the primary outcome, albeit with different end points, while other secondary outcomes varied widely among the studies included. The wide range of endpoints, primary and secondary outcomes hampered effective synthesis of results from the studies. However, the population in the studies were very similar except for one [25]. Only one study reported using a validated and scientifically developed diabetes self-management education (DSME) program [21]. It is very important in future to use common educational interventions and outcome measures to facilitate comparison of results and synthesis. Some of the studies reported delivering health education via short message services (SMS). While this will be cheaper in terms of transport costs and time, some people in resource limited settings may not have access to mobile phones.

The risk of bias across studies included was variable with high risk in at least one domain for all RCTs. Owing to the nature of the intervention, none of the studies reported blinding hence there were both Performance and detection bias in all studies included. It is therefore, difficult to draw firm conclusions about the effect of the educational interventions on primary and secondary outcomes. It is also very difficult to recommend a particular educational intervention in terms of content, duration and format. There are no head to head comparisons of studies conducted in Africa hence, there is no reliable evidence favouring superiority of one intervention over another.

One promising educational intervention for people with diabetes is the one evaluated in a trial by Essien et al. [21]. This particular intervention was an intensive and systematic DSME programme, using structured guidelines adapted from the Health Educator Desk Guide of the COMDIS-HSD group in the United Kingdom, which reflects the core educational elements recommended by the International Diabetes Federation (IDF). The primary outcome was

also objectively measured HbA1C. However, assessment of HbA1C at 6 months from inception might have introduced bias as so many confounders can be encountered during the relatively long period. Similar health interventions can also be used in pregnant women with diabetes. The use of peer educators in the study by Debussche et al. [29] is also commendable as it mitigates the shortage of staff in resource limited settings. One study conducted in Zimbabwe recommended use of peer educators in women with diabetes in pregnancy [8].

This systematic review is designed to identify all educational interventions in people with diabetes conducted in Africa from 2010 to 2019. One strength of this review is the extensive search for studies and rigorous assessment. Narrative synthesis was done as recommended by Popay et al. [30] Studies included were conducted in 5 African countries, namely, DRC [26] Sudan [22] South Africa [23,24] Egypt [19] Rwanda [20] Nigeria [21] and Mali [29]. There were 2 studies each from South Africa, Egypt and Rwanda. It is evident from this systematic review that there is need to conduct robust RCTs of health education interventions. It might also be beneficial to conduct multinational multicentre studies with similar designs in order to generate reliable evidence on diabetes education in Africa.

Limitations of the study

The studies included in this review were heterogeneous which is a limitation of this review. Potential non-English studies might have been missed if they lacked English titles and abstracts. This review focused on studies conducted in African countries and useful information could have been obtained if the search had included studies done worldwide. However, the purpose of the review was to evaluate particularly studies conducted in African countries. Findings of this review will inform adaptation of health education programmes to the African context in order to promote development of culturally congruent health education programmes.

CONCLUSION

It is important to empower the patient through health education and any other recommended means in order the make them active participants in their own care. Health education promotes shared decision making and shared goals of care. This review has shown that health education can improve knowledge, self-care and ultimately glycaemic control in people with diabetes in the short term. The longer term effects are uncertain and one study actually reported no impact on HbA1C after 2 years. It is imperative to conduct more robust randomised control trials with well-designed educational interventions, validated outcome measures on a variety of populations in order to come up with more reliable and certain estimates of impact of educational interventions.

Conflict of interest

None

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