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Review Article

**PRIMARY HEALTH CARE APPROACHES TO PREVENT
DIABETES MELLITUS: SYSTEMATIC REVIEW IN LITERATURE****Fouz BuSaad^{1*}, Albara Alhubaishi², Moaz Alammar³, Ahmed Almohisin³, Rayan Alghamdi⁴, Reemah AlSumairi⁵, Abdulrahman AL-Abdulgader³, Ahmed Alzahrani⁶, Ahmad Alanazi⁷, Ibrahim Ahmed⁸**¹King Faisal University, Alhassa, Saudi Arabia²University of Dammam, Dammam, Saudi Arabia³Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia⁴Umm AlQura University, Makkah, Saudi Arabia⁵Taif University, Taif, Saudi Arabia⁶Mansoura University, Mansoura, Egypt⁷King Saud University, Riyadh, Saudi Arabia⁸King Saud University For Health Sciences, Riyadh, Saudi Arabia**Abstract**

This review is aiming to discuss the Primary Health care approaches to prevent diabetes mellitus, the presented review was conducted by searching in Medline, Embase, Web of Science, Science Direct, BMJ journal and Google Scholar for, researches, review articles and reports, published over the past years. were searched up to November 2018 for published and unpublished studies and without language restrictions, if several studies had similar findings, we randomly selected one or two to avoid repetitive results. On the basis of findings and results this review found the diabetes education, life style and self-management are most common approaches of primary health care to diabetes, and also the Program to Improve Primary Care Access and Quality, health providers' development, chronic care model, Use of a Caloric-Monitoring, this systematic review suggests that Mobile Phone so successful approaches should be conducted to prevent the -presence of diabetes and is complication.

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INTRODUCTION:

Type 2 diabetes is one of the main non-communicable diseases (NCD) and is also an important cardiovascular risk factor. The World Health Organization (WHO) projects that the total number of diabetics will increase, worldwide, to more than 300 million by 2025 with at least two thirds of them living in developing countries. Sub-Saharan Africa countries (SSA) amongst which the Democratic Republic of the Congo (DRC) are experiencing an increase in the morbid-mortality related to non-communicable diseases. These countries counted 7 million diabetics in 2000 and are projected to have more than 15 million in 2030. They are experiencing one of the most rapid epidemiological transitions and are thence confronted with a double morbid burden in a context where their health systems are essentially oriented to manage infectious diseases. Then non-communicable diseases remain globally neglected in SSA countries and most countries have not positioned NCD in their agenda yet.⁽¹⁾ Primary care can be a valuable setting for preventing diabetes in at-risk populations as patients can be offered support for prevention, such as screening and lifestyle advice, by primary care health professionals such as GPs, practice nurses or health care assistants.[2] Anyone with diabetes, including type 2 diabetes, has to make multiple daily choices about the management of their condition, such as appropriate dietary intake, physical activity, and adherence to drugs, often with minimal input from a healthcare professional.[3] In recent years, several clinical trials have demonstrated that is possible to prevent DM2 through educational interventions to change lifestyles. Specifically, in high risk subjects, the risk of developing DM2 can be reduced by around 60% after 3 years of these types of intervention. Additionally, the effects of interventions focused on changing lifestyles seem to last in the long-term.[4] The Brazilian Unified Health System (Sistema Único de Saúde [SUS]) is a decentralized public health system. In 1994, the Ministry of Health (MOH) launched the Family Health Strategy (FHS) for improving primary health care delivery and SUS performance regarding universal and comprehensive care. The FHS delivers health actions addressing health promotion, preventive examinations, and health care to poorer and vulnerable population groups.⁽⁵⁾ The International Diabetes Federation (IDF) has developed clinical practice guidelines of type 2 diabetes care in SSA that contain instructions for a better clinical practice in order to improve type 2 diabetes care in countries with limited resources.⁽⁴⁾ This article used these IDF guidelines as reference to assess the capacities of health facilities belonging to this network in terms of equipments, as well as the

knowledge, and the practice of their health providers related to type 2 diabetes care.[1] Patient self-efficacy has been shown to be positively correlated with improving diabetes control via diabetes self-care.⁽⁸⁻¹¹⁾ Self-efficacy has been defined as one's ability to perform goal-directed behaviors in the presence of an obstacle or barrier.[4] Putting this concept into the context of T2DM, the goal-directed behaviors refer to self-care behaviors including adhering to self-monitoring of blood glucose (SMBG), dietary control, physical activity, foot care and medication intake as recommended.[7] Comprehensive models of care, such as the original Chronic Care Model (CCM), advocate for evidence-based health care system changes that meet the needs of growing numbers of people who have chronic disease. CCM was developed to provide patients with self-management skills and tracking systems. [8] Several studies have been conducted on the use of technology and mobile phones in diabetes management, including studies using interventional approaches—as opposed to control—whereby intervention groups received mobile phone reminders or feedback on self-monitoring of glucose levels. However, research attempting to understand usage patterns of mobile phone-based interventions has been challenging. A few studies have attempted to assess usage patterns, but in a simplistic manner that provided minimal useful information—descriptions, averages, or tabulation of usage data. [6]

METHODS:

The present review was conducted November 2018 in accordance with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) declaration standards for systematic reviews. We reviewed all the topics on primary health care approaches, such as education, self management, health provider's development, life style, anatomy, neurology, bacteriology, pathology, and clinical statistics. To achieve this goal, we searched Medline, Embase, Web of Science, Science Direct, and Google Scholar for, researches, review articles and reports, published over the past 15 years.

Our search was completed without language restrictions. Then we extracted data on study year, study design, and key outcome on diabetes. The selected studies were summarized and unreproducible studies were excluded. Selected data is shown in the Table 1.

Inclusion criteria

Inclusion criteria were diabetes mellitus: type 2, adult, primary health care.

Exclusion criteria

Exclusion criteria were diabetes mellitus: type1, gestational diabetes, elderly, secondary and tertiary care.

Data extraction and analysis

Information relating to each of the systematic review question elements was extracted from the studies and collated in qualitative tables. Direct analysis of the studies of diabetes.

RESULTS:

A database of 6646 records was screened by the research team, and 18 papers were included. Three major themes were identified in this review. The first theme of context and setting of diabetes progression includes the risk and progression of diabetes, primary care as a setting, and where the responsibility for change is thought to lie. This review also found mixed views on the value of preventative services within primary care. The second theme focused on the various patient factors associated with diabetes prevention such as a patient's motivation to modify their current lifestyle, perceptions and knowledge (or lack thereof) of the impacts of diabetes, lack of follow-up in healthcare settings, and trust in healthcare professionals. The third theme was centered on professional factors impacting on diabetes prevention which included workload, time constraints, resources, self-efficacy and knowledge as well as professionals' perception of patient motivations towards change. [10]

HbA_{1c} levels at three years had decreased in both groups. After adjusting for baseline and cluster the difference was not significant (difference -0.02, 95% confidence interval -0.22 to 0.17). The groups did not differ for the other biomedical and lifestyle outcomes and drug use. The significant benefits in the intervention group across four out of five health beliefs seen at 12 months were sustained at three years ($P < 0.01$). Depression scores and quality of life did not differ at three years.[3]

The primary outcome variable will be the relative risk of developing DM2, comparing the accumulated incidence (assessed by the OGTT) in the intervention and control groups after 24 months. The secondary outcome variables will be observed changes at 12 months in a sub-sample of intervention and control patients in: the proportion of patients who meet the recommended aerobic physical activity levels (moderate-intensity physical activity for ≥ 30 minutes 5 days/week or vigorous intensity activity for ≥ 20

minutes 3 days/week), derived from the 7-day Physical Activity Recall questionnaire ; and the proportion of patients who consume ≥ 5 servings of fruits and vegetables, assessed by the Mediterranean Diet Adherence Screener (MEDAS) used in the 'Prevención con Dieta Mediterránea (PREDIMED)' study . Lastly, potential effect-modifying variables will be also measured: age, sex, and level of education, among others.[4]

Out of a total of 38 812 PHCs evaluated in a service census, 17 202 health teams from 13 843 PHCs adhered to the PMAQ. A total of 65 391 users were interviewed, and 8118 of them reported having medical diagnosis of diabetes; 6309 (87.2%) of these had an appointment at 4546 of the PHCs in the last 6 months.[5]

For both diabetes-related healthcare utilization and total healthcare utilization three profiles could be distinguished: for the diabetes-related healthcare utilization these were characterized as 'high utilization and frequent home visits' (n=393), 'low utilization, GP only' (n=3231) and 'high utilization, GP and nurse' (n=3097). Profiles differed with respect to the patients' age and type of medication; the oldest patients using insulin were dominant in the 'high utilization, GP and nurse' profile. High total healthcare utilization was not associated with high diabetes-related healthcare utilization. [9]

The integration of NCD healthcare in the KPHC network is feasible. The majority of HF possessed IDF recommended materials except for the clinical practice guidelines, urinary test strips, and monofilament, available in only one, two and four HF, respectively. KPHCN referral facilities had required materials for biochemical analyses, the ECG and for the fundus oculi test. Patients' management is characterized by a lack of attention on the impairment of renal function during the first visits and a poor respect of recommended practices during quarterly and annual visits. A poor knowledge of the reduction of cardiovascular risk factors-related therapeutic objectives has been also reported.[10]

A total of 340 patients with type 2 diabetes mellitus were recruited. The total mean (\pm SD) of self-efficacy and self-care behavior scores were 7.33 (\pm 2.25) and 3.76 (\pm 1.87), respectively. A positive relationship was found between self-efficacy and self-care behavior (r 0.538, $P < 0.001$). Higher self-efficacy score was shown to be correlated with lower HbA_{1c} (r -0.41, $P < 0.001$). Multiple linear regression analysis demonstrated that higher self-efficacy scores (b -0.398; 95% CI: -0.024, -0.014; $P < 0.001$), shorter duration of diabetes (b 0.177; 95% CI: 0.002,

0.007; $P < 0.001$) and smaller waist circumference (b 0.135; 95% CI: 0.006, 0.035; $P = 0.006$), were significantly associated with good glycemic control.[11]

Barriers to PA reported by participants ($n = 29$) were identified at three levels: health care system (e.g. deficient PA guidelines); individual (e.g. obstructive social norms) and community (e.g. lack of facilities). Participants felt that a multilevel approach is needed to address perceived barriers and to widen current opportunities. In the presence of various diabetes primary care providers, the potential for dietitians to include individualized PA consultations as part of their role was highlighted. Participants felt that consultations should be augmented by approaches within the community (volunteer support and/or appropriate facilities). However, despite lack of experience with technology supported approaches and motivational tools, the telephone application “WhatsApp” and use of pedometers were considered potentially suitable. The need for training in behavior change techniques and clearly communicated intervention guidelines was emphasized.[12]

The 16 studies included various study designs, including 9 randomized controlled trials, and settings, including academic-affiliated primary care practices and private practices. We found evidence that CCM approaches have been effective in managing diabetes

in US primary care settings. Organizational leaders in health care systems initiated system-level reorganizations that improved the coordination of diabetes care. Disease registries and electronic medical records were used to establish patient-centered goals, monitor patient progress, and identify lapses in care. Primary care physicians (PCPs) were trained to deliver evidence-based care, and PCP office-based diabetes self-management education improved patient outcomes. Only 7 studies described strategies for addressing community resources and policies.[8]

Three iDAT app use trajectories were observed: Minimal Users (66 out of 84 patients, 78.6%, with either no iDAT use at all or use only in the first 2 weeks), Intermittent-Waning Users (10 out of 84 patients, 11.9%, with occasional weekly use mainly in the first 4 weeks), and Consistent Users (8 out of 84 patients, 9.5%, with weekly use throughout all or most of the 8 weeks). The adjusted odds ratio of being a Consistent User, relative to a Minimal User, was significantly higher for females (OR 19.55, 95% CI 1.78-215.42) and for those with higher exercise motivation scores at baseline (OR 4.89, 95% CI 1.80-13.28). The adjusted odds ratio of being an Intermittent-Waning User relative to a Minimal User was also significantly higher for those with higher exercise motivation scores at baseline (OR 1.82, 95% CI 1.00-3.32).[6]

Table 1 primary health care approach to diabetes

Author and year	Sample	Approach	Key point
Josie, et al. ²	664 records, 18 papers	Factor related to delivery and uptake of type 2 diabetes prevention interventions.	This review has identified various factors relevant to diabetes prevention in primary care
Kamlesh, et al. ¹³	13 primary care sites (207 practices)	education and self-management structured program .	no difference in biomedical or lifestyle outcomes at three years although there were sustained improvements in some illness beliefs.
Alvaro, et al. ⁴	14 primary health care centers	Feasibility and effectiveness of an educational program for the primary prevention.	a program for preventing DM2, implemented under real conditions in primary health care centers, is able to prevent the development of DM2 in high-risk patients.
Elaine, et al. ⁵	41 federal research institutions	Primary Care Access and Quality.	The findings of this study show that care for people with diabetes in PHCs is still falling short of expectations with regard to both structure and work process
Christel E, et al. ⁹	6721 known type II diabetes patients listed in 48 Dutch general practices	profiles of healthcare utilization obtained from observational data	High total healthcare utilisation was not associated with high diabetes-related healthcare utilisation.

Remy Y , et al. ¹⁰	A multicentre cross-sectional study was carried in 18 Health Facilities	Assessment of health service delivery capacities, health providers' knowledge and practices related to type 2 diabetes care	The capacities, knowledge, and practice of T2D care were poor among HF of KPHCN
Zahirah, et al. ¹¹	A total of 340 patients with type 2 diabetes mellitus were recruited	Relationship between self-efficacy, self-care behavior and glycemic control among patients with type 2 diabetes.	This study demonstrated that higher self-efficacy was correlated with improved self-care behavior and better glycemic control.
Thamra S, et al. ¹²	Four focus group discussions	Health professionals' perceptions about physical activity promotion in diabetes care.	This study highlighted key perceived barriers and opportunities for a PA program for patients with T2D. Despite clinical, individual, and environmental factors that could limit PA behavior, opportunities do exist within the positive spirit of health care workers for PA promotion
Michael , et al. ⁸	The 16 studies included various study designs	The Chronic Care Model and Diabetes Management.	We found evidence that CCM approaches have been effective in managing diabetes in US primary care settings.
Glenn G, et al. ⁶	84 patients with type 2 diabetes mellitus	Use of a Caloric-Monitoring Mobile Phone App Among Patients With Type 2 Diabetes Mellitus in a Primary Care Setting.	The application of LCGM provides a useful framework for evaluating future app use in other patient populations.

DISCUSSION:

This review has examined the factors relating to diabetes prevention in primary care by systematically reviewing the published literature in this area. We found diabetes prevention to be impacted by a patient's desire to modify their current lifestyle, and perceptions and knowledge of the impacts of diabetes. Patients were also influenced by contact with a trusted professional who can help motivate them towards making healthier lifestyle changes that could ultimately lead to a reduction in diabetes risks. Difficulty in changing current lifestyle, lack of time, costs, and personal difficulties were noted as obstacles for prevention for patients. This review also points to professional factors such as workload, knowledge of the professional, willingness to provide advice, and confidence in abilities to provide diabetes prevention advice as playing a big role in preventative services.[2]

Previously we reported that compared with baseline at 12 months HbA_{1c} levels decreased by -1.49% (95% confidence intervals -1.69% to -1.29%) in the intervention group and by -1.21% (-1.40% to -1.02%) in the control group. The present study

showed a small increase in HbA_{1c} levels from the 12-month data; however, overall the decreases in both the intervention group (-1.32%, -1.57% to -1.06%) and the control group (-0.81%, -1.02% to -0.59%) were sustained at three years.[13]

This study is to be an independent assessment of the results of the implementation of a prevention program for DM2 in high-risk populations seen in 14 primary care centers in the Basque Health Service, Osakidetza, commissioned by the Department of Health of the Government of the Basque Country. The scientific evidence provided by this study may be unique internationally as it has not, so far, been demonstrated that a program for preventing DM2, implemented under real conditions in primary health care centers, is able to prevent the development of DM2 in high-risk patients.[4]

The findings of this study show that care for people with diabetes in PHCs is still falling short of expectations with regard to both structure and work process, despite the impressive increase in coverage

of FHS in the last 20 years [5]

The purpose of this study was to develop profiles based on both total and diabetes-related primary healthcare utilization and to investigate the association between profiles of total healthcare utilization and diabetes-related utilization. For both diabetes and total primary healthcare utilization, three clearly distinct profiles were found with regard to the type of contacts and type of healthcare provider (GP or primary care nurse). Patient and disease characteristics were, however, not always associated with the membership of each profile. Age and type of medication – no medication, oral medication or oral medication and insulin – were the strongest indicators for diabetes-related primary healthcare profiles. Diabetes patients with a high total healthcare utilization (profile ‘high utilization’), were not always patients with a high utilization pattern for diabetes (‘high utilization, GP and nurse’), whereas having a low total healthcare utilization profiles was associated with a low contact rate for diabetes.[9]

The present study sought to investigate the capacities of health facilities belonging to KPHC network in terms of equipments, as well as the knowledge, and the practice of their health providers related to type 2 diabetes care. This study found that the clinical diabetes guidelines were not available in all the facilities except for one; this was also the case for the urinary test strips and monofilament. The following results were also noticed: a lack of renal function assessment during the first visits; a poor respect of the IDF quarterly and annual visits recommended practices; a poor knowledge of T2D therapeutic objectives namely body weight, blood pressure, renal function, glycaemia and lipedema control; and smoking cessation. These shortages were found more at the primary level than at the secondary level, then healthcare facilities were provided with the required materials except for those used for neurological exploration and the dosage of HbA1c. They had required staff except chiropodist and dietary advisors in the referral facilities. The integration of care for non-communicable diseases in the primary health care facilities network is feasible. These findings show that the health district system can allow the integration of other activities if the required equipment and the training of healthcare providers are supplied even to those who are not medical doctors⁽¹⁰⁾

This study demonstrated a moderately high mean self-efficacy score (7.33) and participants were found to be most self-efficacious in tasks relating to medication intake and least self-efficacious in blood

glucose testing. These findings were comparable with the study conducted in a hospital setting in Malaysia which showed a mean self-efficacy score of 7.57, where the highest score was for medication intake.[10] On the contrary, their study population was least efficacious in their eating plan.[10] Similar findings were found in a Jordanian study which showed a mean self-efficacy score of 7.26 with the highest score for efficacy to carry out medication intake.[2] Their participants were least confident in performing physical activity.[20] A likely explanation for the highest self-efficacy for medication intake is that this is a straightforward task which does not require much effort to perform. The low self-efficacy score in performing blood glucose testing in our study population highlighted the need to educate patients on self-monitoring of blood glucose (SMBG) to increase their self-efficacy to perform this task.[11]

The current qualitative study is part of a formative piece of work to inform a PA intervention design in diabetes care in Oman. Similar questions were asked a population of T2D patients in a quantitative cross-sectional study reported elsewhere. Consistent with ecological models of health behavior, the responses from the multidisciplinary groups of this study reflect perceptions of the multidimensional influences on PA and the necessity for multilevel actions to address them. Given the sparse evidence available on appropriate PA interventions for Arab populations, this study provides a framework/model for the design and integration of PA in routine diabetes primary care that can be subsequently evaluated.[12]

The findings of these studies contribute to a qualitative understanding of the relationship between the application of CCM components and diabetes outcomes in US primary care settings. Although the original CCM has been critiqued for not adequately meeting the needs of diverse patient populations with diabetes, our systematic review supports the idea that CCM-based interventions are generally effective for managing diabetes in US primary care settings.[8]

To our knowledge, this is the first study to apply LCGM to delineate trajectories of app usage. We were able to distinguish usage patterns of a caloric-monitoring mobile health app into three latent trajectory groups: Minimal (76.8%), Intermittent-Waning (11.9%), and Consistent Users (9.5%). While a majority of patients did not use or rarely used the app, about 20% used the app, with close to 10% using the app on a regular basis during the 8-week post-enrollment period. The adjusted odds of being a Consistent User, as opposed to a Minimal User, were

significantly higher for females and for subjects with higher exercise motivation scores at baseline. The adjusted odds of being an Intermittent-Waning User were also significantly higher for those with higher

CONCLUSIONS:

On the basis of findings and results this review found the diabetes education, life style and self-management are most common approaches of primary health care to diabetes, and also the Program to Improve Primary Care Access and Quality, health

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exercise motivation scores at baseline. The application of LCGM allowed us to delineate distinct trajectories of iDAT app usage and then identify predictors of specific patterns of app use.[6]

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