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Chapter

Baseline Analysis for Effective Diabetes Intervention

Mabitsela Mphasha, Linda Skaal and Tebogo Maria Mothiba

Abstract

Diabetes is a fast-growing disease that is costly to manage, leading to both financial and non-financial burdens. These burdens are worsened in the presence of diabetes complications, so improved interventions are critical. Prior to developing new interventions, a baseline analysis should be conducted to gain insight into the strengths and weaknesses of current interventions. Furthermore, a baseline analysis helps in identifying discrepancies to be addressed and outlining how the environment impacts diabetes management. A comprehensive literature review was adopted to collect data regarding the importance of a baseline analysis in diabetes interventions. The findings of the literature review indicated that a baseline analysis is a critical step for the development of effective diabetes interventions. Knowledge, attitudes, practices, and anthropometric factors such as quality of life and social determinants of health, should be assessed when conducting a baseline analysis. A baseline analysis is affirmed as a fundamental prerequisite for the development of diabetes interventions for better outcomes. There is also a need to assess the capacity of healthcare providers to conduct a baseline analysis to determine the need for support and in-service training. An inappropriately-conducted baseline analysis may lead to inappropriate solutions and misdiagnosis. The implementation of wrongful solutions would defeat the objective of improving diabetes outcomes.

Keywords: diabetes, baseline analysis, interventions, development, effectiveness

1. Introduction

It is essential to diagnose and gain insight into the current state of health prior to the development of disease-managing interventions. Therefore, a baseline analysis should be conducted. A baseline analysis is a critical step that informs the development of healthcare interventions, including improving diabetes management [1]. The purpose of a baseline analysis is to compile details about discrepancies in existing healthcare practices and assess the strengths and weaknesses in current interventions in order to improve practices [2]. The data obtained from a baseline analysis may motivate healthcare providers to create better management strategies with innovation and a sense of urgency. Moreover, a baseline analysis may provide information regarding how the environment surrounding patients impacts their health outcomes.

In the healthcare sector, a baseline analysis is conducted through a health needs assessment. The health needs assessment involves the evaluation and identification of

health issues confronting the people, developing strategies, and allocating resources to improve health and reduce inequalities. A health needs assessment becomes a fundamental prerequisite for effective diabetes interventions. It assists in defining what ought to be done and the accomplishment of the intention [3]. A needs assessment further informs the plan, and identifications of strategies and resources needed in developing the intervention [3]. It is essential to conduct a health need assessment prior to the intervention to envision interventions that are tailored to the target group.

Diabetes is the fastest-growing disease in the world. It is often poorly managed, resulting in complications. Patients diagnosed with diabetes require ongoing evaluation of complications and should regularly monitor glucose levels [4]. The National Institute of Diabetes [5] recommends that patients should be examined 2–3 times a year to acquire information on nutrition, exercise, and overall management of diabetes, including diabetes-related complications. The costs of providing care to patients with diabetes are escalating and place a burden on personal and state budgets. There is a need for interventions to curb diabetes prevalence and its complications. Less developed countries have limited resources to address the economic burden of diabetes management. Conducting a health need assessment at the onset will therefore assist in the effective use of limited resources.

2. Diabetes as global public health problem

According to the International Diabetes Federation (IDF) [6], Diabetes Mellitus remains a public health problem. About 537 million people are living with diabetes, constituting a global prevalence rate of 10.5%. Recent reports indicate that more than 1 in 10 adults is diagnosed with diabetes globally. In some countries, one in five person adults is diagnosed with diabetes [6]. It is projected that 643 million and 783 million persons may have diabetes in 2030 and 2045, respectively. Over this period, diabetes estimation is said to increase by 46%, surpassing the estimated world population growth. In Africa, there are 24 million persons living with diabetes [4]. About 360 million residing in urban areas have diabetes, with a prevalence rate of 12.1%, compared with 176.6 million people in rural areas with a prevalence of 8.3%. Diabetes has been reported to be more prevalent among men compared to women. The Middle East and North Africa regions have the highest prevalence of diabetes at 18.1%. However, Africa has the lowest global diabetes prevalence rate, at 5.3%. China, India, and Pakistan have the highest prevalence of diabetes globally [6].

Undiagnosed diabetes poses serious a threat, with global estimates of 87.5% of cases in low- and middle-income countries. However, low-income countries have the highest estimation of undiagnosed diabetes at 50.5% compared to 28.8% in high-income countries [6]. Africa has the highest estimates of undiagnosed diabetes at 53.6%, followed by Western Pacific at 52.8% and South-East Asia at 51.3%. North America and the Caribbean region have the lowest estimate of undiagnosed diabetes at 24.2% [6].

Diabetes has recently been found to be a high-risk Non-Communicable Disease (NCD) linked to Coronavirus Disease-2019 (COVID-19) deaths worldwide. Higher susceptibility to COVID-19 among patients with diabetes is attributed to an impaired immune response due to chronic metabolic dysfunction [7].

Patients with diabetes may develop complications or other health problems such as cardiovascular disease, hypertension, erectile dysfunction, retinopathy, and

kidney disease [8]. It has been reported by several studies that the identification of risk factors can serve as benchmarks to design appropriate prevention measures and minimize the risk and severity of complications [9–10]. The next section discusses the cost of managing diabetes as a sub-topic to illustrate the severity of diabetes as a global public health problem.

2.1 Costs of managing diabetes

The World Health Organization (WHO) [11] reports that diabetes is costly to manage, more so in the presence of complications. In 2017, the total cost of managing diabetes was $327 billion in direct medical costs, as well as $90 billion in reduced productivity [12]. It has been reported that patients with diabetes incur medical costs 2.3 times higher than those of non-diabetics [12]. When diabetes patients develop complications resulting in hospitalization, the cost of care increases. Hospitalization costs of diabetes are the principal driver of the total costs of managing diabetes. As a result, funds that could have been used for other developmental reasons may be channeled to fighting diabetes. The financial costs of diabetes rise with the rising prevalence of the disease, which is projected to increase in 2045. This increase would strain the healthcare budget, including the overall budgets of governments. Therefore, there is a need for governments to introduce new interventions to manage and prevent diabetes.

3. Developing diabetes interventions

Various studies have reported poor diabetes outcomes among patients [13, 14], including rising prevalence rates. This calls for new interventions and strategies to manage and curb the prevalence of diabetes. For effective intervention, developing diabetes intervention includes identifying and prioritizing health issues and needs, choosing ways to cope with them, and committing support and resources for quality health promotion activities [15]. The process of developing intervention should be an inclusive and participatory process involving the targeted group [16]. The target population should include patients living with all types of diabetes, age groups, and gender. Health needs assessment is hereby discussed as a subheading of developing diabetes intervention.

3.1 Health needs assessment

A health needs assessment is a critical and systematic approach to identifying the unmet healthcare needs of the population and making changes to meet those unmet needs [3]. In this context of diabetes management, it could be used to identify what needs to be done for better outcomes. Health needs assessments are done for the effective use of health services and resources to improve health and the quality of life of patients. A health needs assessment encourages cooperation or partnership and innovation. Needs assessments are the backbone of public health and must be conducted properly. The process of conducting a health needs assessment involves the identification of health problems and inequalities, and a determination of appropriate interventions to address the problems. The requirements for conducting successful health needs assessments are an understanding of what is involved, and the time, and resources to undertake assessments. The cost of managing diabetes and its related complications is

increasing [17]. It is essential to conduct a health needs assessment properly for effective intervention. Without a clear and well-conducted health needs assessment, intervention could result in the misuse of funds. A mixed-method needs assessment study conducted in Tanzania involving diabetes patients with retinopathy demonstrated low levels of stigma and self-efficacy along with high levels of anxiety and depression [18]. Moreover, the study showed inadequate knowledge regarding a healthy diet. On those grounds, a comprehensive diabetes education program was developed to improve diabetes control and prevent complications including retinopathy [18].

According to the WHO [19], diabetes interventions are dietary therapy, increased physical activity, and pharmacological therapy consisting of oral hypoglycaemic drugs or insulin. There is a need to empower diabetes patients and their family members with skills and knowledge related to diabetes. This would help in attaining better diabetes outcomes and an improvement of quality of life, including reducing the chances of family members developing diabetes [20]. Family members of patients diagnosed with diabetes are already at risk due to family history. In South Africa, the Department of Health adopted WHO guidelines for diabetes management [21]. However, implementation has been a challenge. A baseline analysis of factors contributing to poor implementation may be necessary. Behavioral changes among patients with diabetes are difficult to implement due to the inaccessibility of the following: healthy food, an enabling environment for physical exercise, and essential self-management resources [22]. Patients diagnosed with diabetes are from various cultural backgrounds, which influences their behavior. It is therefore essential to conduct a baseline analysis to design and develop diabetes interventions that are sensitive to cultural beliefs. Behavioral changes are influenced by factors including knowledge and attitudes [23]. Education programs incorporating behavior change approaches are extra effective. Behavioral change is a complex process and should be based on a theoretical framework. The use of theory enables a greater understanding of the relationships among factors that influence behavioral change [24].

3.1.1 How to conduct a health needs assessment

According to the Centers for Disease Control and Prevention [25], there are five critical steps on how to conduct a health need assessment, which are as follows:

Plan and design: The first step involves defining the scope and objectives of the assessment. This includes defining who, what, and where.

Logistics and resources: The availability of resources impacts health needs assessment activities, so it is important to have sufficient funds to carry out the assessment. The most important resource is capacitated healthcare providers who understand the importance of the need assessment and how to conduct it.

Review and rate data: Before capturing and analyzing data, a review of the data must take place for team members to reach a consensus. At this point, the team discusses data, shares individual results, and identifies evidence to support collective rating. This step helps in identifying strengths and weaknesses.

Record and summarize data: Following an agreement on rating, data is analyzed to produce findings that will guide the action to be taken.

Action plan: Based on the findings of the data analysis, an action plan should be developed to close identified gaps. At this stage, summarized data is transformed into measurable action items.

3.1.2 Components to assess during need assessment

3.1.2.1 Knowledge regarding diabetes care

Diabetes knowledge is one of the key elements motivating individuals to follow a healthy lifestyle [26]. Nutrition and exercise are essential in diabetes outcomes. Poor knowledge in this regard contributes fundamentally to increasing the prevalence of poor control of diabetes [26], leading to complications and a high mortality rate. Not empowering patients and their family members with knowledge may increase diabetes prevalence among family members who are already at risk due to family history. Poor nutrition and exercise knowledge also normalize poor lifestyle choices, which contribute to obesity. A lack of knowledge about diabetes management often leads to non-compliance to treatment [27].

According to Ajzen et al. [28], having adequate knowledge does not guarantee the adoption of healthy behavior. The combination of knowledge and motivation to change behavior is what yields positive behavioral change [29]. Knowledge enables patients to assess diabetes risk, seek proper treatment and care, and inspires them to lead a healthy lifestyle to manage their disease. Patients with adequate diabetes knowledge tend to take appropriate measures to control the disease [30], by honoring their medical appointments. Adequate diabetes knowledge among patients minimizes comorbidities, which improves their quality of life. Having adequate knowledge about self-care practices leads to better diabetes control for a prolonged period and adherence to self-management practices [31]. Nonetheless, international knowledge and awareness of diabetes stay low [32]. A cross-sectional South African study conducted in the Vhembe district of Limpopo Province has reported poor diabetes knowledge among patients [33]. A mixed method study on diabetes knowledge conducted in Senwabarwana in Limpopo province also reported poor knowledge [34]. It is therefore important to conduct a baseline analysis regarding diabetes knowledge involving a target population.

3.1.2.2 Attitudes regarding diabetes

Attitudes are considered the most important determinants of behavior and behavior change among patients with diabetes. Attitudes towards diabetes and its treatment are associated with self-care, including adherence to a diabetes dietary plan, exercise, and medication [35]. Positive attitudes toward diabetes and its treatment may lead patients to adopting an active lifestyle and changing their behavior to control their diabetes, in contrast to patients with negative attitudes [23]. A cross-sectional study conducted in the Free State province of South Africa among Type-2 Diabetes Mellitus (T2DM) patients reported negative attitudes towards diabetes among patients, which may contribute to morbidity and mortality [36]. Another South African study reported positive attitudes among patient towards diabetes treatment and lifestyle modifications, which may contribute to better diabetes outcomes [37].

3.1.2.3 Practice related to diabetes

Practice related to diabetes management is critical and involves adherence to new treatment regimens [38]. Practice includes remembering and administering medication, honoring medical appointments, adhering to diabetes self-care practices,

monitoring glucose levels, and adhering to dietary treatment and physical activity [39]. Behavioral changes and intensive lifestyle interventions are key components in the management of T2DM [36]. Poor practices, such as non-adherence to treatment, are a great concern to public health. A cross-sectional South African study reported poor practices among patients with diabetes-related to healthy lifestyle modifications [36]. Poor practices related to unhealthy eating among patients were reported in Lebanon [40]. Similar findings of poor practices related to diabetes management were also reported by a cross-sectional study conducted in Mpumalanga [41]. There is therefore a need to employ new measures to improve practices for improved diabetes outcomes.

3.1.2.4 Quality of life

Living with diabetes negatively impacts the quality of life (QoL) of patients, which is worsened in the presence of complications [42]. The negative way that diabetes impacts the patient's QoL includes the psychological impact of being chronically ill, dietary restrictions, changes in social life, symptoms of inadequate metabolic control, chronic complications, and ultimately lifelong disabilities [43, 44]. Diabetes patients from low-income countries can maintain a high QoL when treated with insulin [45]. An Argentinian study reported that the scores of QoL did not differ from those of patients in high-income countries where there is access to a high level of diabetes care [42]. An Indian observational study reported that nearly half of the diabetes patients (48.6%) had a good QoL [44]. An Iranian study reported that men living with diabetes compared to females, non-insulin-treated patients compared with insulin-treated patients had better QoL [46]. Further findings show that patients with Hemoglobin A1c (HbA1c) less than 7% had a better quality of life compared with those with a higher HbA1c [46].

Variables such as age, gender, socio-economic status, obesity, type of diabetes, treatment, chronic complications, health insurance, quality of care, and patient education have been associated with diabetes patients' Health-Related Quality of Life (HRQoL) [42]. Studies have shown that HRQoL is associated with the duration of diabetes, age, gender, diabetic complications, comorbid diseases, and the severity of the disease itself [42, 43]. A South African study that assessed the HRQoL using a Diabetes 39 (D-39) questionnaire reported an association between HbA1c and HRQoL, and no association was found between HRQoL and other clinical parameters such as the number of insulin units used per day, exercise, body mass index (BMI), lipogram and the use of oral hypoglycemic agents (OHAs) [43]. An Indian observational study reported that diabetes had significantly affected HRQoL, especially in the social relationship domain [44].

3.1.2.5 Anthropometric assessment

Anthropometric measurements estimate risk factors of different diseases [47], including diabetes and obesity. Body Mass Index is used to assess obesity, which reflects total body fat but does not reflect patterns of fat distribution [48]. Being overweight is only linked with T2DM morbidity, while obesity is linked with increased morbidity and mortality from diabetes and its complications [48]. The BMI characterization is similar across genders and ethnic groups [47]. The cut-offs for anthropometric indexes of abdominal adiposity, called waist circumference, vary by gender [45]. A high waist circumference is associated with cardiovascular risk,

prevalence of diabetes, and incidences of hypertension [49]. High waist circumference and high body mass index (BMI) are considered risk factors for T2DM, though the relationship may differ with populations [47]. Several studies have reported that central obesity, which is measured through waist circumference, is an important and superior risk factor for developing diabetes, compared to the general obesity which is measured through BMI [47, 48].

Other anthropometric measurements for central obesity are Waist-to-Hip Ratio (WHR) and Waist-to Height Ratio (WtHR). According to Awasthi et al. [48], a Chinese population-based study reported that WtHR was the best anthropometric index for predicting diabetes mellitus. The WHR considers that waist circumference might over- or under-assess the dangers of different heights of individuals with the same waist circumference, while WtHR corrects waist circumference for height and can be used in different ethnic, age, and gender for central obesity [48].

3.1.2.6 Social determinants of health

Social determinants of health are non-medical factors that have an impact on health outcomes, well-being, and quality of life. These include conditions in which people are born, grow, live, work, and age [50]. Social determinants of health contribute significantly to health disparities and inequalities. For instance, a South African family of 5 adults and 4 children, depending only on an R1 890 old-age pension grant provided by the government may not have access to healthy food or good nutrition. Good nutrition is central to the development and progression of diabetes, including its management [12]. In addition, persons with less income and education were found to be 2–4 times more likely to develop diabetes compared to those with higher income and education [51, 52]. Within and outside the health sector, there are initiatives to mitigate the impact of social determinants of health through the adoption of health promotion and equity policies. For example, the introduction of social grants in South Africa is aimed at addressing social determinants of health. It is important for governments to prioritize the introduction of policies to address the social determinants of health in diabetes care, considering the increasing prevalence, complications, and management costs [53].

3.1.2.7 Examples of social determinants of health impacting diabetes

Housing: Access to proper housing is crucial in diabetes management. Improper housing creates a lack of the control and consistency needed for the daily management of diabetes, including diet, which is essential in glycemic control [54]. A lack of proper housing has been linked with increased blood glucose levels and the use of healthcare resources due to hospitalization. In addition, it impacts cholesterol and blood pressure levels, as well as the quality of life of patients with diabetes [55]. It was reported that persons in unstable housing are at a greater risk of developing diabetes, compared to those in stable housing [54]. Improved or stable housing may reduce disparities in diabetes outcomes while also helping with the initiation and maintenance of preventative care, minimizing the risk of diabetes, and improving outcomes overall [54].

Social and economic factors: Social and economic factors include income, education, employment, community safety, and social support; all of which affect the health and quality of life of persons and their life expectancy. These social and economic factors impact patients' ability to make healthy choices such as appropriate eating and active lifestyle, which are important in diabetes care. Employment or income could help in acquiring better houses, education, food, and medical treatment

required in diabetes care. Unemployment or lack of income limits these options, leading to unhealthy eating and poor medical diabetes treatment [56]. Social support which includes family members is fundamental in diabetes care because most of the care happens at home [30]. Family members help with daily living activities including meal preparation and consumption, physical activity, collection of medication, bathing and clothing, distribution of household chores, and honoring of medical appointments. Family members may help patients with diabetes to cope with the disease and help with the finances needed for patients to perform their daily diabetes care activities [33]. Living alone is linked with increased depression, poor diabetes outcomes, and increased mortality [57].

4. Conclusion

A baseline analysis is affirmed as a fundamental prerequisite for the development of diabetes interventions for better outcomes. It also helps in identifying and addressing medical and non-medical factors which could impact diabetes care activities. Therefore, a baseline analysis is a foundational and critical step toward comprehensive healthcare intervention for better diabetes outcomes. There is a need to assess the capacity of healthcare providers to conduct a baseline analysis to determine the need for support and in-service training. An inappropriately-conducted baseline analysis may lead to inappropriate solutions and misdiagnosis. The implementation of inappropriate solutions would defeat the objective of improving diabetes outcomes.

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Conflict of interest

The authors declare no conflict of interest financial or otherwise.

Notes/thanks/other declarations

The authors declare that this manuscript is based on the existing literature regarding baseline analysis in development of diabetes interventions.

Author details

Mabitsela Mphasha[1*], Linda Skaal[2] and Tebogo Maria Mothiba[3]

1 Department of Public Health, University of Limpopo, South Africa

2 School of Health Sciences, University of Limpopo, South Africa

3 Faculty of Healthcare Sciences Executive Dean's Office, University of Limpopo, South Africa

*Address all correspondence to: pitso85@gmail.com

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