



Health Facility Factors Influencing Secondary Prevention Practices among Type 2 Diabetes Mellitus Patients in Meru County, Kenya: A Hospital Descriptive Correlational Study

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Abstract

Background: Diabetes Mellitus (DM) is a chronic metabolic disorder of multiple etiology that results from a deficit in insulin production, insulin action or both. As a chronic metabolic disorder affecting millions of persons worldwide the ailment takes a huge toll of human resources as mismanagement leads to the development of acute and chronic complications. Long term chronic complications of DM include the development of eye retinopathy, foot ulcers and neuropathy, heart diseases and nephropathy. Patients can prevent the development of these complications by adopting secondary prevention measures. These include regular screening for cardiovascular diseases, having cholesterol level check-ups, eye screening for retinopathy annually, doing foot examination in every visit as well as checking urine for albumin. With an increase of patients suffering from chronic DM complications, these practices are often not adopted by a number of patients coupled by a number of impending clinical factors.

Materials and Methods: The study sought to assess the health facility factors influencing secondary prevention practices among Type 2 Diabetes Mellitus patients at Consolata Hospital Nkubu and Meru Teaching and Referral (Level Five) Hospital in Meru County, Kenya. Data was collected from 357 participants who were sampled purposively in both hospitals. A descriptive correlational study design was adopted with questionnaires and Focus Group Discussion Guide used as the data collection methods. Quantitative data was analyzed using SPSS version 25 at 95% confidence interval.

Results: The distance to the facility ($p=0.011$), waiting time ($p=0.062$), availability of drugs ($p<0.001$), good staff reception ($p=0.001$), receiving health education and counseling ($p<0.001$), good care-giver communication ($p=0.038$), availability of DM services, ($p=0.001$) availability of supplies for screening DM complications ($p<0.001$), and client satisfaction ($p<0.001$) all significantly influenced T2DM secondary prevention at a p value ≤ 0.05 .

Conclusion: In reducing the burden posed by the chronic diabetes complications these factors need to be addressed to promote T2DM secondary prevention practice.

Keywords: Health facility factors; Type 2 diabetes mellitus; Secondary prevention practices; Kenya

Introduction

Diabetes Mellitus (DM) is a chronic metabolic disease of multiple etiology that results from a deficit in insulin production, insulin action or both [1-3]. Patients with diabetes presents with hyperglycemia with other profound symptoms such as polyuria, polyphagia, polydipsia, blurred vision and weight loss [2,4]. Diabetes mellitus complications often result from uncontrolled sugar levels. This implies that the sugar levels in the blood can either be higher than normal as state referred to as hyperglycemia or the sugar level can be abnormally low referred to as hypoglycemia that is brought about by a mismatch in the insulin that the pancreases releases and the amount need [5,6]. The most severe acute complications of DM are ketoacidosis and non-ketotic hyperosmolar states that lead to coma and dehydration and in absence of prompt treatment death [7]. Long term effects of poorly controlled DM is associated with an array of neuropathic, macrovascular

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and microvascular complications. Macrovascular complications include peripheral vascular diseases, Cardiovascular Diseases (CVD) and coronary artery ailments while the microvascular complications include neuropathic, renal and retinal diseases [8-10].

The hyperglycemic state in DM leads to long lasting damage of various body organs that is; the eyes, nerves, blood vessels and kidneys in approximately a third to a half of the individuals diagnosed with the condition [9,11,12]. In a study examining the relationship between micro and macrovascular disorders and Metabolic Syndrome (MetS) among T2DM, the results revealed a significant trend for stepwise increases in nephropathy, peripheral artery disease, retinopathy, coronary artery disease and cerebrovascular disease in correspondence to the number of MetS components. Associated risk factors included; metabolic syndrome, dyslipidemia, advanced age, increased hemoglobin levels, sex, wide pulse pressure and a decline in renal function. Similarly metabolic syndrome and the number of its components were greatly associated with micro- and macro-vascular complications among participants with DM resulting in a higher risk of cardiovascular disease. Therefore, screening programs that enable early detection of these pathologies ought to be established to decrease the risk of cardiovascular diseases and other complications [13].

In Kenya, T2DM burden including the burden imposed by macrovascular and microvascular diseases has been on the rise over the years [14-17]. Effective measures are available to prevent the development of long term complications of diabetes through secondary prevention [18,19]. Among these measures include regular screening for cardiovascular diseases by checking the blood pressure, having regular cholesterol level check-ups, eye screening for retinopathy annually, doing foot examination in every visit as well as checking urine for albumin at least annually for nephropathy [20]. Health delivery systems play a critical role in health response in solving the growing problems imposed by diabetes and its complications [21]. The main challenges to increasing the utilization of secondary prevention include lack of services, inadequate supplies, and distance to facilities, cost and unavailability of skilled practitioners [21-23]. Thus, the study sought to assess the health facility factors influencing secondary prevention practices among Type 2 Diabetes Mellitus patients at Consolata Nkubu and Meru Level Five Hospital in Meru County, Kenya.

Statement of the problem

The prevalence of type 2 diabetes is on the rise globally, more so in the developing nations with Kenya not being an exception due to rapid urbanization contributing to unhealthy lifestyles. Chronic complications of diabetes mellitus are the major reason for the increased global burden of the disease. Once an individual has been diagnosed with type 2 diabetes, secondary preventive approaches such as eye, kidney, cardiovascular and foot care are essential in preventing the occurrence of chronic complications. Yet, a majority of the patients do not utilize the secondary diabetes prevention approaches thus, leading to an increased disease burden. More so, a number of healthy facility factors influence the utilization of these preventive approaches aggravating the problem. Secondary prevention is the most efficient way of lessening the complications of diabetes. Given the high prevalence of diabetes in Kenya as high as 12.2 percent in the urban areas, there is a need to improve the practice of secondary prevention.

Materials and Methods

This research was conducted at two man health facilities that are;

Consolata Hospital Nkubu and Meru Teaching and Referral Hospital (Level Five) in Meru County. Meru Teaching and Referral Hospital is a public health facility while Consolata Hospital Nkubu is a private facility. Both healthcare facilities offer comprehensive diabetes services including screening and prevention of DM complications. A hospital based descriptive correlational study design was adopted to assess the health facility factors influencing secondary prevention practices among type 2 diabetes mellitus patients. On the eligibility criteria the study included adult patients with T2DM attending diabetic clinics at Consolata Hospital Nkubu and Meru Level Five Hospital who were willing to participate in the study and excluded those patients who were not willing to take part in the study as well as the patients who were critically ill at the time of the study. Purposive sampling method was used to sample type 2 DM patients in both hospitals. Stratified sampling was then used to get both representation of men and women in the study. Simple random sampling was then used to get the actual respondents as they attended the diabetic clinics. A total of 357 patients were sampled. Below is the power calculation for the sample size.

Data collection was done through interviewer administered questionnaires and focus group discussion guide. Validity was ensured by expert review of the data collection instruments before commencement of the study. Peer proof reading and constant consultations ensured face and content validity. The researcher ensured that all the questions in the instrument were clear, properly grouped and easy to understand. Training of research assistants was done to ensure a proper understanding of the operational definitions of the study and uniformity in the questioning skills. To avoid more than one interview being done on the respondents during subsequent visits, interviewed respondents were assigned codes which were marked against their names in the clinic records after the interview. In ensuring reliability a pretest was done before the actual study using 10% of the sample size. This was important in checking out the data collection tools by finding out if sufficient questions were included that addressed the research study objectives adequately and whether the meaning of the questions asked were similar to all the respondents. After which relevant adjustments were made. Adequate supervision throughout the data collection process was also ensured. The test re-test technique was used to estimate the reliability of the instruments. This involved administering the same test twice to the same group of respondents. A reliability coefficient of 0.78 was obtained and was considered acceptable.

Quantitative and qualitative data was generated. Quantitative data was cleaned, coded and entered into SPSS version 25 for analysis at a significance $p \leq 0.05$. Chi squares was used to test the relationship between dependent and independent variables. For qualitative analysis, data was categorized into emerging themes and analyzed using N-Vivo Version 11. Study results were presented in form of tables, pie charts, bar graphs and narrations.

Ethical considerations

Permission to conduct this study was obtained from National Commission for Science, Technology and Innovation (NACOSTI) through the Chuka University Ethics and Research Committee for review and approval. Permission was also sought from Consolata Hospital Nkubu and Meru Teaching and Referral Hospital before commencement of data collection. Ethical issues addressed in the research included maintaining privacy, confidentiality, anonymity and informed consent. After consent was obtained, the researcher

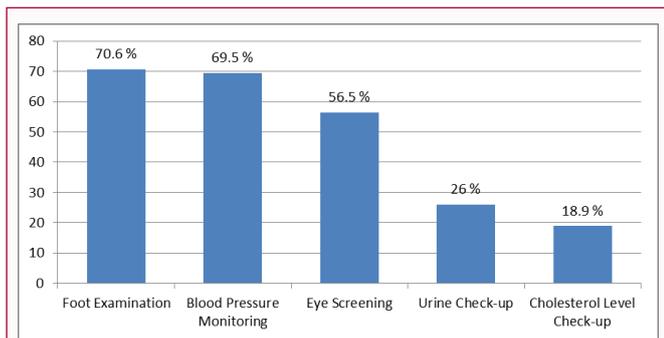


Figure 1: Secondary preventive measures.

urged the participants to feel free and express their discontent anytime they feel like as well as withdraw from the study when they wished to do so.

Results

The secondary prevention practices among the participants

From the study findings the participants practiced varied secondary preventive practices as described on Figure 1. From the findings majority of the participants (70.6%, n=250) did foot examination during every visit, (56.5%, n=200) checked their eyes annually for retinopathy, (26%, n=92) checked their urine annually for albumin, (18.9%, n=67) did check-ups for the cholesterol levels and (69.5%, n=246) had regular blood pressure monitoring to check for their cardiovascular state. The mean score was 48.3% with a SD of 30.1.

Patients level of secondary preventive practice

The level of practice of secondary prevention was determined by the practice items adhered to by the participants as described on Figure 1. Those participants who were adherent to at least three practice items were considered as having good practice of secondary prevention while those participants who adhered to less than three practice items were considered as having poor practice of secondary prevention as illustrated on Figure 2.

Figure 2 illustrates that less than a half of the respondents (45.5%, n=161) had good practice while a majority, more than a half (54.5%, n=193) had poor practice of secondary prevention. The dependent variable was the level of practice of secondary prevention while the independent variables were the health facility factors which were cross-tabulated to check for any level of statistical significance.

Health facility factors affecting diabetes secondary prevention

The health facility factors under investigation included distance

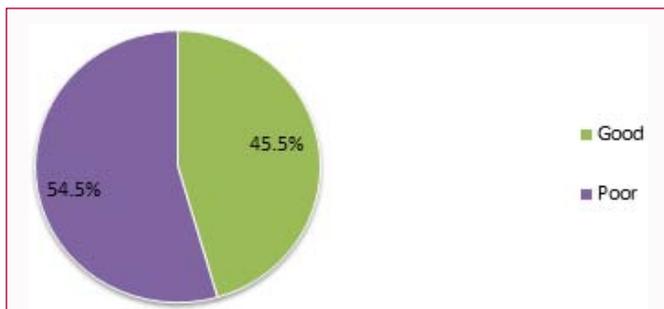


Figure 2: Patients Practice level of secondary preventive measures.

Table 1: Sample Matrix.

Hospital	Patients	Patients Sampled
Meru Level 5 Hospital	2460	191
Consolata Nkubu Hospital	2140	166
Total	4600	357

to the facilities, waiting time, availability of drugs, staff reception, health education and counseling after service delivery, caregiver communication skills, availability of services, availability of equipment and supplies, satisfaction with care, and confidence with care giver.

Distance to the facility and practice of secondary diabetes prevention

Most respondents i.e. 44.6% (n=158) were travelling for more than 5 km to access the health facilities, 37.9% (n=134) travelled for 2 km to 5 km and 17.5% (n=62) travelled for less than 1 km. Distance was collapsed into two categories namely ≤ 5 km and >5 km and cross-tabulated against practice.

Table 2 shows that distance to the clinic/facility significantly influenced secondary diabetes prevention (χ^2 (1, N=354) = 6.483, p=0.011, OR=1.74) whereby, those who travelled for 5 km and below were 1.74 times more likely to practice DM secondary prevention.

In this study it was evident that the distance the patient travelled and means of transport were determining the actual practice or screening for the risks for diabetic complications.

Waiting time and practice of diabetes secondary prevention

Most of the respondents i.e. 59.9% (n=212) spent less than or equal to six hours from arrival at the facility to the time they departed, while 40.1% (n=142) spend more than 6 h.

Table 3 shows that waiting times did not significantly influence DM secondary prevention practice (χ^2 (1, N=354) = 3.49, p=0.062).

Availability of drugs and practice of diabetes secondary prevention

Twenty seven point seven percent of the respondents (n=98) reported that they had never lacked drugs at the hospital while 72.3% (n=256) reported to have ever lacked drugs. Table 4 shows that availability of drugs significantly influenced diabetes secondary prevention (χ^2 (1, N=354) = 15.626, p= <0.001, OR=0.370) whereby, those who had ever lacked drugs at the facilities were less likely to practice DM secondary prevention.

Staff reception and practice of diabetes secondary prevention

Majority of the respondents i.e. 82.2% (n=291) reported that the hospital staffs were friendly to them while 17.8% (n=63) reported that the staffs were not friendly. Table 5 shows that staff reception for patients significantly influenced DM secondary prevention (χ^2 (1, N=354) = 10.574, p=0.001, OR=2.65) whereby, those who felt that the staffs were friendly were 2.6 times more likely to practice secondary prevention.

Health education and diabetes secondary prevention

Most respondents i.e. 79.4% (n=281) reported that health care providers gave health education and counseling after service delivery, while 20.6% (n=73) said that health education and counseling was not provided. Table 6 shows that provision of health education

Table 2: Association between distance to hospital and practice secondary DM prevention measures.

		What is the distance to the clinic/facility?		Total
		5 km and below	Over 5 km	
DM complications secondary prevention practice	Good	101	60	161
	Poor	95	98	193
Total		196	158	354

$\chi^2 (1, N=354) = 6.483, p=0.011$

Table 3: Association between waiting time at the hospital and practice of secondary preventive measures for complications of DM.

		How much time do you spend in the clinic from arrival to departure when seeking the services?		Total
		≤ 6 hours	>6 hours	
DM complications secondary prevention practice	Good	105	56	161
	Poor	107	86	193
Total		212	142	354

$\chi^2 (1, N=354) = 3.493, p=0.062$

Table 4: Association between availability of drugs for DM at the hospital and practice of secondary preventive measures for DM complications.

		Have you ever lacked drugs at the hospital?		Total
		Yes	No	
DM complications secondary prevention practice	Good	28	133	161
	Poor	70	123	193
Total		98	256	354

$\chi^2 (1, N=354) = 15.626, p < 0.001$

Table 5: Association between staff reception and practice of secondary preventive measures for DM complications.

		Are the hospital staffs friendly to you?		Total
		Yes	No	
DM complications secondary prevention practice	Good	144	17	161
	Poor	147	46	193
Total		291	63	354

$\chi^2 (1, N=354) = 10.574, p=0.001$

Table 6: Association between health education and practice of secondary preventive measures for DM complications.

		Do health care providers give health education and counseling after service delivery?		Total
		Yes	No	
DM complications secondary prevention practice	Good	150	11	161
	Poor	131	62	193
Total		281	73	354

$\chi^2 (1, N=354) = 34.302, p < 0.001$

and counseling after service delivery significantly influenced DM secondary prevention ($\chi^2 (1, N=354) = 34.30, p < 0.001, OR=6.45$) whereby, those who reported that health education and counseling was offered were 6.4 times more likely to practice diabetes secondary prevention.

Care giver communication skills and DM secondary prevention

Most respondents, i.e.55.1% (n=195) rated caregiver communication skills as fair to poor while 44.9% (n=159) rated them as good to excellent. Table 7 shows that the rating of care giver communication skills significantly influenced DM secondary prevention ($\chi^2 (1, N=454) = 4.32, p=0.038, OR=1.56$) whereby, those who rated the communication as either good or excellent were 1.6 times more likely to practice secondary prevention.

Availability of diabetic services and secondary prevention

Majority of the respondents i.e. 91% (n=322) reported that diabetic services were always available when needed while 9% (n=32) reported that services were not always available when needed. Table

8 shows that availability of DM services significantly influenced secondary prevention practice ($\chi^2 (1, N=354) = 10.14, p=0.001, OR=4.02$) whereby, those who reported that the services were always available were 4 times more likely to practice secondary prevention.

Availability of supplies and diabetes secondary prevention

Most respondents i.e. 76.8% (n=272) reported that supplies and equipment for diabetes care were always available while 23.2% (n=82) reported that they were not always available. Table 9 shows that availability of supplies and equipment for DM care significantly influenced secondary prevention ($\chi^2 (1, N=354) = 29.02, p < 0.001, OR=4.71$) whereby, those who reported that equipment and supplies for DM care were always available, were 4.7 times more likely to practice secondary prevention.

Client satisfaction and DM secondary prevention

Majority i.e. 82.2% (n=291) agreed that the services provided were satisfactory while 17.8% (n=63) did not. Table 10 shows that satisfaction with service delivery significantly influenced DM secondary prevention ($\chi^2 (1, N=354) = 16.72, p < 0.001, OR=3.57$)

Table 7: Association between care giver communication and practice of secondary preventive measures for DM complications.

		How do you rate health worker communication skills?		Total
		Good-excellent	Fair-poor	
DM complications secondary prevention practice	Good	82	79	161
	Poor	77	116	193
Total		159	195	354

$\chi^2 (1, N=354) = 4.320, p=0.038$

Table 8: Association between availability of services and practice of secondary preventive measures for DM complications.

		Are diabetic services always available when needed?		Total
		Yes	No	
DM complications secondary prevention practice	Good	155	6	161
	Poor	167	26	193
Total		322	32	354

$\chi^2 (1, N=354) = 10.137, p=0.001$

Table 9: Association between availability of supplies and practice of secondary preventive measures for DM complications.

		Are supplies and equipment for diabetes care always available?		Total
		Yes	No	
DM complications secondary prevention practice	Good	145	16	161
	Poor	127	66	193
Total		272	82	354

$\chi^2 (1, N=354) = 29.023, p < 0.001$

Table 10: Association between client satisfaction and practice of secondary preventive measures for DM complications.

		Are the services provided satisfactory?		Total
		Yes	No	
DM complications secondary prevention practice	Good	147	14	161
	Poor	144	49	193
Total		291	63	354

$\chi^2 (1, N=354) = 16.719, p < 0.001$

Table 11: Association between confidence with the care giver and practice of secondary preventive measures for DM complications.

		Do you feel confident under the care of health providers?		Total
		Yes	No	
DM complications secondary prevention practice	Good	148	13	161
	Poor	161	32	193
Total		309	45	354

$\chi^2 (1, N=354) = 5.723, p=0.017$

whereby, those who reported satisfaction with services were 3.6 times more likely to practice secondary prevention.

Confidence with care giver and DM secondary prevention

Most respondent's, 87.3% (n=309) felt confident under the care of the health providers while 12.7% (n=45) did not. Table 11 shows that confidence with health workers significantly influenced DM secondary prevention practice ($\chi^2 (1, N=354) = 5.723, p=0.017, OR=2.26$) whereby, those who felt confident under the care of health workers were 2.3 times more likely to practice secondary prevention.

Most respondents 77.7% (n=275) would recommend another person for the services while 22.3% (n=79) would not. The main reasons why clients would not recommend others for the services were summarized in themes as follows:

a. Time management

The waiting time was too long and some respondents had to wait for the whole day to be served. Delay was witnessed at the waiting bay as clients waited to be seen by the doctor and they ended up going

home late and hungry. This delay was also witnessed at the pharmacy department where patients had to queue for long waiting for drugs. Even the patients who reported to the facilities early in the morning ended up going home late. Elderly patients expected to be given first priority but this was not forthcoming. Despite patients arriving at 8 am in the morning, service delivery started at 11.00 am because health workers arrived on duty late.

b. Staff attitude

Staffs were somewhat hostile to the clients especially when clients insisted on knowing anything, or when they forgot what they had been taught. Staffs were rude and some told the respondents "you are wasting our time". The teachings were shallow and the service delivery was done hurriedly. Doctors for instance, did not take time to explain to patients on how to take the drugs or the kinds of foods to eat. Someone narrated,

"I am happy with what the doctors tell us to do. However, it would be better if they could write down for us the specific foods we need to eat so that our children and grandchildren can prepare them for us."

(Respondent 2 from Nkubu Hospital)

Discussion

In the current study the distance to the health facility was significantly associated with practice of secondary preventive measures for diabetic complications. The patients who came from nearby the facility were reported to be practicing more of the secondary prevention screening measures compared to those who travelled long distances. Therefore, the distance between the patients' home and the health facility was found to be a determinant in receiving the screening measures. Healthcare delivery systems play a significant role in the health response to the growing problems of DM and its complications with distance to the facilities and unavailability of services being significant challenges as cited in the study [21].

Compliance to medication is crucial in management of diabetes. Non-compliance to medication has been reported to influence and lead to diabetic complications; both microvascular and macrovascular [23]. In this study, the patients reported to get the diabetic drugs in the hospital pharmacy most of the time. However, those who missed the drugs were associated with poor practice of secondary preventive measures for diabetic complications. In Ethiopia, physicians were advised to work on drug related problems and prevent side effects to promote compliance to diabetic treatment. This will in turn promote prevention of diabetic complications [24].

The staffs were reported to receive the patients in a friendly manner. This made the patients to adhere and follow up on the scheduled diabetic clinics. In the process, on analysis it was evident that staffs reception significantly influences practice of secondary preventive measures for diabetic complications. The patients reported that they are grouped into support groups. In these groups they are given health messages on preventive measures for diabetic complications. In the groups, health care provider communication skills were good. This helped the patients understand the preventive measures. Those patients with informal level of education were taught in "Kimeru", their local language. This improved level of knowledge on diabetic complications. Health education was key in this group. These results replicate the findings revealed in a study on patient's experiences of diabetes education in Ontario. The respondents cited support group education and follow up by community health workers to have promoted practice of preventive measures for diabetes complications [25].

Diabetic services and supplies needed for delivery of the services were readily available in both the facilities under study. Majority of the respondents, were appreciating the effort made by the county government in provision of the supplies and services. These two factors promoted the practice of secondary preventive measures for diabetic complications. Client satisfaction was reported to improve practice of secondary preventive measures among diabetic patients. The respondents revealed that they were satisfied with the services provided by health care workers, and this promoted the practice of preventive measures. The health workers are well trained and working hand in hand with community health workers in ensuring practice of the recommended practices. These results concur with those reported in India, that combined effort between community workers and training health workers promotes prevention of diabetes complications [26].

The clients who reported to have confidence in the health care workers who served them, showed more practice of secondary

preventive measures than those who didn't have confidence in the health workers. These results agree with those in a study in USA where the patients trusted the health care workers and practiced all the recommended strategies to prevent diabetic complications [27].

Conclusion

The main health service factors that affected secondary prevention were; health education and counseling distance to the health facility, staff reception, offering health education counseling to patients, communication skills of the health worker, availability of services and supplies necessary for screening the patients, client satisfaction and confidence of the patient on health workers' proficiency.

Recommendations

1. The Kenyan government, through the county health governments to advocate for educational campaigns to enlighten the public on secondary preventive practices for DM.
2. All the healthcare workers in all hospitals in Meru County, and in the Kenyan context at large to champion for screening tests for both microvascular and macrovascular complications among diabetes patients.
3. Empowerment of more health staffs in hospitals to cater for large numbers of patients at once to minimize long queues.
4. Promoting diabetes services availability including the drugs, equipment and diabetes supplies in the healthcare centers.
5. Health-educate and remind patients on preventive practices especially the elderly and organizes grass root campaigns and seminars for all to promote DM secondary prevention.
6. Increase the number of clinic days for efficient service delivery.

References

1. International Diabetes Federation. IDF Diabetes Atlas, 10th ed. Brussels: IDF.
2. Skyler JS, Bakris GL, Bonifacio E, Darsow T, Eckel RH, Groop L, et al. Differentiation of diabetes by pathophysiology, natural history, and prognosis. *Diabetes*. 2017;66(2):241-55.
3. Lebovitz HE. Diagnosis, classification, and pathogenesis of diabetes mellitus. *J Clin Psychiatry*. 2001;62(Suppl 27):5-9;discussion 40-1.
4. Yates T, Khunti K. Epidemiology: The diabetes mellitus tsunami: Worse than the "Spanish flu" pandemic? *Nat Rev Endocrinol*. 2016;12(7):377-8.
5. World Health Organization. Global report on diabetes. *Diabetes Fact Sheet*.
6. Orban JC, Van Obberghen E, Ichai C. Acute complications of diabetes. In *metabolic disorders and critically ill patients: From pathophysiology to treatment*. Springer: Berlin; 2018.
7. Brunner LS, Smeltzer SCOC. *Brunner & Suddarth's textbook of medical-surgical nursing*. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins. 2010.
8. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, et al. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: The JNC 7 Report. *JAMA*. 2003;289(19):2560-72.
9. Centers for Disease Control and Prevention, U. D. of H. and H. S. National Diabetes Statistics Report, 2017. Estimates of Diabetes and Its Burden in the United States Background. Division of Diabetes Translation.

10. Gray SP, Jandeleit Dahm K. The pathobiology of diabetic vascular complications-cardiovascular and kidney disease. *J Mol Med (Berl)*. 2014;92(5):441-52.
11. Alaboud A, Tourkmani A, Pharm D, Alharbi TJ, Alobikan AH, Abdelhay O, et al. Microvascular and macrovascular complications of type 2 diabetic mellitus in Central, Kingdom of Saudi Arabia. *Saudi Med J*. 2016;37(12):1408-11.
12. Wu Y, Ding Y, Tanaka Y, Zhang W. Risk factors contributing to type 2 diabetes and recent advances in the treatment and prevention. *Int J Med Sci*. 2014;11(11):1185-200.
13. Lee MY, Hsiao PJ, Huang JC, Hsu WH, Chen SC, Shin SJ. Association between metabolic syndrome and microvascular and macrovascular disease in type 2 diabetes mellitus. *Am J Med Sci*. 2018;355(4):342-49.
14. Christensen DL, Friis H, Mwaniki DL, Kilonzo B, Tetens I, Boit MK, et al. Prevalence of glucose intolerance and associated risk factors in rural and urban populations of different ethnic groups in Kenya. *Diabetes Res Clin Pract*. 2009;84(3):303-10.
15. Jones TLE. Diabetes Mellitus: the increasing burden of disease in Kenya. *South Sudan Medical Journal*. 2013.
16. Ayah R, Joshi MD, Wanjiru R, Njau EK, Otieno CF, Njeru EK, et al. A population-based survey of prevalence of diabetes and correlates in an urban slum community in Nairobi, Kenya. *BMC Public Health*. 2013.
17. Oti SO, van de Vijver SJM, Agyemang C, Kyobutungi C. The magnitude of diabetes and its association with obesity in the slums of Nairobi, Kenya: Results from a cross-sectional survey. *Trop Med Int Health*. 2013;18(12):1520-30.
18. Bayu B. The prevalence of macro and microvascular complications of DM among patients in Ethiopia 1990-2017: Systematic review. *Diabetes Metab Syndr*. 2019;13(1):672-77.
19. Ahmad LA, Crandall JP. Type 2 Diabetes Prevention: A Review. *Clinical Diabetes*. 2010;28(2):53-59.
20. Gæde P, Lund-Andersen H, Parving HH, Pedersen O. Effect of a multifactorial intervention on mortality in type 2 diabetes. *N Engl J Med*. 2008;358(6):580-91.
21. Selhy JV, Swain BE, Gerzoff RB, Karter AJ, Waitzfelder B, Brown AF, et al. Understanding the gap between good processes of diabetes care and poor intermediate outcomes Translating Research into Action for Diabetes (TRIAD). *Med Care*. 2007;45(12):1144-53.
22. World Health Organization. Kenya faces rising burden of diabetes. 2014.
23. Rahaman KS, Majdzadeh R, Naieni KH, Raza O. Knowledge, Attitude and Practices (KAP) regarding chronic complications of diabetes among patients with type 2 diabetes in Dhaka. *Int J Endocrinol Metab*. 2017;15(3):e12555.
24. Ayele Y, Melaku K, Dechasa M, Ayalew M, Horsa B. Assessment of drug related problems among type 2 diabetes mellitus patients with hypertension in Hiwot Fana Specialized University Hospital, Harar, Ethiopia. 2018;11(1):728.
25. Grohmann B, Espin S, Gucciardi E. Patients experiences of diabetes education teams integrated into primary care. *Can Fam Physician*. 2017;63(2):e128-e36.
26. Yasobant S, Saxena D, Trivedi M, Gaurav K, Patel S, Patel M. Advocacy for a responsive health system to control diabetes: Learning from western Indian state Gujarat, India. *International journal of medical sciences and public health*. 2016;5(11):22-39
27. Hafez D, Nelson D, Martin E, Cohen A, Northway R, Kullgren J. Understanding type 2 diabetes screening practices among primary care physicians: A qualitative chart-stimulated recall study. *BMC Fam Pract*. 2017;18(1):50.