

Effect of a Patient-mediated Journaling Intervention on Improving Self-Care Practices among Type 2 Diabetic Mellitus Patients attending Diabetes Clinics in Dodoma, Tanzania: Controlled Quasi-Experimental Trial

Bupe Mwakalindwa*, Julius Edward Ntwenya, Stephen Mathew Kibusi

Department of Public Health, University of Dodoma, Tanzania

*Corresponding author: Bupe Mwakalindwa, Department of Public Health, University of Dodoma, Tanzania.

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Abstract

Background: Tanzania is experiencing one of Africa's worst type 2 diabetes epidemics. In 2011, 2.8% of Tanzanians had diabetes; by 2021, this figure had risen to 12.8%. Maintaining optimum glucose levels in diabetic patients requires proper self-care practices such as healthy eating, being active, taking medication, foot care, healthy coping, and monitoring blood sugar. Patient-mediated journaling means writing down self-care activities, which will enhance patient engagement in managing chronic diseases. This study is designed to assess the effect of a patient-mediated journaling intervention on improving self-care practices among type 2 diabetic mellitus patients attending diabetes clinics in Dodoma, Tanzania.

Methods and Findings: This facility-based, controlled quasi-experimental study pre- and post-test design was conducted among 147 type 2 diabetes mellitus patients randomly selected from current attendees at three selected health facilities in the Dodoma Region. The intervention group ($n = 49$) was exposed to patient-mediated journaling over 8 weeks, and the control group ($n = 98$) continued with usual care over the same period. The data were analyzed using SPSS version 25. The change in mean of the self-care practice scores observed 2 months after the intervention, for the intervention group was 4.47 ± 3.90 , and for the control group 3.90 ± 0.70 . This means that the change in self-care practice from baseline to end line was significantly higher in the intervention group than in the control group.

Conclusion: This study showed that patient-mediated journaling interventions were feasible, and linked with significant improvements in self-care practices among the intervention group participants as compared to the control group. Thus, implementation of patient-mediated journaling interventions initiated at health facilities can improve client-driven diabetes self-care management.

Keywords: Patient-Mediated Journaling, Self-Care Practices, Diabetes Mellitus, Quasi-Experimental Trial.

Abbreviation

ADA : America Diabetes Association
DM : Diabetes Mellitus
DSME : Diabetes Self-Management Education
HbA1c : Glycated hemoglobin
IDF : International Diabetes Federation
MOH : Ministry of Health
NCDs : Non-communicable diseases
SPSS : Statistical Package for Social Sciences

T2DM : Type 2 diabetes mellitus
WHO : World Health Organization

Introduction

The globally number of type 2 diabetic mellitus (DM) patients is increasing rapidly. In 2019, the worldwide diabetes prevalence was estimated to be 9.3% (463 million people). The occurrence is much higher in urban areas (10.8%) than in rural areas (7.2%). The number of people suffering from the disease is expected to

rise to 55 million by 2045. The primary challenge for DM in African countries is the diagnosis. The study done in Tanzania showed that 60% of person with diabetes do not know they have DM. The United Republic of Tanzania reports that the prevalence of DM increase from 9.1% in 2012 to 10.3% 2022 among adults' population [1-5].

The increase in DM prevalence poses a risk for increasing DM late complications thus a need for improved DM self-care practice. DM self-care practice is vital factor to keep the disease under control, about 95% of diabetes care normally carried out by the patients or their family consists of healthy eating, being physically active, monitoring of blood sugar, good problem-solving skills, healthy coping skills and compliant with medications to reduces the risk of developing complications like Kidney failure, blindness, heart attacks, and limb amputation [6, 7].

Available data show that DM self-care is important in number of ways including to increase glycemic control, reduction of diabetes complication, quality of life improvement, preventing hospital admissions, better experience and reducing length of Hospital staying [8-10]. Therefore good self-care practice is absolute critical at keeping DM under control. The latest study from explain that inadequate self-care practice can impose different complications like Ketoacidosis (DKA), anorexia nervosa, terrible life, prolonged hospital admissions, micro and macro vascular disease. Also, it increases the economic burden on the family member, community and hospital settings by increasing the risk of mortality, complications, length of stay, and increased cost per admission [11-13].

Several diabetes self-care programs have already been done, including education intervention, computer-based intervention, mobile base intervention but the problem of poor adherence to self-care is still there. These intervention studies based on providing knowledge and skills only; others are more expensive because they involve internet, phone and computer. Therefore, there is a need to come with an intervention improve self-care practice among type 2 diabetic patients by empowering them, increasing disease ownership by using cost effectiveness, quality, and accessibility ways [14].

Patient-mediated journaling refers to the process of recording self-care activities and health events; it also involves goal setting and evaluation. Journaling helps patients keep track of every aspect of health by writing down their goals every day and keeping a daily log. The health journaling can be used as self-directed health care tool. Also, journaling has shown positive results in self-care practice; The study done by on chronic diseases report that writing in self-care journaling motivate push towards more self-determination, autonomy, self-efficacy and commitment in health. Also, according to the study conducted by participant who journaling at the end of the study had an increase in performance when compared with who did not journaling in control group [15, 16].

This study was designed to assess the effect of a patient-mediated journaling on self-care practice among patients with type 2 diabetes (T2DM) in the Dodoma Region. The patient-mediated journal was adapted from and implemented for diabetes patients in the intervention group, who were encouraged to use it, then

evaluated to assess its effectiveness on self-care practices. Although patient-mediated journaling has never been tested among type 2 diabetic patients, it is viewed as the best option for improving self-care practice among this population [17-19].

Methods

Study Design and Setting

This is a quasi-experimental study with control group pre-test-posttest design that uses a quantitative approach. The study employs two groups: the intervention group and the control group. The study was conducted at Dodoma Regional Referral Hospital (DRRH), Kondoa Town Hospital, and Kisese Health Center (located in Kondoa district). Dodoma Region was chosen because it is among the cities where there are approximately 21074 DM patients.

Study participants

The study population was typing 2 diabetic patients attending diabetes clinics randomly selected at selected hospitals. The inclusion criteria for study participants were Type 2 diabetic patients who are able to practice self-care activities, aged 18 years and older, able to speak, read, and understand the Swahili language. The exclusion criteria include patients who have a disease with severe cognitive function impairment.

Intervention

The intervention was guided by the chronic care model, which makes patient-centered decisions and encourages patient participation. The study applied three critical components of that model: patient self-management support, clinician decision support, and delivery system design for diabetes patients in Dodoma. With self-management support, the diabetes patients were empowered and prepared to manage their health care. Regarding delivery system design, health care providers were used to assure effective, efficient care, sustainability of the intervention, and self-care support. Also, in terms of decision support, trained nurses promote care consistent with patients' preferences.

During intervention implementation, the intervention group was given a diabetes self-care journal named "diabetes self-care journal," adapted from, which was a mobile and intelligent patient diary for chronic diseases that had a list of self-care activities followed by other parts for patients to write down their self-care practices. In this study the journal was in the form of papers and added a list of self-care activities from the module of Diabetes Self-Management Education (DSME), followed by pages on which the patients wrote down their goals and evaluated them. The checklist covered areas such as daily adherence to a healthy diet, blood sugar monitoring, exercise, foot care, daily adherence to medication, emotion and stress management, and hospital care whenever necessary [20].

The trained nurses assisted diabetes patients individually to set goals according to their treatment of each patient and to direct them on how to document and evaluate them daily in their journal. They fill out a journal for two months until the next visit, where a nurse checks it to see if there are any gaps or challenges and solves them; they also set other goals for the coming month by following the treatment they are receiving. Every study participant in the intervention group was required to set goals regarding a healthy diet, blood sugar monitoring, exercise, foot

care, and daily adherence to medication and evaluate them every day to ensure intervention fidelity. Then they were followed up, and two weekly phone calls were arranged to remind them to practice self-care activities and be honest and diligent in using the journal. This process continued until the final information was taken.

Control group

The study participants in the control group did not conduct patient-mediated journaling; after baseline data collection, they were encouraged to practice self-care activities at home. Similar to the intervened group, there were phone calls after two weeks to encourage them to continue with usual care, so that to don't lose follow up.

Post-intervention

After two months, both intervention and control group the study participant was evaluated for their self-care practices. Then the study participants were required to fill out the post-test questionnaire. Also, the control group was assisted by trained nurses to set goals and evaluate them according to the treatment of each patient and to direct them on how to document and evaluate them daily on their local exercise books.

Outcome

The outcome of interest in this study was self-care practice. To measure the self-care, practice The Summary of Diabetes Self-care Activities Scale (SDSCA) was used [21]. The questionnaire SDSCA consists of five scales with 16 questions that assess self-care in the elements of diet, exercise, self-monitoring of blood glucose, medication adherence, and foot care. The SDSCA contains 0 - 7 numbers indicating the number of days spent performing self-care in a week. The participants were asked to remember the number of days they performed self-care in a week. To determine the performance of each scale, the responses of each scale were summed up and then divided by the number of items in that scale.

Sample Size

The sample size was calculated using a formula adopted from a study conducted in Talgh Kermanshah $n = (Z_{1-\alpha/2} + Z_{1-\beta})^2 (\sigma_1^2 + \sigma_2^2) / (\mu_1 - \mu_2)^2$. The number of tests in this research according to had a test power of 80%, a significance level of 0.05, and a mean self-care difference between the groups of 10, with a standard deviation of 17.5, and 15.8 in the intervention and control groups, respectively.

Selection of facility: Three public facilities with 100 or more diabetes mellitus clients were selected purposefully from Dodoma region.

Selection of participants: To recruit 147 study participants from selected facilities. The formula as per Wilkinson and Blanderkar (1979) as used by, the formula for strata ($n_i = P_i \times n/P$) was used [22]. Sample size for strata is n_i P stands for total population

who registered in the research area

$N = \text{sample size}$ Population stratum = P_i

556 persons were registered overall in the study location that were chosen

P_i Dodoma Regional Referral Hospital: $300 \times 147 / 556 = 79$

P_{ii} Kondo Town Hospital: $113 \times 147 / 556 = 30$

P_{iii} Kisese Health center: $143 \times 147 / 556 = 38$

For each study facility there is a control and intervention group by using the ratio of 1:2. Eligible diabetic patients were assigned to the intervention and control groups according to their geographical location. From the chosen hospital, with the help of hospital healthcare providers, a systematic random sampling technique was used to get the study sample.

Data Collection

The method of data collection was researcher-administered; data collection was done in two phases at baseline and end-line (8 weeks post-intervention). The trained data collector collected both baseline and end-line data questionnaires. Trained nurses were facilitating journaling interventions. The primary investigator was coordinating the whole process of data collection. Medical doctors and nurses are those that the Ministry of health has authorized for the responsibility. All discipline groups of workers were well trained in data collection and study conduct. A structure questionnaire containing four sections was used for data collection. The first part has question to assess demographic characteristics. The second part had 16 (SDSCA) questions to examine self-care practice [21].

Data Analysis

Descriptive and inferential analyses were conducted using SPSS program 25. The process also involved merging and appending the baseline and end-line information. Categorical variable was summarized using numbers and percentages while quantitative variable was expressed as mean \pm standard deviation. Chi-square and fisher's exact test were used to compare baseline characteristics of study participants.

The computation of the outcome variable of interest (self-care practice) was a part of the data analysis. Self-care practice scores were compared between treatment and control arms as well as between baseline and endpoint in the analysis. Difference in difference analysis (D-I-D), which utilized linear mixed models, was used for the inferential analysis. The outcome variables' repeated measurements were taken into account by the models and the impacts of the arms were regarded as fixed effects.

Ethical Consideration

The study was conducted with complete compliance with worldwide suggestions for human topics research. The study has been given an ethical approval from University of Dodoma Institutional Review Board with reference number MA.84/261/61/66 dated 17thmarch 2023. Data collection is expected to be in April, 2023 and being completed July, 2023.

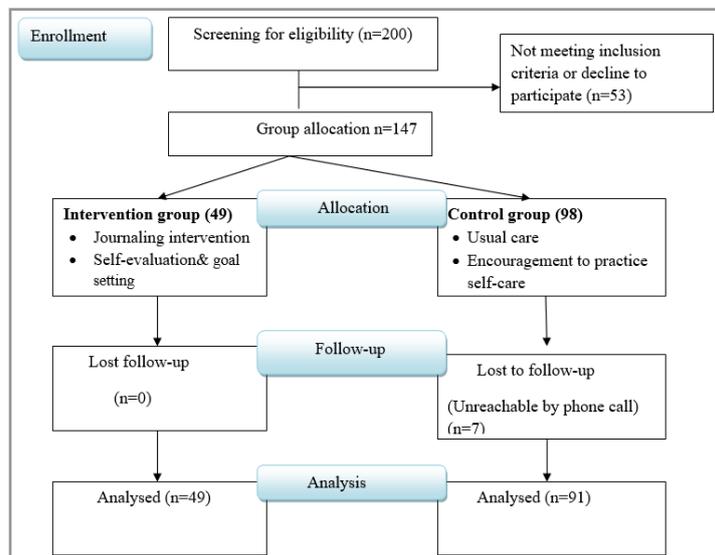


Figure 1

Results

The study involved a total of 147 respondents as shown in the Figure 1. Large proportion of the male diabetic patients were in the control group (39.80%) than in the intervention group (36.73%) as of female patients' majority were in the intervention group (63.27%) while control had fewer female patients (60.20%). Regarding the area of residence majority of the urban respondents were in the intervention group (69.39%) while for

the rural patient's majority were in the control group (34.69%). With respect to the education level of the respondents, large proportions of the informal education were in the intervention group (14.29%) while fewer for control group (12.24%). For the case of primary education majority were in the control group (55.10%), for secondary education (20.41%) intervention group. However, the college or university level, were equally distributed (14.29%) each for the intervention and control group.

Table 1: Participants' Socio-demographic characteristics of Type 2 Diabetic Mellitus patients (n=147)

Variable	ALL N (%)	Intervention N (%)	Control N (%)	X2-Value	P-Value
Age	59.84±10.69			7.2957	0.0630
<50	31(21.09)	8(16.33)	23(23.47)		
50-59	37(25.17)	19(38.78)	18(18.37)		
60-69	49(33.33)	14(28.57)	35(35.71)		
≥70	30(20.41)	8(16.33)	22(22.45)		
Gender				0.1289	0.7195
Male	57(38.78)	18(36.73)	39(39.80)		
Female	90(61.22)	31(63.27)	59(60.20)		
Area of resident				0.2449	0.6207
Urban	98(66.67)	34(69.39)	64(65.31)		
Rural	49(33.33)	15(30.61)	34(34.69)		
Religion of the respondent				3.5000	0.0539
Christian	63(42.86)	15(30.61)	48(48.98)		
Muslim	84(57.14)	34(69.39)	50(51.02)		
Marital status					0.0090*
Single	7(4.76)	4(8.16)	3(3.06)		
Married	92(62.59)	28(57.14)	64(65.31)		
Divorced	19(12.93)	2(4.08)	17(17.35)		
Widowed	29(19.73)	15(30.61)	14(14.29)		
Education Level				0.2780	0.9641
Informal	19(12.93)	7(14.29)	12(12.24)		
Primary education	79(53.74)	25(51.02)	54(55.10)		

Secondary education	28(19.05)	10(20.41)	18(18.37)		
College/university education	21(14.29)	7(14.29)	14(14.29)		
Occupation				4.3067	0.2302
Employed	17(11.56)	6(12.24)	11(11.22)		
Self-employed	60(40.82)	18(36.73)	42(42.86)		
Unemployed	44(29.93)	12(24.49)	32(32.65)		
Retired	26(17.69)	13(26.53)	13(13.27)		
BMI				1.9831	0.5759
<=18.5	6(4.08)	2(4.08)	4(4.08)		
18.6-24.9	52(35.37)	15(30.61)	37(37.76)		
25-29.9	54(36.73)	17(34.69)	37(37.76)		
30+	35(23.81)	15(30.61)	20(20.41)		

Distribution of Clinical Characteristics and Other Social Factors of Type 2 Diabetes Mellitus Patients

Table 2 shows information of other factors, and the measurements were compared across the groups. The results revealed that many of the respondents, 69 (46.94%), were diagnosed with DM less than five years age. Among the patients with less than five years of diagnosis, the majority were in the intervention group (53.06%). However, the results show that only one person uses insulin injections, and the patient was in the control group. Large proportions of the respondents have no co-morbidity 82

(55.78%) and the majority of them were in the control group (58.16%). Large proportions of the respondents are non-smokers 139(94.56%). A large proportion of the respondents were non-drinker alcohol 94 (63.95%). However, many of them attended clinic three times or more for the past six months, 113 (76.87%), and among them many were in the intervention group (79.59%). Regarding level of health facility, 79(53.74%) are from the regional hospital, 38 (25.85%) from health center, and the rest from district hospital.

Table 2: Distribution of clinical characteristics and other social factors of Type 2 Diabetic Mellitus patients (n=147)

Variable	ALL N (%)	Intervention N (%)	Control N (%)	X2-Value	P-Value
Duration of diagnosis of DM				1.9370	0.3797
<5	69(46.94)	26(53.06)	43(43.88)		
6-10		48(32.65)	16(32.65)	32(32.65)	
11+	30(20.41)	7(14.29)	23(23.47)		
Current medication					0.9999*
Insulin	1(0.68)	0(0.00)	1(1.02)		
Oral hypoglycemic agent	146(99.32)	49(100.00)	97(98.98)		
Co-morbidity of respondent				0.6757	0.4111
Present	65(44.22)	24(48.98)	41(41.84)		
Absent	82(55.78)	25(51.02)	57(58.16)		
Smoking history				0.0661	0.7971
Ex-smoker	8(5.44)	3(6.12)	5(5.10)		
Non smoker	139(94.56)	46(93.88)	93(94.90)		
Alcohol history				0.9442	0.3312
Ex-drinker	53(36.05)	15(30.61)	38(38.78)		
Drunker	94(63.95)	34(69.39)	60(61.22)		
Attendance to clinic for the past six months					0.0560
Not at all	1(0.68)	0(0.00)	1(1.02)		
Once	11(7.48)	1(2.04)	10(10.20)		
Twice	22(14.97)	9(18.37)	13(13.27)		
Three times or more	113(76.87)	39(79.59)	74(75.51)		

Number of diabetes education attended for the past 6 months				2.4665	0.4814
Not at all	17(11.56)	6(12.24)	11(11.22)		
Once	58(39.46)	16(32.65)	42(42.86)		
Twice	40(27.21)	13(26.53)	27(27.55)		
Three times or more	32(21.77)	14(28.57)	18(18.37)		
Level of health facility				0.0779	0.9618
Regional hospital	79(53.74)	27(55.10)	52(53.06)		
District Hospital	30(20.41)	10(20.41)	20(20.41)		
Health center	38(25.85)	12(24.49)	26(26.53)		

Self-care practice among type 2 diabetes patients

The findings in Table 3 illustrate the mean score of self-care practice. The results show that in both the control and intervention group taking medication is the highly practiced self-care practice with a mean value above 6 in all the groups and across

time followed by diet with a mean score above 4 for all the groups across time. Self-blood sugar testing had the least mean score below 1 for all the groups across time. However, the overall self-care practice had the mean score of ranging from 3.9 to 4.47 in all groups across time.

Table 3: Self-care practice among type 2 diabetic mellitus patients n=147

	Intervention		Control		
Variable	Baseline	End line	Variable	Baseline	End line
Diet	4.76±0.89	5.29±0.56	Diet	4.76±0.89	5.29±0.56
Exercise	3.97±0.91	4.59±0.73	Exercise	3.97±0.91	4.59±0.73
Test	0.61±0.79	0.77±1.02	Test	0.61±0.79	0.77±1.02
Foot	3.46±1.09	4.38±0.75	Foot	3.46±1.09	4.38±0.75
Medication	6.54±0.89	6.54±0.9	Medication	6.54±0.89	6.54±0.9

Difference-in-Difference analysis for self-care practices among type 2 DM patients

The differences in difference analysis were carried out using a linear mixed model to evaluate the effect of the treatment arm on the change in self-care practices from the baseline to the end line.

Table 4 displays the results of the fitted model. The findings showed that from baseline to the end line self-care increased. The magnitude of the difference in difference β estimate for the intervened group against the control group was positive ($\beta = 0.7499, p < .0001$). This means that the change in self-care practice from baseline to end line was significantly higher in the treatment arm than in the control arm.

Table 4: Parameter estimates of the linear mixed model for difference in differences analysis of self-care practice among type 2 Diabetes mellitus patients n=147

Effect	Estimate	Standard Error	Pr > t
Intercept	4.1327	0.08439	<.0001
Time			
End line	4.2480	0.06268	<.0001
Baseline	Ref		
Treatment			
Intervention	4.2449	0.08487	<.0001
Control	Reference		
Time*Treatment			
Time* Intervention	4.5306	0.1011	<.0001
	D-I-D coefficients		
Effect	Estimate	Standard Error	P-Value
Intervention Vs. Control	0.7499	0.1748	<.0001

Discussion

In this study, two months of patient-mediated journaling intervention showed significant improvement of the self-care prac-

tices in type 2 diabetes mellitus patients. The findings indicate that there was greater improvement in self-care practice in the intervention group than in the control group, with the positive

difference in difference coefficient after controlling for other variables showing significant relationship with self-care practice [23]. The current study's results showed that the general mean of self-care activities for the intervention group was considerably greater than the baseline after the intervention. This is in line with the results of a multi-nation observational study on diabetic patients in Middle Eastern nations, which discovered that individuals who do diabetes journaling instruction were more likely to practice diabetes self-management than those who did not [24-26].

This positive finding is similar to the study done by on chronic diseases, report that writing in self-care journals has shown positive results in self-care practice since it motivates and pushes towards more self-determination, autonomy, self-efficacy and commitment in the health management [16]. Also, the findings of this study are consistent with the study conducted by on the heart transplant recipients. Participants who journaling at the end of the study had increase in performance when compared with who did not journaling in control group. However, our findings differ from study done by which report that there was weaker evidence revealed that goal setting was more effective when paired with external health behavior without feedback (goal evaluation) [15, 27].

The findings of this study indicated that in both the control and intervention groups taking medication is a highly practiced self-care practice, with a mean value above 6 in all groups. On the other hand, self-blood sugar testing had the lowest mean score below 1 for all the groups across time; similar findings have also been reported in previous research studies. The research findings show that diabetes mellitus patients either inadequate knowledge of the importance of blood sugar testing or they feel it is difficult to practice self-monitoring of blood sugar because it is costly and painful [24-26].

Since journaling interventions comprise goal setting and evaluation, the results provide evidence that there is a significant positive mean difference on goal setting and goal evaluation at the end line. This shows that diabetes patients who practice goal setting related to self-care activities are more likely to achieve them and make long-term behavioral changes. Moreover, the findings of this study are similar to those of, which reports that goals setting and evaluation boost self-esteem and improve performance [27].

In this study, assisting people with diabetes with trained nurses to set and evaluate goals supplemented with an informatory journal (printed in Swahili) was one of the key features of the patient-mediated journaling intervention. After two months of this nurses-driven journaling intervention, there was a notable improvement in self-care practices among type 2 diabetes mellitus patients.

Conclusion

This study showed that journaling interventions were linked with significant improvement in the self-care practices of the intervention group participants as compared to the control group. Integrating the journaling intervention into diabetes management may have a beneficial impact on the health outcomes of diabetes mellitus patients. The innovative approach involved in this study

was to empower patients by encouraging them to engage in and own the treatment of their disease. The study carried out in one setting which both intervention and control group are from, which is a risk of cross-contamination. The follow up period was only 2 months which is shorter than other research of similar nature. Iran study parameter used to parameterize the sample size calculation. So, sample size should be interpreted with caution. Also, the use of locally available materials increases sustainability of the intervention. The current study done in Dodoma Region has expanded the assortment of knowledge about the effect of journaling on self-care practice. Therefore, other study should focus on the experimental study at the community and family level since this study was hospital based only, the intervention study that assess effect of journaling on improving glyated hemoglobin level, blood pressure and cholesterol. Also to assess the effect of journaling on self-manage other chronic diseases.

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Author's contributions

BM initiated the study including conceptualization of the research idea, implementation of the intervention, data collection, analysis, interpretation and manuscript preparation. SMK and JEN were student supervisors from initial stages to report writing and review of manuscript. All authors read and approved the final manuscript.

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Availability of Data and Materials

The data set used and/or analysed during the current study will be available from the University of Dodoma on reasonable request.

Declaration

Ethical Approval and Consent to Participate

The study was conducted with complete compliance with worldwide suggestions for human topics research. The study has been given an ethical approval from University of Dodoma Institutional Review Board with reference number MA.84/261/61/66 dated 17thmarch 2023. Data collection is expected to be in April, 2023 and being completed July, 2023. Then the researcher was present an approval letter to introduce the research team to the responsible authority of Dodoma Region, the district administrative commission, and the hospitals included in the study. Written and signed informed consent was obtained from research participant after entire explanation of the study goals and procedures.

Consent for Publication

Not applicable

Competing Interest

The researcher declare that they have no competing interests

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