

Hospitalization Pattern and Treatment Outcome Among Diabetic Patients Admitted to a Teaching Hospital in Ethiopia: A Prospective Observational Study

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Abstract

Diabetes mellitus is associated with frequent hospitalization and high morbidity, mortality and health care expenditure. However, there is scarcity of data on hospitalization pattern and treatment outcome among diabetic patients in Ethiopia. **Objective:** to assess reasons for hospitalization, treatment outcome and its predictors among diabetic patients admitted at a teaching hospital in Ethiopia **Method:** A hospital based prospective observational study was conducted at medical and surgical wards of Jimma University Specialized Hospital from March to June, 2015. All adult patients with the diagnosis of diabetes who met the inclusion criteria were included in the study. Data was collected using pretested abstracting format. Logistic regression was employed for statistical analysis and statistical significance was considered at $p < 0.05$. **Result:** A total of 89 patients were included in the analysis; 59.6% were male, with the mean age 46.9 ± 15.5 years. Type 2 diabetic patients accounted for 74.2%. One third (33.7%) of patients were hospitalized with diabetic ketoacidosis. Other common reasons for hospitalization were infections (19.1%) and cardiovascular diseases (18.0%). Median duration of hospital stay was 9 days ranged from 1 to 88 days. Seventy six percent of patients were discharged with improvement and hospital mortality rate was 11.2%. Patients admitted due to diabetic complications had favorable treatment outcome (AOR=5.7, 95%CI: 1.4-22.9). **Conclusion:** This study identified that the most common reasons for hospitalization of diabetic patients were diabetic complications, infections and cardiovascular diseases. Despite majority of patients discharged with improvement, mortality rate is still high which urges attention to the care of hospitalized diabetic patients and the need to enhance outpatient care of diabetic patients to minimize hospitalization due to preventable causes.

Keywords: reasons for hospitalization, diabetic patients, treatment outcome, Jimma University

Introduction

Diabetes mellitus (DM) is a complex, metabolic disorder causing a significant morbidity, mortality and health care expenditure (1,2). Prevention and management of diabetes thus needs both public health interventions and continuous medical care for those affected (1) to prevent acute and chronic complications of sustained hyperglycemia.

Diabetes mellitus is a growing public health problem that adversely affects the lives of millions of individuals around the world. It causes significant physical and psychological morbidity, disability and premature mortality among those affected patients and imposes a heavy financial burden on health services (2). People with diabetes require at least two to three times the health-care resources compared to people who do not have diabetes, and diabetes care may account for up to 15% of national health care budgets globally (3).

According to the International Diabetes Federation (IDF), 387 million people were estimated to live with diabetes worldwide in 2014, with world prevalence of 8.3%, out of which around 22 million were from Africa. The number is expected to be raised to 592 million worldwide and 41.5 million in Africa by the year 2035 (4). Although Africa has the lowest prevalence of DM, it contributes the highest percentage of deaths as compare with the other regions. Ethiopia, which is one of the developing nations, is at a risk of increased diabetes incidence; where studies showed that prevalence was 1.3% in North Ethiopia (5), but 3.64% in Northwest of Ethiopia (6). According to 2014 IDF report, 4.84% of the population of Ethiopia is estimated to live with diabetes in 2014 (4).

Hospitalization is more common for people with diabetes than for those without diabetes. In addition, patients with diabetes are more likely to be hospitalized for a longer period of time than those without diabetes (7,8). Diabetes is considered an ambulatory care-sensitive condition, and many hospitalizations are potentially preventable. The pattern of hospital admissions can be used to determine the effectiveness of outpatient care of DM (7). Therefore this research will provide information with regard to common causes attributed for hospitalization of diabetic patients and their treatment outcome which is scarce in literatures.

Materials and methods

Study setting and design

A hospital based prospective observational study was conducted at Jimma University Specialized Hospital (JUSH) which is located in Southwest of Ethiopia and having catchment population of over 15 million. The study was conducted from March 1 to June 30, 2015.

Selection of study participants

Patients with age of 14 or above years who admitted at medical or surgical wards with new or previously diagnosed diabetes mellitus were included in the study (**figure 1**). Patients with gestational diabetes mellitus and those who refuse were excluded. All diabetic patients admitted at medical or surgical ward during data collection period who met the inclusion criteria were consecutively recruited in the study and followed till discharge or referral to facilities outside JUSH or death.

Sociodemographic data, medication given before admission, antidiabetic medication adherence, type of diabetes, duration of diabetes since diagnosis, admission blood glucose and comorbidities were explanatory variables while reason for admission and treatment outcome were considered as independent variables of the study.

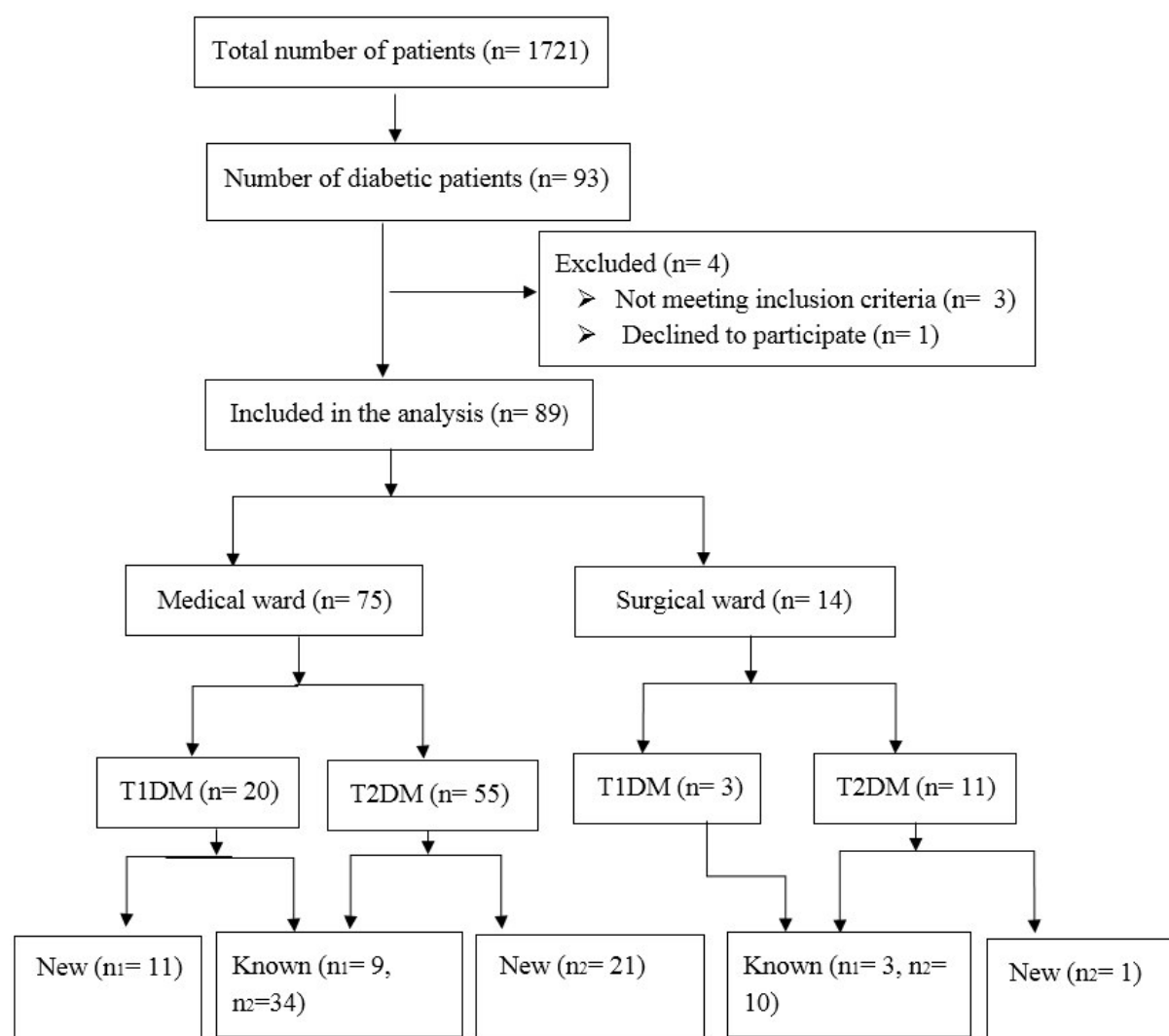


Figure 1: Enrollment of diabetic patients admitted to JUSH medical and surgical wards, March-June, 2015 (n1= number of Type 1 Diabetes mellitus (T1DM), n2= number of Type 2 Diabetes Mellitus (T2DM))

Data collection and statistical analysis

Data abstraction checklist was developed to collect relevant information from patient charts about current diagnosis, comorbidities, diabetic complications, blood glucose, medication given, and laboratory results. Structured questionnaires were used to obtain patient demographics, disease duration, and adherence. Morisky Medication Adherence Predictor Scale (9,10), was utilized to collect information necessary to assess medication

adherence. Adherence level was classified by taking the sum of 8 question responses and grouped as high, medium or low, if the total score was 0, 1 to 2 and greater ≥ 3 respectively. The data was collected by 2 pharmacists and 2 nurses.

Epi Info version 7.0 was used to enter, encode and clear data. Then, the data was exported and analyzed using SPSS version 21.0 for windows. Descriptive statistics, such as frequency, percentage, mean and standard deviation was used to summarize patients' baseline characteristics. Bivariate logistic regression was used to identify independent variables that were candidate for multivariable logistic regression. Multivariable logistic regression model was fitted to determine independent predictors of treatment outcome when the p-value ≤ 0.1 on bivariate analysis. Statistical significance was considered at p-value < 0.05 .

Reason for hospitalization defined as any factor that was considered as immediate cause of hospital admission of diabetic patients while diabetic related admission was considered when patients admitted primary due to short term (DKA, HHS, hyperglycemia, or hypoglycemia) or long term complications of diabetes. Treatment outcome was considered as good when patients discharged with improvement as per the decision of health care team, otherwise considered as poor outcome.

Ethical consideration: The study was conducted after securing ethical clearance and approval from Institutional Review Board of Jimma University. Official permission was obtained from the hospital clinical director before data collection commenced. Written informed consent was secured from all participants. Data collection was done anonymously by coding data collection formats using non-identifiable codes

Results

Background characteristics of participants

A total of 1721 patients were admitted to medical and surgical wards during the study period; 93(5.4%) had diagnosis of diabetes mellitus. Among those, 89 were included in the analysis (**figure 1**). Of the participants, 53(59.6%) were males. The mean age of the participants was 46.9 ± 15.5 years with range of 15 to 87 years; half of them were older than 50 years (50.6%) (**Table 1**).

Table 1: Background characteristic of diabetic patients admitted to Jimma University Specialized hospital medical and surgical wards, March-June, 2015

Variables	Frequency, N=89 (%)
Sex	
Male	53(59.6)
Female	36(40.4)
Age (years)	
14-29	14(15.7)
30-39	15(16.9)
40-49	15(16.9)
50-59	24(26.9)
≥ 60	21(23.6)
Marital status	
Single	8(9.0)
Married	75(84.3)
Widowed	6(6.7)
Educational level	
Illiterate	36(40.4)
Primary	29(32.6)
Secondary	9(10.1)
College and above	15(16.9)
Types of diabetes	
T1DM	66(74.2)
T2DM	23(25.8)
Comorbid condition	
Yes	59(66.3)
No	30(33.7)
Adherence level to antidiabetics*	
Medium	14(25.4)
Low	41(74.6)

* Valid N=55

Out of 89 patients, 66 (74.2%) were type 2 diabetic patients; and 56 (62.9%) patients were known diabetics, while 33 (37.1%) were newly diagnosed (**figure 1**). The mean duration of diabetes for known diabetics was 7.5 ± 6.3 years; most of them were diagnosed in the last 5 years (**Figure 2**).

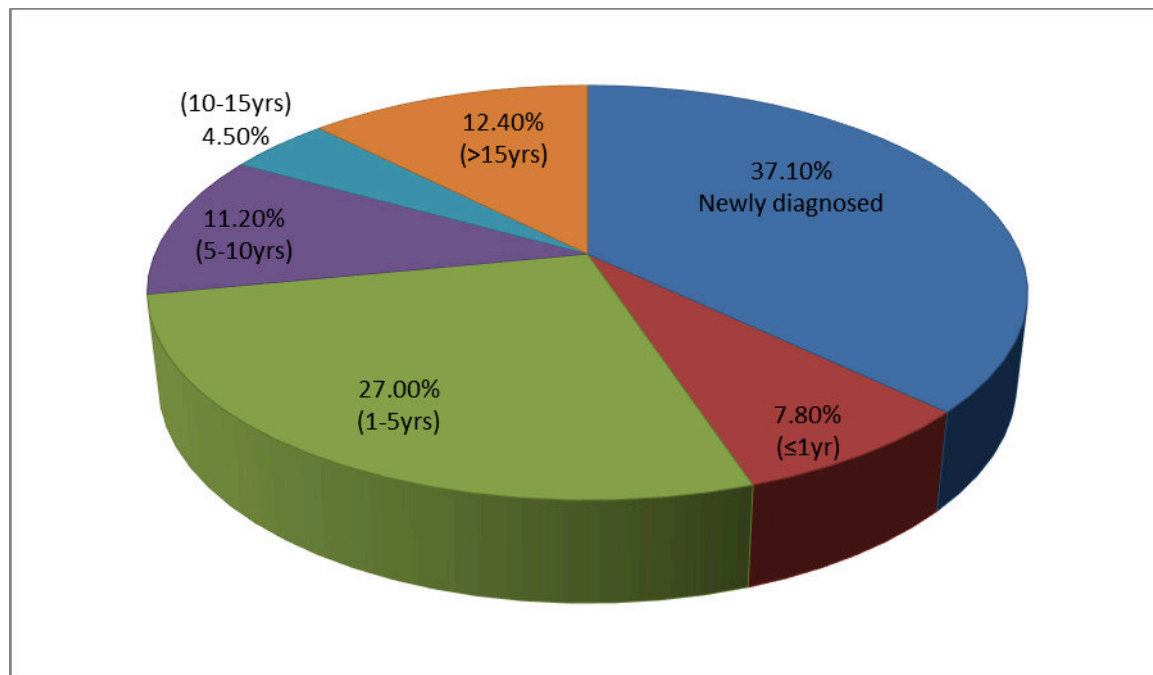


Figure 2: Duration of diabetes among patients admitted to JUSH medical and surgical wards, March-June, 2015. Comorbid medical conditions were identified in 59(66.3%) patients during admission. Hypertension and infections were the most common comorbidities identified in 34.8% and 24.7% of cases respectively (see supplementary table for detail information). Evaluation for chronic complications of DM revealed that 22(24.7%) patients had at least one chronic diabetic complication. Diabetic foot ulcer (10 cases), peripheral neuropathy (7 cases), nephropathy (4 cases) and retinopathy (3 cases) were the chronic complications identified.

Excluding 33 patients who were newly diagnosed, 29 patients were on insulin therapy, 17 patients on metformin, 4 on glibenclamide and 7 patients were on combination of two antidiabetic agents (4 on metformin and insulin, 3 metformin and glibenclamide) before admission. During the current hospitalization, insulin was used to manage the hyperglycemic state in all patients except one who continued with preadmission regimen of metformin.

Reasons for hospitalization

Diabetic ketoacidosis (DKA) was the commonest reason for hospitalization which attributed for admission of 30(33.7%) patients followed by infections, 17(19.1%), and cardiovascular diseases (CVDs), 16(18.0%). The most common infections responsible for admission were skin and soft tissue infections (SSTIs), 14(15.7%) and bacterial meningitis, 4(4.5%) whereas the commonest cardiovascular disease attributed for admission was congestive heart failure (CHF) (Table 2). Among participants, 43(48.3%) patients were admitted due to diabetic complications.

Table 2: Reasons for hospitalization of adult diabetic patients admitted to JUSH medical and surgical wards, March-June, 2015.

Causes of admission	Frequency	Percent
Diabetic keto acidosis	30	33.7
Skin and soft tissue infections (including diabetic foot ulcer)	14	15.7
Heart failure	13	14.6
Acute abdomen	5	5.6
Bacterial meningitis	4	4.5
HHS	4	4.5
Stroke	3	3.4
Acute pyelonephritis	3	3.4
Others	13	14.6

The mean admission blood glucose was 347.8 ± 158.8 mg/dl which ranged from 31 to 600mg/dl. Three patients had hypoglycemia (Random blood sugar (RBS) <70mg/dl) whereas 75 patients had hyperglycemia (RBS>180mg/dl), of whom 65 had RBS of > 250 at the time of hospital admission.

Treatment outcome and its predictors

Out of 89 patients participated in this study, 68 were discharged with improvement, 10 died with in hospital

mortality rate of 11.2% and 5 patients were referred to other institutions while 6 patients left against medical advice. Of 10 patients died, four were admitted due to infections, two patients due to acute diabetic complications, two due to CHF and one each due to hemorrhagic stroke and uremic pulmonary edema. Seven patients were died with 5 days of admission while the remaining three died after 10 days of hospitalization. The mean time to death after hospitalization was 10.2 ± 13.2 days since from date of admission.

The median length of hospital stay was 9 days (interquartile range of 14 days) which ranged 1 to 88 days. The mean duration of hospital stay was longer for those who were admitted to surgical ward (24.9 ± 27.9 days) than medical ward (13.2 ± 13.6 days) which was statistically significant ($p=0.02$, 95%CI: 2.2-21.3). The mean duration of hospital stay was longer for those who had diabetic foot ulcer (24.8 ± 26.0 days) but not statistically significant as compared with patients without ulcer ($p=0.053$).

The mean time to be urine ketone free for patients admitted with DKA was 31.3 ± 38 hours. The mean discharge RBS was 192.6 ± 70.2 mg/dl; 53.2% had discharge blood glucose above 180mg/dl (**Figure 3**). In general, 21(23.6%) patients had poor treatment outcome at the end of their hospital stay.

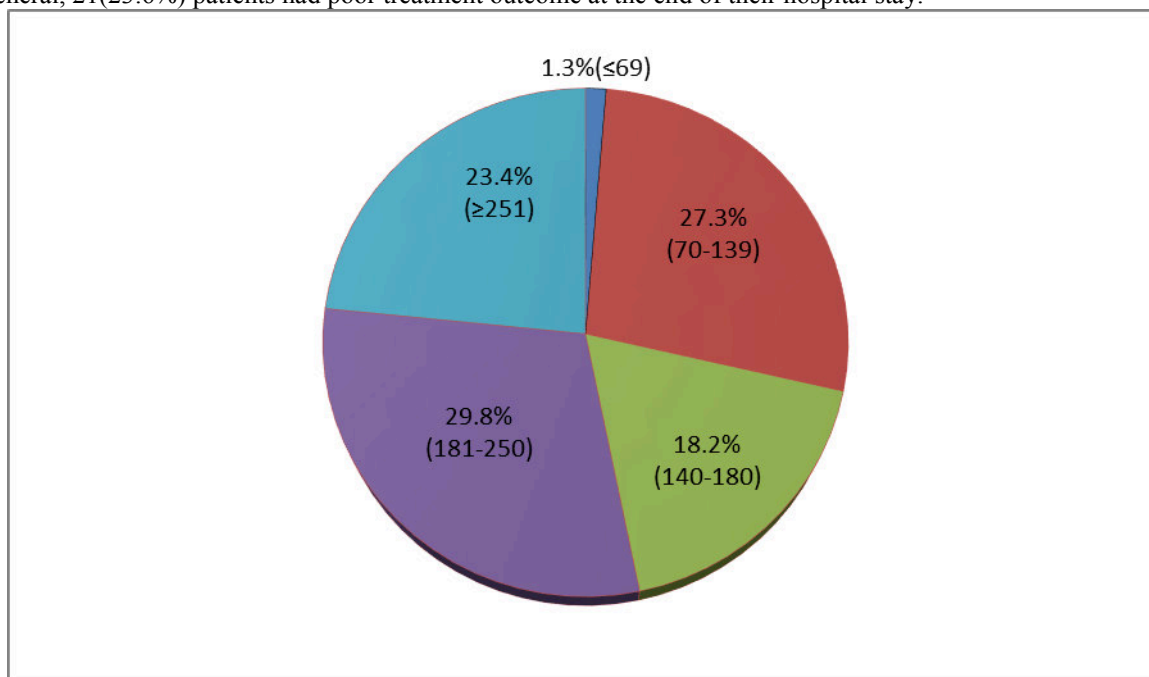


Figure 3: Discharge RBS (mg/dl) of adult diabetic patients admitted to JUSH, March-June, 2015 (N=77)

Patients admitted with DKA as primary reason for admission had good treatment outcome (COR=4.0, 95%CI: 1.1-14.7) which was similar with the result when other diabetic related admission were taken into account (COR=4.0, 95%CI: 1.3-12.3). Of the infectious causes of admission, patients who were admitted with meningitis were significantly associated with poor treatment outcome than patients with other causes of admission (COR=0.9, 95%CI: 0.01-0.9).

However, on multivariable analysis only diabetes related complications remained independent predictors of treatment outcome. Accordingly, patients hospitalized due to diabetic related causes had 5.7 times more likely to be discharged from hospital with improvement than patients admitted due to any other causes (AOR=5.7, 95%CI: 1.4-22.9) (**Table 3**).

Table 3: Predictors of treatment outcome of diabetic patients admitted to JUSH medical and surgical wards, March-June, 2015.

Variables	Treatment outcome		Bivariate analysis		Multivariable analysis	
	Good	Poor	P-value	COR(95%CI)	P-value	AOR(95%CI)
Type of diabetes						
T1DM	19	4	0.42	1.64(0.49-5.33)	0.49	1.97(0.29-13.27)
T2DM	49	17	1.00	1.00	1.00	1.00
Diabetes status						
Newly diagnosed	29	4	0.06	3.16(0.96-10.39)	0.25	2.87(0.47-17.63)
Known diabetic	39	17	1.00	1.00	1.00	1.00
Admission BG(mg/dl)						
≤70	2	1	0.35	0.22(0.01-5.26)	0.74	0.53(0.01-23.58)
71-180	4	7	0.02	0.06(0.01-0.70)	0.38	0.18(0.004-7.99)
181-250	9	1	1.00	1.00(0.05-18.57)	0.32	8.12(0.14-483.73)
251-350	23	3	0.90	0.85(0.08-9.30)	0.34	5.26(0.18-155.56)
351-450	12	2	0.76	0.67(0.05-8.55)	0.81	1.456(0.07-30.03)
450-599	9	6	0.13	0.17(0.02-1.68)	0.58	0.44(0.02-8.26)
≥600	9	1	1.00	1.00	1.00	1.00
DKA admission						
Yes	27	3	0.04	3.95(1.06-14.72)	0.30	6.56(0.19-231.18)
No	41	18	1.00	1.00	1.00	1.00
Meningitis admission						
Yes	1	3	0.042	0.09(0.01-0.91)	0.32	0.17(0.005-5.77)
No	67	18	1.00	1.00	1.00	1.00
Diabetic related admission						
Yes	38	5	0.014	4.05(1.33-12.33)	0.014	5.69(1.42-22.90)
No	30	16	1.00	1.00	1.00	1.00

Discussion

DKA is the main reason for hospitalization of patients with DM at JUSH. The in hospital mortality for patients with diabetes was 11.2%. Patients admitted with diabetes related complications had good treatment outcome.

Of 89 cases admitted with DM diagnosis, 34 (38.2%) of them were admitted with hyperglycemic emergencies (30 DKA and 4 HHS). This findings are higher than reports from both low income and high income settings; 21% in Kingdom of Saudi Arabia (11) and 25.4% in Nigeria(7) which indicates poor glycemic control in our set up and partly due to the inclusion of new DM patients that commonly presented with acute complications of diabetes.

The overall diabetic related admission was 48.3% (Table 2), which is comparable with 50.8% of diabetes related admission in England (12), but higher when compared with the result reported in Barbados which was 33.6% (13). In our study most of diabetes related admissions were due to DKA while diabetic foot disease was the principal diagnosis in Barbados. On other hand, our result is lower than the research done in Nigeria where 62.7% of admissions were due to diabetic related causes, by which diabetic foot ulcer contributed for 37.3% of total admissions (7), but only 7.9% in this study. One possible reason for this might be the difference in duration of diabetes, which determines the occurrence of chronic diabetic complication like foot ulcers.

Infections were the second leading causes of admissions of diabetic patients in this study. It was found that 19.1% of admissions were attributed for infections. In addition, infections were identified as comorbidities in 24.7% of patients. These comorbid infections were implicated as precipitant for many hyperglycemic states. Among those, SSTIs were the prevalent one, which consist of 41.2% of infectious admissions and 13.6% of overall comorbidity. Bacterial meningitis and acute pyelonephritis were attributed in 23.5% and 17.6% of infectious admissions respectively. Overall prevalence of infections in our study was higher than the prevalence of infections reported in Addis Ababa, 36.3% (14), but lower as compared with reports from Nepal; 84.1% of patients had infections (15) which might be due difference in study population; high proportion of females (56.5%) in Nepal; leading to report of high urinary tract infections. In addition, infections that might be treated in outpatient like typhoid fever and pneumonia were also reported in Nepal. Beside infections, 18.0% of admissions were caused by CVDs which is in line with the findings of Adem, et al in Addis Ababa, where CVDs reported in 18% of patients (14) but much lower than 53.6% in Kuwait (16) that might be indicative of the difference in prevalence of CVDs between high income and low income countries.

Two patients were admitted due to hypoglycemia, with blood glucose level of 31 and 34 mg/dl. Their blood glucose levels were within range of severe hypoglycemia which is defined as blood glucose level of <40mg/d (17). Both patients were elderly, 60 and 66 years, where patients in the older age-groups are especially vulnerable to hypoglycemia. Age-related declines in renal function and hepatic enzyme activity may interfere with the metabolism of sulfonylureas and insulin, thereby potentiating their hypoglycemic effects. The vulnerability of the elderly to severe hypoglycemia may be partially related to a progressive age-related decrease in β -adrenergic receptor function (18). The prevalence of hypoglycemic admission in JUSH was 2.25% which is higher than reported from Japan where it was 4.1 per 1000 patients (19), but it was in line with the finding in United kingdom where 2.3% of patients admitted with severe hypoglycemia (20).

Of 89 patients admitted to the hospital, 76.4% were discharged with improvement, which is comparable with 74.6% reported from Nigeria (7) but lower than 89.4% reported by other study from Nigeria (21). The mortality rate was 11.2% which is comparable with 10.6% in Ethiopia (14) but slightly higher than 8.1% in Nigeria (21). These variations may be attributed to institutional difference in care of hospitalized diabetic patients, and reason for admission where the major causes of deaths in JUSH were infections which contributed to 40% of total death, while the Nigerian reported that 39.3% of deaths were caused by hyperglycemic emergencies and infections accounted only for 18% of deaths (21). Among patients who died, 90% were T2DM and 70% were above the age of 50 years. T2DM patients and elderly patients were usually present with complications and multiple comorbidities which might contribute to increased death in these groups.

Duration of hospital stay ranged from 1 to 88 days, with a median duration 9 days. Patients with diabetic foot ulcers had longer duration of hospital stay than their counterparts which was also reported in previous studies (7,13). The overall duration of hospital stay is shorter than reported from Nigeria (7). The cause of this discrepancy may be due to the difference in prevalence of foot ulcers between studies where foot ulcers are more common in Nigerian studies than this study.

Admission due to diabetes complications was independent predictor of treatment outcome with p-value of 0.014. Patients admitted due to diabetic related complications were more likely to be discharged with improvement, had low mortality and referral to other institutions than patients hospitalized with causes other than diabetic complications. But this finding is not similar with the result of study from Nigeria (22) where the most common causes of deaths was DKA, the common DM complication.

Conclusion

The study revealed that the most common reasons for hospitalization of diabetic patients at JUSH were hyperglycemic emergencies, infections and CVDs. DKA was the most common specific cause of admission. Infectious diseases were common among diabetics hospitalized at JUSH as primary reason for admission as well as comorbidity. Over two third of patients were discharged with improvement while 11.2% of admitted patients died in the hospital which was higher in patients admitted due to infections. Diabetic related admission was independent determinants of good treatment outcome. National wide study should have to be conducted for better understanding of common reasons for hospitalization and treatment outcome.

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Conflict of interest: The authors of this paper declared that there is no competing conflict of interest.

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