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Research Article

Medication Error Patients Admitted to Medical Ward in Primary Hospital, Ethiopia: Prospective Observational Study

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ABSTRACT

Medication error (ME) is broadly defined as any error in the prescribing, dispensing, or administration of a drug. ME is the single most preventable cause of patient harm. An infinite number of medication error exist because of the rapidly expanding array of drug products available, the growing number of diseases being recognized & diagnosed, and the growing number of patients entering the health care system. To evaluate the most frequently encountered drug class undergo medication errors, to identify sources of medication error and evaluate predictors of medication errors among patients admitted to medical ward in primary hospital, northwest Ethiopia. Prospective observational study was conducted from April 1/2018-October/2019G.C. All adult patients who met inclusion criteria were included in the study. Patient medication adherence was evaluated using morisky adherence scale. Independent predictors of outcome identified and strength of association between dependent and independent variables determined by using binary logistic regression analysis and statistical significance was considered at $p<0.05$. Two hundred sixty patients were included in the analysis.

Among these, majority of them were encountered medication errors. Anti-infective drugs were mostly prescribed as well as medication error encountered. Unnecessary drug therapy is the most common error. Proportion of patients with medication error is lower among patients who are on 1-3 drugs as compared to those patient who are on more than five drugs ($p=0.025$). Patients who stayed less than one week less likely encountered medication errors as compared to those stay more than a week ($p=0.024$). Since medication availability is significant determinant for medication error, hospital should try to avail medication and prevent medication errors. Clinical pharmacists should involve in multidisciplinary team and continuous patient medication reconciliation should be integral part of patient medical management.

Keywords: Medication error; Primary Hospital; Medical ward

Abbreviation: ADE: Adverse Drug Event; ADR: Adverse Drug Reaction; MAE: Medication Administration Errors; ME: Medication Error; FHRH: Felege Hiowt Referral Hospital.

Introduction

Background

Medication error (ME) is broadly defined as any error in the prescribing, dispensing, or administration of a drug. ME is the single most preventable cause of patient harm [1]. ME is also defined as, 'The failure of a planned action to be completed as intended or use of a wrong plan to achieve an aim [2].

MAE is one of the risk areas of nursing practice and occurs when a discrepancy occurs between the drug received by the patient and the drug therapy intended by the prescriber [3].

An infinite number of medication error exist because of the rapidly expanding array of drug products available, the growing number of diseases being recognized & diagnosed, and the growing number of patients entering the health care system [4].

It would be much better to prevent medication errors than to correct them. But this is not always possible because of the complexity of pharmacotherapy, lack of training and knowledge of health care providers and the behavior of drug users [5].

The Institute of Medicine report implicates (MEs), at least in part as a direct cause between 44,000 and 98,000 patient deaths annually in the United States. The global burden of MEs results

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from all types of adverse events which includes prolong hospital stay, financial burden, disability, morbidity and mortality [6].

Errors can occur at any stage of the process; from medication selection and ordering, to order transcription, drug formulation, drug dispensing and administration [7]. The role of the nurse in medication management has developed exponentially over time. However, the fundamentals of the nurse's role in medication management remain unchanged and nurses are expected to deliver and execute the highest standards of care and safety when it comes to medication management. Nurses represent the last safety check in the chain of events in medication management and therefore the final safeguard of patient wellbeing and potentially the difference between achieving the desired outcome and harming the patient [8].

MEs that result in catastrophic events may result from combined efforts of "latent failures" in the system and "active failures" by individuals working in that system. Efforts are being made globally to establish systems capable of collecting accurate and relevant medication error data, which may provide valuable information needed to minimize MEs [9]. Various studies were conducted in the drug therapy problems done in Ethiopia but medication error was not done till know. This paper can be used as a base line to do further research concerning medication error. This finding also used to identify the sources of medication error and give appropriate and immediate feedback.

Methods

This study was conducted in Alem Ketema Enat Hospital, Ethiopia. Alem Ketema Enat Hospital is located in Alem Ketema town which is 185 km far from the capital city and it is found northwest Ethiopia. It is one of health institutions established by "Karl Henze' in 1996 in north shewa. It is offering diagnosis and treatment for more than 70,000 patients per year. There are about four inpatient services located within the hospital which serve more than 200 admission/month. Among this, about 100 patients are admitted to medical ward per month [10]. This study was conducted specifically at medical ward service from April 1/2018-October/2019G.C.

Hospital based prospective observational study was used to assess medication error among patients admitted to internal medicine ward. All adult with age 18 and above patients admitted to medical ward from April 1-February 10/2011 ward and who are willing to participate were considered as the study population. Finally all adult patients who satisfy the inclusion criteria were candidate as a subject for the study.

Selection of study participants

As shown in Figure 1, all adult patients who met inclusion criteria and presented to hospital in the data collection period were recruited.

Data collection procedure and analysis

Relevant information like patient characteristics, current medications, co-morbidities, number of drugs, length of hospital stay, availability of drugs in the hospital and adherence (assessed by morisky adherence scale) were recorded using structured questionnaire (adapted from different published literature). Relevant data was obtained by interviewing the patient and chart review when necessary.

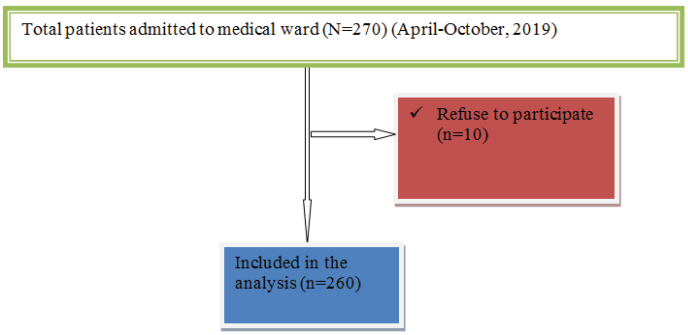

Figure 1: Summary of sampling procedure.

Medication error was dichotomized as error free and presence of errors. Before actual data collection, pre-test was done on 5% of patients in order to check language barrier, if there is missed variables, readability and ease of understanding. Data was collected by two pharmacists and one nurse under supervision of one medical doctor after two days training about objective of study and how to filter data from patient chart/card. Supplementary information and clarifications on some patient's medical information was obtained through discussion with respective nurses and physician. Guidelines concerning MEs were distributed for data collectors. Naranjo scale and Micromedex version 3.1 were used to evaluate adverse drug reaction (ADR) and drug interaction (DI) respectively.

Data was entered into a computer using Epi data 3.1software and analyzed with SPSS version 23. Before analysis, presence of co linearity between independent factor (having less than 2.5 variance inflation factor) and model fitness (with Hosmer lemeshow p-value 0.136) were checked. Chi-square statistics were used to check adequacy of cells for binary logistic regression. Independent predictors of outcome and strength of association between dependent and independent variables was identified by using binary logistic regression analysis and p-value <0.25 entered to multiple regression. P value <0.05 was considered as significant. Descriptive statistics was used to characterize ME and independent variables. Results of the study were organized in the form of frequencies and percentages. The data was summarized and described using tables and figures.

Results

Background characteristics of participants

A total of 260 patients were included in the study of which 162 (55.7%) were males. Overall response rate was about 97%. The mean age was 38.5 (age range 18-85) years with the maximum number of patients being in the age group of 41-59 years. Majority of patients 180 (69.23%) were found to have 1-2 co-morbidities and ≥ 3 co-morbid illnesses 53 (20.38%). Only 37 (14.23%) were without any co morbidity. A total of 989 medications were prescribed. Average number of drugs per day for a patient was 3.5. Majority of the study subjects (47.5%) received 2 to 5 drugs per day. The details of patient demographic characteristics along with other factors that may influence ME like number of co-morbidity, length of hospital stay, unavailability of medication and average number of drugs received per day are shown in Table 1.

As it is indicated in Figure 2 below, disease distribution of the study subjects showed a higher prevalence of infections (36.1%) followed by Congestive heart failure (20.5%), diabetes mellitus

Table 1: Socio-demographic and clinical characteristics of participants, medical ward, Enat Hospital, Ethiopia, 2019.

Socio-demographics and characteristics of patient	Category	Number	Percent	Mean+SD	Range
Sex	Male	162	62.3	-	-
	Female	98	37.7	-	-
Age group	19-40	84	32.3	38.5 ± 13	18-85
	41-59	120	46.15		
	60-75	56	21.55		
Co morbidity	Yes	37	14.23	-	-
	No	223	85.77	-	-
Hospital stay	<1 week	145	55	5 ± 2.3	4-35
	≥ 1 week	115	45		
Number of drugs received/patient	1-3	90	34.62	3 ± 1.4	1-5
	3-5	130	50		
	≥ 5	40	15.38		
Is the drug available?	Yes	170	65.38	-	-
	No	90	34.62	-	-

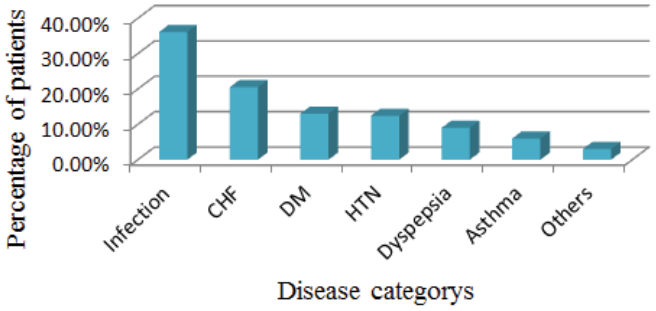

Figure 2: Disease distribution among study subjects, Enat Hospital, Ethiopia, 2019.

(13%), hypertension (12.4%), dyspepsia (9%), asthma (6%) and others (3%).

Among all 989 drugs prescribed, anti-infective were 567, cardio vascular drugs were 213, anti-diabetics drugs 197, GI (gastrointestinal) drugs 123. As shown in Figure 3 the most frequently prescribed drugs were ceftriaxone 405 (40.95%), frusemide and spironolactone 217 (21.94%) each, metronidazole 129 (13%) glibenclamide 118 (11.93%), salbutamol puff 65 (6.5%), and cimetidine 55 (5.68%).

Prevalence of medication errors

MEs were found in 62% of the study subjects. One hundred eighty five medication errors were identified from 161 patients during the study period. Of this about 67% reach to the patient (but did not cause harm to the patient) and the rest were intercepted by health professionals before the patient received. Among the total of ME, one ME was identified in 102 (63.35%) patients, two in 52 (32.3) patients and more than 2 MEs in 7 (4.35%) patients (Figure 4).

Unnecessary drug therapy was the top ranking medication error (40% of all MEs) followed by dose to low (23.5%), need for additional drug therapy (14%), dose to high (12%), product defect (4.3%), Dilution/reconstitution error (3.2%), ineffective drug therapy (2.6%) and monitoring error (0.4%). The type and number of medication error identified were characterized as shown in Table 2.

Among the total of 185 medication errors detected, majority of errors (52.16%) were due to physicians, 21.89% were due to nurses, 15.27% due to patients and remaining 10.68% were due to pharmacists. Majority of medication errors committed by physicians attributed causes of these errors were due to lack of adherence to local/national guidelines and telephone order 35.4% and 16.76% respectively. Patient non adherence (intentional or unintentional) contributes a lot among errors committed by the patient.

Drug classes involved in medication error

As indicated in Figure 5 below, anti-infectious agents were the most common drug class involved in MEs followed by cardiovascular (CV) drugs, gastrointestinal (GI) and anti-asthmatic drugs. Crystalline penicillin, ceftriaxone, metformin, tramadol and cimetidine were the top ranking drugs involved in ME.

Interventions for drug related problems

Once identified any medication errors, possible intervention measures were taken to correct the identified MEs. Interventions were taken after established health care team for the data collection

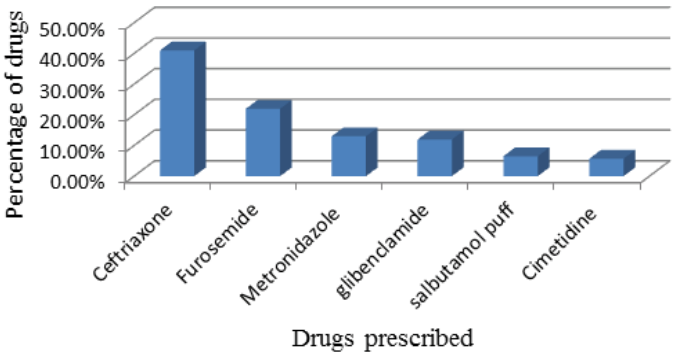

Figure 3: The most commonly prescribed drugs, Enat Hospital, Ethiopia, 2019.

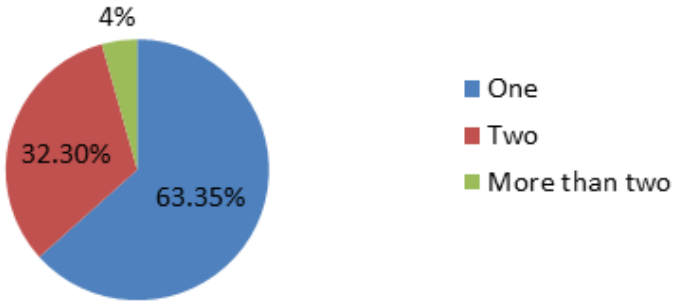

Figure 4: Number of medication error per patient, Enat Hospital, Ethiopia, 2019.

Table 2: Types of medication error, Enat Hospital, Ethiopia, 2019.

Type of medication error	Number	%of errors
Unnecessary drug therapy	74	40
Dose to low	42	23
Need of additional drug therapy	25	14
Dose to high	22	12
Product defect	7	4.3
Dilution/reconstitution error	6	3.2
Ineffective drug therapy	4	2.6
Monitoring error	5	0.4

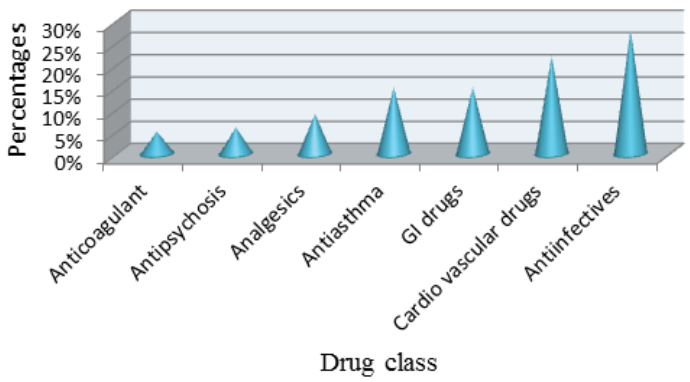

Figure 5: Drugs involved errors, Alem Ketema, Enat Hospital, Ethiopia.

reach in the same consensus. Data collector team tried to intervene all of detected ME. Majority of interventions were undertaken by supervisors after informed by data collectors. There are also MEs that were intervened by physicians/nurses depending on the type of errors and their responsibility after it was notified by data collectors. The most commonly applied intervention was informing the physicians to discontinue unnecessary medications:-it could be because of lack of pharmacologic knowledge, to increase the prescribed drugs, to initiate other medication which is beneficial for the patients and by providing appropriate information for dilution/reconstitution of drugs (Figure 6).

Examples of medication errors identified

Some examples of MEs identified in the study subjects are described in Table 3.

Predictors of medication error

Identification of risk factors for MEs is helpful in finding patients at risk and possible solutions. These patients can then be given special attention and tray to avoid MEs. Sex, age, availability of drugs, average number of drugs/day, length of hospital stay and number of co morbidities were analyzed to evaluate whether they could predict the occurrence of MEs or not. The average number of drugs taken by the patient/day, co-morbidity, drug availability and hospital stay were shown to be a risk factor for the occurrence of MEs while age, sex and co-morbidity were not. As shown in Table 4, patients who took 1-3 drugs per day were less likely to develop medication error as compared to patients who took more than five drugs per day. Patients who stayed more than a week per day were more prone to develop medication error as compared to as compared to those who stayed for less than a week in the hospital. Availability of drugs in the hospital is also significant predictor for occurrence of medication error in which drug unavailability prone to patients to have medication errors.

Discussion

The goal of drug therapy is to achieve defined therapeutic outcomes and improve the patient's quality of life while minimizing patient risk. But inappropriate use of drugs during disease management may lead to drug therapy problems. Identification of MEs and common drugs involved is an important component of quality drug therapy and contributes to reduction of drug related morbidity and mortality. Majority of studies conducted at different countries and various groups of patients showed higher prevalence of drug related problems and indicated different drugs and drug classes involved in ME. This study was carried out to asses MEs in medical ward in one of a primary care hospital in Ethiopia.

This study showed that 62% of patients admitted to the medical ward within the study period had MEs. This result is lower than what was found in Jimma, university specialized hospital, Ethiopia (73.5%) [9,11]. This lower rate of ME is could be because of number of medication per patient is lower in our study participants as compared to previous study conducted in Jimma. The study in Malaysia [12] also found a prevalence of 90.5%. The lower prevalence of MEs in my study as compared to the Malaysian study might be because the study was done on specifically patients with type 2 diabetes mellitus and hypertension. These patients have a higher probability to develop MEs since they prone to receive more drugs and to develop more complications/drug interactions because of poly pharmacy.

The most frequently encountered MEs in the present study were unnecessary drugs, inappropriate dose, need of additional drug therapy and product defect. This finding is disagree the study done at US showed dosing error 175 (28%) was among the top ranking types MEs [13]. and it is in line with study done in Indonesia unnecessary drug therapy is the top ranking medication errors [14]. In this study more than half of the patients had faced combination of medication errors/more than one types of errors which is nearly similar study done in Felege Hiwot Referal Hospital (FHRH) [15]. The most frequent types of interventions given by clinical pharmacists were 'changed drug', 'drug stopped', 'prescriber informed', 'changed dose' and 'drug started' [16]. It is in line with our study in which avoiding of unnecessary drugs, to reduce the dose and addition of other medications.

The most frequently prescribed drugs, anti-infective, cardio vascular drugs were and followed by anti-diabetics drugs. Ceftriaxone, frusemide, spironolactone and metronidazole were the most commonly prescribed individual drug. Aanti-infectious agents were the most common drug class involved in MEs followed by cardiovascular (CV) drugs and gastrointestinal (GI) drugs. This may be because of mostly prescribed drugs. This is nearly similar with the study done in India and Jimma showed that the medication classes involved most were antimicrobial agents followed by cardiovascular agents [17,18].

In this study medication errors were happened at different stages. Majority of errors (52.16%) were due to physicians, followed by nures and pharmacists share the list. Majority medication errors committed by physicians attributed causes of these errors

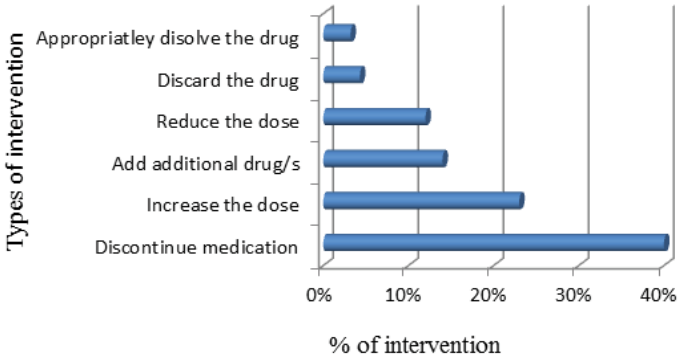

Figure 6: Types of intervention for ME, Alem Ketema Enat Hospital, Ethiopia, 2019.

Table 3: Examples of MEs identified in the study subjects, Alem Ketema Enat Hospital, Ethiopia, 2019.

S/N	Descriptions of MEs	Intervention made
	A 67 years old male patient with history of DM for the last 3 years and he was on metformin for the last 1 and 6 months since diagnosis. But he discontinued for more than 2 months because he perceive that I feel the best	To continue the previous medication after delivering of ample information about negative impact of non-adherence.
	A 54 years old patient admitted with severe community acquired pneumonia from outpatient department. The health care team decides to initiate treatment of pneumonia and started with penicillin 300,000 units.	To increase the frequency of penicillin: it should be given every four hours.
	A 23 years old female known asthmatic patient, presented to hospital with exacerbation increase purulence, cough, increase dyspnea. She is not started antibiotics.	To initiate azithromycin for the management of infection.
	19 years old female patient presented with dysuria, flank pain, fever and she is started ceftriaxone.	To change ceftriaxone to ciprofloxacin because the latter concentrated more to the urine and it is better to preserve ceftriaxone.
	53 years old male patient presented with DKA, constipation and pain for the last 2 days and started with management of DKA and constipation: tramadol for pain	Change tramadol to other NSAIDs because tramadol aggravates constipation.

Table 4: Predictors of MEs in the study subjects, Alem Ketema Enat Hospital, Ethiopia, 2019.

Variable	Category	MEs(%)		Bivariate analysis		Multivariate analysis	
		Yes	No	COR (95% CI)	P-value	AOR (95% CI)	P-value
Sex	Male	54.5	35.0	0.23 (0.1-0.51)	0.023	0.74 (0.22-12.6)	0.06
	Female	45.5	65.0	1.00	1.00	1.00	1.00
Age	19-40	23.3	31.0	0.8 (0.32-0.21)	0.045	0.59 (0.18-2.00)	0.76
	41-59	37.8	40.8	0.5 (0.21-1.5)	0.05	0.15 (0.13-1.92)	0.08
	60-75	38.9	28.2	1.00	1.00	1.00	1.00
Co-morbidity	Yes	65.2	45.2	1.47 (0.52-3.64)	0.23	0.32 (0.3-1.7)	0.052
	No	34.8	54.8	1.00	1.00	1.00	1.00
Length of Hospital stay	<1 week	58.3	46.7	0.47 (0.11-0.55)	0.021	0.21 (0.13-0.87)	**0.024**
	≥ 1 week	41.7	54.3	1.00	1.00	1.00	1.00
Number of drugs received/patient	1-3	26.1	43.2	0.65 (1.3-10.21)	0.034	0.41 (0.3-0.89)	**0.025**
	3-5	31	38.0	0.82 (1.23-7.64)	0.054	0.19 (0.54-5.4)	0.53
	≥ 5	42.9	18.8	1.00	1.00	1.00	1.00
Is/are drug/s available?	Yes	39.5	63.2	0.72 (0.68-3.74)	0.054	0.48 (0.25-0.87)	**0.009**
	No	59.5	37.8	1.00	1.00		1.00

were due to lack of adherence to local/national guidelines and telephone order respectively. Patient non adherence (intentional or unintentional) contributes a lot among errors committed by the patient. This study is disagree with the previous study done in Washington DC [19]. This difference might be because of in our study almost all of physicians are general practitioner and may not have knowledge about patient medication reconciliation.

Multivariate regression analysis was conducted to identify risk factors for occurrence medication errors. The result of this study showed that the number of drugs taken by a patient, availability of drugs and hospital stay are important risk factor for MEs but sex, co-morbidity and age did not have significant correlation with the occurrence of MEs. Patients who took 1-3 drugs were less likely prone to develop medication errors as compared to for those who are on more than five drugs. This is supported by a number of studies [20-23]. Medication availability and hospital stay are also significant predictors to develop medication errors in which the longer hospital stay the more the patient exposed to medication errors. Since medication errors are a cause for morbidity and mortality hospital pharmacist should continuously evaluate the availability of drugs in the hospital. However, sex and age were not found to affect MEs [20,21,24]. A study in Singapore similarly showed increasing number of drugs as a risk factor for MEs and the absence of statistically significant correlation between age and sex with the likelihood of developing MEs [25]. In my study co-morbidity was not found to significantly affect the occurrence of ME. Similarly the study had found in Jimma did not show significant association between likelihood of MEs occurrence and co-morbidity [26].

Limitation: Our study is single center study and external validity is difficult.

Conclusion

This study revealed that majority of patients exposed to at least one types of medication error. Unnecessary drug therapy is the most frequently encountered medication error. Ceftriaxone is the top ranking prescribed drug and medication error happed as well. This study also showed that medication error happen at different stages and physicians account a lot. Non adherence is one of attributable factor for the occurrence of medication error committed by the patient. This study showed that there is significant association between length of hospital stay, number drugs/patient and availability of drugs and medication errors.

Ethical Considerations

Letter of ethical clearance was secured. Letter for cooperation from

department of internal medicine was obtained. Verbal consent from respective physicians, nurses and patients was secured to extract data from patents' medical charts. Participants were also informed that participation was on a voluntary basis and that they have the right to withdraw at anytime if they are not comfortable with the study. In order to keep confidentiality, all data were kept anonymously in the observational checklist and interview questionnaire. Privacy and confidentiality were ensured during patient interview and review of patient charts.

Consent for publication: Not applicable

Availability of data and materials: All data analyzed during this study was available for publication.

Competing interest: The authors declare that they have no competing interests.

Funding: Not applicable

Author's Contribution

Bezie Kebede: proposal development and stastical analysis including manuscript preparation.

Yitayih Kefale: data collection

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