



## **Prevalence and Factors Contributing to Non-adherence to Diabetes Treatment among Diabetic Patients Attending Government Hospitals in Addis Ababa**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author AHJ designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author ZJ wrote the introduction and authors DG managed the analyses of the study. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** Non-adherence to diabetes treatment regimen is possibly the most common reason for poor health outcomes among people with diabetes. Non-adherence in chronic disease is claimed as a patient taking less than 80% of the prescribed treatment. The rates of non-adherence to diabetes regimen tasks are highly variable but have significant consequences on the outcome & the effectiveness of treatment.

The objective of this study was to determine the prevalence & factors associated with non-adherence to diabetes treatment among diabetic patients attending diabetic clinics at a governmental hospital in Addis Ababa.

**Methods:** Institutional based cross-sectional study was conducted on 308 diabetic patients attending diabetic clinics at a governmental hospital in Addis Ababa. Study subjects have been

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selected by using systematic random sampling technique. A pre-tested structured questionnaire was used to collect the data. Data were entered by using Epidata-3.1 & then exported to SPSS version 20 for analysis. Frequency distribution was used to organise the data. Multivariate logistic regression was used to predict the factors which affect adherence.

**Results:** The prevalence of non-adherence to diabetes treatment was found to be 68.1%. In multivariate logistic regression age( $\geq 60$ , (AOR=1.21)), educational status(illiterate (AOR= 1.62)) , duration of treatment( $> 5$  years(AOR= 4.032)) & presence of co-morbidity (AOR= 1.796)) were significantly associated with non adherence to diabetes treatment

**Conclusion:** The result of this study had shown a high prevalence of non-adherence to diabetes treatment with age of the patient, educational level, duration of treatment & presence of co-morbidity having a significant association with non-adherence.

*Keywords: Diabetes mellitus; medication; non-adherence.*

## 1. INTRODUCTION

Diabetes mellitus is defined as a chronic elevated level of blood glucose. There are two main types of diabetes- Type 1 and Type 2. Type 1 Diabetes is due to absolute lack of insulin and Type 2 diabetes results from defective secretion of insulin and/or defective action of insulin (insulin resistance) or both [1,2]. Type 2 Diabetes is more frequent; represents 85% of the cases and is related to excessive weight and physical inactivity [1]. Type 2 Diabetes, most commonly occurs in middle-aged and older peoples but increasingly affects overweight children, adolescents and young adults. It is particularly affecting peoples in the productive years of the life cycle [3].

Diabetes mellitus is a major health problem with a growing prevalence and classified under the leading causes of morbidity and mortality in the world [4]. It was recognised by the World Health Organization as one of the world's most important public health problems for prevention, diagnosis and treatment along with increasing obesity and CVDs [5]. Diabetes mellitus requires life-long treatment and greatly increases the risk of serious, long-term complications. Offering the long-term monitoring and treatment needed is not easy for the healthcare systems of sub-Saharan Africa, which are more focused on managing acute infection [6].

The prevalence of diabetes mellitus is higher in developed than in developing countries. However, it is a rising health problem in developing countries [7]. International Diabetes Federation (IDF) estimates that the world prevalence of diabetes among adults (aged 20–79 years) will rise to 439 million adults. While the major part of this numerical increase will occur in developing countries [5,7,8]. Diabetes was once

considered a rare disease in sub-Saharan African, but because of a rapid urbanisation, the ageing population, population growth, increasing prevalence of obesity and physical inactivity, its prevalence is rising rapidly and considered as an emerged non-communicable disease (NCD) in the region [1,6]. In 2013, over 19.8 million adults in the African region have diabetes with a regional prevalence of 4.9%. More than half of all people with diabetes in the Region live in just four of the high population countries (Nigeria, South Africa, Ethiopia and Tanzania) [9]. In Ethiopia, more than 1.9 million people were estimated to have diabetes in the year 2013, with prevalence ranging from 5.1% in urban and 2.1% rural residents in the age group of 35 years and above [9,10].

Adherence is defined as the extent to which patients take medications as prescribed, following, a diet and/or executing lifestyle changes corresponds with agreed recommendations from the health care providers [11]. In addition to taking the medications, it refers to how the person manages their treatment in relation to doses, times, frequency and duration [12]. Similarly, world health organisation 2003 defines adherence as seeking medical attention, filling prescriptions, taking a medication appropriately, attending follow-up appointments, and executing behavioural modifications [13].

Failure to take medications as prescribed is termed non-adherence. Non-adherence encompasses a wide range of behaviours both intentional and unintentional that leads to either underuse or overuse of prescription medications. Underuse includes: Delay or not filling a prescription, Not picking up a prescription, Skipping doses, Splitting pills, stopping a medication early, Not refilling a prescription [14].

Non-adherence to the therapeutic regimen contributes to poor metabolic control, resulting in acute and long-term complications [12]. Poor medication adherence is relatively common, on average 50% of the patients can't use the medications as prescribed [11,15].

An individual is considered non-adherent in chronic disease if he/she is taking less than 80% of the prescribed treatment [16]. Majority of the published studies show that there are unsatisfactory compliance and glycemic self-control in type 2 diabetic patients globally [17].

Non-adherence to the diabetic's treatment regimen is possibly the most common reason for poor health outcomes among people with diabetes. The rates of non-adherence to diabetic's regimen tasks are highly variable but have significant consequences on diabetes outcome and the effectiveness of treatment [18]. Studies have pointed out that many diabetic patients take less than the prescribed amounts of their medications. Poor adherence compromises safety and treatment effectiveness, leading to increased mortality and morbidity with considerable direct and indirect costs to the healthcare system. Improving adherence to diabetes treatment thus is a vital public health issue [19,20]. Most of the time the determinants of medication non-adherence were age, medication knowledge scores, and the presence of co-morbidities [21].

This study aimed to determine the factors contributing to non-adherence among diabetic patients and to estimate the proportion of non-adherence.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

This study was conducted in Addis Ababa which is the capital of Ethiopia with a total population of more than 4 million.

### 2.2 Study Design and Period

An institution based cross-sectional study design was used to assess the prevalence of non-adherent to diabetic patients and factors associated with non-adherence. This study was being conducted from August 18<sup>th</sup> of 2017 until November of 2017.

### 2.3 Population

#### 2.3.1 Source population

All type 1 and type 2 diabetics patients living in Addis Ababa

#### 2.3.2 Study population

All type 1 and type 2 diabetics patients attending the diabetic clinic at government hospitals in Addis Ababa

#### 2.3.3 Study unit

Systematically selected type 1 and type 2 diabetics' patients who were attending the diabetic's clinics.

### 2.4 Inclusion Criteria

Eligible study participants were outpatient and inpatient diabetics on follow up for at least 90 days, mentally stable and above the age of 18 years

### 2.5 Sample Size and Sampling Techniques/Procedure

#### 2.5.1 Sample size

The sample size was determined by the single population proportion formula by considering 24% proportion of non-adherence, because many of the studies using self-report has found non-adherence for diabetics treatment ranging from 20% to 28.9% [20,22] with a marginal error of 5% between the sample and the population at 95% confidence level.

$$n = \frac{(Z_{\alpha/2})^2 \times p(1-p)}{d^2}$$

The sample size we have got from the formula was 280. However, with the addition of 10% contingency, the final total sample size was 308.

#### 2.5.2 Sampling technique/procedures

Study participants have been selected by using systematic random sampling methods. The first patient was selected by lottery method. Hospitals were selected by lottery method. Sampling fraction had been estimated from a total number of patients on registration books and sample size.

## **2.6 Data Collection Procedures (Instruments, Data Collection Procedures)**

### **2.6.1 Data collection instruments**

Data were collected using pretested questionnaire with both closed and open-ended questions. The questionnaire had been developed in English and then translated into Amharic. Questions were developed based upon literature review with the aim to find important information that could characterise non-adherence.

Data was collected after conducting pre-testing of the questionnaires and measurement scales. The questionnaire incorporates items which are related to socio-demographic characteristics and contributing factors to non-adherence to diabetic's treatment which includes patient factors/beliefs, knowledge on diabetes and travel distance to reach the clinic. Morsky Medication Adherence scale 8 (MMA-8) was used to determine the proportion of medication non-adherence. In 1986, Dr. Morisky and his colleagues published the instrument Morisky Medication Adherence Scale (MMAS) that was first validated in antihypertensive drugs in outpatient settings. The original Morisky scale has four items that have dichotomous response categories with yes or no. The rationale behind the four items was "the drug errors of omission could occur in any or all of several ways: forgetting, carelessness, stopping the drug when feeling better or starting the drug when feeling worse. Afterwards, MMAS-8 has become popular and commonly used in various clinical settings and different populations, as well as been translated and validated in foreign countries [23].

### **2.6.2 Data collection procedures**

Data has been collected by trained nurses working in the selected government hospitals through face to face interview and record.

## **2.7 Data Quality Management**

Training had been given to the data collectors. Research ethics and administrative issues were part of the training. Supervisors were assigned during the data collection period. Questionnaires have been checked for completeness and consistency of information by the supervisor on daily basis.

The questionnaire was prepared in English and then translated into the Amharic language. The questionnaire was pre-tested on 5% of the sample a week before actual data collection period.

## **2.8 Data Analysis**

Data were entered with EPI data version 3.1. Cleaning and analysis were done using SPSS version 20. Univariate analysis was used to describe socio-demographic variables by using categorical variables. Multiple logistic regression analysis was used to predict factors which affect the dependent variable. Odds ratios and their corresponding 95% CI had been calculated.

## **3. RESULTS**

### **3.1 Socio-demographic Characteristics**

Out of 308 patients planned to be included in this study 304 of them were interviewed, with a response rate of 98.7%. The mean age of study participants was 54.9 years with the majority (>39%) in the age range of 41-60 years. About 160(52.6%) of the study participants were male & 144(47.4%) were female. Majority of the study participants 198(65.1%), 88(28.9%) were married & retired respectively. About 20.7 % of the study participants were illiterate. Majority of the study participants 175(57.7%) are receiving treatment free of charge (Table 1).

### **3.2 Clinical Characteristics of Study Participants**

About 120(39.5%) of the study participants were on follow up for five years & above. Majority of them 192(63.2) had co-morbidity. About 66.1% of the study participants are taking two doses per day (Table 2).

### **3.3 Adherence to Diabetes Medication Regimen**

By using MMAS-8, 207(68.1%) of the study participants were non-adhered to diabetes medication regimen (Table 3).

### **3.4 Adherence to Lifestyle Modification Regimen**

Majority of the study participants 287(94.4%), 241(79.3%), were non-smokers, non-consumers of animal products respectively. About 220 (72.6%) of them did not do regular aerobic physical exercise (Table 4).

**Table 1. Socio-demographic characteristics of diabetes patients on follow up (n=304) at government hospitals in Addis Ababa, November 2017**

Variable	Category	Frequency	Percentage (%)
Age study participants (years)	18-40	82	27
	41-60	120	39
	>=60	102	34
Sex	Male	160	52.6
	Female	144	47.4
Ethnicity	Amhara	111	36.5
	Oromo	103	33.9
	Gurage	37	12.2
	Tigraway	31	10.2
Religion	Others	22	7.2
	Orthodox Christian	147	48.4
	Muslim	79	26
	Protestant	53	17.4
Marital Status	Others	25	8.2
	Married	198	65.1
	Single	39	12.8
	Divorced	20	6.6
Occupation	Widowed	47	15.5
	Gov't employed	83	27.3
	Self employed	31	10.2
	Day labourer	11	3.6
	Merchant	17	5.6
	Retired	88	29
Education level	Others	74	24.3
	Illiterate	63	20.7
	Read & write	53	17.4
	Primary & junior schools(1-8 grade)	89	29.3
	High& preparatory schools(10-12 grade)	52	17.1
Family income per month	College degree/diploma	47	15.5
	< 100birr	52	19.4
	1000-2500 birr	102	38.1
Time taken to reach hospital	>2500	114	42.5
	Two hours & less	174	57.2
Cost covering body	More than two hours	130	42.8
	Self	67	22
	Family	48	15.8
	Employer	6	2
	Free	175	57.6
	Others	8	2.6

**Table 2. Clinical characteristics of diabetes patients on follow up=304), at government hospitals in Addis Ababa, October 2017**

Variable	Category	Frequency	Percentage (%)
Treatment duration	< 1 year	32	10.5
	1- 3years	63	20.7
	3-5years	89	29.3
	>= 5 years	120	39.5
Co-morbidity	No	112	36.8
	Yes	192	63.2
Diabetes related complications	No	212	69.7
	Yes	92	30.3
Drugs dosage per day	Two times & less	201	66.1
	Three times & more	103	33.9

Variable	Category	Frequency	Percentage (%)
Missing drugs within the last two weeks	Yes	12	4
	No	292	96
Reason for not taking the drugs	Feeling better	4	33.33
	Forget to take	6	50
	Other reasons	2	16.67

**Table3. Study participants level of adherence to diabetes treatment (n=304) at government hospitals in Addis Ababa, October 2017**

Variable	Category	Frequency	Percentage (%)
Adherence to medication regimen	Non -adhered	207	68.1
	Adhered	97	31.9

**Table 4. Distribution diabetic patients on follow up based on adherence to lifestyle modification (n=304), at government hospitals in Addis Ababa, October 2017**

Variable	Category	Frequency	Percentage (%)
Smoking	yes	17	5.6
	No	287	94.4
Drinking alcohol	Yes	29	9.5
	No	275	90.5
Eating animal products	Yes	97	20.7
	No	241	79.1
Doing regular physical exercise	Yes	84	27.6
	No	220	72.4
Eating fruits & vegetables	Yes	105	34.5
	No	199	65.5
Substance abuse	Yes	8	2.6
	No	296	97.4

### 3.5 Responses to Health Care System Related Questions

Majority of the respondents 297(97.7%) reported that they wait more than two hours in the hospital to get medical service when they come for follow up. About 289(95%) of the study participants reported that they are following their treatment according to their follow up a schedule (Table 5).

### 3.6 Socio-demographic Characteristics & Adherence to Diabetes Treatment

Age & education level were the only variables which are significantly associated with non-adherence to diabetes treatment. Patients over 60 years & illiterate were 1.21 & 1.94 times more likely to be non-adherent than the others groups (Table 6).

**Table 5. Distribution diabetic patients on follow up based on health care systems (n=304) at government hospitals in Addis Ababa, October 2017**

Variable	Category	Frequency (n)	Percentage (%)
Drugs are costly	Yes	48	37.3
	No	81	62.7
Waiting hours during follow up	Up to 2 hours	7	2.3
	>2hours	297	97.7
Attend each appointment	Yes	289	95
	No	15	5
Reasons for not attending each appointment	The hospital is far	4	26.7
	Lack of money	3	20
	Busy with work	2	13.3
	Forgetting	5	33.3
	Others	1	6.7

**Table 6. Association of socio-demographic characteristics with adherence to diabetes treatment among diabetes patients on follow up (n=304) at government hospitals in Addis Ababa, October 2017**

Variable	Category	Adherence to diabetes treatment		AOR(95%CI)	P-value
		Adherence	Non-adherence		
Age study participants (years)	18-40	48	34	1	
	41-60	34	86	1.11(0.52, 2.353)	0.05
	>= 60	18	84	1.21(1.13,11.1)	0.04
Sex	Male	58	102	0.835(0.512, 1.362)	0.50
	Female	39	105	1	
Ethnicity	Amhara	32	79	1	
	Oromo	25	78	0.619(0.185,2.067)	0.07
	Gurage	19	18	0.963(0.21, 4.421)	0.53
	Tigraway	13	18	0.148(0.012, 1.9)	0.08
Religion	Others	8	14	0.132(0.014, 2.367)	0.06
	Orthodox	54	93	1	
	Christian				
	Muslim	19	60	1.237(0.88, 23.549)	0.80
Marital status	Protestant	16	37	1.441(0.088, 23.49)	0.587
	Others	8	17	1.5(0.055, 40.63)	0.60
	Married	70	128	0.914(0.228, 3.662)	0.24
	Single	9	30	1	
Occupation	Divorced	8	12	0.792(0.224, 2.79)	0.70
	Widowed	10	37	0.857(0.188, 3.918)	0.70
	Gov't employed	21	62	1	
	Self employed	13	18	0.929(0.423, 2.037)	0.56
	Daily laborer	3	8	0.461(0.229, 0.928)	0.90
	Merchant	6	11	1.143(0.272, 4.81)	0.43
Education level	Retired	28	60	0.457(0.187, 1.119)	0.98
	Others	26	48	0.268(0.102, 1.702)	0.90
	Illiterate	3	60	1.942(1.193, 1.994)	0.05
	Read & write	18	35	1.407(0.405, 4.892)	0.12
	Elementary & junior school(1-8 grade)	30	59	0.745(0.234, 2.368)	0.44
	High school (9-12 grade)	23	29	1	
Monthly income	College degree/diploma	19	28	0.234(0.042, 4.789)	0.80
	<1000	34	71	0.891(0.419, 4.789)	0.09
	1000- 2500	54	21	1.661(0.321, 1.362)	0.08
Time taken to reach hospital	>2500	70	18	1	
	Up to 2 hours	68	106	1	
Cost covering body	> 2 hours	29	101	2.762(0.981, 6.454)	0.07
	Self	17	50	0.773(0.218, 2.741)	0.57
	Family	12	36	1.257(0.319, 4.956)	0.30
	Employer	3	3	0.571(0.1, 3.273)	0.07
Free	Free	60	115	0.648(0.158, 2.656)	0.80
	Others	5	3	1	

### 3.7 Clinical and Knowledge Factors with Adherence to Diabetes Treatment

Duration of treatment & presence of co-morbidity had shown significant association with non-adherence to diabetes treatment. Study

participants who had been on treatment for more than 5 years were about 4 times more chance to be non-adherent. Presence of co-morbidity increased the opportunity to be non-adherent by 1.796 fold (Table 7).

**Table 7. Association of clinical & knowledge factors with adherence to diabetes treatment among diabetes patients on follow up (n=304) at government hospitals in Addis Ababa October 2017**

Variable	Category	Adherence to diabetes treatment		AOR(95%CI)	P-value
		Adherence	Non-adherence		
Duration of treatment	1 year & less	19	13	1	
	1-3years	23	40	2.771(1.351, 5.681)	0.55
	3-5years	32	57	1.38(0.714, 2.667)	0.21
	> 5years	23	97	4.032(3.18, 20.289)	0.003
Presence of co-morbidity	None	55	57	1	
	Yes	42	150	1.796(1.050, 3.073)	0.03
Diabetes related complications	Yes	31	61	0.799(0.462, 3.797)	0.42
	No	66	146	1	
Frequency of drug intake	Twice & less per day	74	127	0.126(0.0288, 3.797)	0.95
	> 2 per day	23	80	1	
History of previous admission	Yes	26	42	0.865(0.522, 1.433)	0.57
	No	139	97	1	
Knowledge of respondents	knowledgeable	103	54	1	
	Less knowledgeable	92	55	1.555(0.953, 2.538)	0.23
	knowledgeable				

**3.8 Patients Lifestyle and Health Care Systems with Adherence to Diabetes Treatment**

Waiting time in the hospital during follow up & not doing regular aerobic physical exercise have

shown significant association with non-adherence to diabetes treatment on bivariate analysis. However, on multiple logistic regressions, none of them had shown significant association with non-adherence (Table 8).

**Table 8. Association of patients lifestyle & healthcare systems with adherence to diabetes treatment among diabetes patients on follow up (n=304) at government hospitals in Addis Ababa October 2017**

Variable	Category	Adherence to diabetes treatment		AOR(95%CI)	P-value
		Adherence	Non-adherence		
Smoking	Yes	6	11	1.403(0.252, 7.795)	0.70
	No	91	196	1	
Drinking alcohol	Yes	9	20	0.974(0.301, 3.15)	0.98
	No	88	187	1	
Eats animal products	Yes	28	69	1	
	No	69	138	1.013(0.532, 1.931)	0.43
Doing regular physical exercise	Yes	27	57	1	
	No	70	150	0.671(0.645, 4.836)	0.65
Taking fruits on daily diet	Yes	43	62	1	
	No	54	145	0.829(0.365, 1.887)	0.66
Substance abuse	Yes	5	3	0.764(0.043, 11.22)	0.80
	No	92	204	1	
Drugs costly	Yes	21	27	0.147(0.073, 3.296)	0.07
	No	29	52	1	
Waiting time in the hospital	<= 2 years	3	4	1	
	>2 years	94	203	2.09(0.761, 3.806)	0.12
Attends in each follow up	Yes	88	201	1.073(0.543, 2.12)	0.84
	No	9	6	1	



#### 4. DISCUSSION

Non-adherence to the therapeutic regimen contributes to poor metabolic control resulting in acute & long-term complications, and it is an economic burden at the individual and country level [12].

In this study, the prevalence of non-adherence to diabetes treatment was found to be 68.1%. In contrast to this, similar studies conducted in India, Mulago hospital in Uganda and Jimma had shown a lower prevalence of non-adherence to diabetes treatment (24.3 %, 28.7% and 28.9% respectively) [20,22,24]. This inconsistency may be attributable to age, duration of treatment & place of living.

World health organisation identifies that non-adherence is a problem which has many associated factors which include socioeconomic factors, a medical condition related factors, therapy-related factors and patient behaviours [18]. A study conducted in south-west Nigeria indicated that those who omitted their diabetes treatment intentionally (patient dissatisfaction 44.6% and inconvenience of taking medication outside of home 19.8%) were some of the reason of non-adherence or non intentionally (forgot 49.6%) non-adherence [14]. Another study in Poland showed that compliance was significantly affected by factors like patient knowledge of treatment (14 fold increase of the chance to comply), other people support (7 fold increases chances to comply) and insulin therapy (4 fold increases the chance to comply) [17]. Similarly a study conducted in Saudi Arabia from the self respondent participants determines the significant association of non-compliance with variable like sex (males was higher than that of female ( $p=0.003$ ), urban participants was significantly higher than ( $p=0.023$ ) in the rural participants, higher at illiterates (72.6%,  $p=0.001$ ) [25]. In this study, however, education level (illiterate(AOR=1.62) and age ( $\geq 60$ (AOR=1.21) were found to have significant association with non-adherence to diabetes treatment which is consistent with the study conducted at Mulago hospital in Uganda which had shown significant association with medication non-adherence and age(almost one third of respondents in the age group 36-50 years were not adhering ( $n=46$ , 31.3% (OR:0.967, 95% CI: 0.948-0.986) respectively [20]. Published studies have shown a significant association between illiteracy and non-adherence to Diabetes medication in India (72.6%,  $p=0.001$ ) [22].

Cross sectional survey conducted in Malaysia revealed variables which had significant association with non adherence: age (OR: 0.967, 95% CI: 0.948 - 0.986); medication knowledge (OR: 0.965, 95% CI: 0.946-0.984) ; and co-morbidities(OR= 1.781, 95% CI: 1.064 - 2.981) [21].

In contrast to the current study, a study conducted in America showed significant association between younger age and non adherence to diabetes treatment (over the median age of 57 years were significantly greater adherence for both urine and blood glucose testing(both 72%) than their younger counterparts(39% and 50 % respectively) [18]. A similar study in Poland also revealed that patient age above 65 years (1.3 fold increase of the chance to comply) were more compliant [17]. This inconsistency is may due to the workload differences between the younger & old age groups.

The duration of diabetes plays an important role in the management of diabetes. The current study also showed a significant association between duration of treatment ( $>5$  years (AOR=4.032) and non-adherence to diabetes treatment and it is consistent with a study conducted at Mangalore, India [22]. The current study has also shown a significant association between the presence of co-morbidity (AOR= 1.796) and non-adherence to diabetes treatment which is consistent with a study conducted in Malaysia which revealed a significant association between non-adherence and presence of co-morbidity. Patients with co-morbidity were 1.78(95% CI: 1.064 - 2.981) times more likely to be non-adherent compared with patients with type 2 diabetes mellitus only [21].

#### 5. CONCLUSION

The result of this study had shown a high prevalence of non-adherence to diabetes treatment (68.1%). Age of the patient, educational level, duration of treatment & presence of co-morbidity were found to have a significant association with non-adherence.

#### ETHICAL CONSIDERATIONS AND CONSENT

Before the data collection, ethical clearance letter was obtained from the ethical review board of St. Paul Hospital Millennium Medical College.

Permission letter was obtained from administrative bodies of the selected hospitals. The study participants were informed about the purpose of the study, and their consent has been obtained. The participant's right to refuse or withdraw from participating in the interview was fully maintained and the information provided by each respondent was kept confidential.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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