Research Article

Knowledge and self-reported practice of insulin injection device disposal and associated factors among diabetes patients in Addis Ababa, Ethiopia: A cross-sectional study

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Abstract

Background: Diabetes mellitus is a serious long-term condition with a major impact on the lives and well-being, of societies worldwide. Poor disposal practices of devices potentially result in personal injury and injuries to people in the household and the general community. This study aimed to assess the knowledge and self-reported practice of insulin injection device disposal and associated factors among diabetes patients in TASH, Addis Ababa, Ethiopia.

Method: A cross-sectional study was conducted among 182 adults with diabetes. The study participants were selected through systematic random sampling. Data were collected from March/17/2020 - May/18/2020. Patients were interviewed using a structured questionnaire. Data were entered into Epi-data version 4. 6 and exported to SPSS version 25.0 for analysis. Bivariable and multivariable logistic regression with crude and adjusted odds ratios along with the 95% confidence interval was computed and interpreted accordingly. Good practice and adequate knowledge were defined based on median calculation; a result above the median value of good practice and adequate knowledge with a p - value < 0.05 was considered to declare a result as statistically significant.

Results: About 54% of the participants had inadequate knowledge about safe insulin injection waste disposal. More than two-thirds (73%) of respondents had poor practice and 92.3% of respondents did not know how to dispose of lancets after use.

Conclusion: This study revealed that the knowledge and practice of diabetic patients were inadequate and poor towards safe insulin injection waste disposal in the study area. Educating patients and awareness creation training on proper insulin injection device disposal should be considerable.

Introduction

Diabetes Mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia [1]. It is a serious long-term condition with a major impact on the lives and well-being of individuals, families, and societies worldwide and is among the top 10 causes of death in adults [2]. IDF estimated that a total of 463 million adults were living with diabetes in 2019 worldwide and, Ethiopia is one of the top five African countries having the highest number [1,7] millionja adult people living with diabetes [2].

For managing and controlling diabetes mellitus patients administer insulin at their home and use different types of medical instruments such as insulin pens, needles, and syringes as well as measure their blood glucose and inject

insulin daily at their home procedures constantly generate sharps within the household [3]. Although diabetes-related technologies, like insulin pens and lancets made for the management and control of diabetes, are more convenient in home settings. These technologies are also associated with a rise in medical waste at the household level. Since diabetes patients receive at least four insulin injections and test their blood glucose levels 1-10 times daily [4,5].

According to recent estimates by WHO, nearly 16 billion insulin injections are administered annually worldwide but needles and lancets used by diabetic patients are not always disposed of in the proper way [6]. Improper disposal practice of used sharps is a global public health problem in both developed and developing countries and has the ability to cause many public health hazards [7]. The problems related to unsafe disposal of used sharps include injury to the person and blood-borne infections via needle stick injuries to others [4,8].

The proportion of diabetic patients throwing sharps needles in household waste bins approximately ranges from 50% to 90% and findings from a multi-center study revealed that about 47% to 68% of various injection needles were thrown into the household bin and below 10% of cases specific containers were used to dispose of insulin injection waste [3]. Factors associated with poor disposal practices of devices used by diabetes patients include the absence of information, proper advice from healthcare practitioners, knowledge about sharp disposal, and administration of insulin by diabetes patients by themselves, and long duration of diabetes [3]. Despite the great concern that has been made in the proper disposal of the health care waste management, needles and lancets used by diabetes patients at their household level are not always disposed of in the proper way due to inadequate knowledge and lack of information in the study area.

Hence, the findings from the study provide and fills the gap related to the level of knowledge and practice. Therefore, this study aims to assess knowledge, self-reported practice, and associated factors among diabetes patients in TASH, Addis Ababa, Ethiopia

Methods

Study area and period

The study was conducted in Tikur Anbesa Specialized Teaching Hospital in Addis Ababa Ethiopia from March/17/2020 - May/18/2020. Addis Ababa is the capital city of Ethiopia has an estimated population of closer to 4 million and boasts the highest concentration of industry, commerce, and social services in Ethiopia [9]. The city is almost at the geographic center of the nation, covering an area of 527 square kilometers and the population density is estimated to be near 5,165 individuals per square kilometer

available. Tikur Anbessa Hospital is the single largest referral hospital in Ethiopia. The diabetes clinic is one of the various specialty clinics hosted by Tikur Anbessa Hospital and it serves diabetes patients that come from all corners of the country through the referral system.

Study design

An institutional-based cross-sectional study design was conducted

Inclusion and exclusion criteria

Inclusion criteria: All adults with diabetes who had taken insulin for more than one month were included in the study

Exclusion criteria: Those adults with diabetes who are critically and mentally ill, pregnant women, and newly diagnosed adults are excluded.

Sample size determination and sampling procedure

Sample size determination: The sample size is calculated using the single population proportion formula by considering the p - value from a previous study done in Gondar University Referral Hospital(GURH)(3), 95% level of confidence,5% margin of error, and 10% non-response So, the sample size for this study was 178 and after adding a non-response rate of 10% the final sample size became 196.

$$n = \frac{(Z\,\alpha/2)2p(1-p)}{d2} \qquad n = \frac{(Z\,\alpha/2)2p(1-p)}{d2}$$

$$n = \frac{(1.96)20.21\,(0.79)}{(0.05)\,2} \qquad = \frac{(1.96)20.\,19(0.89)}{(0.05)\,2}$$

$$n = 254 \qquad n = 236$$

n = Sample size

z = Standard for 95% confidence interval = 1.96

d = Marginal error (0.05%)

P = Proportion of subjects who have knowledge and practice on insulin injection device disposal

q = Proportion of subjects who do not have knowledge of insulin injection device disposal

N = Total population

Since the total population is below 10,000 the sample size has been adjusted using the following reduction formula. NF = n/1+n/N = 254/1+254/600 = 178. By adding a 10% non-response rate the desired sample size was 196.

Sampling procedure: In order to identify the number of patients to be included in this study, the researcher obtained the total number of diabetes patients on insulin follow-up in the diabetic clinic of TASH. The researcher had

chosen the 2-month follow-up period for data collection to avoid duplication of the cases as patients return to the clinic every 2 months. About 600 patients visited the clinic in the 2-month period. Every third person was selected and who meet the inclusion criteria were included. Thus, atotal of 182 participants were selected through a systematic sampling procedure

Data collection tools

Data were collected using an interviewer-administered standardized structured questionnaire adopted from previous studies [3,10]. The final questionnaire consisted of 34 items and was divided into five parts. The data collection tool is prepared in English language and translated into Amharic language and then retranslated to the former version by another translator to check for logical and conceptual consistency. Two fourth-year BSc nursing students of Addis Ababa University and two health professionals had taken training and were recruited for data collection. The questionnaire was pre-tested on 5% of the sample size in Zewditu Memorial Hospital to ensure consistency of the responses and clarity and understandability of the tool before the actual data collection.

Data collection technique

Data was collected using a pretested structured questionnaire. The sample population was invited to participate voluntarily by explaining the rationality of the study at the time of data collection. After obtaining informed consent, the questionnaire was distributed as hard copies for the participants during their waiting time before taking served by data collectors. The Confidentiality and privacy of the participants were kept After participants completed the questionnaire the data collectors collect questionnaires and check each questionnaire for completeness.

Operational definitions

Adequate knowledge of insulin injection devices disposal: The knowledge part question contains 12 dichotomous "true"/false questions. Total knowledge scores were computed for each participant and possible composite knowledge scores for an individual could range from 0 to12. Individual composite scores were summed up together and median scores were calculated. A higher score above the median is indicative of adequate knowledge of insulin injection device disposal

The good self-reported practice of insulin injection devices disposal: The practice part questions covered 9 dichotomous questions (yes/no) which contains both negative and positive questions. For positive questions, the respondents got 1 score for yes answer and 0 scores for no answer whereas for negative questions they got 0 scores for yes answer and 1 for no answer. The total practice score was computed and ranges from 0 to 9 and the median score was

calculated. a higher score above the median shows the good self-reported practice of insulin injection device disposal.

Data analysis

The collected data were cleaned, coded, and entered into Epi Data 4. 6 and exported to statistical SPSS version 25 analysis was done. Frequency distribution for selected variables was done. The statistical significance and strength of the association between independent variables and an outcome variable were measured by the bivariate logistic regression model. A variable p - value less than 0.25 was a candidate for the multivariable logistic regression model and a p - value less than 0.05 was considered as significantly associated. Finally, the results of the study were presented using tables, figures, and texts based on the data obtained.

Results

Socio-demographic characteristics of the participants

A total of 196 diabetic patients were approached, among which, but 14 interviewees consented, but could not finish the interview, giving a 93% response rate. Of the total interviews, 104 (57.1%) were female, the mean age of the participants was 51.45 ± 14.8 with the age range of 18 to 82 years, and the majority (n = 136, [74.7%] were married. Concerning occupation most of subjects were housewife (n = 66, [36.3%]), government servant (n = 30, [16.5%]), self-employed (n = 41, [22.5%]), and private company employee (n = 18, ([9.9%]). Greater number of participants have attended secondary education (n = 61, [33.5 %]), almost all (90.7%) were urban residents, and 86 (47.3%) earn less than 1500 ETB monthly (Table 1).

Knowledge about insulin injection devices disposal

Overall 12 knowledge questions were included in the assessment tool which consisted of both negative and positive questions. For positive questions, respondents got 1 score for a true answer and 0 scores for a false answer. For negative questions, they got 1 score for a false answer and 0 scores for a true answer. The obtained score is converted in terms of score level and classified into two levels (inadequate and adequate knowledge). Possible scores range from 0-12 points. A median score of 8 was used to classify subjects into two groups as follows. More than half of the participants (54%) had inadequate knowledge. Majority of the participants (n = 168, [92.3%]) did not know how to dispose lancets after use (Table 2).

Practice towards insulin injection device disposal

A 9-item tool was used for assessing the participants' self-reported practice of insulin injection device disposal. The 9-item tool consisted of both positive and negative questions. For a positive question, the 'true' response option was scored as 1 and the 'false' response option was scored as 0. For a negative question, the 'false' response option

Table 1: General Socio-demographic characteristics of respondents.

Variables		Frequency *n* (%)
Sex	Male	78(42.9)
	Female	104(57.1)
Age, in year	< 25	10(5.5)
	25 - 39	26(14.3)
	40 - 59	80(44)
	_> = 60	66(36.3)
Marital status	Single	26(14.3)
	Married	136(74.7)
	Others (widowed, divorced)	20(11)
Occupation	Housewife	66(36.3)
	Government servant	30(16.5)
	Student	6(3.3)
	Self-employed	41(22.5)
	Private company worker	18(9.9)
	Other	21(11.5)
Educational status	Illiterate	27(14.8)
	Primary	44(24.2)
	Secondary	61(33.5)
	College and above	50(27.4)
Residence	Urban	165(90.7)
	Rural	17(9.3)
Monthly income	< 15000 ETB	86(47.3)
	1500 - 3000 ETB	51(28)
	3000 - 4500 ETB	11(6)
	4500 - 6000 ETB	24(13.2)
	> 6000ETB	10(5.5)

Table 2: Level of knowledge of respondents toward insulin injection device disposal.

Level of knowledge	Frequency	Percentage
Adequate knowledge	84	46
Inadequate knowledge	98	54

was scored as 1 and the 'true' response option was scored as 0. Then the total score was computed and ranged from 0 to 9. A median score of 7 was used to classify subjects into two as having good practice (scored ≥ 7) and poor practice (scored < 7). The majority of respondents (73.1%) had a poor practice of insulin injection device disposal (Table 3). About 72% of respondents place insulin injection devices in their household garbage bags.

Factors associated with the knowledge score of study participants

In the bivariate logistic regression analysis, age group, marital status, educational status, occupation and residence, advice from HCP, information from pharmacist/friends, duration of insulin use, and type of DM have shown statistically significant associations with the participants' knowledge of insulin device disposal. However, in the multiple regression model age, marital status, education, residence, type of diabetes, source of information, and duration of insulin use are significantly associated with knowledge of insulin injection device disposal (Table 4). Compared to participants who were less than 25 years old those in the age group between 25 to 39 years old were 8 times more likely to have adequate knowledge (AOR = 8.012,

Table 3: Level of the participants' practice of insulin injection device disposal.

Level of practice	Frequency	Percentage
Good practice	49	26.9
Poor practice	133	73.1

95% CI: (168, 29.600). Participants in that married marriage were 62% (AOR = 0.382, 95% CI: (0.152, 0.950 and those in another marital status group (divorced and widowed) were 93% (AOR = 0.071, 95% CI: (0.016, 0.320) less likely to have adequate knowledge compared to those who were single. Compared to participants who were illiterate those who had attended secondary school were 81% less likely to have adequate knowledge (AOR = 0.193, 95% CI: (0.056, 0.660). Urban residents compared to rural residents were 80% more likely to have adequate knowledge (AOR = 0.197, 95% CI: (0.053, 0.730). Participants with type 1 diabetes were 2.14 times more likely to have adequate knowledge than those with type 2 diabetes (AOR = 2.14, 95% CI: (1.12, 4.00. Participants who received information from pharmacists or friends were 64% more likely to have adequate knowledge compared to those who did not receive information from other sources (AOR = 0.358, 95%CI: (0.129, 0.990).

Factors associated with the practice of insulin injection device disposal

In bivariate logistic regression analysis, age group, marital status, occupation, educational level, duration of insulin use, advice from health care provider (HCP), type of DM, and knowledge of insulin injection device disposal were significantly associated with self-reported insulin injection device disposal practice. In multiple logistic regression models, age, educational level, advice from HCP, duration of insulin use, type of DM, and knowledge of insulin device disposal have shown statistically significant associations with self-reported insulin device disposal practice (Table 5). Compared to participants aged less than 25 years old those in the age group between 25 and 39 years were 90% less likely to have good self-reported insulin injection disposal practice (AOR = 0.101, 95% CI: (0.019, 0.535). Participants in marriage were 86% less likely to have good self-reported practice than those who were single (AOR = 0.141, 95% CI: (0.049, 0.406) Compared to illiterate participants those who attended primary education were 84% less likely to have good self-reported practice (AOR = 0.158, 95% CI: (0.028, 0.903) Participants who received information from pharmacist or friends were 59% less likely to good self-reported practice compared to those who did not receive information from the said sources (AOR = 0.407, 95% CI: (0.169, 0.980). Participants who used insulin for more than 5 years were 77% less likely to have good self-reported practice than those who used insulin for 5 years or below (AOR = 0.230, 95% CI: (0.077, 0.690). Participants with type 1 diabetes were 2.1 times more likely to have good self-reported practice than those with type 2 diabetes (AOR = 2.1, 95% CI: (1.054, 4.200). Furthermore, participants who had adequate knowledge of insulin injection device disposal were 2.5 times more likely to have adequate self-reported practice compared to those who had inadequate knowledge (AOR = 2.5, 95% CI: (1.025, 6.300).

Table 4: Factors associated with knowledge of insulin injection device disposal.

Variables		Knowledge		Crude Odds Ratio (COR), 95% CI	Adjusted Odds Ratio (AOR)	
		Inadequate (n)	Adequate (n)		p - value	95% CI
Age group	< 25	4	6	1		1
	25 - 39	7	19	2.308(0.593,0.9)	0.02	8.012(2.168,29.6)
	40 - 59	47	33	4.176(1.540,11.32)	0.170	0.23(0.036,1.44)
	> 60	40	26	1.08(0.556,2.10)	0.108	0.213(0.033,1.373)
Marital status	Single	8	18	1		1
	Married	73	63	0.384(0.156.0.94)	0.014	0.382(.152,0.95)
	others	17	3	0.078(.0018,0. 346)	0.01	0.071(.016.0.32)
Education	Illiterate	18	9	1		1
	Primary	33	11	0.235(0.87,0.637)	0.045	0.261(.067,1.026)
	Secondary	31	30	0.157(0.63,0.88)	0.009	0.193(.056,0.66)
	College & above	16	34	.455(0.209,0.991)	0.0174	5.00(0.184,1.3)
Residence	Urban	84	8	0.22(0.62,0.802)	0.015	2(0.053,0.73)
	Rural	14	3	1		1
Type of DM	Type 1	24	36	2.31(1,2,4.3)	0.020	2.14(1.12,4.0)
	Type 2	74	48	1		1
Information from pharmacist/friend	Yes	18	32	.366(.186,.718)	0.036	0.358(0.129,0.99)
	No	80	52	1		1
Duration of insulin use	1 mon - 5 years	32	11	0.331(.145,.66	0.014	0.332(0.154,0.71)
	> 5 years	66	73	1		1

Table 5: Factors associated with the self-reported practice of insulin injection device disposal.

Variables		Self-reported practice		Crude Odds Ratio (COR), 95% CI	Adjusted Odds Ratio (AOR)	
		Poor	Good		p - value	95% CI
Age group	< 25	3	7	1		1
	25 - 39	16	10	7.933(1.824, 34.5)	0.007	0.101(0.019, 0.535)
	40 - 59	63	17	2.125(.799,5.6)	.389	0.093(.017,0.52)
	≥ 60	51	15	.917(.418, 2.014)	.306	0.131(.024,0.71)
Education	Illiterate	24	3	1		1
	Primary	35	9	2.057(.504, 8.393)	0.038	0.158(0.028,0.903)
	Secondary	45	16	2.844(.753, 10.743)	0.341	0.551(0.161,1.88)
	College & above	29	21	5.793(1.540, 21.79)	0.001	0.429(0.153,1.20)
Advice from HCP	Yes	67	34	.448(.223, 0.898)	.046	0.407(0.169,0.98)
	No	66	15	1		1
Duration of insulin use	1 mon - 5 years	39	4	1		1
	> 5 years	94	45	.214(.072,.636)	0.009	0.230(0.077, 0.690)
Type of DM	Type 1	37	23	2.3(1.16,4.51)	0.035	2.1(1.054,4.2)
	Type 2	96	26	1		1
Knowledge	Inadequate	83	15	1		1
	Adequate	50	34	3.76(1.87, 7.6)	0.044	2.5(1.026,6.3)

Discussion

This study assessed the knowledge and self-reported practice of diabetes patients toward insulin injection device disposal and associated factors in TASH, Addis Ababa, Ethiopia. The issue of insulin injection device disposal has not been widely addressed by researchers, practitioners, and policy-makers in this country so far. Syringe disposal without an effective waste disposal system opens a new portal of transmission of the blood-borne pathogen from patients to the general community [3]. Disposal of used injection equipment in an open place in rural areas could increase the risk of transmission to children, who play with syringes and can get pricked, and this correlated with transmission of blood-borne infections like HIV, HBV, and HCV to the community [11].

In this study, the overall adequate knowledge score was 46% and the inadequate knowledge score was 54%. This finding was better than the study conducted in Delhi, India, and Gondar University Referral hospital (GURH) in Ethiopia those who had high-level knowledge of insulin injection devices disposal were 23.8% and 21% [3,10]. This might be due to India being a developing country and being home to a huge diabetes population, there is a lack of awareness, and education program remains a major issue. Since, a current study conducted in TASH in Addis Ababa, Ethiopia, even if there is a lack of awareness programs and national guidelines for diabetes patients about insulin injection device disposal at their home in Ethiopia, patients from Addis Ababa have different access to learn about waste management through mass media as well as social media compared with Gondar town.

The current study revealed that the majority of respondents (73%) had a poor practice of insulin device disposal. This finding was higher than the study conducted in India 63.9% of participants had poor practice in insulin

injection devices disposal [10]. This might be due to the fact that Ethiopia has low social media coverage in the health sector and suffers from lower health education on the safe disposal of injection devices, and less attention given by the health system to address proper insulin injection waste disposal.

Education level is directly associated with knowledge level as respondents who joined college and above with 5 times more likely to contribute adequate knowledge score (p = 0.0017) and good practice (p = 0.001) than others. This may be because they had a better chance to get information from courses and social media than those who are not joined. This finding was in agreement with the study done on GURH respondents who join college or university had a significantly higher overall score of knowledge than those who were not joined [3]. However, a study conducted in South Africa reported that there were no significant associations between education level and correct disposal of insulin injection waste [12].

This study showed the significant difference in knowledge among urban and rural residents to ward insulin injection waste disposal. The urban residents (60.6%) are more likely to contribute adequate knowledge score (p = 0.003) than rural residents This might be due to low contact time for counseling and the absence of safe disposing methods for the patients who are coming from the rural area and healthcare providers in a rural area had no good disposing practice. This finding was in agreement with a study done in Murree, Pakistan, and GURH which showed that 60% of rural health practitioners disposed of insulin injection needles in an open place [3,11].

This study revealed that there is a significant difference in knowledge and practice between patients who received advice and information from HCP as well as pharmacists/friends. Respondents who received information had 64% of adequate knowledge and 33.7% good practice compared with those who were not informed. This finding was in agreement with a study done in GURH in Ethiopia [3]. Education from HCP played a very important role in the disposal of insulin injection waste disposal. This indicated that education is necessary for diabetes patients to practice good disposal of insulin injection waste. This finding was also supported by studies done in India and USA showing that education received from healthcare providers played a very important role, as shown by significant correlation [10].

The current study showed the duration of insulin use was significantly associated with the knowledge and practice of respondents. In this study patients who used insulin for more than five years had 52.5% adequate knowledge (p = 0.005) and 32.4% good practice (p = 0.009). This study is consistent with the study done in the Philippines and GURH [3,13]. However, in a study conducted in Malaysia and, patients who

had used insulin for less than five years had almost three times higher knowledge and good practice compared to those who used insulin for greater than five years [14].

The present study showed that type DM was significantly associated with the knowledge and practice of study participants. In this study, type1 DM patients were 2 times more likely to have adequate knowledge and good practice on insulin injection device disposal compared to type 2 DM patients, and knowledge is significantly associated with practice the respondents with adequate knowledge 2.6 times more likely to contribute good practice than respondent's inadequate knowledge.

Strength of the study

Findings from this study addressed the gap that the researcher intended.

The high response rate of study participants.

The data collection tool for this study was standardized, validated, and adopted from similar previous studies.

Limitation of the study

The study is done in one diabetic center; the results found about insulin injection devices' waste disposal may not be representative of all Ethiopian diabetes patients.

As the study design is cross-sectional and depends on self-reported assessment, under or over-reporting is very likely.

Conclusion

The present study showed the knowledge and practice of diabetic patients were inadequate and poor towards safe insulin injection waste disposal in the study area. The study revealed that knowledge and practice of diabetic patients toward safe insulin injection device disposal had a strong association with age, marital status, occupation, residence, education level, education received from healthcare practitioners, type of DM, and duration of insulin use.

Recommendations

To achieve the goal of safe disposal practice of insulin injection wastes at the household level:

The ministry of health should develop a guideline on the management of insulin injection device wastes generated at home.

This severe problem needs urgent attention from the government to ensure the presence of a safe disposal system and that the sharps are no longer disposed of in the household bin or public locations like parks, buildings, or streets.

Health care providers should also be aware of the safe disposing system and counsel and educate patients on the appropriate disposal of used syringes.

Awareness creation training should be given to home insulin users about the safe disposal and hazard of insulin injection wastes.

Insulin injection devices waste management guidelines and related documents should be prepared and given for the patients.

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Author's contribution

FA, TA, and AL worked on the conception and design of the study. AL collected, analyzed, and interpreted the data. FA and TA monitored and evaluated the data. FA and TA Critically revised and edited the article as well as the manuscript and participated as advisors and helped with statistics. All authors read and approved the manuscript.

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Availability of data and materials

The datasets used for the study are available from the corresponding author upon request.

The dataset used for the study is not publicly available in order to maintain data security but is available from corresponding author on reasonable request

Competing interests: All of the authors declare that there is no conflict of interest regarding this work.

Ethical approval: Ethical clearance was obtained from the Institutional Review Board (IRB) of Addis Ababa University, College of Health Science, School of Nursing and Midwifery. Informed consent was also obtained from each participant before conducting this study. Participants' information obtained was kept confidential.

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