

# Assessment of Knowledge, Attitude, and Practice of Diabetic Patients Regarding Sharps Disposal

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**Abstract.** The present research assessed the knowledge, attitude, and practices of diabetic patients concerning the disposal of sharps in community settings and the factors affecting them by using a validated interview questionnaire. A cross-sectional study was done. Three hundred eighty-four patients were selected by systematic random sampling and interviewed to answer the questionnaire at 2 diabetic centers in Alexandria. We found the respondents had fair knowledge ( $7.17 \pm 2.21$  out of 10) and a positive attitude ( $3.682 \pm 0.87$  out of 5) towards sharps disposal. However, the majority (95.1%) had poor disposal practices. Only (4.9%) of participants had acceptable disposal techniques through health care facilities. Good knowledge scores were related to high educational level, single marital status, living in an urban area, and being employed. Based on both crude and multivariable regression models, the study found that attitude was influenced by occupation status and that the parameters predicting disposal in healthcare settings were receiving advice from healthcare workers (HCW), knowledge score, and using insulin outside the house. In conclusion, most patients had inappropriate sharps disposal practices. Accordingly, the researchers expect a massive public health problem towards diabetic sharp waste discarding which implied the necessity to implement a proper community sharps disposal program in the future.

**Index Terms:** Diabetes mellitus, Sharps disposal, Insulin syringe, Insulin needles

## I. INTRODUCTION

Diabetes mellitus (DM) is a chronic condition caused by an inherent or acquired inability of the pancreas to make insulin, or by the ineffectiveness of the insulin produced (type 2 DM) [1]. Egypt is among the top ten nations in the world in terms of diabetes patients, according to the International Diabetes Federation (IDF). The fact that DM prevalence in Egypt has risen dramatically in a very short period, from around 4.4 million cases in 2007 to 8.2 million cases in 2017, is concerning. By 2035, it is predicted to be 13.1 million diabetes patients. [2] Diabetic patients need to measure blood glucose levels regularly by self-monitoring of blood glucose (SMBG) to ensure that the glucose level is within the normal range. Patients with type 1 DM and some with type 2 DM are using insulin injections to control blood glucose levels. These practices, which include using various kinds of medical devices and instruments like insulin pens, syringes, lancets, etc., mostly take place by self-administration at home [3]. Furthermore, if it is known that about 40% of diabetic patients need insulin

injections [1], the health care providers can expect that a considerable number of sharps will be generated and discarded. Without proper sharps disposal practices, accidental injuries with contaminated sharps occur frequently. Sharps expose people to the risk of not only getting a painful stick but also catching a life-threatening disease. [4]. Majumdar et al. (2015) [3], reported a significant association between diabetes mellitus and hepatitis B virus, hepatitis C virus, and HIV infections. Several studies were carried out to assess the knowledge, attitudes, and practices toward sharps disposal among diabetic patients all over the world [5]. On the other hand, hundreds of tons of plastics and metals generated in this process require being disposed of safely. The burning of these plastics contributes to greenhouse gas production, which further affects the atmosphere. To the best of our knowledge, data about the knowledge and practice of diabetic patients regarding sharps disposal in Egypt is relatively rare.

## II. OBJECTIVES

To assess knowledge as a primary outcome of diabetic patients regarding sharps disposal, in addition, attitude and practice, and to assess the effect of socio-demographic factors and clinical characteristics in detail as secondary outcomes.

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### III. METHODOLOGY

#### 3.1. Study Setting

This study was carried out between October 2019 and April 2020 at El-Horraya and Louran diabetic centers, Health Insurance Organization (HIO), Alexandria.

#### 3.2. Study Design

Cross-sectional study

#### 3.3. Target Population

All insulin-requiring type 1 and type 2 diabetes mellitus adult patients who visited El-Horraya and Louran Diabetic Centers were included in the study. The two centers were selected randomly from 8 diabetic centers all over Alexandria. About 8000 patients visited El-Horraya diabetic center and 12000 patients visited Louran diabetic center every two months as each patient returned every 2 months to recheck up. Study subjects were selected from the source population according to a random starting point and every third person encountered in the first center and every fifth person in the second one and who met the inclusion criteria was included. Thus, 192 study subjects were selected from each center through a systematic sampling procedure.

**Exclusion criteria:** The study excluded participants with gestational diabetes mellitus and those who have poor visual acuity

#### 3.4. Sampling design

##### 3.4.1. Sample size

Based on Abebe et al. (2016), [6] 49.5% of diabetics using insulin had poor knowledge (primary outcome) of Sharps waste disposal. Using a margin of error of 5%, an alpha error of 0.05, the minimum required sample size required is 384. The sample size was calculated using Epi info7 software.

##### 3.4.2. Type of sample and method of selection

A systematic random sample was used. All insulin-requiring type 1 and type 2 diabetes mellitus patients who visited El-Horraya and Louran Diabetic Centers (192 patients from each) were selected.

#### 3.5. Data collection methods and tools

After a thorough literature assessment of the relevant existing research [5, 6], a validated interview questionnaire on community sharp disposal was utilized to obtain data on knowledge, attitude, and sharp disposal practice from the participants. Our questionnaire, on the other hand, was heavily influenced by the Filipino research version developed by Quiwa and Jimeno (2014) [5]. A group of professionals, comprising two environmental health professors and one lecturer, assessed the questionnaire's content. The questionnaire included four main sections. The first part was concerned with the socio-demographic factors and the clinical characteristics of the participants. The second section of the questionnaire consisted of 10 items that assessed

knowledge of three important concepts: proper syringe/needle use, dangers of improper disposal, and right syringe/needle disposal practice. The third part assessed the attitude through items covering five concepts. The five themes were: readiness to dispose of sharps appropriately and learn proper disposal, responsibility for needle stick injuries, desire to prevent needle stick injuries, an attitude that improper sharps disposal is a severe problem, and fear of seeking a physician about safe disposal. On the agreement, a 5-point Likert scale will be utilized and rated from one to five. The fourth section looked at sharps and general trash disposal techniques. The most effective practice which determined if the participant had accepted practice or not was disposing of sharps at health care facilities (binary outcome).

#### 3.6. Ethical consideration

1. The researcher requested permission from the High Institute of Public Health's Ethics Committee to perform the study.
2. The international guidelines for research ethics were followed by the researcher.
3. After an explanation of the study's goal and benefits, all study participants gave their verbal agreement.
4. Anonymity and secrecy were guaranteed and maintained.
5. There was no potential for a conflict of interest.

#### 3.7. Pilot study

A pilot study was done before gross data collection. It entailed pretesting of the questionnaire on 20 participants which was not included in the final analysis; it was done to determine the validity of the tool, modify and adjust some questions, estimate the average time needed to obtain the required information, and identify obstacles that could be faced during the implementation of the study. The questionnaire was completed in an average of 26 minutes by respondents, with a range of 20 to 32 minutes. The questionnaire was easy to understand for the vast majority of respondents. A few items have been rephrased for clarity. Before the actual data collection began, relevant changes were implemented.

## IV. RESULTS

A total of 384 eligible Type 1 and Type 2 DM patients were recruited for this cross-sectional s. They all completed the survey and were considered in the final analysis.

#### 4.1. Socio-demographic factors

The percentage of males was (64.1%), and females were (35.9%), and the age range was from 24 years to 74 years. The Majority of the respondents were male (64.1%) and married (75%). Concerning occupational status, it was found that 46.6% of the participants were retired and 43.8% were employed. As regards education,

the study results showed that about one-third of them (34.1%) reported that they had a graduate certificate, 2.9% had a postgraduate certificate, while (5.2%) said that they were illiterate. Concerning residence, it was found that (76.8%) of them lived in urban areas, (23.2%) in slum and rural areas, and only 1% of participants shared their homes with others (table 1). About half of the participants (47.7%) had children when they lived there, and (44.8%) of them had 2 children in the family as displayed in table 1.

**Table 1: Distribution of the studied diabetic patients according to socio-demographic characteristics**

(n = 384) (El Horrara and Louran diabetic centers, 2019).

Socio-demographic factors	No.	%
<b>Age (years)</b>		
20 –	25	6.5
30 –	31	8.1
40 –	74	19.3
50 –	103	26.8
60+	151	39.3
Min. – Max.	24.0 – 74.0	
Mean ± SD.	54.68 ± 12.41	
Median (IQR)	58.0 (46.0 – 64.0)	
<b>Gender</b>		
Male	246	64.1
Female	138	35.9
<b>Marital status</b>		
Single	18	4.7
Married	288	75.0
Widowed	72	18.8
Divorced	6	1.5
<b>Occupation</b>		
Employed	168	43.8
Unemployed	37	9.6
Retired	179	46.6
<b>Education</b>		
Illiterate	20	5.2
Read and write	14	3.7
Basic education	70	18.2
Intermediate qualification	116	30.2
High technical qualification	22	5.7
University education	131	34.1
Postgraduate	11	2.9
<b>Residence area</b>		
Urban area	295	76.8
Rural area	10	2.6
Slum area	79	20.6
<b>The house</b>		
Independent	380	99.0
Shared with others	4	1.0

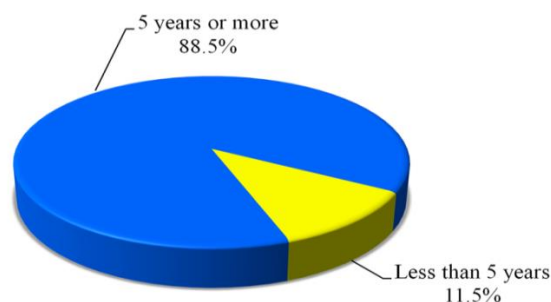
Regarding the crowding index, it was found that the mean crowding index was  $1.10 \pm 0.45$  as explained. It was found that 48% of the participants had lived in crowding and overcrowding status as explained. About half of the participants (47.7%) had children at their

place of residence and (44.8%) of them had 2 children in the family as displayed.

In terms of medical history, it was found that 57.3% of the participants had diseases other than diabetes mellitus; the percentage of hypertension among participants was 82.7% and of heart diseases was 28.6%. Interestingly, 15.4% of participants had viral hepatitis C.

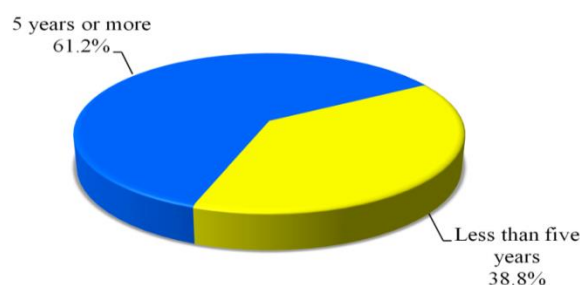
**4.2. Descriptive data about diabetes, diabetes treatment characteristics, and medical history**

In terms of diabetes and insulin treatment features, the patients' mean duration of diabetes mellitus was 13.98 7.51 years. In comparison, the average length of insulin use was around half that, at 7.80 6.56 years. The majority of responders (88.5 %) had been diagnosed with diabetes for at least five years (Figure 1). However, only 61.2% of patients (61.2%) had been prescribed insulin therapy over the previous five years (Figure 2). More than half of the respondents used reusable insulin pens (56.3%), however, (38.8%) used syringes, and (4.9%) used both. The majority took an insulin injection twice daily (80.4%), while (11.2%) took once, (6.8%) took three times, and only (1.3%) took four times. Regarding the total number of discarded syringes and pen needles monthly, it was found that about 2355 syringes and 3031 pen needles were discarded monthly with the mean of  $14.02 \pm 9.95$  for syringes and  $12.90 \pm 10.55$  for pen needles. Regarding medical history, it was found that 16.3% of participants had hepatitis C and B.



**Figure 1. Distribution of the studied diabetic patients according to the duration of diabetes (years)**

(n = 384) (El Horrara and Louran diabetic centers, 2019).



**Figure 2. Distribution of the studied diabetic patients according to the duration of insulin use (years)**

(n = 384) (El Horrara and Louran diabetic centers, 2019).

### 4.3. Diabetic patients’ knowledge, attitudes, and practices towards disposal of sharps

#### 4.3.1. The knowledge of diabetic patients about sharps disposal

The researcher assessed the participants' knowledge of how to use and dispose of insulin syringes by using ten multiple-choice questions. We covered three key subjects with two, three, and five items: proper syringe/needle use, hazards of inappropriate disposal, and appropriate syringe/needle disposal practices. All the participants answered ten multiple-choice questions that assess their knowledge regarding sharps disposal. By asking about what should be done if there is a will to reuse the syringe or the pen after using it for the first time, 98.2% selected the choice of putting the cap back on. Regarding what should be done if an insulin syringe slips out of one's hand and falls to the ground, 74.2 % of people said throwing it away and getting a new one is a correct option.

Concerning infectious disease, which can be got after accidental prick by a syringe used by another person, 68.5% had chosen hepatitis. On the other hand, 95% had nominated garbage scavengers as Community members are at the greatest risk of being accidentally injured by used insulin syringes. About the best place to store used insulin syringes or pens, only 23.2% selected the choice of keeping the syringes and pens in place hard to reach by children while 57% preferred to keep them in the refrigerator.

Concerning using insulin outside the house, 58.3% stated that they preferred to bring the used syringes back to the home while, 40.9% throw them in the nearest garbage can. Interestingly, 86.7% of the participants considered placing the sharps in a puncture-resistant container as the best way to dispose of them. Furthermore, 78.9% knew that the best container for storing used insulin syringes or needles safely is a hard puncture-resistant plastic bottle, while 13.3% had chosen plastic bags. Concerning the disposal of used syringes, 73.7% selected the choice of covering needles before throwing them, while 20.3% of participants preferred to bend them. At the general level, 60.4% knew that used insulin syringes are best discarded through the community disposal program regarding household sharps, while 30.2 % considered burning in the backyard is the best one.

Distribution of the studied patients according to total knowledge score displayed that 50.5 % of the participants had High level ( $\geq 75\%$ ) knowledge, 36.2 % had Moderate level ( $\geq 50 - < 75\%$ ) of knowledge and lastly, 13.3% had a low level (0 – 50%) of knowledge with the mean score of  $71.72 \pm 22.10$  which corresponds to a moderate level (table 2).

**Table 2: Distribution of the studied diabetic patients according to their total Knowledge score (n = 384)**

(El Horraya and Louran diabetic centers, 2019).

Total knowledge score	No.	%
Good level ( $\geq 75\%$ )	194	50.5
Fair level ( $\geq 50 - < 75\%$ )	139	36.2
Poor level (0 – < 50%)	51	13.3
<b>Total Score</b>		
Min. – Max.	2.0 – 10.0	
Mean $\pm$ SD.	7.17 $\pm$ 2.21	
Median (IQR)	8.0 (6.0 – 9.0)	
<b>Percent Score</b>		
Min. – Max.	20.0 – 100.0	
Mean $\pm$ SD.	71.72 $\pm$ 22.10	
Median (IQR)	80.0 (60.0 – 90.0)	

#### 4.3.2. The attitude of diabetic patients towards sharps disposal

The attitude component of the questionnaire contained nine items that covered five concepts. We assessed the level of agreement by using a 5-point Likert scale ranging from strongly agree (score of 5) to strongly disagree (score of 0). The attitude scale used a score range of 1.00-1.79 for a severely negative attitude, 1.80-2.59 for a negative attitude, 2.60-3.39 for a neutral attitude, 3.40-4.19 for a positive attitude, and 4.20-5.00 for a strongly positive attitude.

We discovered that 59.4 percent of individuals strongly agreed that incorrect disposal of insulin syringes is a severe problem, while just 6.8% disagreed. About 45.8% strongly agreed that they should learn how to appropriately dispose of their used insulin needles. If garbage scavengers are hurt by insulin syringes and needles dumped in the trash, 31.5 % believe it is their fault, while 54.7% disagree.

About 45.8% were strongly willing to improve their present methods of disposing of insulin syringes and needles. Besides, 79.2% of the sample population was firmly not willing other people to get injured by their insulin syringes and needles. However, 40.6% disagreed that they are afraid or embarrassed to ask their doctors about the proper disposal way of insulin syringes and needles.

Surprisingly, 82 % of responders said they would bring their used insulin syringes to the hospital if it would dispose of them. Furthermore, 66.5 % of participants believed it was their fault if someone else was wounded by their discarded syringes and needles. Finally, just 13.6 % said the government was fully responsible for the correct disposal of insulin syringes.

The distribution of the studied patients according to total attitude score showed that 52.1% of the participants had a strong positive attitude, 35.2% had a positive attitude, 12.2% had a neutral attitude, and 0.5% had a negative

attitude. The mean score of the respondents was  $3.682 \pm 0.87$ , corresponding to a positive attitude.

**Table 3: Distribution of the studied diabetic patients according to their total attitude score (n = 384) (El Horrara and Louran diabetic centers, 2019).**

Total attitude score	No.	%
Strongly positive (4.20 – 5.00)	200	52.1
Positive (3.40 – 4.19)	135	35.2
Neutral (2.60 – 3.39)	47	12.2
Negative (1.80 – 2.59)	2	0.5
<b>Total Score</b>		
Min. – Max.	2.10 – 4.50	
Mean $\pm$ SD.	$3.682 \pm 0.87$	
Median (IQR)	3.80 (3.30 – 4.10)	
<b>Percent Score</b>		
Min. – Max.	33.33 – 100.0	
Mean $\pm$ SD.	$77.26 \pm 13.53$	
Median (IQR)	80.56 (66.67 – 88.89)	

**4.3.3. The sharps disposal practice of diabetic patients**

As shown in table (4), it was found that the bulk of sharps (94 percent) were disposed of through domestic rubbish collection, either loosely mixed with household waste or in a dedicated container such as a bag or bottle. 4.9 percent of participants, however, disposed of their sharps in health care facilities. and only 1.1% disposed of sharps in the toilet through the sanitation system (table 4).

Regarding participants who used household garbage for sharps disposal, it was found that 63.3% of them did not use any container before disposing while 30.7% used plastic bags or bottles. Concerning sharps disposal practices, it was found that 64.3% of the participants did not use any container before disposing of sharps, 32.8% used plastic bags, 1.6% used bottles, 0.8 used detergent plastic bottles, and 0.5% only used sharps bins (Table 2).

Out of 384 respondents, 62.2% practiced insulin injections outside the home. Among them, 64% brought their syringes and pens home and 36% threw their sharps in the nearest garbage container. Only 27 participants representing 7% of participants reported receiving guidance on how to dispose of sharps. The most prevalent source was family members. of guidance at (48.2%), followed by pharmacists (25.9%), then nurses (18.5%), and lastly physicians and laboratory technicians at (3.7%) for each (Table 4).

**Table 4: Distribution of the studied diabetic patients according to their sharps disposal practice**

(n = 384) (El Horrara and Louran diabetic centers, 2019)

Questions for assessing the practice of disposing of sharps	No.	%
<b>The methods used in disposing of used insulin syringes:</b>		
<b>a. Thrown through household garbage</b>	<b>361</b>	<b>94.0</b>
Thrown immediately into the garbage and be mingled with the household waste	243	63.3
Placed in a container, such as a bag or a bottle before being thrown away.	118	30.7
<b>b. Disposal at health care facilities</b>	<b>19</b>	<b>4.9</b>
Sharp bin	2	10.5
Bottles	6	31.6
Detergent plastic bottles	3	15.8
Plastic bag	8	42.1
<b>c. Toilet</b>	<b>4</b>	<b>1.1</b>
<b>Type of container that was used for insulin syringes just before disposing of them:</b>		
No container used	247	64.3
Plastic bag	126	32.8
Bottles	6	1.6
Detergent plastic bottles	3	0.8
Sharp bin	2	0.5
<b>Using insulin outside the house:</b>		
No	145	37.8
<b>Yes</b>	<b>239</b>	<b>62.2</b>
<b>If Yes</b>		
<b>The best way of disposing of used insulin syringes outside the house:</b>		
I carry them home with me	153	64.0
I dispose of them in any available trash container	86	36.0
<b>The presence of a person who gave you advice on how to dispose of your used insulin syringes:</b>		
No	357	93.0
<b>Yes (n.= 27)</b>	<b>27</b>	<b>7.0</b>
Physician	1	3.7
Nurse	5	18.5
Pharmacist	7	25.9
Family member	13	48.2
Lab technician	1	3.7

**4.4. Factors affecting knowledge, attitude, and practice**

**4.4.1. Factors influencing knowledge**

The factors that influenced the respondents' knowledge level were looked at. Marital status (single and divorced), occupation (employed and retired), college and postgraduate education, and civilized residence area were associated with a higher mean knowledge score and reached statistical significance.

As for marital status, it was found that the single and divorced had good mean knowledge scores at  $8.17 \pm 1.25$  and  $8.17 \pm 1.83$  respectively while, married and widowed had fair mean knowledge scores,  $7.38 \pm 2.11$  and  $6.00 \pm 2.43$  respectively.

Regarding occupational status, it was found that participants who were employed or retired had better mean knowledge scores than unemployed, ( $7.38 \pm 1.98$ ,  $7.31 \pm 2.26$ ), ( $5.57 \pm 2.36$ ) respectively.

Concerning education, the respondents who had postgraduate and university certificates demonstrated a good mean knowledge score,  $9.64 \pm 0.50$ , and  $8.53 \pm 1.53$ . While illiterate and those who could read and write had the least knowledge score,  $5.05 \pm 2.04$ , and  $5.93 \pm 1.44$ , respectively.

According to the residence area, it was found that participants who lived in an urban area had a better mean knowledge score ( $7.36 \pm 2.22$ ) than those who lived in a rural area ( $6.80 \pm 1.40$ ).

When an analysis of variance (ANOVA) F test is significant, a post hoc test is performed to identify particular differences between the means of three or more groups. Thus, it was used to determine the significant differences among subgroups of marital status, occupation, education, and residential area concerning total practice score. Regarding marital status, there was a significant difference among married versus widowed subgroups with p-value < 0.001 and among single versus widowed with p-value = 0.001. Concerning occupation status, a significant difference was found among employed versus unemployed and unemployed versus retired subgroups with a p-value < 0.001. On the other hand, education status subgroups exhibit significant differences among, illiterate vs. intermediate qualification with p-value =0.003, illiterate vs. high technical qualification with p-value =0.004, illiterate vs.

university education with p-value <0.001, read and write vs. university education with p-value <0.001, basic education vs. intermediate qualification with p-value =0.006, basic education vs. high technical qualification with p-value =0.029, basic education vs. university education with p-value <0.001, intermediate qualification vs. university education with p-value <0.001, high technical education vs. university education with p-value =0.027. Besides, there was a significant difference between urban and slum resident areas with a p-value = 0.007 regarding total practice score.

**4.4.2. Factors influencing the attitude**

We conducted the univariate linear regression analysis to determine the factors associated with attitude as an outcome. History of self-inflicted needle stick injury and female sex was negatively associated with attitude. In contrast, the presence of children at the house, receiving advice from health care workers or family members, having an occupation, duration of insulin use, male sex, knowledge, and college education were positively associated with attitude towards proper disposal.

Table 5 shows the stepwise multiple linear regression analysis of factors that influence the attitude. Twelve factors entered the regression analysis, namely: history of needle stick injury to self, use of insulin pens, advice from health care workers, occupation, duration of insulin use, knowledge, gender, presence of children at home, use of insulin syringes, advice from family friends, education (college level or beyond), and marital status (married). From the twelve factors entered the regression analysis, only occupation significantly predicted attitude; occupation explained 73.5% of the variation of the attitude score. It was found that the employed participants had a more positive attitude than retired and unemployed ones.

**Table 5: Stepwise multiple linear regression analysis of factors that predicted the attitude (n = 384) (El Horraya and Louran diabetic centers, 2019).**

Attitude	B	SE	Beta	t	p
Constant	42.453	6.893		6.159	<0.001*
History of needle stick injury to self	-9.669	4.518	-0.390	2.140	0.070
Use of insulin pens	0.323	0.262	0.415	1.235	0.257
Advice from health care workers	0.654	1.655	0.117	0.395	0.704
Occupation	8.729	2.869	0.733	3.043	0.019*
Duration of insulin use	0.014	0.152	0.018	0.089	0.931
Knowledge	0.896	1.121	0.349	0.799	0.451
Gender	-2.019	1.806	-0.176	1.118	0.300
Presence of children at home	1.860	4.925	0.148	0.378	0.717
Use of insulin syringes	-0.708	0.362	-0.756	1.956	0.091
Advice from family friends	–	–	–	–	–
Education (college level or beyond)	2.754	1.247	0.555	2.208	0.063
Marital status (married)	-5.062	3.918	-0.333	1.292	0.237
$R^2 = 0.897$ , adjusted $R^2 = 0.735$ , SE = 2.927, F = 5.547, p = 0.016*					

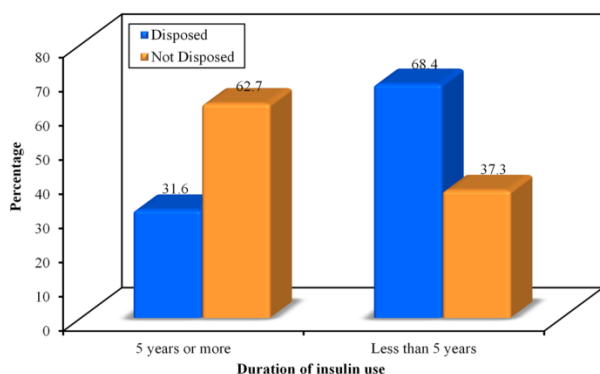
B: Unstandardized Coefficients: represents the amount of change in a dependent variable Y due to a change of 1 unit of independent variable X  
 SE: Estimates Standard error                      Beta: Standardized Coefficients                      t: t-test of significance  
 F, p: f and p values for the model                      R: coefficient of regression                      R<sup>2</sup>: Coefficient of determination

#### 4.4.3. Factors contributing to sharps waste disposal at a health care facility

The univariate logistic regression analysis for the parameters affecting sharps disposal at health care facilities. Several criteria were investigated to discover which of them were related to approved sharps disposal methods (sharp waste disposal at health care facility). Shorter duration of insulin use with odds ratio 3.648 (1.355 – 9.822) and p-value 0.013, good knowledge score with odds ratio 3.897 (1.269 – 11.965) and p-value 0.011, previous advice from health care workers with odds ratio 40.0 (13.778–116.129) p-value <0.001, previous advice from family/friends with odds ratio 18.256 (5.655 – 58.934) and p-value <0.001, attitude with odds ratio 0.849 (0.743 – 0.971) and p-value 0.013, and none using insulin outside the house with odds ratio 2.990 (1.149 – 7.780) and p-value 0.019.

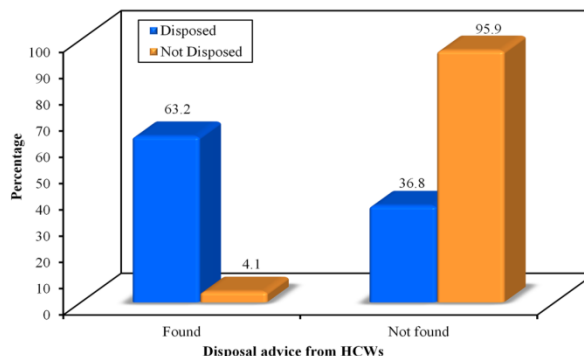
A substantial link was found in this study between the length of insulin use and a sharp return to healthcare facilities. Patients who had been on insulin for less than five years had 3.65 times the odds of disposing of sharps waste in health care settings, as compared to those who are using it for more than five years (Figure 3).

Regarding the knowledge score, it was found that participants who had good knowledge scores had about 4 times the odds of having accepted disposal practice (Sharps disposal in medical facilities ) as compared to those who had fair and poor knowledge. Moreover, it was found that patients who received advice from HCWs and family/friends had 40 and 18.256 times respectively the odds of returning their sharps in medical contexts, against those who did not receive any advice (Figures 4). On the other hand, it was found that patients who did not use insulin outside the house had 2.990 times the odds of returning sharps in health-care settings, as compared to those who used it.



**Figure 3: Relation between disposal practice at a health care facility and duration of insulin use (n = 384)**

(El Horrara and Louran diabetic centers, 2019).



**Figure 4: Relation between disposal practice at a health care facility and disposal advice from HCWs (n = 384) (El Horrara and Louran diabetic centers, 2019).**

Multiple logistic regression analysis was done to determine parameters predicting sharps disposal at health care facilities. It was found that high knowledge score, disposal advice from Health Care Workers (HCWs), and not using insulin outside the house are significantly predicted good disposal practice at health care facilities with odds ratio 1.529 (0.315 – 7.429), 19.838 (4.729 – 83.21), and 3.989 (1.093 – 14.56) respectively. The adjusted odds of sharps disposal at health care facilities among participants who had a good knowledge score were about 1.5 times compared to those who had a fair and poor score. The adjusted odds of disposal sharps at health care facilities among those who received disposal advice from HCWs were 19.8 times compared to the odds of those who did not receive any advice. The adjusted odds of sharps disposal in health-care settings among participants who didn't use insulin outside the house were 3.99 times compared to the odds of those who used it.

## V. DISCUSSION

In the current study, the mean knowledge score was  $7.17 \pm 2.21$  corresponding to a fair level of knowledge which is aligned with the Philippine study, it was found that the mean knowledge score was  $6.22 \pm 1.57$ , corresponding to a fair level of knowledge [5]. In the present study, the mean attitude score was  $3.682 \pm 0.87$  which represented a positive attitude which is parallel with the Philippine study where the mean attitude score was  $3.90 \pm 0.58$ . The participants had a highly positive attitude toward 3 concepts first one was a willingness to dispose of sharps correctly and learn proper disposal while in the Philippine study it was positive, this implied that if the authority implement accessible community sharps disposal program, the majority of diabetic patients will utilize it to dispose of their sharps as they have a well to do it, the second concept was the desire to prevent needle stick injury, and the third one was the belief that improper sharps disposal is a serious problem which was parallel to Philippine study. Besides, the respondents had a positive attitude toward two concepts, the first one is the responsibility for needle stick injuries and the second one is the fear or embarrassment in asking physicians

about proper disposal which was compatible with the Philippine study [5].

**Table 6: Multiple logistic regression analysis for the parameters predicting sharps disposal at health care facilities**

(n = 384) (El Horraya and Louran diabetic centers, 2019).

Parameters affecting disposal at health care facilities	Multivariate logistic regression				
	B	S.E.	Wald (df)	p	OR (95% C.I)
Duration of insulin use	-0.963	0.607	2.518 (1)	0.113	0.382 (0.116 – 1.254)
Knowledge score	0.425	0.806	3.767 (1)	0.024*	1.529 (0.315 – 7.429)
Disposal advice from HCWs	2.988	0.732	16.678 (1)	<0.001*	19.838 (4.729 – 83.21)
Disposal advice from family/friends	0.943	0.971	0.943 (1)	0.331	2.567 (0.383 – 17.21)
Attitude	0.092	0.098	0.883 (1)	0.347	1.097 (0.905 – 1.329)
Not using insulin outside the house	1.384	0.661	4.386 (1)	0.036*	3.989 (1.093 – 14.56)

OR: Odds ratio

df: Degree of Freedom

C.I: Confidence interval

LL: Lower limit

UL: Upper Limit

\*: Statistically significant at  $p \leq 0.0$

The present study showed that the most popular way to get rid of leftover insulin needles and syringes was to throw them in household garbage (94%). This may be because there is no sharp community disposal scheme in Egypt. This finding was consistent with a study in South Africa where over 97% of the study population discarded their sharps inappropriately [7] and higher than that in India and Pakistan studies where 84.4% and 86% of participants with diabetes used the household garbage bin to dispose of their sharps respectively [8, 9]. Furthermore, it was higher than that of a study done in Banha, Egypt, where (83%) of respondents disposed of injections of sharps into the household garbage [10]. However, this was in contrast to a study conducted in Stafford, where only 35.1% of participants disposed their lancets and syringes into the household garbage bin, and another study carried out in Virginian and France were 50% and 49.9% of the study population disposed their lancets into the household garbage [11, 12]. While in the USA study it was found that (59%) of participants disposed of their sharps correctly and 41% disposed of their sharps incorrectly [13]. Concerning sharps disposal practices, it was found that 64.3% of the participants did not use any container before disposing of sharps; which could increase the risk of infection; 32.8% used plastic bags, 1.6% used bottles, 0.8 used detergent plastic bottles, and 0.5% only used sharps bins.

In our study, only 19 (4.9%) of patients disposed of their sharps at health care facilities; this trend was similar to previous studies in other developing countries such as the Philippines and Africa, where only 2.0% of diabetic patients disposed of sharps at health care facilities [5, 7]. However, our findings were lower than those of a Malaysian study, in which only 35 (11.5 percent) of 304 respondents were able to dispose of their used sharps at a health care facility, such as a health clinic or a hospital. The majority of patients who disposed of their sharps in a health care facility in the current study did not use suitable containers to hold their sharps, only 10.5% of them used sharp bin while the highest percentage (42.1%) used plastic bags, 15.8% used detergent plastic bottles, and lastly (31.6%) used bottles, most likely

because these products were readily available and simple to locate in their home. It was found that only (7%) of the participants reported receiving instructions on sharps disposal. However, about 70% of them have practiced correctly. This finding was in contrast with the Philippine study, where more than half of the respondents (59.7%) reported having received advice regarding sharps disposal [5]. Furthermore, it was found in the UK study that (64.6%) of patients received advice regarding sharps disposal [12]. In the present study, the source of information was the doctor for only one patient representing (3.6%), nurse for five patients (17.9%), a lab technician for only one patient representing (3.6%), a pharmacist for seven patients (25.0%) and lastly family member for 13 patients representing (46.4%), this was in contrast to Ethiopian study where 72.5% cited doctors, 18.1% cited nurses, and none of them cited pharmacist and to Filipino study where lower than half (48.5%) of participants cited doctors as the most common source of advice followed by nurses (21.6%) and family members (13.4%) [5].

So in the current study, 46.4% of the participants considered family members as a major source of advice while a study held in Virginia in 2010 reported that pharmacists (40.0%) were cited as the primary source of information [14]. In contrast, in Pakistan, approximately half of the patients (49.7%; n = 185) reported that they had been educated by their physicians about the disposal of used syringes, lancets, and needles [9].

The study showed that only 13 (3.4%) patients reported having a history of needle stick injury to other household members. Interestingly, six (46.1%) patients share their syringes and insulin pens with their husbands or wives. Therefore, this can explain the reasons for the high percentage of 15.4% of Hepatitis C Virus among diabetic patients who are using insulin for their treatment. However, in the Philippine study, it was found that only 1 (0.77 %) of participants had a history of needle stick injury to other people [5].

Regarding **factors influencing knowledge**, we found that respondents who had a university education and postgraduate certificates have a good mean knowledge



score of  $8.53 \pm 1.53$  and  $9.64 \pm 0.20$ , respectively which was consistent with the Ethiopian study. This could be because they had a better opportunity to obtain information through courses and social media than illiterate people [6]. A South African study, on the other hand, found no significant connections between education level and proper disposal of insulin injection waste. [15].

This study exhibited a significant difference in knowledge among urban and rural residents toward insulin injection waste disposal. It was found that the urban residents had a mean knowledge score of  $7.36 \pm 2.22$  higher than that of the rural and slum area residents who had a score of  $6.80 \pm 1.40$  and  $6.52 \pm 2.15$  respectively with  $p = 0.001$ . This finding was in line with the Ethiopian study, which used the same knowledge score system, it was found that the urban and rural residents had a mean score of  $8.88 (0.54)$ ,  $p = 0.001$ , and  $6.81 (0.86)$ ,  $p = 0.003$  respectively [6]. This might be due to short contact time for counseling, and the absence of safe disposing options in rural

Regarding **factors influencing attitude**, from stepwise linear regression analysis, the only significant independent factor contributing to a positive prediction to attitude was the occupation. Occupation explained 73.5% of the variation of the attitude score. We found that the employed participants had a more positive prediction attitude than retired and unemployed ones. This finding is aligned with another Egyptian study that reported that the level of education and occupation were significant predictors for attitude score [10].

Regarding **factors contributing to sharps waste disposal at a health care facility**, from univariate logistic regression analysis, significant independent factors associated with sharps waste disposal at health care facilities were identified, one of them was the patients who had insulin use for less than five years had 3.65 times the odds of disposing of sharps at health care facilities, as compared to those who are using it for more than five years which was comparable with Malaysian study where patients with diabetes for less than five years had nearly three times the likelihood of returning sharps to health care institutions than those with diabetes for five years or more, according to the study. [16] and also with Filipino study which reported that a longer duration of insulin use negatively influenced proper disposal with odds ratios 0.904 [5]. It's understandable because long-term medication use and self-management can leave them exhausted and frustrated. As a result, they may begin to overlook diabetic self-care. [17]. Another explanation is that long-term diabetic patients could develop other diseases which can affect their behavior negatively. Other factors such as previous advice from family/friends with an odds ratio of 18.256 (5.655 – 58.934) and  $p$ -value  $<0.001$ , and the attitude with odds ratio 0.849 (0.743 – 0.971) and  $p$ -value 0.013 were also specified. Regarding the use of insulin outside the house, it was found that diabetic patients who did not use insulin outside the house had 2.99 times the odds of

disposing of their sharps in health-care settings compared to those who used it.

Moreover, from multiple logistic regression, it was found that the adjusted odds of disposing of sharps at health care facilities were 19.838 times among those who received advice from health care workers regarding sharps disposal compared to those who did not (Figure 4.3) which reflects the value of health care education. This finding was consistent with previous research, which found that diabetic patients who received advice and were instructed on how to properly use and dispose of sharps were more likely to do so than those who had never been advised. [13, 18]. According to one Malaysian study, diabetic patients who had previously received sharp disposal advice were six times more likely to bring their used sharps to health care facilities to be properly disposed of than those who had never received any advice. [16]. Another study in India discovered that diabetic patients who received sharps disposal information from their physicians were less likely to discard the sharps directly into domestic trash than those who were not informed. [9]. However, this finding was contrasted to a Filipino study, which concluded that advice did not affect sharps disposal [5].

Furthermore, the relation between knowledge score and disposal practice at healthcare facilities with an odds ratio of 1.529 (0.315 – 7.429) and  $p$ -value of 0.026 implied that participants with good knowledge scores had about 1.5 times the odds of disposing of sharps at healthcare facilities compared to those who had fair and poor knowledge scores, this finding was compatible with a Malaysian study where it revealed that knowledge is one of the required components for safe sharp disposal behavior [16].

In the current study, the participants had shown a positive attitude and appeared to have fair knowledge towards the correct disposal of insulin syringes and needles. Despite this, only 4.9% were assessed to have proper disposal techniques. This implies that a good attitude and knowledge by itself does not necessarily translate to action. Therefore, patients may have a knowledge background and are ready to engage in behavior, but they require momentum to implement them, in particular, education on the correct disposal.

### Study Limitation

The study contains various limitations that should be considered when evaluating the findings. Because this study was limited to two diabetic clinics of HIO, Alexandria, which introduced free and subsidized health care services, the findings on insulin injection waste disposal may not be indicative of all Egyptian diabetic patients. Furthermore, the age category was restricted to adults exclusively. Moreover, the study design was cross-sectional and depended on self-reported assessment which resulted in under- or over-reporting which might potentially arise a recall bias, this could have an impact on the study's internal validity. Another threat to this

study's internal validity was the possibility of interviewer bias.

To reduce the impact of interviewer bias in this study, the researcher mostly administered the interviewer-guided questionnaire, and each respondent had a standardized interview to ensure that differences in responses were not due to the interviewer's conduct. . Despite these limitations, this study highlights the problem of diabetes patients disposing of sharps from the standpoints of the environment and public health, and it provides important local data on sharp handling and disposal in a community setting. Such information could provide evidence and direction for authorities and policymakers to take future action on this issue.

## VI. CONCLUSION

Patients of EL Horrara and Louran diabetic centers, Alexandria, Egypt have a positive attitude and fair knowledge about sharps disposal. The majority of patients at both diabetic centers did not practice acceptable sharps disposal methods. Whereas, the percentage of participants who never recap insulin syringes before disposing of them was only 1%). Marital status (single and divorced), occupation (employed and retired), college and postgraduate education, and civilized residence area were associated with a higher mean knowledge score and reached statistical significance. It was found that the employed participants had a more positive attitude than retired and unemployed ones. It was found that the knowledge was fair about the ideal place to keep insulin syringes at home, the way of disposing of sharps outside the house, and the role of the used sharps in transferring infectious diseases like hepatitis. However, 86.7% of the participants considered placing the sharps in a puncture-resistant container as the best way to dispose of them. There was a neutral attitude concept about the responsibility of needle stick injury. The participants had a highly positive attitude toward 3 concepts first one was a readiness to properly dispose of sharps and learn proper disposal, the second concept was the desire to prevent needle stick injury, and the third one was the perception that improper sharps disposal is a serious issue

The most statistically significant and clinically meaningful variable that affects the practice of disposing of sharps at health-care facilities was identified as receiving sharps disposal advice from HCWs. It was found that a huge amount of insulin syringes, insulin pen needles, glucometer lancets, and syringes for other treatments were thrown monthly through household garbage system by the respondents; therefore, we suspect a massive public health problem which implied the necessity to implement a proper community sharps disposal program immediately.

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