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Assessment of Perception on Sharp Waste Management among the Diabetic Patients Attending in a Hospital of Dhaka City

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Abstract

Background: Approximately 16 billion injections are administered globally each year, with nearly half occurring outside medical facilities. Managing diabetes mellitus (DM) involves self-monitoring of blood glucose levels and administering insulin or other injectable medications using devices such as lancets, needles, and syringes, which are categorized as medical sharps. Improper disposal of sharps can lead to needle stick injuries, posing significant public health risks.

Aim: To assess the perception of sharp waste management among diabetic patients.

Methods: A descriptive cross-sectional study was conducted among 202 insulin-dependent diabetic patients attending selected hospitals in Dhaka. Data were collected through face-to-face interviews using a pre-structured questionnaire.

Results: The results showed that 62.4% of the respondents were male and 37.6% were female. A gradual increase in insulin use has been observed among patients with diabetes. It was found that 50% of the participants used the same syringe approximately five times in a month. All respondents disposed of their used syringes directly into general waste bins. The majority of respondents (81% males and 93.5% females) had poor knowledge of proper sharps waste disposal. Among the total respondents, 87.1% reported that they did not receive any instructions on sharps disposal at home. It was also found that only 35.6% of respondents were concerned about the health risks of sharps waste, which is related to self-injury, and 29.7% were unaware of any risk. This study revealed a significant association between the respondents educational level and knowledge of sharp waste management ($p = 0.000^*$).

Conclusion: The study concluded that the majority of the respondents had poor knowledge regarding proper disposal of sharps waste and its health hazards due to lack of education and did not receive any instructions on sharps disposal at home. Awareness programs on the proper disposal of sharps waste are needed in communities for a healthy lifestyle.

Keywords: Perception, Knowledge, Practice, Diabetes, Sharp waste, Management, Disposal.

1. Introduction: The prevalence of diabetes mellitus (DM) is increasing worldwide. The worldwide burden of disease continues to be significantly impacted by diabetes mellitus (Lin X, Xu Y, X P, JingyaXu J, Ding Y, Sun X, et al. Nature. 2020). Diabetes patients are more likely to suffer from a range of serious and life-threatening micro- and macro vascular problems that can increase treatment costs, reduce quality of life and even increase mortality (Baena-Díez JM, Peñafiel J, Subirana I, Ramos R, Elosua R, Marín-Ibañez A, et al. Diabetes Care. 2016). According to the International Diabetes Federation (IDF), 700 million adults will have diabetes worldwide by 2045, up from an estimated 463 million in 2019 (Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Diabetes Research and Clinical Practice. 2019). Ninety-nine percent (99%) of people with diabetes live in low- and middle-income countries (low-income countries). It is estimated that there will be 153 million cases of diabetes in Southeast Asian countries by 2045, up from 88 million in 2019. In Bangladesh, 8.4 million adults had diabetes in 2019, a number that is expected to almost double (15.0 million) by 2045.It is also estimated that in2019, 3.8 million people had prediabetes in Bangladesh. (International Diabetes Federation (IDF) Diabetes Atlas, 9th edition. Brussels. Belgium: 2019).

Self-care is essential for controlling diabetes and maintaining optimal blood sugar levels. These include the self-administration of insulin and/or self-monitoring of blood glucose (SMBG). (Majumdar A, Sahoo J, Roy G, Kamalanathan S, 2015).Treating chronic diabetes requires regular blood tests and insulin injection at home. Thousands of used sharp wastes and potentially infectious wastes generated daily by diabetes patients in their home environments must be properly disposed of (World Health Organization). The Global Diabetes Compact: What You Need to Know (Geneva, 2021). The disposal of sharps waste that is generated in the community has been recognized as an area of public health and environmental health concern (Jansen KE, Kocks DJ, Roberts H.2020).

People living with diabetes inject insulin and measure blood as part of their daily life (World Health Organization, 2016; American Diabetes Association, 2015; Majumdar, Sahoo, Roy, & Kamalanathan, 2015).On average, a person with diabetes who takes insulin requires two or more injections per day. This means at least two syringes per person per day if syringes are not reused, in addition to the lancets used to test blood glucose (Ogle et al., 2017; American Diabetes Association, 2015; Coustan, 2013).

Each year, approximately 7.5 billion syringes and needles are used by patients suffering from diabetes, migraines, infertility, arthritis, human immunodeficiency virus (HIV), and other illnesses. Sharps waste, such as needles, scalpels, and disposable blades, accounts for 1% of all waste and is a major source of disease transmission if not disposed of properly. Improper disposal of these sharp, highly polluting materials can cause injuries to people and pets and contaminate water sources and agricultural land (Gold, 2011). Improperly disposed of sharps waste is a problem for society as it can put people's health at risk of injury and infection with blood-borne infectious diseases such as HIV, acquired immunodeficiency syndrome (AIDS) and viral hepatitis(Sharif SI, Al Sha'rawy M, Mhithawi H, Alketbi A, Sharif RS, Rashrash M, 2018). Different countries have implemented many policies and programs to regulate the proper disposal of sharps used by diabetic patients at home. The U.S. The Department of Health and Human Services recommends distributing biohazard boxes to patients; the boxes can be returned to the pharmacy or picked up locally. (Markkanen et al., 2015; U.S. Department of Health and Human Services (2016). In developing countries such as Sri Lanka, India, and Ethiopia, where there are insufficient safes, hard plastic bottles are used to contain sharp objects and then

discarded in local hospitals (Atukorala, Su,manasekera & R., Sumanasekera, R. D., Wickramasinghe, K. H., &Wickramasinghe, S. I. (2016).Many studies has shown that most people throw used syringes in household trash, into the toilet, on the street or in the forest if there is no safe available areas (Ishtiaq, O., Qadri, A. M., Mehar, S., Gondal, G. M., Iqbal, T., Ali, S.Janjua. (2012).

2. Methodology: This was a descriptive, observational, cross-sectional study. The study was conducted among insulin-requiring type1 and type 2 diabetes mellitus adult patients who visited BIHS General Hospital, Dhaka, Bangladesh, and were willing to participate in the study. Participants with gestational diabetes mellitus, poor visual acuity, and incomplete questionnaire responses were excluded.

The sample size was calculated using the standard formula for estimating proportions ($n= Z^2pq/d^2$). Based on the reference of Abebe et al. (2016), 49.5% of diabetic patients using insulin had poor knowledge (primary outcome) of sharps waste disposal. (B. M. Abebe, B. M. Gebresillassie, D. A. Erku, K. Taye Haile, and E. M. Birru, "Knowledge and SelfReported Practice of Insulin Injection Device Disposal among Diabetes Patients in Gondar Town, Ethiopia: A Cross-Sectional Study," J. Diabetes Res., Vol. 2016, No., p. 1897517. 2016); The calculated sample size was 323; however, due to the availability of study participants, a total of 202 were included. Data were collected using an interviewer-administered, pretested, and validated questionnaire to assess participants knowledge, attitudes, and practices (KAP). It covered respondents socio-economic profiles, knowledge, and practice of sharp waste management and disposal among the study population. The questions were designed in simple language to ensure clarity and were provided in English and Bangla. Verbal informed consent was obtained from the respondents who agreed to participate, and their confidentiality was assured.

The collected data were recorded in MS Excel and analyzed using SPSS. Descriptive statistics were used to observe KAP levels using frequencies and percentages. To determine the associations between variables, a chi-square test with a p-value of <0.05 was considered significant. To analyze the knowledge score, all the correct answers of the knowledge-related questions were scored, which carried 1 mark, and each wrong answer and non-responded answer carried 0 marks and were aggregated. Subsequently, the scores were transformed into percentages. Respondents with > 80% correct answers were assigned good knowledge, those with 41-60% were assigned average knowledge, and those with less than 40% were assigned poor knowledge.

3. Results: In this study, the majorities (62.4 %) were male, and the rest (37.6 %) were female. Among the respondents, the highest frequency of respondents, that is 42.6% were in the age group of above 60 years. This was followed by 31.7% who were within 51–60 years and 5% were in the age group of 41-50 years, while 3% were in the age group of 20-30 years. The mean age was 57.92±11.12 years. The educational qualifications of the respondents, that is, 37.6% were completed primary level, followed by 41.5% completed secondary or above level, 17.8% completed graduation or above level and rest 2.9% were illiterate. In this study, it was also shown that the majority of the respondents (29%) were housewives, followed by businessmen (26%). Among the total respondents, 72.2% lived in a joint family and 22.8% lived in a nuclear family.

Table 1: Socio-demographic characteristics of the respondents

Characters		Frequency (n=202)	Percent (%)
Gender	Male	126	62.4
	Female	76	37.6
Age group	20-30	6	3.0
	31-40	10	5.0
	41-50	36	17.8
	51-60	64	31.7
	Above 60	86	42.6
Academic qualification	Illiterate	5	2.97
	Primary	76	37.6
	Secondary or above	85	41.5
	Graduation or above	36	17.8
Occupation	Govt. Service	8	4.0
	Private Service	32	15.8
	Business	55	27.2
	Agriculture	22	10.9
	Housewife	60	29.7
	Unemployed	8	4.0
	Retired	17	8.4
Family type	Joint family	156	77.2
	Nuclear family	46	22.8

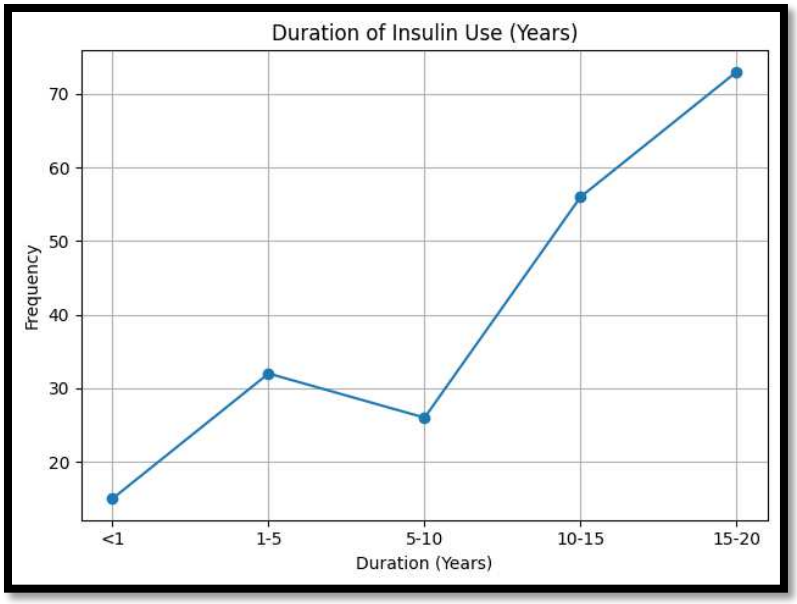


Figure 1: Duration of insulin use among the participants

Figure 1 shows the distribution of participants according to their duration of insulin use. Overall, a gradual increase was observed. Specifically, the lowest proportion of participants (7.4 %, n = 15) had been using insulin for less than 1 year. This number increased by 15.8% (n=32) in the 1–5 year, followed by a slight decline of 12.8 % (n=26) in the 5–10 year category. Thereafter, a marked rise was observed, with 27.8% (n=56) of participants in the 10–15 year group, and the highest frequency recorded among those using insulin for 15–20 years was 36.2% (n=73).

Table 2: Distribution of respondents by use of insulin format

Insulin format	Frequency	Percent
Insulin vial	34	16.8
Insulin pen	62	30.7
Both	106	52.5
Total	**202**	**100.0**

In Table 2, 16.8% of respondents mentioned that they used insulin vials, 30.7% mentioned insulin pens and 52.5% mentioned that they used both formats.

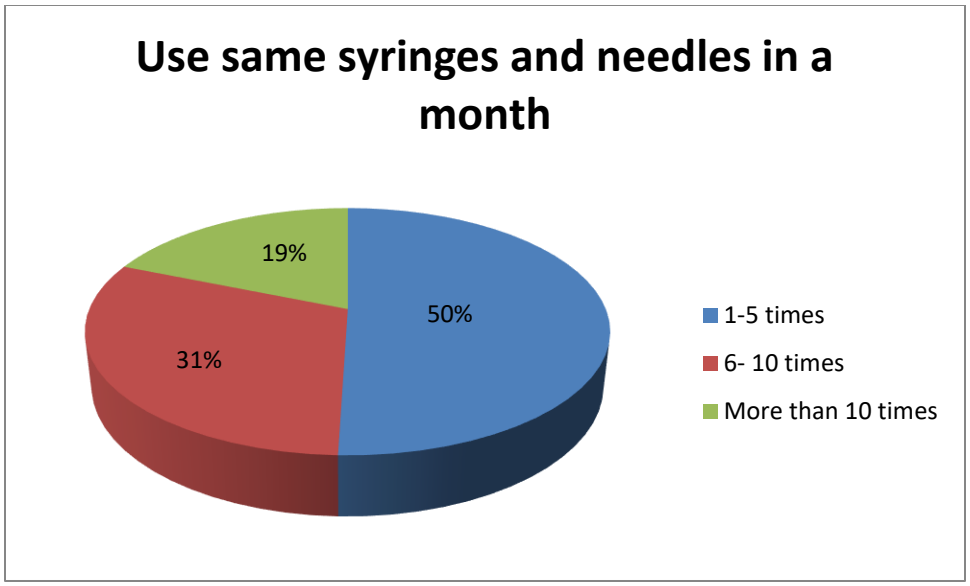


Figure 2: Distribution of respondents by use same syringes and needles in a month

Figure 2 shows that among the total respondents, 50% are using same syringes 1 to 5 times in a month and 19% use same syringe more than 10 times in a month.

Table 3: Distribution of respondents by dispose used syringes

	Frequency	Percent
Directly dispose used syringes into the general waste bin	**202**	**100.0**
Total	**202**	**100**

Table 3 reveals that 100% of the respondents disposed their used syringes directly into the general waste bin.

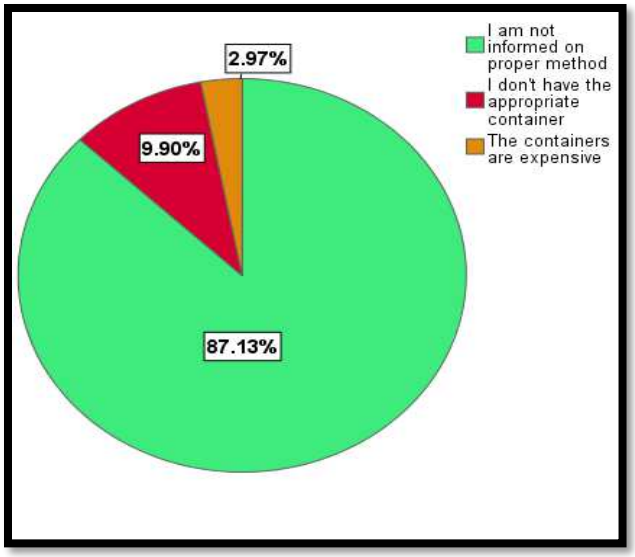


Figure 3: Main challenges faced in disposing the used syringes and needles at home

In figure 3, illustration the main challenges faced in disposing the used syringes and needles at home. Among the respondents 87.1% said that they did not informed about the proper method for dispose the used syringes and needles at home.

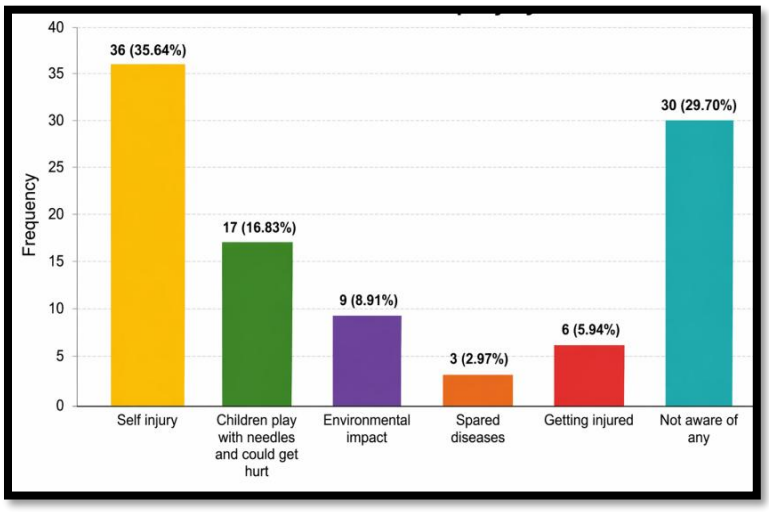


Figure 4: Perceptions of the risks associated with sharps waste

Figure 4 represent the perceptions of the risks associated with sharps waste are 35.6% mentioned about self-injury followed by 16.8% think children play with needles and could get hurt, 8.9% mentioned about environmental impact, 2.9% about spared diseases, 5.9% getting injured and 29.7% did not aware of any risk.

Table 4: Distribution of respondents by knowledge towards sharp waste management

SL No.	Knowledge related questions	Yes	No	Not sure	Total
1	Sharp waste produced due to insulin use at home is infectious	156 (77.2%)	12 (5.9%)	34 (16.8%)	202 (100%)
2	Sharp wastes are harmful for our environment	114 (56.4%)	42 (20.8%)	46 (22.8%)	202 (100%)
3	Agricultural products can be toxic due to disposal of sharp waste like needles, syringes, lancets etc.	24 (11.9%)	102 (50.5%)	76 (37.6%)	202 (100%)
4	One can reuse needles and lancets if they are still sharp and clean	66 (32.6%)	104 (51.6%)	32 (15.8%)	202 (100%)
5	The needles and lancets can be cleaned by spirit /hexisol and reused	160 (79.2%)	20 (9.9%)	22 (10.9%)	202 (100%)
6	Lancets and needle should be recapped after use and before throwing away in bin	28 (13.9%)	170 (84.2%)	4 (2%)	202 (100%)
7	Sharps like needles and lancets can cause injury if disposed in public places like parks, streets etc.	154 (76.2%)	42 (20.8%)	6 (3%)	202 (100%)
8	The sharps in household waste can be cause injury to rag pickers and garbage handlers	146 (72.3%)	44 (21.8%)	12 (5.9%)	202 (100%)
9	Used needles and syringes can be misused by rag pickers	60 (29.7%)	112 (55.4%)	30 (14.9%)	202 (100%)
10	Sharps like needles can be recycled like plastics	54 (26.7%)	80 (39.6%)	68 (33.7%)	202 (100%)

Table 4 exposes the knowledge on sharp waste management. Participants demonstrated moderate awareness of direct risks, with 77.2% recognizing sharps as infectious and 76.2% aware of injury risk from improper disposal, while 72.3% acknowledged risks to waste handlers. However, misconceptions were significant regarding 79.2% believed sharps could be disinfected and reused, 32.6% supported reuse if clean, and only 11.9% recognized environmental/agricultural toxicity.

Table 6: Distribution of respondents by overall score of knowledge levels on sharp waste management

Respondents	Score of overall knowledge level			Total
	1-40	41-80	81-100	
	(Poor)	(Average)	(Good)	
Meal	102 (81%)	24 (19%)	-	126 (100%)
Female	71 (93.5%)	5 (6.5%)	-	76 (100%)

Table 6 shows the scoring of knowledge level of the respondents. It shows that 81% meal and 93.5% female had poor knowledge level while among the male 19% and 6.5% female had average and on one had score any good level of knowledge on sharp waste management.

Table 7: Association between educational status and knowledge level of participants on sharp waste management

Association between educational status and knowledge level of participants on sharp waste management					
Education	**Score of overall knowledge level**			**Total n (%)**	**P-Value**
	0-40	**41-80**	**81-100**		
	(Poor) n (%)	**(Average) n (%)**	**(Good) n (%)**		
Illiterate	6 (100%)	-	-	6 (100%)	0.000*
Primary	74.8 (98.5%)	1.2 (1.5%)	-	76(100%)	
Secondary	71.8 (85.5%)	12.2(14.5%)	-	84 (100%)	
Graduation or above	8 (24%)	28 (76%)	-	36 (100%)	
	Total			202 (100%)	

The above analysis shows a strong and statistically significant association between educational status and knowledge on sharp waste management ($p = 0.000$). Participants with no formal education had entirely poor knowledge (100%). Similarly, those with primary (98.5%) and secondary education (85.5%) mostly demonstrated poor knowledge, with only a small proportion having average knowledge. In contrast, participants with graduation or higher education showed markedly better understanding, with 76% having average knowledge and only 24% falling into the poor category. No respondents achieved a “good” knowledge score.

4. Discussion: This study assessed the knowledge and self-reported practice of diabetes patients toward insulin injection device disposal and associated factors. The issue of insulin injection device like syringes and needle disposal has not been widely before. Syringe disposal without effective waste disposal system opens a new portal of transmission of blood borne pathogen from patients to general community and also impact on the environment (Basazn Mekuria A, et al. 2016). Disposal of used injection equipment at open place could increase the risk of transmission to children, who play with syringes and get pricked, and results in transmission of blood-borne infection like HIV, HBV, and HCV in the community (O. Ishtiaq, et al., 2012). In this study 16% respondents mentioned they use insulin vial, 30% mentioned insulin pen and 52% mentioned both format.

This study showed that among the total respondents 50% are use same syringes 1 to 5 times in a month and 19% use same syringe more than 10 times in a month.

In the current study 100% of the respondents disposed their used syringes directly into the general waste bin. This finding was consistent with a study in South Africa where over 97% of the study population discarded their sharps inappropriately (D. Govender and A. Ross, 2012) 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 (A. P. Singh and R. S. Chapman, 2011, O. Ishtiaq, et al., 2012). 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 (M. F. El Gendi, et al.2017).

It was found that 87% of the participants reported they did not receive any instructions on sharps disposal at home. 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 (L. Quiwa and C. Jimeno, 2014). Furthermore, it was found in the UK study that 64.6% of patients received advice regarding sharps disposal (B. Olowokure, H. Duggal, and L. Armitage, 2003). This study revealed the perceptions of the risks associated with sharps waste are 35.6% mentioned about self-injury followed by 16.8% children play with needles and could get hurt, 8.9% environmental impact, 2.9% spared diseases, 5.9% getting injured and 29.7% did not aware of any risk.

Participants demonstrated moderate awareness of direct risks, with 77.2% recognizing sharps as infectious and 76.2% aware of injury risk from improper disposal, while 72.3% acknowledged risks to waste handlers. However, misconceptions were significant regarding 79.2% believed sharps could be disinfected and reused, 32.6% supported reuse if clean, and only 11.9% recognized environmental/agricultural toxicity. Overall, the findings indicate inadequate comprehensive knowledge and a need for targeted education.

In the current study, majority of the participants had inadequate knowledge of sharp waste disposal. It showed that 81% meal and 93.5% female had poor knowledge level while among the male 19% and 6.5% female had average and on one had score any good level of knowledge on sharp waste management and its impact on environment. However, which is aligned the studies reported from India and Gondar town in Ethiopia (Basazn Mekuria A, et al. 2016).

This study exhibited a significant association between the educational levels of respondents and knowledge on sharp waste management. (p-value=.000*). This finding is aligned with another Egyptian study that reported that the level of education and occupation was significant predictors for attitude score (M. F. El Gendi, et al.2017).

5. Conclusion and Recommendations:

This research showed insufficient understanding and unsafe self-reported behaviors concerning the disposal of insulin injection devices among individuals with diabetes. The incorrect disposal of used sharps was widespread, with all participants indicating they tossed used syringes into regular household trash, putting the community, waste workers, and the environment at risk of potential dangers. The reuse of syringes was prevalent as well, significantly heightening the risk of harm and blood-borne diseases. Participants demonstrated some understanding of the immediate dangers linked to sharps waste, yet significant misunderstandings and a lack of thorough knowledge about safe disposal methods were apparent.

A significant number of respondents demonstrated a lack of understanding about sharps waste management, and the majority had never been provided with guidance on appropriate disposal methods, underscoring critical deficiencies in patient education and counseling. Educational attainment revealed a noteworthy connection with knowledge level, suggesting that education is crucial for enhancing awareness and behaviors.

The results highlight the immediate requirement for focused health education, patient guidance during insulin treatment, and the creation of suitable community-oriented sharps disposal protocols and systems to encourage safe disposal methods and lessen public health and environmental hazards.

Data availability:

The data supporting the findings of this study are available from the corresponding author upon reasonable request. However, access to the data is restricted due to ethical or privacy-related considerations.

Author contributions:

I.J. led the research work, developed the study concept and methodology, collected and curated data from the study participants, performed statistical analysis, created tables and figures, and wrote the original manuscript draft.

M.R.A. validated the study tool, supervised the research process, provided academic resources, and reviewed the manuscript with critical input.

A.M.S. contributed to, literature review and manuscript preparation for important intellectual content.

M.M.R. contributed to assist in data collection and data interpretation.

A.K.M.S.A. contributed to methodological refinement, supervised the research activities, and critically revised the manuscript.

M.J.A.S. provided technical guidance in study implementation, contributed to interpretation of findings, and reviewed and edited the manuscript.

S.A.A. contributed to overall supervision, provided expert guidance on research quality and manuscript development, and critically reviewed and approved the final manuscript.

All authors read and approved the final manuscript.

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Ethical approval and consent to participate:

Ethical approval for this study was obtained from the Ethical Review Committee (ERC) of the Bangladesh University of Health Science (BUHS) (BUHS/ERC/EA/22/41(1)). Throughout the research process, participant's privacy and confidentiality were strictly maintained. Verbal Informed consent was obtained from all individual participants included in the study.

Consent for publication: Not applicable.

Competing interests: The authors declare no competing interests.

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