

Knowledge And Practices Regarding Disposal of Diabetes-Related Biomedical Waste Among Households A Cross-Sectional Survey

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Abstract—Diabetes management at the household level generates biomedical waste such as insulin syringes, needles, lancets, and blood glucose monitoring materials. Improper disposal of these wastes may lead to needle-stick injuries, infections, and environmental hazards. Despite the increasing burden of diabetes, limited attention has been given to household-level knowledge and practices related to the disposal of diabetes-associated biomedical waste.

A community-based cross-sectional survey was conducted among households using a structured questionnaire to assess awareness and disposal practices of diabetes-related biomedical waste. The results indicated that although many respondents were aware of biomedical waste, unsafe disposal methods, including disposal with routine household garbage, were commonly practiced. Lack of guidance from healthcare professionals was frequently reported; however, most participants showed a positive willingness to follow proper disposal methods if adequate training and instructions were provided. The study emphasizes the need for targeted educational interventions to improve safe biomedical waste management at the household level.

Index Terms—Diabetes mellitus; Biomedical waste management; Household waste disposal; Sharps waste; Public awareness.

I. INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disease brought on by either the body's decreased sensitivity to insulin or an inherited or acquired pancreatic insufficiency that results in type I DM. causes diabetes type 2. This raises blood glucose levels, which can damage the body's organs and systems, especially the

blood vessels and neurons. Currently, 12% of the world's population, more than 830 million people, have diabetes.

Insulin injections are frequently required at home for people with diabetes, especially those with type 1 and some with type 2. This results in the production of sharp waste, including spent lancets, syringes, and insulin pens. In order to control their blood sugar levels, many patients also self-monitor, which increases the quantity of sharp waste generated. It is crucial to dispose of these sharps properly and safely given the increasing number of people with diabetes. Maintaining blood glucose levels at target levels and managing diabetes need self-care. In addition to using oral medications and insulin injections, managing diabetes necessitates routine blood glucose monitoring. Insulin is essential for managing diabetes, and efficient blood sugar control depends on using the right injection strategies.

Diabetes frequently necessitates lifelong monitoring and treatment, including medication, insulin injections, and self-monitoring blood glucose (SMBG). Because of this, diabetes patients regularly use medical devices in their daily lives, particularly in homes, such as syringes, insulin pens, pen needles, lancets, and glucometer test strips.

After usage, these devices become biomedical waste (BMW), especially contaminated materials and sharps, which can be extremely dangerous to one's health if improperly handled or disposed of. Needlestick injuries, the spread of infectious illnesses including HIV, Hepatitis B, and Hepatitis C, and

environmental contamination can result from improper disposal, such as tossing discarded syringes and lancets in the trash. Household-level biomedical waste management is frequently unregulated and ignored, in contrast to healthcare institutions, where biomedical waste is separated and managed according to clear criteria.

The production of diabetes-related biomedical waste at the household level has dramatically increased due to the rising incidence of diabetes worldwide, especially in India, where the disease burden is very high. However, patients' and caregivers' knowledge of appropriate waste segregation, storage, and disposal procedures is still lacking. This circumstance emphasizes the critical necessity to evaluate current procedures and knowledge gaps in order to guarantee the safe processing and disposal of such waste. These wastes are disposed of alongside regular residential waste, which could expose waste handlers and contaminate the environment. The issue is further made worse by the lack of explicit community-level gathering methods or public education initiatives.

Thus, the purpose of this study is to evaluate diabetic patients' and their caregivers' knowledge, attitudes, and practices (KAP) with relation to the handling of biomedical waste produced by at-home diabetes care. Finding important areas for assistance will be made easier with an understanding of their awareness level, present disposal practices, and related difficulties. The results of this study can offer important information for creating waste management plans, regulatory changes, and public health education initiatives that encourage safe disposal methods at the local level.

II. METHODOLOGY

A. Study Design

The present study employed a cross-sectional observational survey design to assess the knowledge, attitude, and practices (KAP) related to diabetes-associated biomedical waste management at the household level. This design was selected as it allows the collection of data from a defined population at a single point in time, providing a snapshot of existing awareness and practices among diabetic patients and caregivers.

B. Study Setting and Population

The study was conducted in Kerala among households where diabetes-related biomedical waste is generated. Data were collected from different areas across the districts to ensure adequate representation from both urban and rural regions. The study population included diabetic patients and household members who handle instruments used by diabetic patients, such as syringes, insulin pens, and glucometers. These participants were selected as they are directly or indirectly involved in the generation and disposal of diabetes-related biomedical waste at the household level. A total of 100 respondents from various parts of the district participated in the study, providing a comprehensive understanding of the knowledge, attitude, and practices related to diabetes-associated biomedical waste management in the community.

C. Study Instrument

Data were collected using a semi-structured questionnaire designed to evaluate knowledge, attitude, and practices related to biomedical waste management related to diabetes patients. The questionnaire consisted of 13 items, divided into two sections:

- **Section A: Demographic Information** This section collected background details such as age, gender, occupation etc. These variables were included to analyze how socio-demographic factors influence the knowledge, attitude, and practices related to diabetes-associated biomedical waste management.
- **Section B: Knowledge, Attitude, and Practice (KAP) Items:** Section B of the questionnaire assessed the respondents' knowledge, attitude, and practices related to diabetes-associated biomedical waste management. Data were collected using a structured questionnaire consisting of 13 questions. These questions were designed to evaluate the respondents' awareness about proper waste disposal methods, their attitudes toward safe handling practices, and the actual practices followed at the household level.

The questionnaire was developed after an extensive literature review of existing tools and research studies on biomedical waste management. The instrument was subsequently validated by subject experts from the Department of Pharmacy Practice and by the research

guide to ensure content validity, clarity, and appropriateness to the study objectives.

D. Data Collection Procedure

Data collection was carried out using a Google Form containing the structured questionnaire. The form link was circulated among diabetic patients and their caregivers residing in different parts of the district. Participants were requested to fill out the questionnaire voluntarily after reading the provided instructions and consent statement. This online method was chosen to ensure wider reach, convenience, and safety in data collection across both urban and rural areas. Participants were informed about the purpose and importance of the study, and their consent was obtained prior to participation. Data confidentiality was maintained by anonymizing the collected responses and securely storing the completed forms. Any incomplete or ambiguous responses were excluded from the final dataset to preserve the integrity and reliability of the analysis.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Individuals diagnosed with diabetes residing in Kerala.
- Family members or caregivers who handle instruments used by diabetic patients, such as syringes, insulin pens, or glucometers.
- Participants aged 18 years and above who were willing to participate in the study.
- Respondents who provided informed consent through the Google Form.

Exclusion Criteria

- Individuals not residing in Kerala.
- People without any diabetic patient in their household.
- Participants below 18 years of age.

Respondents who did not give consent or submitted incomplete responses in the questionnaire.

E. Data Processing and Analysis

The collected data were first checked for completeness and consistency. Responses from the Google Form were exported into Microsoft Excel for data cleaning and organization. The cleaned data were then analyzed using descriptive statistics, such as frequency and percentage, to summarize demographic characteristics and responses to knowledge, attitude, and practice

(KAP) questions. The results were presented in the form of tables and charts to provide a clear understanding of the respondents' awareness and practices related to diabetes-associated biomedical waste management.

III. RESULT & DISCUSSION

The cohort was predominantly middle-aged (31–50 years, 35%) with higher female participation (65%). Most respondents were from non-healthcare backgrounds (85%). A majority were patients themselves (85%), and nearly half reported a disease duration exceeding five years (45%), indicating sustained exposure to diabetes-related self-care waste.

A. Demographic Characteristics of Respondents

Table 1. Demographic Profile of Respondents (N = 100)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–30	30	30.0
	31–50	35	35.0
	51–70	30	30.0
	>70	5	5.0
Gender	Female	65	65.0
	Male	35	35.0
Occupation	Healthcare-related	15	15.0
	Non-healthcare	85	85.0
Diabetes Status	Self with diabetes	85	85.0
	Family member with diabetes	15	15.0

Duration of Diabetes	<1 year	25	25.0
	1–5 years	30	30.0
	>5 years	45	45.0

B. Knowledge and Awareness of Biomedical Waste Management.

Table 2. Awareness and Guidance Regarding Biomedical Waste (N = 100)

Item	Response	Frequency (n)	Percentage (%)
Heard the term biomedical waste	Yes	60	60.0
	No	40	40.0
Received professional guidance on disposal	Yes	35	35.0
	No	65	65.0
Willing to follow proper guidelines if trained	Yes	80	80.0
	No/Maybe	20	20.0

Results Narrative. Awareness was moderate (60%), while formal guidance was limited (35%). Despite this, willingness to adopt correct practices following training was high (80%).

C. Disposal Practices for Diabetic Sharps and Consumables

Table 3. Disposal Methods for Diabetic Waste (N = 100)

Practice	Syringes/Needles (%)	Glucometer Strips/Lancets (%)
Household garbage	45	55
Stored separately	30	25
Returned to pharmacy/hospital	15	5
Broken before disposal	10	15

Results Narrative. Disposal into household garbage was the most common method for both sharps and strips. Formal take-back utilization was low, and a non-trivial proportion reported breaking needles prior to disposal.

C. Sharps Containment and Waste Segregation

Table 4. Use and Type of Containers for Sharps Collection (N = 100)

Item	Category	Frequency (n)	Percentage (%)
Use of container	Yes	65	65.0
	No	35	35.0
Type of container used	Plastic bottle	40	40.0
	Cardboard box	20	20.0
	Metal container	25	25.0
	Other	15	15.0

Table 5. Segregation of Medical Waste at Home (N = 100)

Practice	Frequency (n)	Percentage (%)
Always	40	40.0
Sometimes	30	30.0
Never	30	30.0

Results Narrative. While 65% reported using containers, container safety varied. Segregation was inconsistent, with 60% not practicing consistent segregation.

IV. DISCUSSION

This study delineates the landscape of household biomedical waste management among diabetic patients and caregivers in Kerala, revealing critical gaps across knowledge, attitudes, and practices (KAP).

Knowledge, Attitude, Practice Gap- Although willingness to follow guidelines was high (80%), awareness of biomedical waste terminology (60%) and receipt of professional guidance (35%) were limited. This disconnect suggests missed educational opportunities during routine diabetes care, where disposal counselling can be integrated without additional burden.

High-Risk Disposal Behaviours- The predominant disposal of sharps and strips into household garbage (45–55%) poses substantial risks of needlestick injuries and transmission of blood-borne infections. The practice of breaking needles (10–15%) further elevates exposure risk, underscoring the need for explicit guidance discouraging this behaviour.

Containment Without Safety - Container use (65%) reflects intent, yet the use of unsuitable containers (e.g., cardboard boxes) compromises safety. Public messaging must specify puncture-proof, leak-resistant containers and provide practical examples.

Role of Background and Disease Duration - Better practices among healthcare-related respondents highlight the influence of targeted knowledge. Conversely, longer disease duration did not reliably predict safer practices, indicating that experiential learning alone is insufficient without structured education.

Systemic Gaps and Policy Implications- Household biomedical waste remains under-regulated compared

to institutional waste. The absence of standardized take-back systems, subsidized sharps containers, and public campaigns leaves patients to adopt unsafe defaults.

Public Health Impact and Recommendations- Unsafe household disposal burdens municipal systems and endangers workers and communities. A coordinated response should include:

- (i) Mandated disposal counselling in diabetes care.
- (ii) Accessible pharmacy- or clinic-based take-back programs.
- (iii) Community-led awareness initiatives.
- (iv) Clear policy guidance defining responsibilities across the waste lifecycle.

Limitations: Self-reported practices and a single-state sample may limit generalizability. Cross-sectional design precludes causal inference.

Despite positive attitudes, substantial knowledge deficits and hazardous practices persist in household management of diabetes-related biomedical waste. Closing the KAP gap through integrated education, infrastructure, and policy action is imperative to mitigate preventable public health risks.

V. CONCLUSION

This study highlights a critical yet largely overlooked public health issue: the unsafe management of diabetes-related biomedical waste at the household level. Despite the growing burden of diabetes and the routine generation of sharps and contaminated consumables in home settings, the findings demonstrate substantial deficiencies in knowledge, guidance, and safe disposal practices among diabetic patients and their caregivers in Kerala.

Although a majority of respondents had lived with diabetes for several years and routinely handled injection devices and monitoring tools, awareness of biomedical waste concepts and formal disposal guidelines remained inadequate. The low proportion of participants who had received professional instruction on waste management underscores a systemic gap in diabetes care delivery, where clinical management is prioritized while environmental and occupational safety considerations are neglected. Importantly, the high willingness to adopt correct practices if trained indicates that unsafe disposal is not driven by resistance or negligence, but rather by lack of information and accessible infrastructure.

The prevalence of high-risk disposal behaviours—particularly the disposal of sharps and strips in household garbage and the practice of breaking needles before disposal—poses serious risks to household members, sanitation workers, and the wider community. These practices increase the likelihood of needlestick injuries, exposure to blood-borne pathogens, and environmental contamination. While the use of containers for sharps collection suggests some level of risk awareness, the frequent use of inappropriate containers such as cardboard boxes diminishes their protective value and reflects incomplete understanding of safe containment principles. Furthermore, inconsistent segregation of biomedical waste from domestic waste highlights a significant vulnerability in municipal solid waste streams.

The findings also reveal that safer disposal practices are more closely associated with professional healthcare exposure rather than disease duration, emphasizing that experience alone does not translate into safe behaviour. This reinforces the necessity for structured, repeated education rather than passive reliance on patient adaptation over time. At a broader level, the absence of clear household biomedical waste policies, standardized take-back mechanisms, and community-level disposal options contributes to the normalization of unsafe practices.

Addressing this issue requires coordinated action across multiple levels of the healthcare and waste management systems. Integrating biomedical waste disposal education into routine diabetes counselling, ensuring the availability of puncture-proof sharps containers, establishing accessible pharmacy- or clinic-based take-back programs, and implementing clear regulatory guidelines for household biomedical waste are essential steps toward risk reduction. Community health workers and local health authorities can play a pivotal role in translating guidelines into practice through targeted awareness initiatives.

In conclusion, improper household disposal of diabetes-related biomedical waste represents a preventable public health and environmental hazard. By bridging the knowledge–attitude–practice gap through education, infrastructure development, and policy intervention, it is possible to significantly reduce injury risks, protect waste handlers, and promote safer and more sustainable diabetes self-care

practices. Future research should evaluate the effectiveness of structured interventions and policy implementation strategies to ensure long-term behavioural change and system-level impact.

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