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Healthcare Solid Waste Generated by Insulin Therapy Users in Relation to Sociodemographic and Epidemiological Profile

Resíduos Sólidos de Saúde Gerados de Usuários em Insulinoterapia em Relação ao Perfil Sociodemográfico e Epidemiológico

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Abstract

This study aimed to identify the sociodemographic and epidemiological characteristics and their possible associations with the behavior of insulin therapy users regarding the disposal of Healthcare Solid Waste (HSW) generated in the community of Sapezal, MT, Brazil. A quantitative, analytical, and descriptive study was conducted with users registered in Primary Health Care services in the municipality of Sapezal, MT. Data collection was carried out between January and February 2018 using a structured questionnaire addressing sociodemographic and epidemiological information, as well as possible associations with behaviors related to the proper disposal of Healthcare Solid Waste. This study was approved by the Research Ethics Committee (REC), and all participants signed an Informed Consent Form (ICF). Results showed that 48% of participants disposed of HSW in regular household waste, while 52% returned it to health units; 58% reported having received prior guidance on proper disposal, and receiving such guidance was strongly associated with correct disposal (RR = 5.55; $p < 0.001$). Additionally, 24% of participants reported having experienced needlestick accidents. These findings indicate that the absence or presence of proper guidance directly influences the disposal of HSW. Therefore, one strategy to promote correct waste disposal is the development of educational activities or health education interventions targeting the community of insulin therapy users, involving both patients and healthcare professionals. Considering the profile of individuals with low levels of education, it remains a challenge for health professionals to develop strategies aimed at raising awareness among these users, providing clear and easily understandable guidelines

for the proper management of healthcare solid waste generated during insulin use.

Keywords: Primary Health Care. Diabetes Mellitus. Waste Management. Occupational Risks.

Resumo

O estudo teve como objetivo identificar as características sociodemográficas e epidemiológicas e suas possíveis relações com o comportamento de usuários em insulinoterapia em relação ao descarte de Resíduos Sólidos de Saúde (RSS) gerados na comunidade do município de Sapezal-MT. Foi realizado um estudo quantitativo, analítico e descritivo, com usuários cadastrados na Atenção Básica em Saúde no município de Sapezal, MT. A coleta de dados foi realizada entre janeiro e fevereiro de 2018, utilizando-se um formulário com perguntas estruturadas sobre informações sociodemográficas e epidemiológicas, bem como as possíveis relações com o comportamento referente à devolução correta dos Resíduos Sólidos de Saúde. Esta pesquisa foi aprovada pelo Comitê de Ética em Pesquisa (CEP), e todos os participantes assinaram o Termo de Consentimento Livre e Esclarecido (TCLE). Os resultados mostraram que 48% dos participantes descartavam os RSS no lixo doméstico comum, enquanto 52% os devolviam às unidades de saúde; 58% relataram ter recebido orientação prévia sobre o descarte adequado, sendo essa orientação fortemente associada ao descarte correto (RR = 5,55; $p < 0,001$). Além disso, 24% dos participantes relataram já ter sofrido acidentes com perfurocortantes. Esses achados indicam que a ausência ou presença de orientação influencia diretamente o descarte dos RSS. Assim, uma estratégia para auxiliar no descarte correto dos resíduos é o desenvolvimento de atividades educativas ou ações de educação em saúde com a comunidade envolvida na insulinoterapia, sendo necessário envolver tanto os usuários quanto os profissionais de saúde. Levando em consideração o perfil de indivíduos com baixa escolaridade, constitui-se um desafio para os profissionais de saúde desenvolver estratégias que promovam a sensibilização desses usuários, por meio de orientações claras e de fácil compreensão sobre o manejo adequado dos resíduos sólidos de saúde gerados durante o uso da insulinoterapia.

Palavras-chave: Atenção Básica em Saúde. Diabetes Mellitus. Gestão de Resíduos. Riscos Ocupacionais.

1 Introduction

Diabetes Mellitus (DM) is a metabolic disorder of multiple etiologies. It is not considered a single disease, but rather a heterogeneous group of metabolic disorders characterized by elevated blood glucose levels and alterations in carbohydrate, protein, and lipid metabolism. These changes result from defects in insulin secretion and/or action (Brasil, 2014; SBD, 2023).

This metabolic disorder is recognized as a global public health problem. Recent estimates indicate that more than 500 million people worldwide are currently living with diabetes, with projections suggesting that this number will reach 1.3 billion by 2050 (Ong *et al*., 2023).

The International Diabetes Federation (2025) reports that in Central and South America, the prevalence of diabetes was approximately 32 million people in 2021, with projections indicating an increase to around 49 million by 2045. In Brazil, it is estimated that approximately 16.6 million adults (aged 20 to 79 years) were living with diabetes in 2024, corresponding to a prevalence of 10.6% of the adult population. In this context, the country remains among the top ten worldwide in absolute number of cases, highlighting the magnitude of the problem and the need for more robust public health policies to address it.

This increase is associated with population growth and aging, intensified urbanization, a rising prevalence of obesity and sedentary lifestyles, as well as improved survival among individuals with diabetes due to advances in treatment technologies, particularly insulin therapy (International Diabetes Federation, 2025; SBD, 2023).

For glycemic control in individuals undergoing insulin therapy, the Ministry of Health recommends monitoring capillary blood glucose three or more times per day, as outlined in Primary Care Guideline No. 36. This requires the use of devices such as glucometers, reagent strips, lancing devices or sterile lancets, in addition to syringes and needles for insulin administration (Brasil, 2013). According to Law No. 11,347/2006, these supplies must be provided free of charge by the Unified Health System (SUS) (Brasil, 2006; SBD, 2023).

Insulin therapy generates daily Healthcare Solid Waste (HSW) in households, which may present biological, chemical, and physical risks (Freitas; Silva, 2012). In terms of volume, this type of waste represents approximately 1% to 3% of total urban solid waste. However, its relevance should not be assessed based on quantity, but rather on its pathogenic potential, which may pose risks to public health and cause environmental impacts (Ramos *et al.,* 2011; Silva, 2013).

The Brazilian Diabetes Society (2023) reports that there are currently no specific guidelines addressing the management of waste generated by insulin therapy users at home. Therefore, it recommends following existing regulations, including RDC Nº 306 of ANVISA, CONAMA Resolution Nº. 358, standards from the Brazilian Association of Technical Standards (ABNT), Regulatory Standard Nº. 32 (NR-32), and Law Nº. 12,305, which establishes the National Solid Waste Policy (Brasil, 2004a, 2004b; 2005; 2012).

Healthcare solid waste should be discarded immediately after use in appropriate containers, such as sharps disposal boxes. In their absence, users should be instructed to use alternative containers with specific characteristics: rigid, puncture-resistant, leak-proof, with a wide opening and a secure lid (Brasil, 2004a, 2013).

Guidance on the proper disposal of HSW in households is the responsibility of healthcare professionals involved in patient care, aiming to ensure safe disposal and minimize potential environmental and health impacts. In this context, understanding the profile of the assisted population is essential for developing effective health education strategies. Therefore, this study aimed to identify the sociodemographic and epidemiological characteristics and their possible associations with the behavior of insulin therapy users regarding the disposal of healthcare solid waste generated in households.

2 Material and Methods

2.1 Study setting and design

A cross-sectional, descriptive, and quantitative study was conducted in the municipality of

Sapezal, Mato Grosso, Brazil, located approximately 480 km from the state capital, Cuiabá. The municipality has an area of 13,614.552 km² and a population of 28,944 inhabitants, according to the 2022 Census, with an estimated population of 32,514 in 2025 (IBGE, 2022).

Data were collected in Primary Health Care units in the municipality, which includes six units: one in a rural area and five in urban areas. The study was carried out in the units where diabetic patients undergoing insulin therapy are registered (Sapezal, 2018).

For data collection, a structured questionnaire with closed-ended questions was used to obtain sociodemographic and epidemiological information, as well as data on household waste management practices.

The instrument also aimed to identify possible associations between user behavior regarding the proper disposal of healthcare service waste (HSW) and variables such as age, education level, duration of treatment, and receipt of prior guidance on waste disposal, among others. Interviews were conducted individually, with an average duration of approximately 30 minutes, in a private setting.

2.2 Study population and sample

The study population consisted of users undergoing insulin therapy who were registered in the HiperDia Program within Primary Health Care. Inclusion criteria were: being registered in the HiperDia Program and currently using insulin. Exclusion criteria included individuals under 18 years of age. The sample corresponded to 100% of eligible users.

A convenience sampling approach was adopted, in which individuals with diabetes using insulin were invited to participate when attending the health units.

2.3 Ethical aspects

This study was approved by the Research Ethics Committee (REC) of the University of Cuiabá, under Opinion Nº 2,441,257. Data collection was conducted between January and February 2018 at Family Health Unit I, where all participants were informed about the study and signed the Informed Consent Form (ICF).

2.3 Statistical analysis

Data were entered into a dichotomous database and tabulated in an electronic spreadsheet. Subsequently, bivariate analyses were performed to assess whether sociodemographic and epidemiological variables influenced the type of disposal of healthcare service waste generated by insulin therapy users. Statistical analyses were performed using Epi Info™ software, version 7.2.5 (CDC, 2021), with significance of fisher set at a 5% probability level ($p < 0.05$).

3 Results and Discussion

A total of 50 users undergoing insulin therapy were interviewed. The analysis of sociodemographic data showed that 60% of the participants were female, and the most prevalent age group was 61 to 70 years (34%), as presented in Table 1. Regarding educational level, most participants had completed primary education (64%), while 18% had secondary education and 10% had higher education. Concerning family income, 38% reported earning less than one minimum wage. These findings are consistent with the literature, which indicates a higher prevalence of diabetes and a greater need for insulin therapy among older populations, individuals with lower income, and with a slight predominance among females (Peyrot *et al*., 2012).

Table 1 – Distribution of insulin therapy users according to sociodemographic characteristics; Sapezal, Mato Grosso, Brazil, 2018

Variable	N	%
Sex		
Female	30	60
Male	20	40
Age group (years)		
18 – 20	1	2
21 – 30	4	8
31 – 40	4	8
41 – 50	7	14
51 – 60	12	24
61 – 70	17	34
Mais de 70	5	10
Education Level		
Illiterate	4	8
Primary education	32	64
Secondary education	9	18
Higher education	5	10
Family income		
Less than 1 minimum wage	19	38
1 – 2 minimum wages	15	30
2 – 3 minimum wages	7	14
3 – 4 minimum wages	3	6
More than 4 minimum wages	6	12
Health Agent Guidance		
Yes	50	100
No	0	0
Does not know	14	28
Follow-up in Health Services		
Yes	21	42
No	15	30
If yes, which unit		
I	14	28
II	16	32
III	7	14
IV	5	10
V	3	6
Rural	5	10

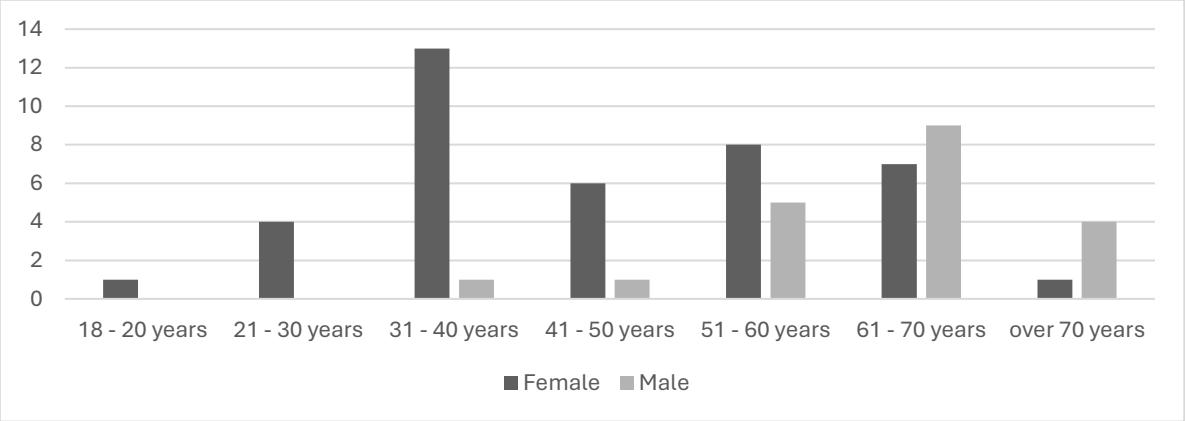
Source: research data.

The high proportion of participants with a family income below one minimum wage reinforces recent findings in the literature. According to Kim *et al*. (2024), there is a strong association between unfavorable socioeconomic conditions and a higher prevalence of Diabetes Mellitus, as well as greater inequalities in disease awareness and treatment. The same authors report that individuals with lower income and education levels are more exposed to risk factors such as inadequate diet, limited access to healthcare services, and lower adherence to treatment, which contributes to increased prevalence and disparities in the awareness and management of Diabetes Mellitus.

Regarding sex, Smaniotto (2015) highlights that women tend to present a higher prevalence of sedentary behavior and obesity, which are considered risk factors for the development of Diabetes Mellitus. In addition, another factor that may contribute to the findings of this study is the greater use of healthcare services by women compared to men. This behavior facilitates the identification and diagnosis of the disease, especially in earlier stages (Bosi *et al*., 2009; Lyra *et al*., 2010).

With respect to age distribution by sex, a predominance of females was observed in most age groups, particularly between 21 and 60 years. In the 18–20 age group, 1 female case was identified; between 21 and 30 years, 4 females; between 31 and 40 years, 3 females and 1 male; between 41 and 50 years, 6 females and 1 male; and between 51 and 60 years, 8 females and 5 males (Figure 1). In contrast, in older age groups, a higher proportion of males was observed, particularly in the 61–70 age group (7 females and 9 males) and among those over 70 years (1 female and 4 males).

Figure 1 – Graph distribution of respondents according to gender and age; Sapezal - Mato Grosso



Source: research data.

These results suggest a possible shift in sex predominance in older age groups, which may be associated with factors such as higher male survival in specific groups or characteristics of the studied population. International evidence supports this hypothesis: according to Kautzky-Willer (2023), men tend to be diagnosed earlier and with lower body fat mass, whereas women accumulate a greater risk burden over the life course, which may alter prevalence patterns in older ages. Furthermore, Kaptoge

et al. (2023) report that age at diagnosis strongly influences life expectancy, suggesting that differences in survival between men and women may contribute to the observed shift in older age groups. Epidemiological data showed that 6% of participants had been diagnosed with diabetes for less than one year, while 58% reported living with the disease for more than 10 years. Regarding diabetes classification, 22% reported having type 1 diabetes, and 44% reported type 2 diabetes (Table 2).

Table 2 – Distribution of insulin therapy users according to epidemiological characteristics; Sapezal, Mato Grosso, Brazil

Variable	N	%
Time since diagnosis		
< 1 year	3	6
1 -6 years	13	26
6-10 years	5	10
>10 years	29	58
Diabetes classification		
Type 1 diabetes	11	22
Type 2 diabetes	22	44
Does not know	17	34
Insulin administration site		
Home	49	98
Healthcare service	1	2
Time on insulin therapy		
<1 year	9	18
1-6 years	24	48
6-10 year	7	14
>10 year	10	20
Type of insulin		
NPH insulin	4 1	82
NPH/Regular insulin	5	10
Other	4	8
Self-administration of insulin		
Yes	38	76
No	9	18
Sometimes	3	6
Number of insulin administrations per day		
1	10	20
2	29	58
3	6	12
>3	5	10
Source of insulin		
Healthcare unit	46	92
Public pharmacy	4	8
Source of diabetes supplies (syringes, needles, lancets, and test strips)		
Healthcare unit	48	96
Public pharmacy	1	2
Private pharmacy	1	2
Number of syringes and needles per month		
30	15	30

continued…

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60	29	58
90	4	8
>120	2	4
Type of syringe		
With attached needle	50	100
Without attached needle	0	0
Syringe reuse		
Yes	20	40
No	30	60
If yes, number of times syringes are reused)		
2 times	15	75
>2 times	5	25

Source: research data.

These findings are consistent with epidemiological studies indicating the increasing prevalence of type 2 diabetes among adults, particularly among those with more than 10 years since diagnosis, reflecting the global rise in the incidence of this chronic condition (Lau *et al*., 2017; Ong *et al.,* 2021).

All participants (100%) reported receiving follow-up care and diabetes management at Family Health Units in the municipality. However, 98% of users administer insulin at home, while only 2% rely on health units for its administration.

This finding is consistent with studies indicating a preference for home-based insulin administration, driven both by convenience and by patients' autonomy in managing their condition. Furthermore, follow-up care provided by Family Health Units aligns with the strategy of Brazil's Unified Health System (SUS), which aims to integrate diabetes care into primary health care, ensuring continuous management within the community (Malta *et al.,* 2022).

The most prevalent duration since diagnosis was greater than 10 years, highlighting increased survival among individuals with diabetes (Kaptoge *et al.,* 2023). Nevertheless, and WHO (2016) warns that longer survival with diabetes, particularly type 2 diabetes, is associated with a higher risk of microvascular and macrovascular complications, underscoring the importance of sustained long-term glycemic control strategies.

The predominant type of insulin among the interviewed participants was NPH (Neutral Protamine Hagedorn), used by 82% of patients. NPH insulin is widely prescribed due to its relatively low cost and intermediate-acting profile, which supports effective glycemic control.

Furthermore, the Brazilian Diabetes Society recommends its use in treatment protocols, particularly within the Unified Health System (SUS), where NPH insulin remains one of the main

therapeutic options available to patients (SBD, 2021).

Self-administration of insulin was predominant among participants, with 76% reporting independent administration. Among those who did not self-administer, 18% relied on third parties for insulin administration. Regarding the frequency of daily injections, 58% of participants reported administering insulin twice a day, while 10% required more than three injections per day.

Self-administration is a common practice among patients with diabetes, particularly in intensive insulin therapy regimens, which often require multiple daily injections to achieve glycemic control. Peyrot *et al*. (2012) emphasized that adherence to self-administration is strongly associated with patient education and the support provided, both of which are crucial for therapeutic success. Furthermore, Edelman and Pettus (2014) noted that a higher frequency of injections is associated with improved glycemic control, although it may pose psychological and physical challenges for patients.

In this regard, the Brazilian Diabetes Society (2021) underscores the importance of continuous education and multidisciplinary follow-up to ensure the effectiveness of insulin therapy.

The findings of this study indicate that the longer the duration since diabetes diagnosis, the greater the likelihood of insulin use. This observation is supported by international guidelines and epidemiological studies that associate longer disease duration with the need for treatment intensification and an increased risk of complications (Cigolle *et al*., 2022).

The reuse of syringes was reported by 40% of participants, while 60% stated that they did not reuse them. Among those who reported reuse, 75% indicated reusing syringes up to two times, and 25% reported reuse more than three times. Although this practice is relatively common, it is not recommended due to the risk of infection, tissue damage, and reduced insulin efficacy.

Frid *et al.* (2016) demonstrated that needle and syringe reuse is associated with an increased risk of local complications, such as lipodystrophy and inflammation, which may impair insulin absorption. Current guidelines from the American Diabetes Association emphasize that syringes and needles should be used only once to ensure treatment safety and effectiveness (ADA, 2026).

The management of solid waste associated with insulin therapy showed varied behaviors among participants. Approximately 48% of respondents reported discarding waste such as syringes and needles in regular household waste, while 52% stated that they use appropriate containers and return them to the health units responsible for their follow-up care.

However, a substantial proportion (48%) still dispose of these materials in household waste, contributing to environmental contamination and posing risks to public health (Table 3).

Table 3 – Distribution of insulin therapy users according to the management of solid waste generated by the insulin therapy process. Sapezal – Mato Grosso

Variable	N	%
Storage of healthcare waste (HCW)		
Regular household waste	24	48
PET bottle	14	28
Fabric softener bottle	6	12
Sharps disposal container	6	12
Disposal site of HCW		
Health unit	26	52
Environment	24	48
Received guidance on HCW disposal		
Yes	29	58
No	21	42
Experienced accident with HCW		
Yes	12	24
No	38	76

Source: research data.

The considerable proportion of participants (48%) who dispose of healthcare waste (HCW) in regular household waste or bury it in inappropriate locations highlights a concerning practice. Previous studies have emphasized the scientific community's concern regarding the potential consequences of such behavior (Freitas; Silva, 2012).

André and Takayanagui (2015) also reported similar findings regarding the disposal of HCW, noting that although most users return their waste to designated collection points, some individuals still engage in improper disposal, particularly in the environment.

Inadequate management of household HCW, especially syringes and needles, represents a serious environmental and public health issue. Oliveira *et al.* (2021) point out that improper disposal of these materials may facilitate disease transmission and cause significant environmental impacts. In this context, the World Health Organization (WHO, 2014) recommends the segregation and proper disposal of sharps in appropriate containers, aiming to reduce the risks associated with unsafe handling of hazardous waste.

Janik-Karpinska *et al.* (2023) emphasize that healthcare waste (HCW) must be considered within the context of occupational health, as when disposed of in regular household waste or inappropriate locations, it becomes a potential source of infectious disease transmission. Such practices increase health risks for healthcare professionals and urban waste collectors, while also generating significant environmental impacts.

When asked about the guidance received regarding the disposal of healthcare waste (HCW) during treatment, 58% of respondents reported having received instructions on proper disposal methods, while 42% stated that they had never received such guidance. The lack of adequate information is a concerning factor, as ineffective waste management, particularly of sharps, may lead to accidents and result in negative impacts on both public health and the environment.

Studies indicate that the lack of training and clear instructions on the safe disposal of sharps increases the risk of accidents. Schillie *et al.* (2016) reported that such incidents may occur due to insufficient knowledge or inadequate infrastructure for safe disposal.

Janik-Karpinska *et al.* (2023) further emphasize that improper management of healthcare waste poses significant risks to both workers and the community.

Similarly, Dias *et al.* (2021) highlight that incorrect disposal of syringes and needles can facilitate disease transmission and cause considerable environmental impacts. In line with these findings, the WHO (2014) recommends the segregation and proper disposal of sharps in appropriate containers to minimize the risks associated with unsafe handling of hazardous waste.

It is evident that healthcare professionals play a crucial role in providing appropriate safety guidance to insulin users. Studies indicate that the involvement of these professionals contributes to shared responsibility in care and plays a key role in raising awareness, promoting behavioral change, and enhancing individuals' capacity for self-care (Brasil, 2013).

Furthermore, additional studies reinforce this perspective, highlighting that health education is essential for the proper management of insulin therapy waste and for preventing accidents related to the unsafe disposal of sharps (Cunha *et al.,* 2017).

Among the participants, 24% reported having experienced needlestick injuries during treatment, while 76% did not report any such incidents. The (WHO (2014) and Janik-Karpinska *et al*. (2023) emphasize the importance of continuous training on safe practices in the management of healthcare waste (HCW), particularly in home-based treatments, as a strategy to reduce the occurrence of these accidents.

Table 4 presents the sociodemographic characteristics of the respondents, aiming to identify possible associations between these variables and user behavior regarding the final disposal of HCW.

Table 4 - Association between the destination of Healthcare Solid Waste (HCW) and sociodemographic variables among insulin-dependent users, Sapezal – Mato Grosso, 2018

	Destination of Healthcare Solid Waste (HCW)								
Sociodemographic Variables	**Health Post**		**Environment**		**Total**		**RR**	**IC (95%)**	***p-value**
	N	%	N	%	N	%			
Sex									
Female	15	50	15	50	30	60	0,9		
Male	11	55	9	45	20	40		0,53 – 1,55	0,477
Age									
18 – 50 years	9	56,2	7	43,7	16	32	1,12		
>50 years	17	50	17	50	34	68		0,65 – 1,94	0,457
Education Level									
Secondary education or lower	23	52,3	21	47,7	44	88	1,04		
Higher education	3	50	3	50	6	12		0,44 – 2,44	0,626
Family income									
Up to 1 minimum wage	10	52,6	9	47,4	19	38	1,01		
More than 1 minimum wage	16	51,6	15	48,4	31	62		0,59 – 1,76	0,587
Health Unit									
I	11	84,6	2	15,4	13	26	2,08	1,32 – 3,28	0,006*
II	4	25	12	75	16	32	0,38	0,15 – 0,93	0,009*
III	2	28,6	5	71,4	7	14	0,51	0,15 – 1,70	0,176
IV	3	50	3	50	6	12	0,95	0,40 – 2,23	0,626
V	2	66,7	1	33,3	3	6	1,3	0,55 – 3,04	0,53
Rural	4	80	1	20	5	10	1,63	0,96 – 2,78	0,2
Community Health Worker									
Yes	9	64,3	5	35,7	14	28	1,36		
No	17	47,2	19	52,8	36	72		0,80 – 2,29	0,221

*Significant according to Fisher's exact test
Source: research data.

No significant association was observed between the analyzed variables—sex, age, educational level, family income, and the presence of Community Health Workers (CHWs)—and the disposal practices of healthcare waste (HCW) generated at home by insulin therapy users. In other words, these variables do not appear to directly influence users' decisions regarding the proper or improper disposal of such waste.

Regarding the association between the disposal of healthcare waste (HCW) and epidemiological variables among insulin therapy users, although some participants reported inadequate disposal practices, statistically significant associations were identified, particularly for variables related to needle/syringe reuse and the guidance received on waste disposal (Table 5).

Table 5 – Association between the destination of Healthcare Solid Waste (HCW) and epidemiological variables among insulin-dependent users; Sapezal – Mato Grosso, 2018

	Destination of Healthcare Solid Waste (HCW)								
Epidemiological Variables	**Health post**		**Environment**		**Total**		**RR**	**IC (95%)**	***p-value**
	N	%	N	%	N	%			
Time Since Diagnosis									
<1 Year	2	66,7	1	33,3	3	6	1,3		
>1 Years	24	51	23	49	47	94		0,55 – 3,04	0,53
Time on Insulin Therapy									
<1 Year	5	55,6	4	44,4	9	18	1,08		
>1 Years	21	51,2	20	48,8	41	82		0,56 – 2,09	0,553
Number of Insulin Administrations Per Day									
<2	22	57,9	16	42,1	38	76	1,73		
>2	4	33,3	8	66,7	12	24		0,74 – 4,04	0,124
Syringe Reuse									
No	21	70	9	30	30	60	2,8		
Yes	5	25	15	75	20	40		1,26 – 6,19	0,002*
Guidance on HCW Disposal									
Yes	23	79,3	6	20,7	29	58	5,55		
No	3	14,3	18	85,7	21	42		1,91 – 16,08	0,000*

*Significativo pelo teste exato de Fisher
Source: research data.

Regarding the reuse of needles and syringes, it is evident that, in addition to adopting an unsafe practice during insulin administration, some individuals also dispose of contaminated sharps directly into the environment, thereby increasing the risk of accidents and contamination.

Previous studies corroborate these findings, highlighting that the reuse and improper disposal of sharps are among the main risk factors for occupational and environmental accidents (Cunha *et al*., 2017; Janik-Karpinska *et al.*, 2023; WHO, 2014).

It can be observed that guidance on waste disposal influences the proper disposal of healthcare waste (HCW), as significant associations were identified in Health Units I and II. These findings suggest that patients undergoing treatment in different units exhibit distinct behavioral patterns. Furthermore, patients registered at Unit I were 2.08 times more likely to return their household HCW to designated collection points. In this context, Table 6 shows that Health Units I and II provided sufficient guidance on proper HCW disposal, contributing to patients returning their waste to appropriate collection sites.

Table 6 - Association between guidance on the disposal of healthcare waste (HCW) and health units in the municipality of Sapezal, Mato Grosso, Brazil, 2018

Health Unit	Guidance on HCW Disposal				Total		RR	IC (95%)	*p-value
	Yes		No						
	N	%	N	%	N	%			
Unit I									
Yes	11	84,62	2	15,38	13	26	1,73	1,16 – 2,60	0,023*
No	18	48,65	19	51,35	37	74			
Unit II									
Yes	3	18,75	13	81,25	16	32	0,24	0,08 – 0,69	0,000*
No	26	76,47	8	23,53	34	68			
Unit III									
Yes	4	57,14	3	42,86	7	14	0,98	0,49 – 1,95	0,634
No	25	58,14	18	41,86	43	86			
Unit IV									
Yes	4	66,67	2	33,33	6	12	1,73	0,63 – 2,18	0,500
No	25	56,82	19	43,18	44	88			
Unit V									
Yes	3	100	0	0	3	6	1,80	1,39 – 2,33	0,186
No	26	55,32	21	44,68	47	94			
Unit Rural									
Yes	4	80	1	20	5	10	1,44	0,86 – 2,39	0,291
No	25	55,56	20	44,44	45	90			

*Significant according to Fisher's exact test

Source: research data.

It is evident that these results are directly associated with prior guidance received regarding the proper disposal of healthcare waste, particularly since the units that showed significant associations corresponded to those in which patients reported having received instructions on appropriate disposal. This finding reinforces evidence that health education and the role of healthcare professionals are key determinants of behavior change and the adoption of safe practices (Cunha *et al*., 2017; Janik-Karpinska *et al*., 2023).

This analysis supports what has been widely described in the literature: health education is a highly impactful tool in health promotion, capable of fostering autonomy and a sense of co-responsibility among individuals in relation to their treatment process. Falkenberg *et al.* (2014) emphasize that health education should be understood as a political-pedagogical process that stimulates critical and reflective thinking, enabling individuals to propose transformative actions and assume an active role in both self-care and collective care.

These findings reinforce the need to strengthen health education strategies and continuous professional follow-up in order to promote behavioral change and ensure safe waste management practices. This result highlights the importance of health education and professional engagement in fostering safe behaviors. According to Gomes and Merhy (2011), participatory educational practices enhance autonomy and strengthen community bonds, thereby promoting behavioral change and the adoption of safe practices.

4 Conclusion

The results of this study indicate that the management of healthcare waste (HCW) generated by insulin therapy users in the home environment still presents important weaknesses. Although some participants adopt appropriate practices, a significant proportion still dispose of waste in regular household waste, which poses risks to public health and the environment, particularly regarding the improper disposal of sharps.

The influence of guidance provided by healthcare professionals demonstrates that units offering adequate instructions achieve higher rates of waste return to appropriate collection points. In this context, health education emerges as a central element in promoting safe practices, contributing to users' awareness and to the adoption of more appropriate behaviors in waste management.

Therefore, there is a clear need to strengthen educational strategies and continuous professional follow-up, especially within Primary Health Care, focusing on user autonomy and shared responsibility in the care process.

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