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**Key words:** sharps disposal, public health, safety, insulin, needlestick injuries

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**Abstract**

*Objective: To determine (1) how patients currently dispose of used insulin needles, (2) whether patients were educated about disposal of their used insulin needles, and (3) who educated patients about the disposal of their used insulin needles.*

*Methods: A self-administered questionnaire was designed for this study. The survey assessed patient knowledge about disposal of used insulin needles and the patient-reported source and location of education about disposal techniques. The questionnaire was administered to a convenience sample of patients from four locations in Richmond, Virginia. Any patient who used insulin, was at least 18 years old, and was willing to complete the survey was eligible for inclusion.*

*Results: Fifty responses were received with 40% indicating that education had been received on the disposal of used needles. From that 40%, nurses were identified as the source of education 60% of the time and pharmacists 25% of the time. Approximately 50% of the respondents reported disposing of used needles directly in the trash when at home. While away from home, 22% reported placing used needles in the trash, and 38% took them home for disposal.*

*Conclusion: Patients are not consistently educated regarding the proper disposal of used needles. Health care practitioners should play a larger role in educating patients about the potential risks of inappropriate needle disposal and appropriate disposal methods. Future research is still needed to understand fully the magnitude of the problems associated with inappropriate needle disposal by patients.*

## Introduction

Proper disposal of used syringes and needles is essential to the prevention of inadvertent injuries from discarded needles. Injuries from contaminated needles and sharps present a concern in society today since they may increase risk for the transmission of blood-borne pathogens, such as human immunodeficiency virus, hepatitis B, and hepatitis C.[1] The primary sources of used sharps in the community are prescribed, self-injected medications and injected drugs of abuse. Over half of the estimated 3 billion annual injections can be attributed to insulin users.[2,3] Information regarding needlestick injuries among health care workers has been extensively reported.[4,5] These injuries are not, however, limited to controlled healthcare environments, as sanitation workers, law enforcement personnel, and even children have been victims of needlestick injuries.[6-13] Although these injuries are relatively rare with an incidence of less than 0.1%,[6,9] community-based needlestick injuries are likely underreported.

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Currently, the United States Environmental Protection Agency (EPA) has guidelines for disposal of used sharps.[14] State laws and regulations do not all conform to EPA guidelines and vary considerably in addressing patient-generated sharps (e.g., needles from self-injected medications).[2,15] Guidelines are often not followed by patients despite the presence of regulations and community awareness efforts.[2,3] The Coalition for Safe Community Needle Disposal in conjunction with the EPA has identified options available for patients to dispose of used sharps. These include drop boxes or supervised collection sites, mail-back programs, syringe exchange programs (SEP), at-home needle destruction devices, residential special waste pick-up, and household hazardous waste collection.[14,16-17] The lack of easily accessible disposal options at the local community level is likely an issue contributing to the needle disposal problem, as is the lack of patient knowledge that these options exist. The objectives of this study were to identify how patients currently dispose of used insulin needles, to determine whether patients were educated about disposal of their used insulin needles, and to describe who educated patients about the disposal of their used insulin needles.

**Methods**

This study used a convenience sample of patients from two local independent pharmacies, a private endocrinology practice, and a pharmacy services clinic in an ambulatory internal medicine clinic at an academic medical center in Richmond, Virginia. Any individual at the participating sites who used insulin, was at least 18 years old, and was willing and able to complete the self-administered questionnaire was eligible to participate.

The study questionnaire was developed to gather information about how respondents disposed of used insulin needles both at home and away from home, about education related to used needle disposal, and whether the patient or any individual in their household experienced an accidental needlestick injury as a result of a disposed insulin needle. The items related to insulin needle disposal practices were based on recommendations created by the EPA.[14] Additional items relating to general patient demographics were also included. The initial questionnaire was reviewed by a group of practitioners, and the draft questionnaire was pilot tested with 5 patients who had diabetes and used insulin. Although a formal assessment of the questionnaire's reading level or whether health literacy standards were met was not performed, some initial items were reworded for readability and clarity with respect to the study objectives as a result of the pilot testing. For example, feedback from the pilot test determined that the best term to obtain the desired information on disposal practices was "used insulin needle" rather than "used insulin syringe" or "used sharps." While these three terms may be relatively interchangeable by providers, the participants in the pilot test felt that "used insulin needle" would be easier for patients to understand. The pilot testing group also provided useful information on formatting of the questionnaire. The final study questionnaire consisted of 15 items (see appendix).

Descriptive statistics were reported. Fisher's exact test was also used to compare used needle disposal practices among patients who received diabetes education to those who did not receive diabetes education, as well as those who did and did not receive education about needle disposal. In addition, the differences in disposal practices by gender, race/ethnicity, age, and education level were explored. All analyses were conducted with a two-sided alpha level of 0.05. This project was approved by the Virginia Commonwealth University Institutional Review Board.

**Results**

Fifty responses were collected between January and April 2009. The mean (standard deviation) age was 58.3 (13.6) years. Twenty-one (42.9%) of the respondents were female, and 30 (60.0%) were Caucasian. Complete demographic information is provided in Table 1. Responses to needle disposal practices are provided in Table 2. Forty-six percent of respondents reported throwing their used insulin needles directly into the trash when at home, and 22.5% reported discarding used needles directly into the trash when away from home. Forty-four percent of respondents placed used needles in a special container at home with 59.1% of these respondents throwing the container into the trash when it was full. Twelve percent of respondents reported they had experienced a needlestick from their own disposed needles, while none indicated that other family members experienced accidental needlesticks from used needles. Sixty-three percent of respondents indicated they would participate in a program where they could drop off used insulin needles if it were free.

Only 40.0% of respondents recalled being educated about how to dispose of their used needles. Of those who reported receiving education about needle disposal, 50.0% recalled receiving the information in a physician's office and 25.0% in the pharmacy. Pharmacists and nurses provided 25.0% and 60.0% of the education, respectively. Four respondents reported receiving this information from multiple sources (e.g., nurse and pharmacist).

Respondents who received education about disposal were more likely to use a special container than those who did not receive this education (70.0% vs. 26.7%, respectively, *P* =

0.004; Table 3). With respect to diabetes education, 66% of respondents indicated they had received formal diabetes education. Education about disposal techniques was higher among those who received formal diabetes education than among those who did not receive formal education (51.5% vs. 18.8%, respectively; *P* = 0.032; Table 4). Interestingly, methods for disposing of used needles at home or away from home were not significantly different between those who did or did not receive diabetes education, nor was there a significant difference in clipping/bending practices between respondents who did or did not receive diabetes education. There was no statistical significance associated with any of the respondent demographics and disposal practices.

**Discussion**

We identified a large percentage of individuals who inappropriately disposed of used insulin needles. Almost half of respondents reported that they threw needles directly into the trash. This is lower than a 1996 report in which 93% of respondents reported throwing used needles in the trash.[3] Although two-thirds of respondents reported receiving formal diabetes education, less than half recalled being educated about proper used sharps disposal, which is similar to previous reports.[3] This low level of education could be placing patients, their households, and others in the community at risk for needlestick injuries.

A higher proportion of respondents educated about the disposal of sharps had also received formal diabetes education. Despite formal diabetes education, their practices were not significantly different from those who had not received such education. Using the Health Belief Model[18] as a theoretical framework could help explain this counterintuitive finding. Despite the provision of education about appropriate used needle disposal, some patients may not perceive sufficiently high severity of or susceptibility to the adverse outcome (i.e., a needlestick) to change their needle disposal behavior. Furthermore, the penalty to patients for inappropriate syringe disposal is generally low. Some localities like New York City impose fines for individuals who fail to dispose of used syringes properly.[12] Because of the relatively low perceived threat, initiatives to change disposal practices may be difficult. Health care providers should also be aware of used syringe disposal guidelines so that they can counsel patients on appropriate disposal of used syringes.[14] By periodically reassessing and reinforcing syringe disposal strategies and asking whether patients or household members have experienced a needlestick injury, providers can provide necessary cues to action to promote changes in behavior among insulin users resulting in improved syringe disposal practices.

Convenience and cost are important factors for patients when it comes to syringe disposal programs. Respondents were largely willing to use syringe drop-off programs as long as it was free. It is unclear if patients would be willing to adhere to proper used sharps disposal methods if those methods were inconvenient or costly. Further investigation of these factors may be useful in identifying a solution to the syringe disposal problem.

The study was limited by the small sample size and convenience sampling, which limits the generalizability of these findings. In a similar fashion, those who chose to participate may not be similar to those who did not participate with respect to needle disposal practices. Respondents' interpretations of the questions may have confounded the responses. For example, respondents using insulin pen delivery devices may have interpreted and responded to the questions differently. Although pretesting was performed to create exhaustive response options and an "other" option was provided, important alternative answers may have been omitted on the questionnaire. Open-ended items or direct interviews allowing respondents to describe their actual needle disposal practices may have been more informative. Some respondents may have had difficulty in reporting events that happened in the past (e.g., duration of insulin therapy, diagnosis of diabetes, etc.), so the potential for recall bias must also be considered as a limitation. Still, the results will be useful in providing information for further study.

In future studies, it may be useful to use the Health Belief Model[18] as a framework to examine the best way to address the issue of appropriate needle disposal by considering the best way to portray the risks and consequences of inappropriate needle disposal. It would also be important to consider the roles of cost and convenience in promoting changes in patients' disposal practices. The effect of time since formal diabetes education or how long since education on disposal techniques was provided could be helpful in assessing the need for re-education. It is also important for providers to understand appropriate needle disposal techniques and the availability of local options since a lack of understanding of these topics among providers could be an important contributing factor to inappropriate needle disposal techniques by patients. Further studies to assess provider knowledge would be useful.

**Conclusion**

Despite published guidelines and safe disposal options, patients are still disposing of used sharps through less than optimal methods. More research is needed to understand the magnitude of the problem of inappropriate sharps

disposal by patients, as well as why patients do not follow safe disposal recommendations. Health care practitioners should familiarize themselves with recommendations for safe needle disposal, as well as disposal options in their local area, so that they can appropriately counsel patients about the safe disposal of their used needles.

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**Table 1 – Characteristics of respondents**

| | No. (%)* |
|---|---|
| Female gender (n = 49) | 21 (42.9) |
| Age (years), mean ± SD | 58.3 ± 13.6 |
| Years since diabetes mellitus diagnosis, mean ± SD | 14.8 ± 9.5 |
| Duration of insulin use (years), mean ± SD | 7.3 ± 6.6 |
| Education Level (n = 47) | |
| Less than high school | 7 (14.9) |
| High school diploma or equivalent | 15 (31.9) |
| Some college | 8 (17.0) |
| College degree | 17 (36.2) |
| Race | |
| African American | 17 (34.0) |
| Caucasian | 30 (60.0) |
| Other | 3 (6.0) |
| Insurance | |
| Private Insurance | 24 (48.0) |
| Medicare | 16 (32.0) |
| Medicare & Medicaid | 5 (10.0) |
| Medicaid | 3 (6.0) |
| Other | 2 (4.0) |

SD = Standard deviation
*All figures are frequency (percent) except where specified.

**Table 2 – Needle disposal practices reported by respondents**

| | No. (%) |
|---|---|
| What do you do with your used needle when you are at home? | |
| Throw in trash | 23 (46.0) |
| Put in special container | 22 (44.0) |
| Other | 5 (10.0) |
| If you use a special container, what do you do when the container is full? (n = 22)* | |
| Throw it in trash | 13 (59.1) |
| Take it to the landfill/dump | 5 (22.7) |
| Mail it to a processing facility | 0 (0.0) |
| Take it to the pharmacy or some drop-off spot | 2 (9.1) |
| Other | 6 (27.3) |
| Do you clip or bend your needles before you dispose of them? | |
| Clip | 12 (24.0) |
| Bend | 8 (16.0) |
| Neither | 30 (60.0) |
| What do you do with your insulin needles when you are not at home? (n = 49) | |
| Throw them in the trash | 11 (22.5) |
| Put in special container to take home for disposal | 19 (38.8) |
| Put in special container at site | 2 (4.1) |
| Other | 18 (36.7) |
| Do you re-use your insulin needles? | |
| Yes | 10 (20.0) |
| No | 40 (80.0) |
| If you re-use your insulin needles, about how often do you replace your needle with a new one? (n = 10) | |
| Daily | 3 (30.0) |
| Weekly | 5 (50.0) |
| Monthly | 1 (10.0) |
| Other | 1 (10.0) |
| Have you received any formal diabetes training? | |
| Yes | 33 (66.0) |
| No | 17 (34.0) |
| Has anyone ever told you about how to dispose of your needles once they are used? | |
| Yes | 20 (40.0) |
| No | 30 (60.0) |
| If yes, who gave you that information? (n = 20)* | |
| Pharmacist | 5 (25.0) |
| Nurse | 12 (60.0) |
| Physician | 4 (20.0) |
| Other | 4 (20.0) |
| Where was the information given? (n = 20)* | |
| At the pharmacy | 5 (25.0) |
| In the physician's office | 10 (50.0) |
| Over the phone | 0 (0.0) |
| In the mail | 0 (0.0) |
| Other | 6 (30.0) |
| If there were a program where you could drop off your used insulin needles, would you participate in the program? (n = 49) | |
| No, I would not participate | 13 (26.5) |
| Yes, I would participate, but only if it were free | 31 (63.3) |
| Yes, I would participate even if I had to pay for it | 5 (10.2) |

Unless otherwise noted, there were 50 responses for each question
*Some respondents indicated more than one answer

**Table 3 – Needle disposal practices among those who did or did not receive education about needle disposal techniques**

| | Educated about used needle disposal (n = 20) [No. (%)] | Not educated about used needle disposal (n = 30) [No. (%)] | *P*-value |
|---|---|---|---|
| Received formal diabetes education | 17 (85.0%) | 16 (53.3%) | 0.032 |
| What do you do with your used needle when you are at home? | | | 0.004 |
| Throw in trash | 4 (20.0%) | 19 (63.3%) | |
| Put in special container | 14 (70.0%) | 8 (26.7%) | |
| Other | 2 (10.0%) | 3 (10.0%) | |
| What do you do with your used needle when you are not at home? (n=49) | | | 0.148 |
| Throw in trash | 2 (10.0%) | 9 (31.0%) | |
| Put in special container to take home | 10 (50.0%) | 9 (31.0%) | |
| Put in special container at the site | 1 (5.0%) | 0 (0.0%) | |
| Other | 7 (35.0%) | 11 (37.9%) | |
| Do you clip or bend your needles before you dispose of them? | | | 0.660 |
| Clip | 5 (25.0%) | 7 (23.3%) | |
| Bend | 2 (10.0%) | 6 (20.0%) | |
| Neither | 13 (65.0%) | 17 (56.7%) | |

Fisher's exact test used for all comparisons.

**Table 4 – Needle disposal practices among those who did or did not receive formal diabetes education**

| | Received formal diabetes education (n = 33) [No. (%)] | Did not receive formal diabetes education (n = 17) [No. (%)] | *P*-value |
|---|---|---|---|
| Received education about disposal of used needles | 17 (51.5%) | 3 (17.7%) | 0.032 |
| What do you do with your used needle when you are at home? | | | 0.176 |
| Throw in trash | 12 (36.4%) | 11 (64.7%) | |
| Put in special container | 17 (51.5%) | 5 (29.4%) | |
| Other | 4 (12.1%) | 1 (5.9%) | |
| What do you do with your used needle when you are not at home? (n=49) | | | 0.764 |
| Throw in trash | 6 (18.8%) | 5 (29.4%) | |
| Put in special container to take home | 12 (37.5%) | 7 (41.2%) | |
| Put in special container at the site | 1 (3.1%) | 0 (0.0%) | |
| Other | 13 (40.6%) | 5 (29.4%) | |
| Do you clip or bend your needles before you dispose of them? (n = 49) | | | 0.191 |
| Clip | 9 (27.3%) | 3 (17.7%) | |
| Bend | 3 (9.1%) | 5 (41.2%) | |
| Neither | 21 (63.6%) | 9 (52.9%) | |

Fisher's exact test used for all comparisons.

**Appendix – Final study questionnaire**

1. How long have you had diabetes? _____ years

2. How long have you been using insulin to control your blood sugar? ____ years

3. a. What do you do with your used insulin needles when you are at home?
   - ☐ Throw them in the trash
   - ☐ Put them in a special container → Please describe the container (ex., a milk jug):_____
   - ☐ Other – Please describe:

   b. If you use a special container, what do you do when the container is full (check all that apply)?
   - ☐ Throw it in the trash
   - ☐ Take it to the landfill/dump
   - ☐ Mail it to a processing facility
   - ☐ Take it to a pharmacy or some drop-off spot
   - ☐ Other – Please describe:

   c. Do you clip or bend your insulin needles before you dispose of them?
   - ☐ Clip them
   - ☐ Bend them
   - ☐ Neither

4. What do you do with your used insulin needles when you are <u>not</u> at home (ex., when you have to give yourself an insulin shot while at a restaurant)? (Check all that apply.)
   - ☐ Throw them in the trash
   - ☐ Put them in a special container to take home for disposal
   - ☐ Put them in a special disposal container for needles that is available where you are
   - ☐ Other – Please describe:

5. a. Do you re-use your insulin needles?
   - ☐ No
   - ☐ Yes

   b. If yes, about how often do you replace your needle with a new one?
   - ☐ Daily
   - ☐ Weekly
   - ☐ Monthly
   - ☐ Other – Please describe:

6. a. Has anyone ever told you about the proper way to dispose of your needles once they were used ?
   - ☐ No
   - ☐ Yes

   b. If yes, who gave you that information? (It could be more than one person, so check all that apply.)
   - ☐ Pharmacist
   - ☐ Nurse
   - ☐ Physician
   - ☐ Other – Describe:

   c. Where was the information given? (Check all that apply)
   - ☐ At the pharmacy
   - ☐ In the physician's office
   - ☐ Over the phone
   - ☐ In the mail
   - ☐ Other – Describe:

7. Have you ever been accidentally stuck by one of your own insulin needles after you threw it away?
   - ☐ No
   - ☐ Yes

8. a. Has anyone in your home (other than yourself) been accidentally stuck by one of your insulin needles after it was thrown away?
   - ☐ No
   - ☐ Yes

   b. If you or someone in your home was accidentally stuck by one of your insulin needles after you threw it away, did it cause you to change how you dispose of your needles?
   - ☐ No
   - ☐ Yes → Please describe what you did differently:

9. If there were a program (such as through a pharmacy or a doctor's office) where you could drop off your used insulin needles so that you didn't have to worry about them at your home, would you participate in the program?
   - ☐ No, I would not participate in this program.
   - ☐ Yes, I would participate in the program, but only if it were free.
   - ☐ Yes, I would participate in the program even if I had to pay for it.

10. Have you received any formal diabetes training (ex., attended a special diabetes training class)?
   - ☐ No
   - ☐ Yes

11. How old are you? _____

12. What is your gender?
   - ☐ Male
   - ☐ Female

13. What is your race or ethnic background?
   - ☐ African-American
   - ☐ Caucasian (white)
   - ☐ Hispanic
   - ☐ Other – Describe:

14. What type of health insurance do you have?
   - ☐ Private insurance (through work or spouse)
   - ☐ Medicaid
   - ☐ Medicare
   - ☐ No insurance
   - ☐ Other/Not sure – Please describe:

15. What is the highest level of education you completed?
   - ☐ Less than high school
   - ☐ High school diploma or GED
   - ☐ Some college
   - ☐ College degree