A qualitative study of the causes of improper segregation of infectious waste at Nemazee Hospital, Shiraz, Iran

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KEYWORDS
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Summary
Background and objectives: Medical waste management is a major concern for healthcare facilities. One important element is the segregation of infectious waste from domestic, non-infectious waste. The aim of this qualitative study was to identify factors that negatively affect proper segregation at Nemazee Hospital, which is affiliated with Shiraz University of Medical Sciences.

Methods: Study data came from focus groups involving hospital workers. Participants expressed their opinions regarding barriers to proper segregation of medical wastes. The participants gave their permission to have their comments recorded. Data analyses were based on a grounded theory approach.

Results: The results indicated that managerial weakness was an important factor in suboptimal disposal of medical waste. It appears that hospital authorities should pay better attention to educational planning, organizational resources and supervision. Together, these considerations should help reduce waste-management errors. The results also suggest that healthcare worker training needs improvement. In general, patients and their companions, as well as the local population, did not appear to have sufficient knowledge concerning disposal of infectious medical waste.

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Introduction

Rapid population expansion has resulted in the need for additional healthcare facilities and diagnostic laboratories, leading to the generation of larger amounts of medical waste worldwide. One factor affecting this increase is the wider employment of single-use disposable devices [1].

Medical waste is a type of waste generated during diagnosis, treatment or immunization of patients in healthcare settings [2]. Based on epidemiologic data, medical waste can be divided into two categories — infectious and non-infectious. Some infectious and non-infectious waste can also be hazardous — potentially harmful because of the presence of dangerous chemicals or pharmaceuticals or radioactivity or otherwise able to cause an adverse reaction [3].

Infectious medical waste has the proven ability to transmit disease among healthcare workers (HCWs) and other exposed individuals. Infectious waste accounts for approximately 15–25% of all medical waste; however, it has the potential to negatively affect human safety and health [4,5]. If medical waste is not managed correctly, it can cause serious infectious disease such as hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV) and respiratory, enteric and soft tissue infections [6].

A clear definition of infectious waste is needed to assist HCWs to correctly separate different types of waste. One definition of infectious waste includes anything potentially infectious, such as body fluids or secretions (e.g., blood, pleural fluid, semen, vaginal secretions, vomit, feces or urine), contaminated sharp objects (e.g., contaminated needles, syringes and surgical blades), biological laboratory waste (e.g., cultures, stocks and growth media), pathological waste (such as human tissue, organs or body fluids), and single-use disposable equipment, utensils and instruments soiled with potentially infectious agents.

The definition of waste is also influenced by the location of disposal, such as veterinary clinics or hospital areas (e.g., isolation wards or rooms, operating theaters, emergency rooms, intensive care units, pathological and biological laboratories and autopsy rooms) [2,7,8]. Non-infectious waste is usually considered infectious after being mixed with infectious waste [7].

The amount of medical waste generated depends on various factors, including the size of the healthcare facility, number of beds, occupancy rate, segregation procedures and types of services provided [1,4]. The quantity of infectious waste can also be affected by the level of insurance reimbursement [9].

Stages of medical waste management include segregation, collection, packaging, storage, treatment, transport and disposal. Infectious waste must be segregated from non-infectious waste and treated by incineration or autoclaving prior to disposal. A lack of appropriate labeling can result in improper segregation of medical waste and increased associated costs [4].

Generation and handling of waste differs worldwide [7,10]. Medical waste management is a special concern in areas with severely limited resources. In parts of Asia, proper management is generally thought to be inadequate [7]. Developing countries often pay less attention to waste management, resulting in mixing of regulated medical waste with non-infectious waste [11,12]. The WHO indicates that 64% of hospitals in 22 countries do not perform correct waste procedures [13]. Factors associated with improper segregation include inadequate awareness, poor HCW attitudes and practices and inadequate management by facility leadership [2,7,14]. Physicians are usually aware of the need for proper infectious waste management and the associated risks for disease transmission; however, they are often unfamiliar with the tenets of the rules and regulations [15].

WHO reports indicate that the level of infectious waste generated is higher in developing countries, including Iran. This can be attributed to a lack of awareness by HCWs concerning correct definitions for infectious medical waste, as well as a poor
understanding of waste regulations and standards, especially concerning proper segregation [14].

There are many quantitative studies about the management of infectious medical waste. However, qualitative studies are uncommon. Combining these two methods could produce a deeper understanding of the complex relationships among the factors involved. One qualitative study reported that improper waste segregation was associated with inadequate education and HCW understanding of proper waste disposal [11].

In this study, we used a qualitative methodology to identify previously disregarded barriers to knowledge of salient definitions and practices concerning the correct segregation of infectious waste in the Nemazee Hospital at Shiraz University of Medical Sciences, which is the largest hospital in the Shiraz University of Medical Sciences.

Methods
An exploratory qualitative approach used thematic analysis of focus group responses. Data collection lasted for two months — September and October, 2012. After receiving approval from the Ethics Research Committee of Shiraz University of Medical Sciences, we created four job-stratified focus groups, each comprising five to twelve HCWs from Nemazee Hospital.

All participants, including nurses, medical students, nursing students and cleaners, were selected randomly from various wards. All agreed to participate and were available to attend all focus group discussion sessions. There was no attempt to ensure homogeneity of the participants; however, we did obtain information concerning gender, age and years of experience.

Audio recording of focus group discussions underwent verbatim transcription. We used a semi-structured discussion format employing open-ended questions about infectious medical waste, including definitions, segregation processes and potential problem areas. Each session lasted between 35 and 60 min.

Using content analysis, we independently reviewed all transcripts, using an iterative process to identify idea/position patterns. We investigated the similarities and differences in the data and coded all the responses. After comparing the data, we established analytical categories and selected the key overarching concepts. In accordance with content analysis methodology, focus group discussions continued until thematic saturation was achieved. We used a member check system to assess the credibility of the data.

Results
The participants were 40 Nemazee Hospital personnel divided into four focus groups of unequal sizes. The mean age was 31.50 ± 7.23 years, and the mean work experience was five years; 62.5% of the participants were female. Only 20% of the participants worked full-time; the others were contract employees or interns.

Two main themes, health literacy and management weakness, were explored (Fig. 1).

Health literacy
Health literacy — lack of training
All the participants indicated they were familiar with the correct definition of infection; however, they did not agree on the importance of waste segregation at the point of generation. Nurses were

![Figure 1](https://example.com/figure1.png)  
*Figure 1* Schema of the original themes.
aware of the importance of segregation. However, nursing and medical students reported a belief that "separation of infectious medical waste is of little practical value because all types of waste will eventually mix together." Cleaners initially indicated that segregation immediately after generation was important. However, further questioning and discussions revealed that this belief was superficial.

All study groups stated that patients and their companions are not informed of the correct definition of segregation and the importance of separation of infectious medical waste (e.g., placing each waste item into the proper containers). Some participants stated that "patient companions placed left-over general patient waste into yellow bins" (reserved only for infectious medical waste). Other participants reported seeing patients or their companions place water bottles into yellow bins. One participant stated that "patients and their companions are not trained and do not have enough information regarding segregation."

Nursing and medical students (externs or interns) stated they had not been sufficiently trained. For instance, one student said, "We have no information about the waste guidelines." Another student said, "We have not been trained on control and disposal of hospital waste." A third student said, "We are not aware of the waste disposal process."

All study participants believed that waste management educational programs should provide public health information as part of health literacy training. One experienced nurse said, "Importance of the waste should be made at the school level, so the importance of waste disposal is instilled from childhood." Another participant said, "Lack of basic training regarding controlling the wastes in society is a major concern."

Health literacy — lack of sensitivity
Participants considered lack of attention and sensitivity to infectious medical waste segregation as barriers to correct management. They mentioned that they were aware of the importance of segregation but that they were sometimes careless and mistakenly mixed infectious medical waste with domestic waste. This indicated an attitudinal problem existing among the participants.

Participants also believed that patients’ companions do not give sufficient attention to safety. One participant mentioned, "Patients’ companions do not pay attention to the bin labels". On the other hand, some groups attributed waste mixing to carelessness of the service personnel and stated, "Unfortunately, sometimes the cleaners are not in the mood to change the bins."

Management weakness
Another theme of this study was managerial weakness, which includes poor planning, organizational resource shortages and lack of supervision and evaluation.

Management weakness — poor planning
Participants felt that a main duty of hospital management is operational planning for training HCWs as well as facility visitors. However, weaknesses were detected. Nurses mentioned, "We have not had a comprehensive educational program for infection control and waste disposal." Students were also aware of weaknesses in their curricula, and some said, "There is a need to inform patients and their companions; however, there is no plan for preparing brochures or pamphlets to be given to the patients during admission." All the cleaners stated, "Collecting each department’s waste only by dedicated personnel is not a good idea. The previous plan was to have cleaners collect waste from bins in all departments and it was better."

Management weakness — lack of organizational resources
The focus groups reported that hospital guidelines do not cover all aspects of infectious waste management. Additionally, participants mentioned the shortage of human resources including cleaners, nurses and qualified managers.

Most study participants believed that their hospital is understaffed, with a particular shortage of cleaners. Some cleaners stated, "There are few personnel during the evening shift, making moving waste bins difficult." In addition, they mentioned, "We have asked the authorities to employ more workers, but they do not seem to care." Moreover, the nurses referred to their departments as being "crowded." For instance, they said, "The waste is not correctly separated when the departments are crowded." Additionally, in the emergency department, all the waste is considered infectious, which increases the volume of infectious waste.

Nurses familiar with national waste guidelines mentioned several important points including, "We face problems while working. For example, we do not know what to do for disposal of secretions and contaminated fluids resulting from the washing of wounds."

Management weakness — lack of supervision and evaluation
The focus groups in this study revealed a general lack of knowledge concerning national guidelines. Further, there was no process for evaluating and
monitoring waste management. Most study participants believed that the waste collection procedures used in the hospital were inappropriate for the number of personnel available. They also felt that the authorities were unaware or did not pay attention. Some cleaners mentioned, "Each department's personnel have to carry out and change full bins, but we do not have enough time to change the full bins in each work shift."

Considering the guidelines, nurses said, "They require review and revision and are not complete regarding liquid infectious wastes. The hospital needs to solve its problems." They also stated, "In the pediatrics department, diapers are not considered infectious waste, and the guidelines are not clear in this regard." They believed that novel and more complete guidelines must be developed.

All the groups agreed that wastes are not correctly separated during evening and night shifts because of the lack of supervision and the lower number of personnel. Another problem was a lack of empty bins. In fact, the participants felt that this led to inadequate waste separation.

Hospital management does not monitor HCWs' performance, due to the size and composition of the workforce. Management also does not provide workers with incentives such as more favorable work shifts and increased salaries.

Discussion

Focus groups were asked about the definitions of various types of waste and the importance of segregating infectious waste. All participants indicated that they have sufficient knowledge in this regard. However, as discussions continued, it became apparent that barriers existed concerning correct segregation of infectious wastes, which could increase the total waste volume.

After analyzing the recorded discussions, two main themes were established: lack of health literacy and poor managerial performance. Health literacy is a social demand that facilitates obtaining, processing, and perceiving health information and is gained through training. Deficiency can lead to lack of job satisfaction and improper compliance with guidelines [16].

In this study, most participants believed that one barrier to correct separation of infectious wastes and reduced total waste volume was the lack of training programs for hospital personnel, students, patients and visitors. Another study also conducted at Nemazee Hospital indicated that training of personnel played a critical role in reducing the volume of waste, thus increasing efficiency even in the presence of understaffing [2]. There appears to be a need for more practical and less theoretical training.

Nemazee Hospital is an educational training facility with most patient care provided by interns. Therefore, lack of HCW knowledge and the presence of incorrect practices may lead to deficiencies in the segregation process. Discussions revealed that participants did not have a correct understanding of the waste disposal process, especially concerning the separation of infectious waste. This leads to waste mixing and inflated amounts of waste.

A study conducted by Hashemi [17] revealed that students had low health literacy regarding waste recycling. This implies that waste management might not be emphasized during healthcare training. Healthcare workers focused on their diagnostic and treatment roles and paid less attention to the proper management of waste. In any event, we recommend that hospital management have a comprehensive plan to improve training and health literacy regarding waste separation.

Another barrier expressed in this study was that patients and their companions were not informed of proper waste separation. Most study participants believed that improving patient and companion awareness could be accomplished through various methods, such as the use of instructional media.

Lack of training programs and educational facilities has led to an increase in production of infectious waste in various hospital departments. Findings from Miyazaki's study indicated that informing patients and their families was one of the major strategies of the treatment centers for safer and more effective waste management [18]. Chao Chung stated that the general population could learn to categorize different types of wastes through the use of visual training aids, such as announcements and special displays [19].

The study participants thought that waste segregation is sometimes neglected because patient care is considered to be more important. This might be due to carelessness or a lack of sufficient sensitivity and attention to the issue, which might indirectly affect the patients' health as well as that of society.

Training can be useful for problems associated with waste management. Of course, it should be noted that the problem cannot be completely solved by improving training. An effective program is needed for waste disposal. One way would be to ensure that waste bins are frequently checked to help prevent improper waste disposal [19]. A study by Kumar reported that regular supervision and training of HCWs resulted in significant improvements in waste segregation practices [7].
Study results indicated that managerial weakness was an important negative factor. This included poor planning and a lack of organizational resources, supervision and evaluation. Muduli found that the most important barrier to effective hospital waste management was lack of activity by top management and the inability to overcome operational barriers on time. Another barrier to waste separation was poor training of staff and students.

According to WHO guidelines, successful waste management requires regular and effective training programs as well as the development of information systems [4]. In Iran, national guidelines are used as educational resources [20]. According to the findings of the present study, these guidelines have several weaknesses. For instance, nurses stated that clear, operational explanations have not been provided for some waste types, such as infectious liquids. Thus, the national guidelines need to be reviewed by authorities and compared to international standards.

Organizational resources were noted as another important barrier. In the emergency department, as well as other departments, cleaners do not correctly separate the wastes primarily because of understaffing. This can lead to an increase in the volume of infectious waste, creating a financial burden. Proper management requires cost-effective measures, including providing a sufficient human workforce as well as the necessary physical facilities [8].

Hospital management and key staff must cooperate on planning and evaluation. Appropriate budgets should be allocated to supply organizational resources and provide comprehensive training at the hospital level, along with development of health literacy. Because Nemazee Hospital is a diagnostic, treatment and educational center, specialists tend to be less involved with waste separation.

This study has some limitations. Most studies of hospital waste management are quantitative. The few quantitative studies conducted were used to discuss our findings. Further qualitative studies are needed to better identify and describe problem areas in waste management.

Conclusions

Based on the present results, it appears that health authorities and policy-makers need to perform a comprehensive review of training regarding medical waste management. Because of the issue’s importance concerning general health, as well as the environment, a concerted effort is required. There must also be improvement regarding HCWs’ and visitors’ health literacy beyond clinical care. By empowering individuals, excessive production of infectious waste could be minimized, and expense levels could be held in check. This solution would involve recurring evaluation and improvement of the management system.

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Competing interests

None declared.

Ethical approval

Not required.

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