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CASE REPORT

Hazardous Home Medical Care Waste Collection: A Six Year Follow-up Study

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Abstract:

Background:

Domestic medical waste from Home Medical Care (HMC) is a concern in Japan. In 2005, the Japanese government provided that HMC waste is collected by municipalities. HMC waste includes infectious or sharps, thus such waste should be collected by doctor or nurse. Nevertheless, no studies have examined the collection of separate HMC waste items, such as needles and infectious agents.

Objective:

To demonstrate the current HMC waste collection status for individual items and to assess whether HMC waste collection rate by nurses has been changed since the initial study.

Methods:

A questionnaire was mailed and delivered 1,022 offices, from which 677 office nurses replied for the follow-up study, 27 had closed down, and five had integrated with other offices. Thus, the final analysis was conducted in 645 offices. Offices were classified into three groups according to the size of the local population.

Results:

Most of the used syringes and needles, were collected by a nurse or doctor. More nurses in small-sized cities collected used syringes and needles from patients' homes than nurses in medium- or large-sized cities. In contrast, more doctors in large-sized cities collected used syringes and needles from patients' homes than doctors in small- or medium-sized cities. HMC waste collection rates by nurses for all city sizes had decreased since the baseline study. Both 2009 and 2015 study, the collection rate of HMC waste by nurse was as high as small-sized city and lower as large-sized city. The trend of this did not change over six years.

Conclusion:

The collection rate of HMC waste by nurses has declined in the last six years. This indirectly indicated that the HMC waste collection rate of municipalities improved in six years. Safe HMC waste collection program awareness should be promoted among nurses, doctors and patients. It is necessary for healthcare workers to work in cooperation with municipalities. The development of standardized guidelines for HMC waste handling protocols should be a priority for all municipalities.

Keywords: Home-visit nursing, Home-medical-care waste management, Domestic medical waste, Manuiapalities.

1. INTRODUCTION

Home medical care (HMC) services have become more prominent and widespread in Japan over the past few years with 7,153 HMC offices currently in operation [1]. Domestic medical waste is a constant concern with HMC. The

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Japanese Waste Disposal and Public Cleansing Law classifies waste materials as either industrial or general waste [2]. Industrial waste results from business activities and general waste refers to any waste other than industrial waste [3]. Infectious waste from hospitals or clinics, such as blood and needles are designated as “specially controlled industrial waste” and absorbent cotton and cotton gauze and infectious HMC waste discharged from household are designated as “specially controlled general waste” [4]. Due to increasing concerns over the amount of waste collection associated with HMC, the Japanese government demanded that HMC waste should be collected by the municipalities in 2005 [5]. Thus, municipalities are now responsible for the collection of HMC waste. However, some municipalities do not collect some or all HMC waste due to fear of infection or presence of sharp objects [6 - 9]. On the other hand, some large municipalities have been collecting HMC waste and have developed guidelines for HMC waste handling [10 - 12]. HMC waste collection started in the larger municipalities, and it was assumed that the small- and medium-sized municipalities would also begin processing this type of waste. However, thus far, there has been no research as to whether they are complying with these requirements. Another concern is with the type of items included in HMC waste because some sharps may be contaminated with infectious agents, thereby introducing significant possible risk factors for municipalities and their workers. Studies on HMC sharp waste in USA [13, 14] and HMC waste infection control in UK [15, 16] have generally recommended that sharp or infectious items should be disposed of by doctors or nurses, even if there is an occupational health risk, and it has been particularly emphasized that needles and infectious bloody materials should not be handled by non-medical personnel. Further studies have also recommended that professional HMC education on the proper handling of HMC waste should be given to all patients [14, 17, 18]. However, regardless of these concerns and recommendations, there has been little research on HMC waste collection, and the research that has been conducted has only included small samples [19 - 21] and a low response rate [21]. Unfortunately, none of these small studies has examined the collection and disposal of separate HMC waste items, such as needles and infectious agents. Therefore, the purpose of the current study was to investigate the current HMC waste collection status for individual items and to assess whether HMC waste collection rate by nurses has been changed or not over six years since the initial study.

2. SUBJECTS AND METHODS

2.1. Subjects

This study was a follow-up to a previous prospective cohort study. 1,283 office nurses participated in the 2009 baseline study [18]; thus, the follow-up questionnaire was mailed to the same 1,283 HMC offices, of which 261 went undelivered, and of those delivered, 677 (66.2%) office nurses replied. Since the baseline study, 27 HMC offices had closed down and five others had integrated with other offices. Analysis of the remaining 645 offices was performed. Offices were first classified into three groups by population size; offices in municipalities with <50,000 people were classified as small-sized city offices, those with $\geq 500,000$ people were classified as large-sized city offices, and populations that fell between these two were classified as medium-sized city offices.

2.2. Questionnaire

The questionnaire was evaluated for recovery rate and inappropriate answer in advance by pilot study targeting 200 offices. The questionnaire was mainly a selection formula. The choices were created with reference to previous studies [19, 21]. The question items are the opening year, the number of full-time nurses, the number of part-time nurses, the number of visits per month, the type of visiting nursing performed at the office, the collection status per waste item, the container of waste, what is troubling at the time of collection, burden of processing cost, education at patient home, separation status at patient's home. The questionnaire was completed by a representative nurse of the nursing office. Among the many question items, the basic information of the office (establishment year, number of nurses, the number of visits per month, *etc.*), and collecting status of each HMC waste items were used for this study.

2.3. Statistical Analyses

Statistical analyses were conducted using SPSS[®] statistical software (Ver.21, IBM corp). To compare the three nursing office groups, analysis of variance was performed, and if significant, pairwise comparisons were performed. Scheffe's multiple comparison procedure was applied to adjust the statistical significance to 5% when the three groups were compared. Trend analysis for three population groups was also performed. Jonkheere-Terpstra trend tests were performed for continuous valuable, Cochran-Armitage trend tests were performed for binary variables. Continuous parameters with normal distributions were analyzed using Student's *t*-test. Binary variables were analyzed using a chi-

square test. A two-tailed test was used for all statistical analyses, and in all cases, a *p*-value of 0.05 was used as the threshold significance level.

3. RESULTS

3.1. Basic Characteristics of the Subjects

Compared to the baseline survey, the follow-up 645 office had a feature that the opening year was early (1998.4 vs 1999.3), number of full-time nurse was many (3.92 vs 3.64). These differences were statistically significant (data not shown). The classification of the 645 offices was performed according to population size [22] as outlined in the previous section and as shown in Table (1). Small-sized cities had fewer fulltime nurses (*p*=0.006 for trend) with fewer home visits (*P*=0.004 for trend) conducted per month (Table 1).

Table 1. Basic nursing office characteristics ¹.

| | Small-sized city (n=211) | Medium-sized city (n=265) | Large-sized city (n=169) | P fortrend |
|--|--------------------------|---------------------------|--------------------------|------------|
| Opening year ² | 1998.2 ± 0.7 | 1998.7 ± 0.3 | 1999.6 ± 0.4 | 0.328 |
| Full-time nurse ² | 4.15 ± 0.17 | 4.70 ± 0.15 | 4.72 ± 0.19 | 0.006 |
| Part-time nurse ² | 3.06 ± 0.22 | 3.32 ± 0.21 | 3.84 ± 0.36 | 0.065 |
| Number of home visits per month ² | 422.5 ± 21.8 | 454.7 ± 19.6 | 487.9 ± 23.2 | 0.004 |

¹ Values are means ± SE.

² Differences were not statistically significant in the three population groups.

3.2. Waste Collection status

Except for pen-type self-injection needles, more than 50% of nurse had collected used syringes and needles. Table (2). More nurses in small-sized cities collected used syringes (Table 2, *p*=0.001 for trend), needles (Table 2, *p*=0.002 for trend) and infusion needles (Table 2, *p*=0.001 for trend) from patients’ homes than nurses in medium- or large-sized cities. On the other hand, More doctors in large-sized cities collected used syringes (Table 2, *p*<0.001 for trend), needles (Table 2, *p*<0.001 for trend) and infusion needles (Table 2, *p*<0.001 for trend) from patients’ homes than doctors in medium- or small-sized cities. The collection rate by nurses of Infusion bag, tube, catheter was 66.8% in small-sized city. These waste collection rates were lower for large-sized cities (*p*<0.001, Table 2). There were no items with a collection rate exceeding 50% in other items (Table 2).

3.3. HMC Waste Collection Status Changes Over Six Years

To examine the HMC waste collection status changes, the follow-up study examined the nurse collection rate on HMC waste and compared these with the base line study. HMC waste collection rates in all city categories had decreased (*p* <0.01, Fig. 1). It was observed by a study conducted in 2009 and 2015, the collection rate of HMC waste by nurse was as high as small-sized city and lower as large-sized city. The trend of this did not change over six years. (Fig. 1, *p*=0.001 for trend).

DISCUSSION

This study demonstrated the current HMC waste collection status by item, population, and collection rate change based on a follow-up study six years after the original baseline study.

Hazardous HMC items, such as a syringes or needles, were found to be collected by nurses and doctors because the risk of danger and infection was high. Previous studies regarding the HMC waste of sharp items in USA [13, 14] and infection control [15, 16] and legislation in UK [23, 24] have recommended that sharp or infectious items should be collected by doctors or nurses even if there are occupational health risks. The Japanese Waste Disposal and Public Cleansing Law categorize infectious waste from households as general waste [2]. However, if the law were to be strictly followed, it would not be strictly legal for patients to store their infectious materials and sharps in their own house until the general waste collection day [18]. Therefore, it is considered appropriate that health care workers collect these infectious materials and sharp objects. In its guidelines for HMC waste, Japan Medical Association also states that health care workers should suitably be placed to collect sharp or infectious materials [25]. Depending on the population size, needles or syringe waste was collected by either doctors or nurses. Many doctors collected needles or syringe waste in large-sized cities; in contrast, many nurses collected these in small-sized cities Table (2). There are two reasons

for these differences, first, the number of doctor/nurse visits to patient's homes may be different in urban and rural areas. If doctors visit a patient's home more time in urban areas than rural areas, doctors collect used needles or used syringes more than nurses. In Table (1), the number of visits per month by offices in large cities was greater than those of small cities ($p=0.004$ for trend). However, this is a total number of home visits by office. Therefore, whether the doctor/nurse is visiting a number of times per month on a same patient house is unknown. Further studies are required to understand this. Secondly, large cities may be promoting to a greater extent the collection of infectious waste by doctors than small cities are. In actual fact, some large municipalities have been developing guidelines for correct handling of HMC waste [10 - 12]. It was assumed that the small- and medium-sized municipalities would also begin developing guidelines. Pen-type self-injection needles were often disposed of by the patients themselves. These items are used for insulin self-injections and have a safety mechanism regarding disposal.

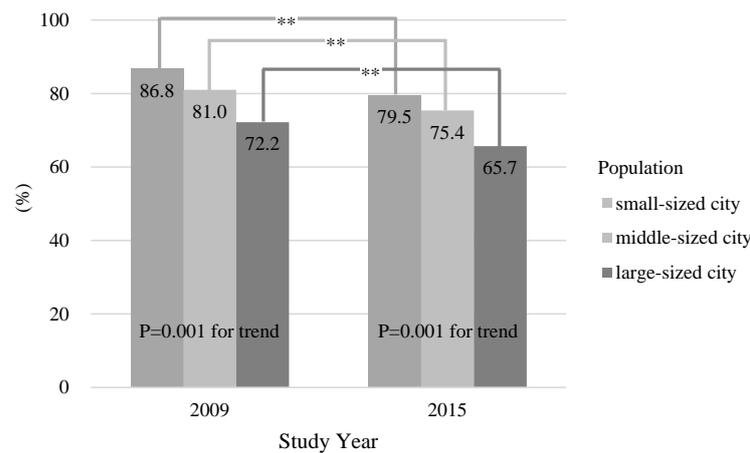


Fig. (1). HMC waste collection rate by nurses. **: $p < 0.01$, significant differences between the two study years.

Nonhazardous items, such as nutrients, tubes, and bags, have a low collection rate by doctors or nurses. Moreover, the collection rate of some nonhazardous waste items was dependent on the city size. For concerning these nonhazardous HMC wastes, patients either returned these items to the hospital or discharged them as general waste. In 2005, the Japanese government instructed municipalities that they are responsible for the collection of HMC waste devoid of sharps or needles [5]. Accordingly, municipalities in metropolitan areas are collecting nonhazardous HMC waste items [10 - 12]. Additionally, some home patients do not want to treat HMC waste as general waste because of their underlying fears of revealing their disease in public [19]. This is particularly the case in small-sized cities where patients in a neighborhood know each other. The present study did not show directly that large-sized cities collected more HMC waste than small-sized cities. A cause for this was that nurses responded to the questionnaire; that is, municipality personnel did not respond to the questionnaire directly. However, HMC waste items are low collection rate by the nurses or doctors are considered municipality has been collected. Further study is needed for municipalities.

At the follow-up, it was observed that HMC waste collection by nurses had decreased, which may have been because of the progress made in the municipality collection rate over the previous six years. The rankings had not changed over the six year period. Municipalities are followed the Ministry of Environment recommendations, and this trend is expected to continue. However, further follow-up is required.

Table 2. HMC waste collection percentage on each item by HMC doctor or nurse.

| Medical care items | Occupation | Small-sized city (n=211) | Medium-sized city (n=265) | Large-sized city (n=169) | P for trend |
|-------------------------------|------------|--------------------------|---------------------------|--------------------------|-------------|
| Used syringes (blood adhered) | | | | | |
| | *** Doctor | 37.9 | 53.6 | 62.1 | <0.001 |
| | ** Nurse | 73 | 60.8 | 57.4 | 0.001 |
| Used syringes (drug only) | | | | | |
| | *** Doctor | 33.2 | 41.9 | 54.4 | <0.001 |
| | ** Nurse | 70.1 | 56.2 | 53.8 | 0.001 |

(Table 2) contd....

| Medical care items | Occupation | Small-sized city (n=211) | Medium-sized city (n=265) | Large-sized city (n=169) | P for trend |
|---|------------|-----------------------------|------------------------------|-----------------------------|-------------|
| Needle | | | | | |
| *** | Doctor | 37 | 58.9 | 62.7 | <0.001 |
| ** | Nurse | 74.4 | 64.9 | 59.2 | 0.002 |
| Infusion needle | | | | | |
| *** | Doctor | 36 | 56.6 | 60.4 | <0.001 |
| ** | Nurse | 73.5 | 63.8 | 58 | 0.001 |
| Pen-type self-injection needle | | | | | |
| ** | Doctor | 19.4 | 30.9 | 34.3 | 0.001 |
| | Nurse | 29.9 | 28.3 | 28.4 | 0.743 |
| Infusion bag, tube, catheter | | | | | |
| | Doctor | 26.1 | 28.7 | 29.6 | 0.437 |
| *** | Nurse | 66.8 | 49.4 | 40.8 | 0 |
| Infusion pump | | | | | |
| | Doctor | 20.4 | 26 | 29 | 0.05 |
| * | Nurse | 26.5 | 18.9 | 16 | 0.01 |
| Central venous catheter | | | | | |
| | Doctor | 34.6 | 37 | 33.1 | 0.811 |
| | Nurse | 31.3 | 26.4 | 23.7 | 0.093 |
| Nasal tube, gastric fistula catheter | | | | | |
| | Doctor | 31.3 | 32.1 | 32 | 0.882 |
| | Nurse | 30.3 | 23.4 | 23.7 | 0.121 |
| Enteral nutrients, nutritional adjustment diet vessel, feeding tube | | | | | |
| * | Doctor | 9.5 | 4.5 | 10.7 | 0.809 |
| | Nurse | 16.6 | 13.2 | 14.2 | 0.477 |
| Portable injector (for morphine injection) | | | | | |
| * | Doctor | 25.1 | 34.7 | 34.9 | 0.033 |
| | Nurse | 16.1 | 16.6 | 16 | 0.982 |
| Ventilator mask | | | | | |
| | Doctor | 7.6 | 7.5 | 10.1 | 0.404 |
| | Nurse | 9 | 9.8 | 11.8 | 0.371 |
| Endotracheal suction catheter | | | | | |
| * | Doctor | 9.5 | 6 | 13.6 | 0.222 |
| | Nurse | 21.8 | 16.6 | 17.2 | 0.22 |
| Tracheal cannula | | | | | |
| | Doctor | 39.3 | 43.8 | 47.3 | 0.115 |
| | Nurse | 15.2 | 10.6 | 13 | 0.472 |
| Continuous Automated Peritoneal Dialysis (CAPD) bag | | | | | |
| | Doctor | 8.5 | 5.3 | 7.1 | 0.522 |
| | Nurse | 5.7 | 5.3 | 4.7 | 0.681 |
| Urinary catheter, bag | | | | | |
| | Doctor | 12.8 | 9.1 | 16 | 0.423 |
| ** | Nurse | 38.9 | 27.2 | 26.6 | 0.007 |

Multiple answers were allowed. Values are percent for each population size.

*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$, Significant difference by chi-square test among three population groups.

The present study had several advantages over previous studies with respect to study design. First, it collected data from a larger representative sample of domiciliary nursing offices. In this study, the subjects were 1,283 HMC nurse offices, of which 36.1% were registered with the National Association for Home-Visit Nursing Care [26] and 18.0% with Japanese Home-Visit Nursing Stations [1]. Despite being a nationwide survey, the response rate of this follow-up study was 66.2%. However, the limitations must not be overlooked. First, the follow-up 645 office had a feature that the opening year was early (1998.4 vs. 1999.3), number of full-time nurse was many (3.92 vs. 3.64). Conversely, the establishment year is short, and small offices were closed or failed to follow up. Second, because the subjects surveyed

were only home-visit nursing offices, no conclusions can be drawn about any other services involved with HMC waste disposal, such as municipalities, other waste disposers, and medical institutions. Third, the questionnaires were only completed by the nurses; thus, situations faced by home doctors may be improper. Fourth, this study has only determined current status in home care settings. Occupational health issues, such as infection risks, were not addressed. These additional questions and considerations, among others, should be the focus of future studies.

CONCLUSION

Domestic medical waste is a constant concern with HMC services. The collection rate of HMC waste by nurses has declined in the last six years. This indirectly indicated that the HMC waste collection rate of municipalities improved in six years. Safe HMC waste collection program awareness should be promoted among nurses, doctors and patients. It is necessary for healthcare workers to work in cooperation with municipalities. The development of standardized guidelines for HMC waste handling protocols should be a priority for all municipalities.

AUTHOR NOTE

This study were was supported by the Japan Ministry of the Environment (grant-in-aid for scientific research to promote a recycling-oriented society 08065604, 2008-2010) and The Yuumi Memorial Foundation for Home Health Care (2014-2015).

CONFLICT OF INTEREST

The author confirms that this article content has no conflict of interest.

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