Healthcare workers' Knowledge about the segregation process of Infectious Waste Management in a Hospital

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Article

Healthcare Workers' Knowledge about the Segregation Process of Infectious Waste Management in a Hospital

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Abstract: Any Hospital's primary goal is to restore human health and save lives through health services provided to patients, but at the same time, hazardous wastes are produced. Inconsistent management of unsafe wastes might cause adverse effects and other issues to workers, the environment and public health. Segregation is considered the critical stage for a successful Healthcare Waste Management. Mixing hazardous waste with non-hazardous waste will be avoided by correctly applying practices at the segregation stage. This study aimed to assess personnel's knowledge about Infectious Medical Waste and segregation practices used at six wards in Nicosia General Hospital. An analytical cross-sectional study was conducted, and data were collected through a structured self-administered questionnaire. The Statistical Package of Social Science (SPPS) version 25 was used with a minimum statistical significance α=0.05. The study population was nurses, nurse assistants, ward assistants and cleaners working at the study wards. Out of 191 questionnaires, 82 were received, with a response rate of 42.93%. Most participants were female (72%) and nurses (85,4%). Participants had medium to good knowledge about Infectious Medical Waste management and good knowledge regarding segregation practices applied in their ward. Segregation was not carried out as it should have since most participants stated that Infectious Medical Wastes were mixed with non-hazardous waste. Correct answers given by the participants regarding color-coding of different Healthcare Waste categories was 67.5%, and only four answered correctly to all questions. Although participants knew segregation practices and the colour-coding process applied for Healthcare Waste, they didn't use them satisfactorily. They applied methods regarding segregation without specific training, knowledge and guidance. Due to the issue's importance, training programs must be implemented and performed.

Keywords: infectious waste management; healthcare waste; hospital; color coding; segregation; public health

1. Introduction

Through the years, changes in human activities and lifestyle have led to a rise in the generation of various types of waste [1], and the healthcare industry could not avoid being affected by these changes.

According to the World Health Organization (WHO), Healthcare Waste (HCW) refers to all waste generated during human diagnosis, treatment or immunization, mainly in healthcare facilities, research centres and laboratories dealing with health procedures. Hospitals are the most important producers of HCW since they provide health services 365 days a year, 24 hours a day [2].

HCW constitutes about 1-2% of waste generated within the community [3]. Based on the literature, HCWs are divided into two major categories: Hazardous waste and non-hazardous Waste. Around 85% of the total waste is considered non-hazardous or general waste and does not cause any harm to human life and the environment. The remaining 15% is Hazardous waste, and due to their composition (infectious, toxic, radioactive), they can negatively affect human life and well-being, the environment and the finances of healthcare facilities if not managed correctly [4,5]. According to

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WHO, around 10% is Infectious Medical Waste (IMW), and the remaining 5% is toxic and radioactive waste [2].

It is well known that effective IMW management protects public health and the environment if IMW is treated and disposed of with safety and responsibility. Effective IMW management also helps to prevent the spread of infectious diseases like Hepatitis A and C and HIV (Human Immunodeficiency Viruses). Finally, proper IMW management helps reduce related costs associated with IMW treatment and disposal due to possible reduction of IMW quantity [6,7].

A clear definition of IMW is required for staff to identify correctly IMW from non-hazardous waste. The purpose of IMW varies between countries, and its characterisation often depends on health professionals. In Cyprus and according to the waste law of 2011 (Law 185(I)/2011) [8] and its amendments, IMW includes all HCWs that are potentially infectious, such as waste contaminated with blood and other body fluids. These materials have been in contact with patients infected with highly contagious diseases and sharp objects like contaminated needles, syringes and surgical blades.

The amount of IMW depends on various factors. Some of them are:

(1) the number of beds and the occupancy rate

(2) the size of the hospital and type of specialisation

(3) segregation procedures and

(4) preference for single-use disposable equipment.

According to WHO, the IMW generated in high-income countries per occupied bed/day is higher than in low-income countries. However, in low-income countries, the actual amount of IMW produced is believed to be much higher since, in most cases, effective segregation procedures are not applied, and IMW is mixed with non-hazardous waste [9]. Inconsistent segregation practices can be attributed to the staff's lack of knowledge of correct segregation practices, regulations, and guidelines.

In all countries, most problems regarding the management of IMW are associated with non-compliance with directives, legal guidelines and regulations. Due to limited economic resources, More issues are identified in developing and non-developed countries, leading to environmental and public health hazards. Although the procedures applied for IMW management differ from hospital to hospital, the problematic areas that need improvement are similar in almost all hospitals [10].

The IMW management process consists of a chain of procedures, including segregation, collection, temporary storage, transportation inside and outside the hospital, final storage, treatment and final disposal [11]. Segregation is considered the key stage for successful HCW management [12]. In Nicosia General Hospital (N.G.H) and according to the colour-coding process, IMW is collected in yellow containers (boxes and bags), non-hazardous wastes in black bags, empty bottles and vials that previously contained medicinal/pharmaceutical substances in red boxes and cytotoxic wastes in purple containers. Factors associated with improper segregation include lack of knowledge, awareness, attitudes, practices and inadequate management and guidance [13].

In 2019, in N.G.H, the largest hospital in Cyprus regarding bed availability, more than 268 tons of IMW were produced. Due to the COVID-19 pandemic, the quantity of IMW produced significantly increased by 18.45% in 2020, 75.90% in 2021 and 66.11% in 2022, compared to 2019 and before the pandemic. The quantities of IMW were affected mainly due to the increase of available beds, the growth of continuous use of Personal Protective Equipment from staff and the addition of single-use equipment, practices implemented worldwide to prevent the transmission and spread of the virus. Vast quantities of IMW had been additionally created through the assessments for detecting the Covid-19 virus since they required special treatment in case of positive results.

The study objective was to assess personnel's knowledge about IMW as well as segregation practices applied at six wards in N.G.H.

2. Materials and Methods

2.1. Study settings

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This study is an analytical cross-sectional conducted at six wards in N.G.H. from the beginning of June 2022 to the end of July 2022. Specifically, the study was employed in Pathology A/Neurology ward, Pathology B/Neurology ward, General Surgery A and B wards and Orthopaedic A and Orthopaedic B/Urology ward. All six wards had 172 beds as a capacity, of which 165 were available for inpatient treatment, 95.93%.

2.2. Study population

Study population included nurses, nurse assistants, ward assistants and cleaners, frequently come into contact with IMW. Total of study population was 191 workers at the aforementioned wards, regardless of age, gender, working experience and educational level.

2.3. Sampling Technique

Method used for data collection, was survey questionnaire given to study population. A validated, anonymous, structured self-administered questionnaire was utilized for data collection. Aim of questionnaire was to help researchers to identify the level of personnel's knowledge about IMW as well as segregation practices applied at workplace. Questionnaire involved demographic and professional data, general questions for IMW, questions regarding segregation practices applied, training programs and color-coding of different HCW categories at N.G.H. Questionnaire was pre-tested for reliability and a pilot study was conducted in order to estimate time of completion, verify that questions included were understandable, correctly expressed and to identify any possible barriers to data collection.

2.4. Statistical analysis

Statistical Package of Social Science (SPPS) version 25 was used for data statistical analysis. A minimum level of statistical significance was counted at α=0.05, which has been established in the medical and social sciences field, and p value rounded to 3 decimals.

2.5. Code of Ethics

All relevant permissions have been obtained before conducting the study. All questionnaires were anonymous, and confidentiality was ensured. Additionally, all participants were assured that no personal information would be shared, in accordance with the Bottom of Form Protection of Natural Persons about the Processing of Personal Data and the Free Movement of such Data Law of 2018 (Law 125(I)/2018 [8].

3. Results

Table 1. shows the demographic and professional data of the selected sample of 82 questionnaires.

Table 1. Questionnaire data.

Questionnaire attributes	Categories	Count	Column N %
Gender	Male	23	28.0%
	Female	59	72.0%
Education level	High school	10	12.2%
	Bachelor	57	69.5%
	Master	15	18.3%
Working position	Nurse	70	85.4%
	Ward assistant	6	7.3%
	Cleaner	6	7.3%
Working status	Permanent	46	56.1%
	Temporary/indefinite	20	24.4%

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	On contract basis	16	19.5%
Age of respondents	<= 35	41	50%
	36 – 50	27	32.9%
	51+	13	15.8%
	No answers	1	1.3%
Work experience at N.G.H	<= 5	33	40.2%
	6 – 15	29	35.4%
	16+	20	24.4%
Work experience at workplace (ward)	<= 5	41	50.0%
	6 – 10	17	20.7%
	11+	24	29.3%

During the delivery of the questionnaires, the study population included nurses, nurse assistants, ward assistants and cleaners, frequently come into contact with IMW. A total of 82 questionnaires were received, with a response rate 42.93%. Majority of the participants were female 59 (72%), as opposed to males who were less 23 (28%). The professional group that predominated in the sample were nurses with a percentage of 85,4%, while ward assistants and cleaners responded with a percentage of 7,3%. Questionnaire was not completed by any nurse assistant. A percentage of 69.5% of the participants owned a bachelor's degree, 18.3% owned a master's degree, while the remaining 12,2% completed only high school education. Out of the total sample, 56.1% worked under permanent employment, 24.4% under temporary/indefinite employment and 19.5% on contract basis. Most participants had a work experience at N.G.H. and at a ward equal to or less of 5 years. Out of 81 responses (one participant didn't mention the age), half of the participants had age equal or less of 35 years old.

Table 2. Frequency of study participants regarding general knowledge among each item question.

Questions	**Answers**	
	Yes	**No**
I am aware that in N.G.H. are generating infectious medical waste.	74 (90.2%)	8 (9.8%)
All healthcare waste generated in N.G.H are hazardous.	45 (54.9%)	37 (45.1%)
I am aware of infectious medical waste management process in N.G.H.	54 (65.9%)	28 (34.1%)
I have an important role in infectious medical waste management process	68 (82.9%)	14 (90.2%)
I have consequences on my work if I don't manage infectious medical waste correctly.	58 (70.7%)	24 (90.2%)
I am aware of the safety measures I must take every time I come into contact with infectious medical waste.	73 (90.1%)	8 (90.2%)
I am aware of the national legislation and regulations regarding the management of infectious medical waste	26 (31.7%)	56 (90.2%)
Total average score		4.85

Table 2 shows that most study participants (90.2%) knew that N.G.H. IMW was generated, while the remaining percentage (9.8%) did not. Almost half of the participants (54.9%), answered that all waste produced in N.G.H. are dangerous. Around 2/3 of the participants knew the IMW management process, while the remaining 1/3 stated the opposite.

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Sixty-eight (68) of the respondents believe they play an important role in managing IMW, while almost 70.7% of the participants believe they have consequences if they don't manage IMW correctly. Most participants were aware of the measures that need to take place in case they come into contact with IMW. Out of 82 responses, only 26 participants stated that they were aware of the national legislation and regulations regarding the management of IMW, with a response rate of 31.7%. Based on the results of the questionnaires, we came to the conclusion that the knowledge of participants in regards to IMW management was moderate to good, and this is confirmed by the total average score of 4.85 out of 7.

Table 3. Significance between general knowledge in IMW and demographic and professional data.

Variable	Categories	P-value
Gender	Male Female	0.95
Age of responses	<=35 36 – 50 51 +	0.162
Educational level	High school Bachelor Master	0.795
Working position	Nurse Ward assistant Cleaner	0.145
Working status	Permanent Temporary / Indefinite On contract basis	0.801
Work experience at workplace (ward)	< =5 6 – 10 11+	0.924
Work experience at N.G.H	< =5 6 – 15 16+	0.987

As shown in table3, there was no statistically significant difference between the demographic and professional data examined and participants' knowledge in IMW, since the p value was found in all cases be higher than 0.05. In this study, a p-value of 0.05 or less is considered to be statistically significant ($p<0.05$).

Table 4. Frequency of study participants regarding knowledge segregation practices applied.

Questions	Answers	
	Yes	No
Segregation of healthcare waste is necessary	82 (100%)	0 (0%)
I recognize the infectious medical waste produced at my workplace	73 (89%)	9 (11%)
Segregation of infectious medical waste from non-hazardous waste occurs at the point of generation.	62 (75.6%)	20 (24.4%)
Healthcare waste is segregated according to the color coding process	70 (85.4%)	12 (14.6%)

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I am aware of the color coding process applied regarding healthcare waste	62 (75.6%)	20 (24.4%)
Color coding process for segregation of healthcare waste is applied by all staff	46 (56.1%)	36 (43.9%)
There is a mix of infectious waste with non-hazardous waste.	63 (76.8%)	56 (23.2%)
Total average score		1.20

Table 5. Significance between segregation practices and demographic and professional data.

Variable	Categories	P-value
Gender	Male Female	0.783
Age of responses	<=35 36 – 50 51 +	0.307
Educational level	High school Bachelor Master Ward assistant Cleaner	0.449
Working status	Permanent Temporary / Indefinite On contract basis	0.077
Work experience at workplace (ward)	< =5 6 – 10 11+	0.231
Work experience at N.G.H	< =5 6 – 15 16+	0.102

Table 6. Frequency of study participants regarding training programs.

Questions	**Answers**	
	Yes	**No**
I am training every year in infectious waste management issues.	8 (9.8%)	74 (90.2%)
I have been trained in infectious waste management issues in the past	21 (25.6%)	61 (74.4%)
Both legislations and regulations regarding the management of infectious waste are included in the training programs of the N.G.H.	43 (52.4%)	39 (47.6%)
Infectious waste management training is really very useful for my work	77 (93.9%)	5 (6.1%)
Total average score		1.55

Table 7. Significance between training programs and demographic and professional data.

Variable	Categories	P-value

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Gender	Male Female	0.665
Age of responses	<=35 36 – 50 51 +	0.358
Educational level	High school Bachelor Master Ward assistant Cleaner	0.623
Working status	Permanent Temporary / Indefinite On contract basis	0.070
Work experience at workplace (ward)	< =5 6 – 10 16+	0.810
Work experience at N.G.H	< =5 6 – 15 16+	0.530

For the purposes of analysing the results, if the average of answers was closer to 1, it meant that the participants were aware of the practices applied in their workplace, while if the average of answers was closer to 2, then this meant that they did not know.

A different approach was used for training programs. If the average of the responses was closer to 1, it meant that the participants' choices were YES, while if the average responses were closer to 2, most of the participants' choices were NO.

All participants (100%) perceived that segregation of HCW was necessary, but 11% (9 participants) could not identify the IMW produced in their workplace. Three-quarters of the participants stated that segregation of IMW from non-hazardous waste was applied at the point of generation. The same percentage responded that they knew the color-coding process, while 70 participants (85.4%) stated that it was actually applied. More than half of the participants (56.1%) believed that the color-coding process for the segregation of HCW was applied by all staff, but most of them (76.8%) stated that IMW was mixed with non-hazardous waste. The remaining 23,2% considered that effective segregation was applied, that is, each HCW was placed in the correct container based on color coding process and avoiding mixing IMW with non-hazardous waste.

In regard to training, the vast majority of 90.2% stated that they are not trained, while 25.6% stated that they had been trained at least once in the past. Regarding the topics included in the training, specifically legislation and regulations of IMW management, the answers were 52.4% and 47.6%, respectively. One of the most important percentages recorded in this study was the 93.9% of participants indicated that training programs for IMW management would be really useful for their work.

According to the results, it appears that participants' knowledge of segregation practices applied was good (total average score 1.20).

Additionally, and based on the results, there was no statistically significant difference between the demographic and professional data examined and participants' knowledge of applied segregation practices since the p-value was found in all cases to be higher than 0.05.

Regarding participants responsiveness for training programs (total average score 1.55), it appears that staff lacked of training programs, in spite of the fact that participants believed that training programs are very useful for their work. Additionally, and based on the results, there was no statistically significant difference between the demographic and professional data examined and training programs since the p-value was found in all cases to be higher than 0.05.

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Table 8. Segregation and color-coding of different HCV categories .

Questions	Answers	
	Right	Wrong
Gauzes and gloves used on patients with infectious diseases	66 (80.5%)	16 (19.5%)
Empty ampoules that previously contained pharmaceutical substances	8 (9.8%)	74 (90.2%)
Outside packaging of medical consumables and pharmaceutical products	73 (89%)	9 (11%)
Blood-contaminated waste	76 (92.7%)	6 (7.3%)
Human tissues	54 (65.9%)	28 (34.1%)
Intravenous fluids plastic container	55 (67.1%)	27 (32.9%)

Table 9. Correct answers regarding segregation and color-coding of different HCV categories.

Descriptive Statistics					
Variable	Total	Minimum	Maximum	Mean	Std. Deviation
Percent	82	0.17	1.00	0.675	0.201

A response rate of 80.5% displayed correct answers regarding the segregation of gauze and gloves used on patients with infectious diseases. Additionally, correct answers regarding human tissues and blood-contaminated waste (considered IMW), were 65,9% and 92,7%, respectively. Regarding the segregation of empty ampoules that previously contained pharmaceutical substances, only 9,8% responded correctly. The remaining 90,2% stated the opposite. Response rates of 89% and 67.1% responded correctly regarding the segregation of outside packaging of medical consumables and pharmaceutical products and intravenous fluids plastic containers, respectively. Correct answers given by the participants resulted in 67,5%, which corresponded to 332 correct answers out of 492.

4. Discussion

Based on the questionnaire results, we concluded that the knowledge of participants in regards to IMW management was moderate to good, and this is confirmed by the total average score of 4.85 out of 7. Additionally, there was no statistically significant difference between the demographic and professional data examined and participants' knowledge in IMW since the p-value was found to be higher than 0.05 in all cases. In this study, a p-value of 0.05 or less is considered to be statistically significant ($p<0.05$). The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted. The most significant proportion of the sample (72%) consisted of females, in contrast to males (28%). The predominance of the female gender, as well as female nurses, was expected, since the number of female workers and female nurses in N.G.H is bigger, as this stands for most hospitals worldwide. Findings regarding the predominance of female nurses, agreed with the data prevailing in the USA for 2008 [14], where male nurses were the minority in healthcare organizations. The findings also agreed with the study of Musa et al., where 91.3% of the participants were female nurses [15].

Almost 9 out of 10 participants had a bachelor's or master's degree. The result may be affected by the fact that the majority of participants were nurses, and according to Parliament's decision in 2007, nursing education was upgraded to university level, and all nurses in Cyprus had the opportunity to upgrade their diploma to bachelor's degree.

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More than half of the respondents considered all waste generated as hazardous, so there is a big possibility that all wastes were collected in yellow containers, creating an unnecessary increase in quantities of IMW and hospital expenses. IMW treatment costs around 10-20 times more than non-hazardous waste management. Therefore, effective segregation will probably reduce the cost of the treatment of IMW and the risk of infection, mainly through injuries. A similar result was also reported in the study by Deress et al., where more than half of nurses stated that all HCWs were dangerous [16].

It is not only important for staff to know the IMW management process applied in their workplace, but it is also their obligation. Also, administration's responsibility is to inform all staff about IMW management processes. Based on participants answers, nearly 1/3 was not assure of IMW management process and as a result they probably did not follow correct practices. For example, the fact that 54,9% considered that all HCW produced in N.G.H was hazardous or the fact that only 65,9% knew the IMW management process were elements that need to be corrected immediately by N.G.H administration. The result was similar to that reported in the Deress et al, study concerning nurse's participants [16].

The percentage of 31.7%. who stated that they were aware of the national legislation and regulations regarding IMW management, which was very low, which indicates that the hospital's management and the staff may not have paid the required attention. This percentage was considered unsatisfactory since only three out of ten participants were aware of the legislation in an area that was so important for the performance of their work, their personal safety, the safety of patients and visitors, the wider public and the environment, but also for the hospital's budget. These findings agreed with the study by Sharma et al, where it is reported that 31.7% of nurses were sufficiently aware of the regulations and legislation governing the IMW management [17]. In contrast, Mathur et al, reported that the percentage of nurses with knowledge about regulations and legislation was 91.7%, a result much higher than that recorded in this study [18].

The effectiveness of IMW procedures regarding segregation implies important requirements such as the ability of the responsible staff to recognize the various types of HCW and the availability of all necessary consumables. Many researchers consider the segregation stage as the most important stage of infectious waste management; when implemented correctly, the success of the management is almost guaranteed. The importance of the segregation stage is recognized by WHO and also recognized by all participants. This result was substantially better than the findings of Romin and Pensiri's, study, where 86.8% believed that the segregation of HCW is important [19].

Ideally, if color coding process is executed properly, the mixture of different types of HCW will be prevented and that will result in a positive effect on the environment, public health and hospital itself. A rate of 85,4% believed that segregation of HCW and color-coding process were applied, although only 75.6% knew of the color-coding process applied in their workplace. Based on these results, we can presume that some of the participants might not be aware of the right color-coding process. Similar results were concluded in the study of Deress et al, 2018, where 73.6% of nurses responded that they were aware of the color-coding process [16], while in the study of Maluni et al, 2018, 32% of the respondents were not aware of segregation process [20].

Based on the responsiveness, segregation was not applied as it should be and mixture of non-Hazardous waste with IMW occurred. Inadequate segregation, may lead to an increase in hospital expenditure since the cost for treatment of IMW is much higher than the cost for treatment of non-Hazardous waste. N.G.H. compensated €1.45 per kg for IMW, which includes collection from final storage room, transport, treatment and final disposal. On the other hand, compensation for the same services regarding the management of non-hazardous waste is €100 per route, transporting 1.5 tons per route on average. The results were in agreement with the study in Tanzania by Manyele and Lyasenga, 2010, where it is reported that segregation procedures for IMW were applied but not in satisfactory level which required improvement [21].

An important procedure is the segregation of HCW at the point of generation, practice encouraged and supported by WHO. If segregation of IMW applied at the point of generation, mixture of different types of HCW as well as injuries and transmission of infectious diseases will be

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avoided. Administration of N.G.H, in collaboration with the supervisors, must promote segregation of IMW at the point of generation, since 1 in 4 participants believed that it is not applied. Deress et al. report in their study that 84% of nurses believe that segregation of IMW should be applied at the point of generation [16].

Tables 8 and 9 demonstrates more accurate results for participants knowledge regarding segregation and color-coding process. Participants answers were incorrect at a rate of 32,5%, meaning that participants chose the wrong color. The result was not satisfactory, since 1/3 of HCW were not placed in the right container, causing a mixture of various types of HCW. As mentioned before, inadequate segregation process, may cause negative effects to public and the environment as well as additional hospital's costs. Segregation and color coding process demands significant improvement, which is clearly stated from the results. It is noteworthy to mention that only 4 participants (less than 6%), responded correctly in all 6 questions in regards segregation of HCW based on color-coding of different HCW categories. Results reinforces from the majority of the participants, that IMW were mixed with non-Hazardous waste and color coding process was not applied by all staff. Responses of participants regarding segregation of HCW based on color-coding process, proves also the lack of sufficient knowledge by staff and the need for regular training programs. Similar results were found in the study by Maluni et al, 2018, where more than 20% of the participants placed HCW in the wrong containers [20].

In regards to training programs, results showed that most of participants were never trained for IMW management. This result agreed with the findings of the study by Ali et al, 2015, where it stated that educational programs were not implemented [22]. The percentage of participants who responded that were trained in IMW management at least once in the past was almost similar to the 31% reported in the study conducted in Ethiopia by Hayleeyesus and Cherinete, 2016 [23]. However, it was lower than 36.8% and 61.6% reported in the study by Deress et al, 2018 and Uddin et al, 2014 respectively [16, 24].

From participants' replies, it was concluded that the majority support that training programs should be carried out regularly to help them perform their tasks properly and confidently. It is almost certain that participation in training programs improves both knowledge and efficiency of the procedures. The result is similar to the outcome of the study by Shivalli and Sanklapur 2014, where almost nine out of ten nurses (86%) expressed the need for continued training [12].

Results concerning training programs were a direct message to the administration of N.G.H. that staff were positive to be trained regularly and update their knowledge regarding IMW management. Therefore, training programs should be included in the policies and procedures of the hospital. Adopting training programs for all newly hired staff and, more particularly, for newly hired nurses would also be a positive approach since newly hired nurses will know from the beginning how they should act and behave in matters of IMW management and, more particularly, segregation procedures.

Many studies have concluded that one of the most important factors to improve the HCW management process in healthcare facilities is upgrading the knowledge level, which is achieved primarily through systematic training [25,26].

Hospital administration should provide regular education and training to their staff on the proper IMW management and inform them about the latest regulations and practices. Furthermore, hospital administration needs to ensure that all personnel are familiar with the hospital's policies and procedures in regard to segregation.

5. Conclusions

Based on present results, staff requires training programs regularly regarding IMW management, primarily on segregation practices. All staff should be obligated to identify all types of HCW generated in their workplace and apply relative segregation practices. Moreover, staff should have adequate knowledge to distinguish a hazardous HCW from a non-hazardous HCW and place them according to the color coding process and when a practice applied is correct and when it is not.

Since IMW management plays an important role in hospital management, public health and the environment, a concerted effort is required by all personnel. By empowering personnel's knowledge and practices regarding segregation, production of IMW could be minimized, and expenses for their treatment could be decreased.

An important aspect that needs improvement is the contribution of the supervisors of each ward in terms of HCW segregation practices through regular and intensive audits to guide staff properly. Regular audits and inspections can help identify areas for improvement and ensure compliance with requirements. Due to the seriousness and importance of the issue, it is strongly suggested that training programs be held for all hospital staff.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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