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EFFECT OF AN EDUCATIONAL PROGRAM FOR HEALTHCARE PROVIDERS REGARDING HEALTHCARE WASTE MANAGEMENT AT MATERNAL AND CHILD HEALTH CENTERS

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ABSTRACT

Background: Healthcare waste represents one of the most important environmental problems in the world because of the potential environmental hazards and public health risks, and its management is an integral part of infection control programs. **Aim:** The aim of the study was to evaluate the effect of an educational program for healthcare providers regarding healthcare waste management at maternal and child health centers. **Design:** A quasi-experimental design was used. Setting: The current study was conducted in 5 maternal and child health centers at Qalyobia Governorate. **Subjects:** A Convenient sample of healthcare providers (nurses and health technicians) in the previously mentioned setting was recruited. **Tools of data collection:** Three tools were used. I. A structured interviewing questionnaire: consisting of 3 parts to assess: 1) demographic characteristics of healthcare providers. 2) Healthcare providers' past history of exposure to health problems due to healthcare wastes. 3) healthcare providers' knowledge about healthcare waste management. II. Observational checklist to assess healthcare providers' practices regarding healthcare waste management. III. Modified Likert Scale: was used to assess healthcare providers' attitude regarding healthcare waste management. **Results:** This study showed that 65.3% of healthcare providers aged from 35 to <50 years old, 93.9% of them were nurses, and 46.9% of them had less than 10 years of experience. Regarding healthcare providers' knowledge; only 12.2% of healthcare providers had good total knowledge score regarding healthcare waste management which increased to 73.5% post educational program intervention. The total score of healthcare providers' practices were satisfactory for 16.3 % of the preprogram and increased to 81.6 % post educatuionaprogram. Preprogram 22.4% of healthcare providers had positive total attitude score which increased post program implementation to 81.6%. **Conclusion:** This study concluded that the educational program had a significant effect on the improvement of the healthcare providers' knowledge, practices and attitude. **Recommendations:** Further studies should be provided in other MCH centers to implement healthcare waste management educational program for all healthcare providers.

Keywords: Educational program, Healthcare providers, Healthcare waste management

INTRODUCTION

Healthcare waste (HCW) can be defined as the total waste that is generated from healthcare establishments, health-related research facilities, and laboratories. Hospitals, clinics, laboratories, medical research centers, pharmaceutical manufacturing plants, pharmacies, blood banks, veterinary health care centers, and home healthcare activities are some of the generators of healthcare waste irrespective of volumes, characteristics, and composition (Derso *et al.*, 2018). HCW mismanagement may expose people inside the healthcare facilities (e.g. staff, employees who handle medical waste, patients and their families), and individuals outside the facility to potential risks. Moreover, some accidental exposures to these hazardous medical wastes can also occur (WHO, 2014).

Unregulated healthcare waste management is a public health problem. Approximately, 5.2 million

people die every year due to wasterelated diseases. Healthcare waste (HCW) carries higher risk of infection and injuries than other types of waste. This has posed a grave threat to not only human health and safety but also to the environment for the current and future generations. Safe and reliable methods for handling of healthcare wastes are of paramount importance. Effective healthcare waste management is not only a legal necessity but also a social responsibility (Swathi *et al.*, 2018). Inadequate and inappropriate handling along with poor disposal of healthcare waste may have serious public health consequences and a significant impact on the environment (Berkel, 2018).

The practices of Health Care Waste Management (HCWM) greatly vary by country. Many developing countries are facing significant challenges to handle HCW due to low socio-economic conditions, lack of HCWM regulation, inadequate training of staff, and treatment technologies. Inappropriate management and disposal methods exercised during handling and disposal of health care wastes is an increasing significant health hazards and environmental pollution/hazards due to the infectious nature and unpleasant smell of the waste (Win *et al.*, 2019).

Community participation is also vital in the implementing policies and programmes for healthcare waste management. Community participation in implementing policies and programmes can be improved by enhancing the awareness of the community towards safe management of healthcare waste. Actions involved in implementing effective healthcare waste management programmes require multi-sectoral and interaction at all levels (Healthcare-waste.org. 2017).

Community health nurses play a key role in the management of HCW. They should be able to segregate the waste and store it in the correct bins at the point of generation; and in order for them to fulfill this function efficiently, it is important that they have adequate knowledge about the importance of segregation and the must know to distinguish the different containers and bins for the various types of HCW. Nurses and all the sanitation staff working in maternal and child health centers need to know the health hazards of wastes and the proper techniques and methods of handling the waste. This knowledge and proper practice can go a long way towards the safe disposal of hazardous medical waste and the protection of healthcare personnel, patients, as well as the community at large and the environment (Rafiq *et al.*, 2013).

Significance of the study

In Egypt, waste disposal is governed by laws of the Ministry of Environmental Affairs and the Ministry of Health and Population. There are regulations that classify the waste from healthcare settings to be hazardous. According to (WHO, 2014) between 75% and 90% of the waste produced by healthcare providers is comparable to domestic waste and usually called non-hazardous or general health-care waste. It comes mostly from the administrative work, kitchen and housekeeping functions at health-care facilities and may also include packaging waste and waste generated during maintenance of health-care buildings. The remaining 10–25% of health-care waste is regarded as "hazardous" and may pose a variety of environmental and health risks.

According to the WHO report around 85% of the hospital wastes is actually non-hazardous, 10% are infective and the remaining 5% is noninfectious but hazardous (chemical), pharmaceutical and radioactive. Inadequate and inappropriate handling of health-care waste may have serious public health consequences and a significant impact on the environment. These wastes may enhance environmental pollution and the spread of infectious diseases, including acquired immunodeficiency syndrome (AIDS), hepatitis, tuberculosis, diphtheria, cholera, and many others (Rudraswamy, 2014).

Aim of the study

The study aimed to evaluate the effect of an educational program for healthcare providers regarding healthcare waste management at maternal and child health centers.

Research Hypothesis

The educational program will improve healthcare providers' knowledge, practices and attitude regarding healthcare waste management.

METHODOLOGY

Subjects and Methods

Research Design: A quasi-experimental design was used in this study.

Study setting: The study was conducted at 5 maternal and child health centers (Elzamorania, Elshokr, Elsafan, Barkata and Tosfa). These were

chosen by simple random sample out of 20 MCH centers following kafr-shokr city (25%), which was selected randomly from 11 administrative Units at Qalyobia Governorate.

Sample: A Convenient sample of healthcare providers (all nurses and health technicians) in the previously mentioned setting was recruited.

Tools of data collection

The researchers used three tools to collect data to achieve the aim of the study:

Tool 1: An interviewing questionnaire was developed by the researchers based on literature review, and written in simple clear Arabic language. The questionaire consisted of three parts as the followings:

1st part: it was designed to collect data about demographic characteristics of healthcare providers. It included questions about age, educational qualification, occupation, years of experience, training about healthcare waste and marital status.

2nd part: it is concerned with healthcare providers' past history of exposure to health problems from healthcare wastes.

3rd part: it was devoted to assess healthcare providers' knowledge about healthcare waste management and was divided into:

A. Knowledge about healthcare waste management, it included 10 close–ended questions. The questions covered areas such as, meaning of healthcare waste products, meaning of healthcare waste management, categories of healthcare waste products, types of healthcare waste products, risks of healthcare waste products, mode of infection transmission, factors that increase risk of healthcare waste product on health, prevention of health risks, steps of healthcare waste products management and methods of getting rid of healthcare wastes.

Scoring system: knowledge variables were weighted according to the items included in each question and the score was calculated by the number of its correct answers. Means and standard deviations were estimated.

B. Knowledge about the different types of healthcare waste products, it included one close ended question about different types of healthcare wastes.

Scoring system: The score of each item is given as 1 for correct answer and 0 for incorrect answer.

Total knowledge score: was evaluated in three categories as follows: Good: >75%, average: 60% - 75% and poor: < 60%.

Tool 2: The Observational checklist was designed to assess healthcare providers' practices regarding healthcare waste management. This tool composed of seven parts which included items related to; hand washing, protective measures, separation process, waste collection, transportation in and out, safety and security, and final disposal.

Scoring system for practices: Each item scored as 1 if done and 0 if not done and each part score was calculated as satisfactory if the healthcare provider did ≥60% of items, and unsatisfactory if the healthcare provider did the activity <60% of items. The scores of all parts were summed-up and the total practices score was evaluated as unsatisfactory when practices level <60%, and satisfactory when practices level ≥ 60%.

Tool 3: Modified Likert Scale: - Adopted from (Nemoto & Beglar, 2014). It was used to assess healthcare providers' attitudes regarding healthcare waste management. The scale consisted of 16 statements.

Scoring system each statement has three levels of responses ranging from 0= never, 1= sometimes, 2= always

Total attitude score was assigned as:-

- Negative attitude--less than 50% of total attitude score.
- Uncertain attitude--50 %-< 75% of total attitude score.
- Positive attitude--75% and above of total attitude score.

Validity and Reliability

Content validity was done by five experts from the field of community health nursing. The developed tool was reviewed for appropriateness of items and measuring the concepts. Modification was carried out accordingly. The reliability was done by Cronbach's Alpha coefficient test which revealed that the tool consisted of relatively homogenous items (0.82).

Pilot Study

The pilot study was carried out including (10%) of the sample size were chosen randomly from the same study setting to test content, clarity and consistency of the tools using the interviewing questionnaire as a pre-

test sheet. No modifications were done, so the pilot study sample was included to the total sample.

Field work

Data were collected during a period of 5 months which started from the beginning of January 2019 to end of May 2019. It was carried out by the researchers in the selected setting.

Health Education program Construction: which included 3 phases

I. Preparation Phase

Based on the results obtained from the interviewing and observational sheets, as well as extensive review of the current and past available national and international references related to the research title, the health educational program was developed by the researchers. It was implemented immediately after the pre-test.

Program contents

Booklet was designed to meet healthcare providers' needs and to fit into their interest and levels of understanding. It consisted of different elements which are as follows: introduction about healthcare waste products, categories and types of healthcare waste products, risks of healthcare waste products and infection transmission, prevention of health risks, importance and steps of healthcare waste products management and methods of getting rid of healthcare wastes.

Methods of teaching

All healthcare providers received the same program content using the same teaching methods, there were: lectures/Discussions, and presentation.

Teaching Aids: suitable teaching aids were prepared for the program as pictures, handouts, and video films.

II. Implementation Phase

The data was collected from healthcare providers working in the previously selected MCH Centers after interview with them, during work hours. The researcher visited MCH Center two times a week for five months. The total number of sessions was 6. During first session, the researchers introduced themselves to participants, and explained the nature and aim of the study (6-8 participants). Oral consent was taken, and then each participant was asked to fill in the pretest using tool 1, 2, and 3. This session took about 20-30 minutes.

During second, third, and fourth sessions, the researchers explained the information about introduction about healthcare waste products, categories and types of healthcare waste products, risks of healthcare waste products and infection transmission, prevention of health risks. Each session took about 30-45 minutes. The fifth and sixth sessions contain information about importance and steps of healthcare waste products management and methods of getting rid of healthcare wastes. The researchers gave posttest intervention using the same tools, and then provided them an illustrated booklet in order to help them at home.

Each session started by a summary about what had been given through the previous session then the objectives of the new topics, taking into consideration the use of simple language to suite the participants.

The Discussion, motivation and reinforcement during sessions were used to enhance level of healthcare providers learning process. Direct reinforcement in the form of a copy of the content was given as a gift for each participant to use it as future reference.

III. Evaluation Phase

Evaluation of the program was done by using the posttest questionnaire which was the same format as the pre-test in order to evaluate the effect of health Permission to conduct the study and implement the program was obtained .

Administrative Design

Permission to conduct the study and to implement the program was obtained by submission of official letters issued from Faculty of nursing, Benha University to the Undersecretary of the Ministry of Health in Qalyobia Governorate.

Ethical considerations

Permission was obtained from each participant before conducting the interview and after giving them a brief orientation to the purpose of the study, participants were reassured that their participation in the study is voluntary and about their right to withdraw at any time without giving reasons. They were also reassured that the information gathered would be confidential and used for the purpose of the study only. No names were required on the forms to ensure anonymity and confidentiality.

Statistical Analysis

Data collected were analyzed using the Statistical

Package for Social Sciences (SPSS), version 20. Mean, SD, *T* test and correlation test were used to analyze the collected data. Statistical significance was considered at *p*-value <0.05.

RESULTS:

Table 1: Distribution of healthcare providers regarding their demographic characteristics (n=98)

Demographic characteristics	No.	%
Age in years		
20-<35	24	24.5
35-<50	64	65.3
≥50	10	10.2
Mean±SD	**38.57±9.83**	
Educational qualification		
Secondary education	24	24.5
Technical education	62	63.3
Bachelor degree	12	12.2
Occupation		
Nurses	90	93.9
Laboratory technician	8	6.1
Years of experience		
Less than 10 years	46	46.9
10-20	42	42.9
>20 years	10	10.2
Mean±SD	**9.67±5.34**	
Marital status		
Single	8	8.2
Married	70	71.4
Divorced	8	8.2
Widow	12	12.2
Received any training about healthcare waste management Yes	32	32.6
No	66	67.4

Table 1 showed that 65.3% of healthcare providers aged from 35 to less than 50 years old with mean age 38.57±9.83, 93.9% of them were nurses. About 63.3% had technical education, and 46.9% of them had less than 10 years of experience. Also, 71.4% of healthcare providers were married. Only 32.6% of study participants received training about healthcare waste management.

Table 2: Mean knowledge score of healthcare providers regarding healthcare waste management pre and post program (n=98)

Knowledge variables	Items	Pre-program Mean±SD	Post-program Mean±SD	Paired *t* test	*P* value
Meaning of healthcare waste products.	2	0.9583±0.82406	1.5208±0.68384	-3.153	<0.001**
Meaning of healthcare waste products management	2	0.7708±0.75059	1.5833±0.61310	-5.387	<0.001**
Categories of waste products.	3	1.5000±0.94531	2.5000±0.71459	-5.598	<0.001**
Types of healthcare waste products.	7	2.9792±1.60438	5.6250±1.86371	-6.507	<0.001**
Risks of healthcare waste products.	4	1.7500±1.15777	3.0208±1.36038	-5.111	<0.001**
Mode of transmission of infection	3	0.8750±1.12278	2.1875±0.95997	-6.789	<0.001**
Factors increase risk of healthcare waste product on health.	5	1.7917±1.36769	3.8333±1.66738	-6.261	<0.001**
Prevention of health risks	3	1.2917±0.92157	2.4792±0.77156	-6.875	<0.001**
Steps of healthcare waste products. management	5	2.2083±1.47256	4.1875±1.06504	-6.503	<0.001**
Methods of getting ride of healthcare waste products.	4	1.8333±1.34217	3.2500±0.86295	-5.537	<0.001**

***Highly significant at p< 0.01 level*

Table 2 shows that improving mean and standerd deviation of studied healthcare providers' knowledge post program compared by preprogram including (meaning of healthcare waste products, meaning of healthcare waste products management, categories of waste products, types of healthcare waste products, risks of healthcare waste products, mode of transmission of infection, factors increase risk of healthcare waste product on health, steps of healthcare waste products, management, methods of getting ride of healthcare waste products). There were highly statistical significant differences regarding all knowledge items between pre and post program implementation (*P*<0.001).

Table 3: Distribution of healthcare providers regarding their knowledge about containers of healthcare waste products pre and post program (n=98)

Knowledge	Preprogram				Post-program				Chi square test	*P* value
	Incorrect		Correct		Incorrect		Correct			
	No.	%	No.	%	No.	%	No.	%		
Infective wastes	52	53.1%	46	46.9%	6	6.1%	92	93.9%	25.90	<0.001**
Pathologic wastes	50	51.0%	48	49.0%	10	10.2%	88	89.8%	19.21	<0.001**
Radioactive wastes	56	57.1%	42	42.9%	8	8.2%	90	91.8%	26.72	<0.001**
Sharp tools	42	42.9%	56	57.1%	18	18.4%	80	81.6%	6.91	<0.05*
Medicines	58	59.2%	40	40.8%	4	4.1%	94	95.9%	34.39	<0.001**
Chemical wastes	54	55.1%	44	44.9%	14	14.3%	84	85.7%	18.01	<0.001**
General wastes	44	44.9%	54	55.1%	10	10.2%	88	89.8%	14.77	<0.001**

***Highly significant at p< 0.01 level*

Table 3 illustrates that there was noted improvement healthcare providers' knowledge about typess of healthcare waste products post program when compared with their knowledge pre-preprogram. It was also noted that many of the healthcare provider (53.1%, 51.0%, 57.1%, 42.9%, 59.2%, 55.1%, 44.9%) had incorrect knowledge pre program which decreased post program results 6.1%, 10.2%, 8.2%, 18.4%, 4.1%, 14.3%, 10.2%) regarding varuos factors (Infective wastes, Pathologic wastes, radioactive wastes, sharp tools, medicines, chemical wastes, general wastes) respectively. There were highly statistical significant differences regarding all knowledge items between pre and post program implementation (*P*<0.001).

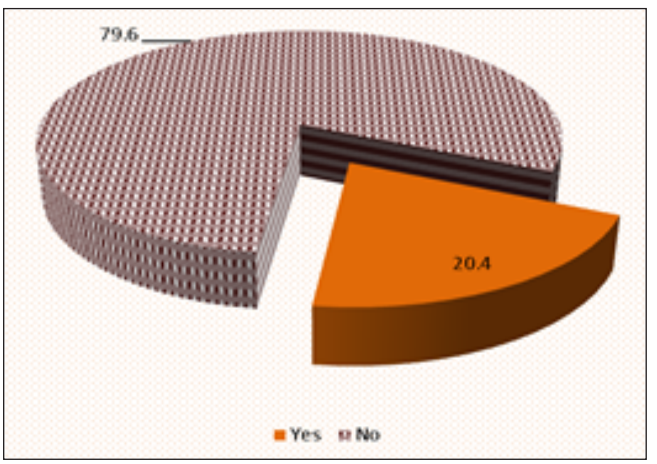

Figure 1: Distribution of studied healthcare providers according to their exposure to health problems from healthcare wastes (n=98)

Figure 1 displays that, 20.4% of the studied healthcare providers were exposed to health problems from healthcare wastes.

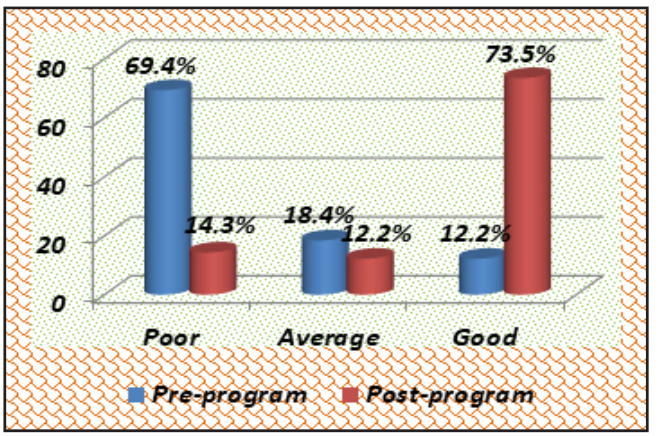

Figure 2: Distribution of studied healthcare providers according to their total knowledge score pre and post program implementation (n=98)

Figure 2 displays that at preprogram only 12.2% of healthcare providers had good total knowledge score regarding healthcare waste management which increased to 73.5% post program.

Table 4 shows that there is a marked improvement of studied healthcare providers' practices regarding healthcare waste management post program implementation compared by pre educational program (73.5%, 71.4%, 69.4%, 65.3%, 59.2%, 55.1%) of health care providers had unsatisfactory practice preprogram and this changed to (95.9%, 83.7%, 91.8%, 85.7%, 83.7%, 83.7%) with satisfactory practice regarding final disposal, safety and security, transportation in and out, waste collection, protective measures and hand washing, at post program implementation respectively and there were highly statistical significances difference regarding all practice items between pre and post educational program (*P*<0.001).

Table 4: Distribution of healthcare providers according to their practices regarding healthcare waste management pre and post program (n=98)

Procedure	Pre-program				Post-program				Chi square test	*P* value
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory			
	No.	%	No.	%	No.	%	No.	%		
Hand washing	54	55.1%	44	44.9%	16	16.3%	82	83.7%	16.04	<0.001**
Protective measures	58	59.2%	40	40.8%	16	16.3%	82	83.7%	19.14	<0.001**
Separation process.	44	44.9%	54	55.1%	18	18.4%	80	81.6%	7.97	<0.05*
Waste collection	64	65.3%	34	34.7%	4	4.1%	95	95.9%	40.53	<0.001**
Transportation in and out.	68	69.4%	30	30.6%	16	16.3%	82	83.7%	28.16	<0.001**
Safety and security	70	71.4%	28	28.6%	8	8.2%	90	91.8%	40.92	<0.001**
Final disposal	72	73.5%	26	26.5%	14	14.3%	84	85.7%	34.84	<0.001**

***Highly significant at p< 0.001 level*

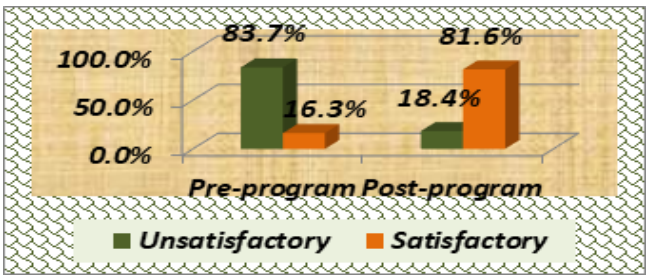

Figure 3: Distribution of studied healthcare providers according to their total practices score pre and post program implementation (n=98)

Figure 3 displays that, pre the program implementation 83.7% of healthcare providers had unsatisfactory total practices score while only 16.3% had satisfactory total practices score which increased post the program implementation to 81.6%.

Table 5 Illustrates that, there were a highly significant improvement of mean and standerd deviation for healthcare providers' attitude score levels regarding all items of healthcare waste management after program implementation (*P*<0.001).

Table 5: Mean attitude score of healthcare providers regarding healthcare waste management pre and post program (n=98)

Attitude variables	Pre-program	Post-program	Paired *t* test	*P* value
	Mean±SD	Mean±SD		
Waste may be hazardous to the environment.	0.4082±0.64286	1.5714±0.50000	-10.183	<0.001**
Safe disposal of waste reduces the transmission of diseases	0.7347±0.78463	1.7551±0.43448	- 8.138	<0.001**
Wear gloves is necessary to protect against the dangers of healthcare waste.	1.0000±0.84163	1.6327±0.48708	- 4.658	<0.001**
The use of personal protective tools increases the incidence of infection.	1.4694±0.54398	1.7755±0.42157	-3.136	<0.001**
Waste disposal The work of a team is not related to the employees of the unit.	0.3061±0.61928	1.7755±0.42157	-15.854	<0.001**
The process of separating healthcare waste is important.	0.6122±0.86160	1.7347±0.44607	-8.687	<0.001**
I have the readiness to apply the processes of separation and collection in a healthy and safe.	0.6122±0.93131	1.7347±0.44607	-8.276	<0.001**
Revising the rules for the safe disposal of healthcare waste is important.	0.7347±0.63821	1.7347±0.44607	-8.854	<0.001**
Cooperation with the waste treatment team has a significant role in protecting caregivers.	1.0816±0.53373	1.8163±0.39123	-8.058	<0.001**
It is important to report when you have acupuncture.	0.4898±0.81961	1.6939±0.46566	-9.478	<0.001**

The elimination of healthcare waste disposal rules increases the workload	1.4490±0.57956	1.8163±0.39123	-4.272	<0.001**
The unit work in implements the rules of safe disposal of healthcare waste well.	1.2245±0.68512	1.7551±0.43448	-4.846	<0.001**
Always put the waste in the correct plastic bags.	1.0204±0.96803	1.6939±0.46566	-4.260	<0.001**
Efforts to eliminate waste are a financial burden on management	0.5306±0.86848	1.7347±0.44607	-9.238	<0.001**
It is necessary to enforce binding laws to deal with waste.	0.5510±0.89119	1.7347±.44607	-8.927	<0.001**
The awareness and training of healthcare waste treatment workers is essential.	0.5306±0.89214	1.7551±0.43448	-9.106	<0.001**

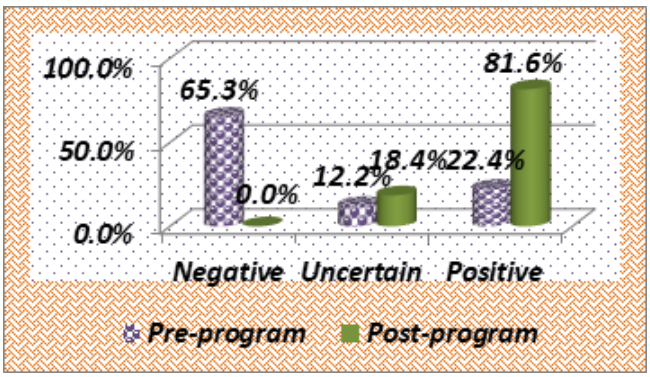

Figure 4: Distribution of studied healthcare providers according to their total attitude score pre and post program implementation (n= 98)

Figure 4 showed that at pre program implementation about 65.3% of healthcare providers had negative total attitude score. Only 22.4% had positive total attitude score which increased post program implementation to 81.6%.

Table 6: Correlation between total knowledge score and total practices score of studied healthcare providers regarding healthcare waste management pre and post program (n=98)

Variables	Knowledge-pre program		Knowledge post program	
	R	***P* value**	***R***	***P* value**
Practices pre-program	0.243*	<0.05*	-	-
Practices post-program	-	-	0.547**	<0.001**

***Highly statistically significant at p<0.001*

Table 6 presents correlation between knowledge and practice related to healthcare waste management pre and post program. The table indicates that there is a highly statistically significant positive correlation between knowledge score and practice score of the health care providers (r=0.547** at p<0.001**)

DISCUSSION

Safe and adequate environmental conditions in healthcare facilities including the availability of water, sanitation, hygiene, energy, and waste management – and the availability of standard precaution items (e.g. disposable gloves) are essential to protect and improve the health of patients, staff, visitors, and the wider community (Ryan & Jamie, 2018).

Good health depends in part on a safe environment. Practices or techniques that control or prevent transmission of infection help to protect healthcare workers from disease. The last decade witnessed a significant increase of public concern regarding health care waste disposal (Crisp & Potter, 2015). Establishing good practices for proper handling and disposal of healthcare waste is an important part of the health care delivery system.

The present study aimed to evaluate the effect of an educational program for health care providers regarding healthcare waste management at maternal and child health care centers. The findings indicatenoverall total knowledge score, total practice as well as total attitude score levels of study subjects was unsatisfactory and they need good quality training to improve their current knowledge, practice and attitude about healthcare waste management.

According to demographic characteristics of the healthcare providers, Table 1 of the present study findings revealed that the majority of health care providers were nurses with the mean age 38.57±9.83 and the mean years experiences of 9.67±5.34 and more than two-thirds of them had technical education. This finding was in accordance with a study done in Chennai

among 140 health workers at hospitals by Sutha Irin (2018) who found that 36% nurses, 8% pharmacist, 7% laboratory technician while the other 18% of respondents were distributed among quality management, also includes working experienced 57% for 4-7years. While, this result was in contrast with the study conducted in India about biomedical waste management by Chudasama *et al.*, (2013) and found that the majority of study participants belongs to 21-30 years and more than two third of them were working in hospital for 1 to 5 years.

Regarding training of healthcare providers about healthcare waste management, the present study findings showed that, one third of them received training. This result was in agreement with Hosny *et al.*, (2018) and reported that about 72% of participants did not attend related training. While this finding disagreed with Hakim *et al.*, (2014) based on the study conducted at Ain Shams University Hospitals, Cairo, Egypt which showed that majority of nurses (67.5%) received training on waste management, compared with only 38.2% of physicians and 21.3% of housekeepers. Furthermore, Omer & Alsubaie (2017) found that only 3 (18.8%) of the healthcare centers workers did not have any training in medical wastes management.

Regarding exposure to health problems Figure 1, the present study finding revealed that one fifth of the studied healthcare providers were exposed to health problems from healthcare wastes. In the same line Win *et al.*, (2019) it was found that the risk of acquiring infection was smaller in non-hospital type PHCs than in hospital type PHCs. On the other hand this result disagreed with Ismail *et al.*, (2013) who found that among the class-IV waste handlers 67% had history of multiple needle stick injury in the past one year which was unacceptably high. These could be explained that the environments, in MCH are less contaminated with healthcare wastes versus the areas in hospital were it is more infectious for health care personal. Moreover, nurses spend more time with patients in the ward than any other member of the health team. This increases their exposure to hospital environmental hazards, primarily health care waste, and associated risks.

Concerning the mean knowledge score for health care providers regarding health care waste management pre and post program from Table 2 of the present study finding revealed that, improvement in the mean and standerd deviation of studied healthcare providers' knowledge post program 5.6250±1.86371 compared by 2.9792±1.60438 regarding types of health waste products. Also, there was improvement of knowledge post program 4.1875±1.06504 compared by 2.2083±1.47256 regarding steps of healthcare waste products. This finding was in agreement with Swathi *et al.*, (2018) who reported that the majority (60%) of the nursing staff during pre-assessment were found to score <10 marks while remarkable improvement was observed during the course of post assessment as evidenced by 55% scoring more than 15 as against 7.5% who scored more than 8 during pre-test assessment.

Regarding knowledge about containers of healthcare waste products, Table 3, the present study findings revealed that, more than half of the health care provider had incorrect knowledge pre program implementation regarding infective wastes, pathologic wastes, radioactive wastes, medicines, chemical wastes. These could be explained that the health care perssonal were unaware about the different kinds of healthcare waste products as a result of inadequate training courses. This finding is congruent with Sutha Irin (2018) whose findings showed that respondents (60) from government and private hospital did not identify the different types of hospital wastes. On the contrary, Swathi *et al.*, (2018) reported that all doctors, nurses, and laboratory technicians have better knowledge of sanitary system regarding biomedical waste management.

Concerning total knowledge score level for healthcare providers regarding health care waste management pre and post program implementation in Figure 2 revealed that in pre program implementation only eighth of healthcare providers had good total knowledge score level regarding the healthcare waste managment, while the majority of them had good total knowledge score level with significant improvement post program implementation. The improvement in knowledge score indicates that the program succeeded to achieve its targeted goals. This may be attributed to one or more causes, which include the comprehensive content of the educational program, health care provider are interested and eager to know regarding waste management, they encourage change and ask questions, involve in interactive talk with use of multimedia and repetition of the message through a variety of materials. This study finding was in agreement with Hosny *et al.*, (2018) who reported that the majority of waste workers (80.8%) had moderate knowledge before training. However, after implementation of the training program,

there were significant improvements with an increased number of participants who achieved high scores, post-intervention, from 9.6% to 97.3%. In the same line Zagade & Pratinidhi (2014) who implemented an educational program on medical waste management for biomedical waste handlers revealed that percentage of participants had excellent knowledge increased from 0.5% pre-intervention to 79.1% after implementing the program.

Regarding the total practices score level for health care providers, Figure 3 and Table 4. The current study findings showed that, the majority of the studied subjects had unsatisfactory total practice score pre educational program implementation regarding healthcare waste management. This may be due to lack of knowledge regarding the healthcare waste management combined with lack of supervision. While, after implementation of the educational program majority of them had satisfactory total practice with highly statistically significant differences regarding all items of practices pre and post educational program. This finding was in accordance with Hosny *et al.*, (2018) and reported that 80.0% of the healthcare waste workers had poor practice score regarding health-care waste management before implementation of the educational training program while, 18.9% and 1.1% of participants had fair and good practice score, respectively.

Also, agreed by El-nour *et al.*, (2015) who stated that more than half (55%) of the study sample intervention group had fair practice scores regarding health care workers management before intervention, while after the implementation of the intervention program showed that, the proportion of hospital staff with good practice scores with a rise in score from 42% to 55% after three months. In line with this finding, by El-sayed *et al.*, (2012) the study conducted in Mansoura university Hospital, Egypt about intervention program for nurses based on health care waste management, This study found that all nurses had inadequate practices in most areas of waste management before the implementation of the educational training program. After the implementation of the program, there were significant improvements with the number of participants who achieved adequate score in the post and follow–up periods (99.3%, 96.2 % respectively).

Concerning the mean attitude score levels for healthcare providers Table 5, the present study findings revealed that a highly significant improvement of mean and standerd deviation for healthcare providers' attitude score levels regarding all items of healthcare waste management after program implementation (P<0.001).

As regard total attitude score levels pre and post program implementation for health care provider regarding healthcare waste management Figure 4, the present study finding showed that, pre program implementation; more than two thirds of studied subjects had negative total attitude score level.While, after program implementation the majority of them had positive total attitude score levels. This finding was in accordance with Singh *et al.*,(2018) and found that the majority (91.82%) of participants had a positive attitude towards safe management of biomedical waste whereas less than 50% of students are aware of the guidelines laid down by Government of Nepal.

The present study findings revealed a highly statistically significant positive correlation between healthcare provider knowledge and practice score throughout the phases of educational programs (Table 6). This may be due to the investment of time and effort by participants for attending the training program which did result in improvements in both knowledge and practice. Perhaps, this study was the first intervention study for health care provider in the setting. This is in line with Hussein (2011) who found that there was significant positive correlation between nurses' knowledge and performance throughout the training program. Also, Sarma *et al.,* (2011) found that the nurses with good knowledge, however, showed good practice percentage with very high performance. The same author showed that nurses with a higher level of education have a greater awareness of the national and international activities on biomedical waste management.

CONCLUSION

This study concluded that educational program had a significant effect on the improvement of the healthcare providers' knowledge, practices and attitude.

RECOMMENDATIONS

1 Regular training for healthcare providers on healthcare waste management.

2 Prioritizing healthcare waste management activities to protect staff and improvement of care.

3 Further studies should be provided in other MCH centers to implement healthcare waste management educational program for all healthcare providers.

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