Intervention program about Health Care Waste Management for Nurses working in Maternal and Child Health Care Centers At kalyubia Governorate

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Abstract:
Background: Waste produced in the course of healthcare activities entails a higher risk of infection and injuries than municipal waste. The problem of how to manage healthcare waste has become one of critical concerns .**The aim** of the study was to assess the effect of an Intervention program about Health Care Waste Management for Nurses working in Maternal and Child Health Care Centers At kalyubia Governorate on their knowledge and practice. **Design:** a quasi- experimental design was used. **Settings:** This study was conducted at 11 Maternal and Child Health Care Centers that are chosen randomly from 22 Maternal and Child Health Care Centers at Kalyubia Governorate. **Sample:** purposive sample of criteria accepted to participate used in the study involved All nurses working in the selected Maternal and Child Health Care Centers who accepted to participate in the study (n=185). **Tools**: two tools were used for data collection. **Tool I:** Self-administered Knowledge Questionnaire, which was used to collect data about general characteristics of the nurses, and their knowledge about Waste Management before and after implementation of the program. **Tool II :** Observation Checklist to assess nurses' practice toward waste management. **Results**: the current study revealed that, years of experience for more than three quarters of nurses were ≤ 10years; also more than three quarters of them didn't have any training courses related to Waste Management. There was a highly statistically significant difference between nurses' knowledge and practice toward Waste Management pre and post program implementation (p<0.001). **Conclusion**: The study showed a statistically significant improvement in nurses' knowledge and practice about health care waste management after implementation of the program. **Recommendations**: the study recommended that**,** training programs for nurses to be aware about the method use for waste management and the potentially serious implications of the mismanagement of waste for the health should be conducted in all Maternal and Child Health Care Centers.

Key Words: Waste, Management, Nurses, Intervention, Centers

Introduction

The health care facilities (HCFs) produce huge amount of bio-medical waste which may be hazardous to all those who come in contact with this waste. Healthcare waste (HCW) is a special category of waste, which is highly hazardous due to its infections and/or toxic characteristics *(Sharma, 2010)*.

Waste Management is one of the key problems of modern society due to the ever expanding volume and complexity of discarded domestic and industrial waste, it includes "generation, prevention, characterization, monitoring, treatment, handling, reuse and residual disposition of solid wastes, it is generated from biological, medical sources and activities, such as the diagnosis, prevention, or treatment of diseases *(Alagoze and Kocasoy, 2007).*

Common generators of biomedical waste are physicians, dentists, veterinarians, home health care, funeral homes, hospitals, clinics, doctors offices, veterinary hospitals and clinical laboratories. Steps in the management of biomedical waste include generation ,accumulation , handling ,storage ,treatment and Disposal, transport to final disposal site *(Environmental Protection Agency, 2013).*

It has classified by *(Wikipedia,2014)* that biomedical waste into solid or liquid. infectious waste include discarded blood, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human or animal tissue, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids, and laboratory waste that exhibits the characteristics described above. Medical waste has classified by *(WHO,2012)* into eight categories: general waste, Pathological, Radioactive ,Chemical, Infectious to potentially infectious waste, Sharps, Pharmaceuticals and Pressurized containers.

Health-care activities are means of protecting health, curing patients and saving lives. But they also generate waste, 20 percent of which entail risks either of infection, of trauma or of chemical or radiation exposure. Although the risks associated with hazardous medical waste and the ways and means of managing that waste are relatively well known *(International Committee of the Red Cross., 2011).* To prevent injury to health care, employees, patients and the environment by medical wastes, person responsible for waste management ought to have requisite knowledge, attitude plus behavior *(Akbolat , et al .,2012).* Availability of equipment & supplies & maintenance of equipment & facilities, register for waste management in MCHs & availability of posters for safe waste handling in each

department are considered the important factors affecting the implementation of waste management system *(WHO, 2012)*.

The exposure to infectious and hazardous waste can cause serious health problems to those who handle it, particularly to waste collectors or rag pickers and the environment*(WHO, 1995)*This can also become a source of many communicable diseases (*Gupta, et al.,2006).* Improper disposal practices of hospital waste affects the people who come indirect contact with it *(Jain ,2009).* Unsafe health care waste management practices may result an exposure to infectious wastes by Health care workers , patients, clients that could in turn create infection due to blood borne pathogens .Information levels and awareness of health personnel on the subject are important in waste management *(Pruss ,et al., 2013)*.

In order to be able to comprehend and implement the health care waste management and handling rules, it is mandatory to provide training program for nurses to make them aware of the potentially serious implications of the mismanagement of waste for the health of waste handlers and patients, provide them with an overall view of the fate of waste after collection and removal and teach them the importance of proper segregation of the different categories of waste *(Deno, 2011).*

Significance of the Study:

Expansion of health care facilities as well as the recent trend of using disposables has led to an unprecedented burden of health care related waste, so unregulated handling of biomedical waste is emerging as a serious threat to human health and safety *(Ostafa , et al .,2010).* Magnitude of healthcare waste in Egypt generates an average of 24,600 tons of hazardous or infectious waste daily from all health care facilities (excluding military hospitals*) (Ibrahim , 2009).*

At the global level, 18 to 64 percent of health care centers are reported to have unsatisfactory Bio-Medical Waste Management; predictors include lack of awareness, insufficient resources and poor disposal mechanisms *(WHO, 2013).* Biomedical waste must be properly managed and disposed of to protect the environment, general public and workers, especially nurses and sanitation workers who are at risk of exposure to biomedical waste as an occupational hazard. *(Sağlık, et al., 2014)* . This program based on nurses need assessment and hypothesized that this would upgrade nurse's knowledge and practice in relation to health care waste management.

Aim of the Study:

This study aims to assess the effect of an Intervention program about Health Care Waste Management for Nurses working in Maternal and Child Health Care Centers At kalyubia Governorate on their knowledge and practice level,through

- ❖ Determining the knowledge level of nurses regarding health care waste management before and after implementing the intervention program.
- ❖ Assessing practice of nurses before and after implementing the intervention program.

Research Hypothesis:

The implementation of the intervention program will improve the nurses knowledge and practice about waste management in MCH centers.

Material and Methods:

Research Design:

a quasi-experimental design used in this study.

Research Settings:

The study was conducted at 11 maternal and child health care centers from 22 health centers at kalyubia Governorate. 50% of these centers were chosen randomly and named Benha maternal and child care centre, Benha family health centre, Kafr shoukr maternal and child care centre, Kaha maternal and child care centre, Toukh maternal and child care centre, Sheibin Elkanater maternal and child care centre, Kalyub maternal and child care centre, kalyub family health centre, Elshmout healh centre, Batamda healh centre and Met Elsebah health centre.

Subjects:

Purposive sample used in the study, all nurses working in the selected maternal and child health care centers were taken according to criteria they accepted to participate (n=185). the total number of nursing personnel was 215 but 8 of them were dropped out because they refuse to participate in the study and 22 nurse was excluded for a pilot study .The sample included 21 nurses working in Benha maternal and child care center, 17 in Benha family health center, 18 in Kafr Shoukr maternal and child

care center, 20 in kaha maternal and child care center, 16 in Toukh maternal and child care center, 15 in Shebin Elkanater maternal and child care center, 18 in kalyub Maternal and child care center, 17 in kalyub family health center, 15 in Elshmout healh center, 14 Batamda healh center and 14 in Met Elsebah health center.

Tools of Data Collection:

Two tools were used for data collection:

Tool I- Interviewing questionnaire sheet: It was developed by the researchers after reviewing related literature (***WHO, 1996 & Sandra,2011& Sowmya, 2013***). It was written in Arabic language and composed of closed ended questions to assess the following:

Part I: General characteristics of the nurses, which include nurses 'age, educational level, years of experience, attending training courses, awareness of job description.

Part II: questionnaire sheet was constructed to assess nurses' knowledge about waste management before and after implementation of the program. as (Definition of bio medical waste, Types of bio medical waste, Sources of bio medical waste, Hazards of bio medical waste, Method of exposure to health risks, Method of exposure to health risks, Persons who are greater risk to the hazard of waste, technology methods for handling of wastes, Methods of waste management in hospitals and Segregation of bio medical waste).

The Scoring system for questionnaire sheet was calculated for each item as follows: correct and complete answer was scored (two points), the correct incomplete answer was scored (one point), while don't know or wrong answer was scored (zero point). The total score for all questions related to knowledge was 56 score. This score was converted by the researcher into a percent score categorized into two levels as followings

         Satisfactory   < 60.0%   ____   1-33

         Unsatisfactory ≥ 60.0%   ____   34-56

Tool II: Observation checklist: It was developed by the researcher to assess nurses' practice toward waste management such as (Labeling of infectious and non –infectious waste, Segregation of waste, Closing the container, use of personal protective devices, use of needle cutter, hand wash and use alcohol-based antiseptic hand rub).

The scoring system for the observation checklist consisted of giving a score of one for the step done correctly, while the step not done was scored zero. This score was converted by the researcher into a percent score.

Total practice scoring was for each category as the following:

Adequate   < 60.0%   ____   0-4

Inadequate   ≥ 60.0% ____   5-7

The practice was considered adequate if the percent score was 60% or more and inadequate if less than 60%

Field work :

1. An official letter clarifying the purpose of the study was obtained from the Faculty of Nursing to conduct the study and collect the necessary data.

2. The tools were revised for content validity by 5 juries who were experts in the related field, for clarity, relevance, comprehensiveness, and applicability.

3. Internal consistency reliability of all items of the two tools was assessed using coefficient alpha. It was 0.8 for self-administered knowledge questionnaire items while it was 0.9 for Observation Checklist items.

4. A pilot study was excluded from the study sample, it includes 10.0% of the expected sample size (22 nurses) to test content, clarity, and consistency of the tool and to determine the time needed to fill each tool. Modification needed was done included rephrasing of some questions, rearrangement of the questions and omission

5. The intervention program contained 4 phases, the preparatory phase started from the beginning of January 2014 to end of April 2014, covering three months and including the following: Reviewing the national and international related literature using journals, magazines, periodicals, textbooks, internet and theoretical knowledge of the various aspects concerning the waste disposal.

6. Preparation for training program objective to promote and enforce nurses' knowledge and practice related to healthcare waste management through number of learning session included all information about healthcare waste management.

7. A time schedule suitable for nurses was developed to conduct the program that included; date, place, topic, time and duration of each session. Intervention program designed for this study has been implemented through 15 sessions. These sessions have lasted for 30 hours (10) hours of theory and 20 hours of practice). These sessions were conducted for each M.C.H separately all nurses for every M.C.H and a copy of

the intervention program contents was given to each nurse. Nurses participated in the intervention program.

8. Implementation phase beginning by assess the staff nurses' knowledge of health care waste management before starting the intervention program topics include definition, sources, important, of waste, segregation of bio medical waste…. ect ,using the teaching strategies in the program were discussion, paper, data show, pen and paper, handouts. The teaching course included 2 parts: The first part was theoretical part which included 5 lectures, 2 hours for each. It was given within 11days. The second part was practical part; this part was implemented within 10 days for each MCH center covered Wash hand, antiseptic hand, personal protective devices like gloves, mask and segregation infectious procedures related to precautions and application of healthcare waste management. Using simulation, pencils for application exercises and role-play. The teaching aids & media included hand outs, CDs, pictures, & real model of incident report.

9. Evaluation phases ,Post-test immediately after implementation of the program to evaluate the change in the staff nurses knowledge regarding healthcare waste management using the same formate for the pre- test.

10. The researchers reassessed the nurses' practice of healthcare waste management using observation checklist directly after the intervention program.

Statistical Design:

The collected data were verified prior to computer entry. Statistical analysis was done by using Statistical Package for Social Science (SPSS) Version 11. Data tabulated and analyzed with the suitable statistical methods by using frequency, percentage, chi square, mean value and standard deviation, Pearson correlation coefficients were used for investigation the relationships between total knowledge and total practice and socio demographic characteristic , Also fisher Exact Test was used . Statistical significance was considered at:

- P value > 0.05 not significant
- P value < 0.05 significant
- P value < 0. 001 highly significant.

Results:

Table (1): Demographic characteristics of the studied nurses (n=185)

Characteristics	N	%
Age		
• <20	0.0	0.0
• 20-	61	33.0
• 30-	22	11.9
• ≤40	102	55.1
Mean ± SD	**40.62±9.339**	
Educational qualification		
• Bachelor of nursing	12	6.5
• Institute of nursing	6	3.2
• Diploma of nursing	167	90.3
Years of experience		
• 1>5	0	0
• 5-10	38	2.5
• ≤10	147	79.5
Mean ± SD	**2.79±.40509**	
Attending of related training courses	26	14.1
Job description describing waste management	-	-
Vaccination against virus B and tetanus	-	-
Total	**185**	**100%**

Table (1): Presented the demographic characteristics of the studied nurses, it displayed that the mean age of nurses was (40.62±9.339) years. Concerning their education, these qualifications had (90.3%) diploma of nursing. As regards to years of experience was (79.5%) more than ten years. (74.1%) of nurses did not attend any training courses related to waste management. Also, as regards to vaccination against virus B and tetanus, all the studied nurses did not receive any vaccination.

Table 2: Distribution of nurses correct Knowledge about bio medical waste management as reported by studied nurses throughout the program (n=185).

Knowledge Variables	Pre program		Post program		X^2	P-Value
	Correct complete		Correct complete			
	No	%	No	%		
1-Definition of bio medical waste	46	24.9	133	71.9	30.08	0.000
2-Types of bio medical waste	101	54.6	150	81.1	84.96	0.000
3-Source of bio medical waste	85	45.9	167	90.3	139.98	0.000
4-Hazards of bio medical waste	21	11.4	130	70.3	42.32	0.000
5- Methods of exposure to health risks	97	52.4	153	82.7	39.03	0.000
6-Persons exposed to hazard of waste	105	56.8	147	79.5	78.73	0.000
7-Personal protection to prevent the transmission of diseases from bio medical waste	46	24.9	125	67.6	168.98	0.000
8-Alternative means for replacing restoration.	20	10.8	137	74.1	58.67	0.000
9- Symbol used on biomedical waste transport vehicle	30	16.2	94	50.8	56.01	0.000
10-Causes of used of un safe equipment as needle	43	23.2	107	57.8	100.48	0.000
11- Technology methods for handling of wastes	58	31.4	127	68.6	71.83	0.000
12-Disease transmitted by biomedical waste	41	22.2	116	62.7	135.83	0.000
13- Collection of wastes according to hospital waste management law	36	19.5	142	76.8	45.94	0.000

Table (2) showed knowledge scores about health care waste management as reported by studied nurses throughout the program. According to the table, a low level of knowledge scores was reported in relation to all items of healthcare waste management before implementation of the program. As seen (90.3% , 70.3%, 82.7%, 67.6%, 74.1%, 68.6%, 62.7%, 76.8%) of the sample responded correctly and completely post test about Source of bio medical waste, Hazards of bio medical waste, Methods of exposure to health risks , Personal protection to prevent the transmission of diseases from bio medical waste , Alternative means for replacing restoration, Technology methods for handling of

wastes, Disease transmitted by biomedical waste, Collection of wastes according to hospital waste management law .while pretest were (45.9%, 11.4%, 52.4%, 24.9%, 10.8%, 31.4%, 22.2%, 19.5%) each respectively .This difference was statistically significant (p <0.001).

Table 3: Knowledge scores about bio medical waste management as reported by studied nurses throughout the program (n=185)

Knowledge Variables	Pre program		Post program		X^2	P-Value
	Correct complete		Correct complete			
	No	%	No	%		
14-Segregation of bio medical waste	44	23.8	100	54.1	39.84	0.000
15-Color coded of human anatomical waste	63	34.1	108	58.4	92.87	0.000
16-Color coded of tubing, catheter and IV sets	43	23.2	132	71.4	98.19	0.000
17-Color coded of discarded medicines	35	18.9	106	57.3	111.71	0.000
18- Color coded of sharp equipment	70	37.8	131	70.8	45.28	0.000
19-Uses of waste management - Segregation	106	57.3	132	71.4	13.60	0.001
20-Methods of waste management in hospitals	44	23.8	124	67	77.02	0.000
21- Time that the cover in the waste color container should be tied	50	27	113	61.1	43.57	0.000
22- Steps done if the bag containing waste is broken	12	6.5	114	61.6	129.88	0.000
23-Personal protective equipment to be used while dealing with anatomical waste	88	47.6	162	87.6	69.94	0.000
24-Hazards prevented from using shields	22	11.9	111	60	108.19	0.000
25-Definition of dioxenate	38	20.5	129	69.7	93.76	0.000
26- Healthy &safe work environment	92	49.7	147	79.5	36.66	0.000
27- waste management documentation	78	42.2	151	81.6	64.83	0.000
28- Waste management procedures	27	14.6	110	59.5	87.11	0.000

Table (3) described nurses' knowledge about health care waste management as reported by studied nurses throughout the program. It revealed that there were highly statistical significant differences, with an improvement in knowledge scores post test as compared to pre test in all items. As observed regarding steps done if the bag containing waste is broken, Hazards prevented from using shields,

Definition of dioxenate, Waste management procedures , (61.6%, 60%, 69.7%, 59.5%) of the sample responded correctly and completely post test as compared to only (6.5%, 11.9%, 20.5%, 14.6%) of the sample in the pretest phase.

Table 4: Distribution of nurses practice related to precaution follow when handling of bio medical waste as observed among study nurses throughout the program (n=185).

practice Variables	Pre program		Post program		X^2	P-Value
	Done Correctly		Done Correctly			
	No	%	No	%		
1-Identification and segregation infectious and non –infectious waste.	55	29.7	145	78.4	88.14	0.000
2-Segregation of waste is carried out at site of waste generation. injection , dressing	61	33	158	85.4	105.27	0.000
3-Closing the container soon after putting the waste	56	30.3	144	77.8	84.27	0.000
4-Use of personal protective devices like gloves, mask while handling the waste.	55	29.7	143	77.3	84.13	0.000
5-Use of needle cutter at the site of procedure	95	51.4	138	74.6	21.43	0.000
6- Hand washing	50	27	160	86.5	133.24	0.000
7-Use alcohol-based antiseptic hand rub after removing gloves when handling waste	79	42.7	140	75.7	41.63	0.000

Table (4) demonstrated the practices percent related to precaution follow up when handling health care waste as observed among studied nurses throughout the program. It revealed that there were highly statistical significant differences, According to the table, a low level of practice scores were done in relation to all items of waste management of healthcare before implementation of the program. It can be noticed that the nurses who participated in the study had the lowest level of practice (27%) at the pre- program phase in relation to hand washing. There was, however, statistically significant increase in the level of practice in the post test (86.5%). Also (77.3%) Used personal protective devices like

gloves, mask while handling the waste in post test compared to (29.7%) of nurses in pre test.

Table (5): Total Knowledge and practice among study nurses throughout the program n=185.

Level	Pre program		Post program		X2	P-Value
	No	%	No	%		
Total Knowledge						
Satisfactory	2	1.1	182	98.4	350.28	0.000
Unsatisfactory	183	98.9	3	1.6		
Total Practices						
Adequate	36	19.5	160	86.5	166.81	0.000
Inadequate	149	80.5	25	13.5		

Table (5) shows the number of studied nurses with satisfactory knowledge & adequate practice scores about health care waste management throughout the program. It is clear from the table that before implementation of the program, almost all nurses (98.9%) had unsatisfactory knowledge and most of nurses (80.5%) were inadequate practice regarding health care waste management. After the implementation of the program, almost all nurses (98.4%) had satisfactory knowledge & and most of nurses (86.5%) were adequate practice at the post test.

Table (6): Relation between Total Knowledge and practice among study nurses throughout the program (n=185).

Time of assessment	Practice	
	r	P value
Knowledge		
Before program	.544**	.000
After program	.606**	.000

Table (6) denoted the relation between total knowledge and practice among studied nurses throughout the program. It displayed highly statistically significant correlation between total knowledge and practice before implementation of the program. As observed (r=.544, p = 0.000), Also highly statistically significant correlation between total knowledge and practice after implementation of the program, as (r=.606, p = 0.000)

Table (7): Correlation between total Knowledge and practice and socio demographic characteristics among study nurses throughout the program (n=185).

Variable	Age		Year of experience	
	r	p	r	p
Total Knowledge score pre program	-.534	.000	-.664	.000
Total Knowledge score post program	-.813	.000	-.752	.000
Total practice score pre program	-.516	.000	-.523	.000
Total practice score post program	-.549	.000	-.620	.000

Table (7) showed the correlation between total knowledge and practice and socio demographic characteristics among studied nurses throughout the program. It displayed highly statistically significant correlation between total knowledge, practice and socio demographic characteristics among studied nurses throughout the program. As for age and years of experience, the table showed that the knowledge& practice scores have highly statistically significant correlation with the age and years of experience pre and post implementation of the program.

4. Discussion

Poor management of health care waste potentially exposes health care workers, waste handlers, clients , MCHs and the community at large to infection, toxic effects and injuries, and risks polluting the environment. It is essential that all medical waste materials are segregated at the point of generation, appropriately treated and disposed of safely*(WHO, 2011).*

Proper handling and disposal of bio-medical waste is very essential. Unfortunately, laxity and lack of adequate knowledge and practice on bio-medical waste disposal leads to staid health and environment apprehension *(Tsakona, et al .,2013).*The current result revealed that, Waste Management is one of the key problems of modern society due to the ever expanding volume and complexity of discarded waste This creates a need for more research on current disposal methods and corporate awareness, and general education *(patway,et al .,2011)*.So the aim of this study was to develop ,implement and evaluate an intervention program for nurses about health care waste management*.*

As revealed from the current study, the age of the studied sample ranged from twenty to fifty years old with the mean age of 40.62±9.339 .In fact more than half of nurses aged from ≤ 40 years old and the majority of nurses have diploma of nursing.

As regarding years of experience, more than three quarters of nurses had worked more than ten years. A similar study was conducted by *(Sz Quazi, et al., 2012)* among private medical practitioners in a slum area of Mumbai revealed that less than half of the sample had ≤10 years of experience. The findings of a similar study was conducted by *(Sumi, 2010)* revealed that more than half of bio medical health personnel had experience of 3years.

Although majority of nurses had more than ten years of experience, it was surprising to find that the majority of them didn't have any training courses. This disagreed with *(Akbolat,et al, 2012)* who conducted a study to evaluate level of knowledge of health care professionals about medical wastes and found that the majority of health employees had received training of the subject of medical wastes. Also this contradict with *(pudussery, 2012)* who found that more than half of the workers surveyed haven't attended training in past 12 months and positive practice was shown by the Norfolk and Norwich University Hospital employees towards the training on proper medical waste management and improving the current waste management practice.

Also it was matched with *Ozder ,et al., (2013)* who conducted study about medical waste management training for health care managers -/64. They deduced that training programs for the subject about waste management in the health sector has a significant effect in increasing the information level of the health care personnel. This go in line with *Madhavi ,et al., (2013)* who conducted study about awareness regarding biomedical waste management among interns in a tertiary health care hospital. They showed that lack of training regarding medical waste management impacts practices of appropriate waste handle and disposal.

The results of the current study stated that there is no job description for nurses about waste management, as what mentioned by *(Shafee, et al.,2013)* who found that more than half of primary settings had no guidelines or designated person for handling of biomedical waste management. The result of the present study revealed that, all studied nurses did not receive any vaccination against virus B and tetanus that predispose them to infection. Also *Opekpa, et al., (2011)* found that absence of

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written policies and clear guidelines, lack of personal protection tools, as well as ineffective training programs are the most factors that affecting hospital waste management system

The findings of the present study showed that most nurses had unsatisfactory knowledge regarding health care waste management before the implementation of the training program,. After the implementation of the program, there were significant improvements in the post test. This may be attributed to the lack of refresher conferences during employment, unavailability of waste management handouts to be used as a nursing guide & absence of an orientation program related to waste management

The findings of the present study revealed that most of the sample responded correctly and completely post test about Source of bio medical waste, Hazards of bio medical waste, Methods of exposure to health risks , Personal protection to prevent the transmission of diseases from bio medical waste , Alternative means for replacing restoration, Technology methods for handling of wastes, Disease transmitted by biomedical waste, Collection of wastes according to hospital waste management law These findings are consistent with the study of *(El-Sayed,et al.,2012)* who conducted a study at Main Mansoura University Hospital and found that none of the nurses gave correct answers related to definition, types, sources& health hazards of health care waste, classification of hazardous waste, purpose of waste management, who are at greater risk to the hazard of waste & use of incineration before implementation of the program ,while post implementation the score of knowledge was high in these points

This contradicts with the findings of *(Omara, et al., 2012)* who carried out study to determine the variations and similarities in the activities of clinical waste management practices within three district hospitals located in Johor, Perakand Kelantan, found that Majority of the respondents from Hospital Batu Pahat (97.7 percent), Hospital Taiping (98.9 percent) and Hospital Tumpat (73 percent) were aware that clinical waste can cause risks and health hazards to health if not properly handle. They were also aware that clinical waste can cause risks and adverse effects to the environment when not handling properly with Hospital BatuPahat (98.4 percent), Hospital Taiping (98.9 percent) and Hospital Tumpat (87 percent).

Also *(Stanley ,et al., 2011)* supported the findings of the study who stated that However, most of the developed countries have defined policy and regulations to handle and manage medical waste such as Germany, France, Canada, and USA. Unfortunately, health care waste management is not yet

carried out with a satisfactory degree of safety in many parts of the globe especially in the underdeveloped world

The study results revealed that low percentage of the sample in the pretest phase responded correctly and completely regarding steps done if the bag containing waste is broken, Hazards prevented from using shields, Definition of dioxenate, Waste management procedures, this agree with *(Tesfahun, 2015)* Recently, considerable gap exists with regard to the assessment of healthcare waste management practices in Ethiopia. The nature and quantity of healthcare waste generated as well as institutional practices with regards to sustainable methods of healthcare waste management, including waste segregation and waste recycling are often poorly examined and documented in Ethiopia .

It was surprising to find that less than one quarter of nurses responded correctly and completely about color coding of biomedical wastes before implementation of the program. This contradict with (*Mziray, 2015)* who found that the HCW are discarded at the point of use by the person who used the items. The waste is separated according to the color coding of Muhimbili National Hospital. The procedures of handling HCW, including segregation, packing of waste, and labelling is explained to all the workers and they have the instruction on board for each ward.

Also this came in accordance with (*UWA, 2014*) who conducted study with the aim of assessing the health care waste management practices by hospital staff. The study involved the survey of a cross section of four (4) tertiary health institutions and found that wastes are hardly treated, are not properly handled by assigning proper colour codes and the use of separate bins for sharps and non-sharps for final wastes disposal and the disposals from the hospitals to landfills are not frequently performed.

The findings of the present study showed that all nurses had inadequate practices in most areas of waste management before the implementation of the intervention program. This findings could be explained by the fact that un availability of instructional handouts, lack of training courses and programs, inadequate supplies, nurses do not think biomedical waste management as an important prerequisite for a good patient care service, some also felt that this is not their duty to find out whether or not such a system exists and that biomedical waste management is the responsibility of the administration and sanitary staff not the nurses *(Environmental Protection Agency.,2013).*

Regarding Practices related to precaution follow when handling of bio medical waste as observed among study nurses throughout the program, the nurses who participated in the study had the lowest level of practice at the pre- program phase in relation to hand washing. There was, however, statistically significant increase in the level of practice in the post test. . This came in accordance with *Ebrahim ,(2012)* who assess the quality of care in Cairo university hospital, Egypt and revealed that wearing gloves and hand washing are two areas of weakness that need more training among staff nurses.

As regard, *Potter and Perry (2009)* stated that the hand washing is the most basic and effective infection control measures that prevents and controls the transmission of infectious agents. Also (77.3%) Used personal protective devices like gloves, mask while handling the waste in post test compared to (29.7%) of nurses in pre test, this was supported by (*Manga et al., 2011)* who stated that health care workers should wear heavy utility gloves, heavy shoes, mask and eye protection during cleaning of the containers, baskets and intermediate storage room .

It was observed from the present study that more than three quarters of nurses did not do Identification and segregate infectious and non –infectious waste and did not carry out segregation of waste at site of waste generation. injection , dressing. This was supported by *(Nagaraju, et al., 2013)* who stated that Segregation is the responsibility of the person who introduces health care to the patient, it must be done at point where was generated and immediately after giving the care because practical segregation at the source is the main factor that enable health care facility to save money on cost of waste disposal. Always keep separate containers in convenient places wherever both municipal and hazardous are generated , Also according to *Mathur et al., (2012)* segregation is separating waste by type. Hazardous waste that must be specially handled to reduce the risk of infections or injuries. Therefore segregating the waste at the point which generated can greatly reduce the amount that needs special handling.

The findings of the present study revealed that almost all nurses (98.9%) had unsatisfactory knowledge and most of nurses (80.5%) were inadequate practice regarding health care waste management .This was supported by *(El-Sayed, et al., 2012)* who conducted a study at Mansoura university Hospital. It has included the general surgical, orthopedic and obstetrics departments and found that before implementation of the program; almost all nurses (98.7%, 100% respectively) had unsatisfactory knowledge & inadequate practice regarding health care waste management. After the

implementation of the program, almost all nurses (100%, 99.3% respectively) had satisfactory knowledge & adequate practice at the post test

The present study findings revealed a statistically significant relation between nurse knowledge and practice scores. This is go in line with **Hussein, (2011)** who found that there was significant positive relation between nurses knowledge and performance throughout the training program. Also, **Sarma, et al. (2011)** found that the nurses with good knowledge, however, practice percentage is also very high.

In the present study, the finding revealed that highly statistically significant correlation between total knowledge, practice, age and experience among studied nurses throughout the program. This was supported by **(El-Azab ,2013)** who conducted a study at two hospitals, Benha University Hospital and Benha Teaching Hospital Awareness and Commitment of Nurses and Workers toward Hospital Waste Management System and found highly statistically significant difference between nurses awareness of waste management ,age and, experience as that the best total mean score of nurses awareness who had more than 40 years of age and working at Benha Teaching Hospital is (68.35) better than the best total mean score of nurses awareness who had more than 40 years of age and working at Benha University Hospital (31.85). Also found that the best total mean score of staff nurses awareness who had more than 20 years of experience and working at Benha Teaching Hospital is (68.35) better than the best total mean score of staff nurses awareness who had more than 20 years of experience and working at Benha University Hospital (31.82).

This was also congruent with **(Haylamicheal, et al.,2010)** who assessing the management of Health care Waste in Hawassa City, Ethiopia , the study result indicated that there is significant different between the variables with p-value of 0.005. It is shown that respondents with service of duration below 3 years have higher knowledge and awareness in correct handling and management of clinical waste compared respondents having higher length of working time.

Conclusions:

The study results and research hypnosis concluded that there was increase in nurse's knowledge and practice in relation to management of health care waste. The study showed a statistically significant improvement in nurses' knowledge and practice about health care waste management after implementation of the program. Also a statistically significant correlation between nurse knowledge

and practice scores was detected. The study indicated that the knowledge& practice scores have statistically significant correlation with age and years of experience of nurses.

Recommendations

In the light of the present study the following recommendations are suggested:

-periodical in service education programs is the solution to the proper disposal of bio-medical waste at PHCs and it should be conducted refreshing courses for all staff nurses to fill the deficiency of their knowledge and practice

-Knowledge and skill for the protection of self from the infectious or non infectious waste while working in the health centers should be stressed.

-Update the organization job description to put into consideration that wastes are important source infection.

-The all health care center administration should provide newly employed nurses on bio-medical waste management with orientation to organization.

- Nursing protocol should be made for handling infectious as well as non-infectious wastes.

- Adequate supplies and equipments should be available in MCH centers to take care of waste properly.

- Future research is encouraged to be conducted as to oversee and further assess the current status of clinical waste management and the problems exist.

References

1-Akbolat M, Işık O, Dede C, Çimen M., (2012): *Evaluation of level of knowledge of healthcare professionals about medical wastes. University of Acibadem, Health Sciences Journal.*

2-Alagoz, B. A. Z., and Kocasoy, G., (2007): *Treatment and disposal alternatives for health-care wastes in developing countries – A case study in Istanbul, Turkey. Waste Management, 25(1): 83-89.Balrampur Hospital, Lucknow, India. Waste Management Research.; 24:*

3-Deno, T., (2011): *Medical Waste Management ,Education and Training. Available at http://www.business.com.*

**4-Ebrahim. S.A.,(2012):Environmental impacts to the problem of waste disposal by incineration, journal of assiute Environmental Studies (36).*

5-El-Azab,N,A., (2013): *Awareness and Commitment of Nurses and Workers toward Hospital Waste Management System ,Master thesis Submitted to faculty of Nursing ,Benha University p96.*

6-El-Sayed I.ZakariaA, and Gheith N.,(2012):*Intervention Program for Nurses about Health Care Waste Management ,Mansoura university Hospital. Research Journal of Medicine and Medical Sciences, 7(1): 25-37*

7-Environmental Protection Agency.,(2013): *"Guidance on Closed Containers". Retrieved 15 May.*

8-Gupta S, Boojh R. Repor M.,(2006): *Biomedical waste management practices at Balrampur Hospital, Lucknow, India. Waste Management Research. 2006; 24:584-591.*

9-Haylamicheal I , Dalvie, M, Yirsaw, B, & Zegeye, H., (2010):*Assessing the Management of Health care Waste in Hawassa City, Ethiopia. Waste Management & Research , 29(8), 854-862*

10-Hussein, F.M., (2011): *Implementation A developed Nursing Care Standards for Hemodialysis Patients in Zagazig University Hospital. Ph. Thesis. Faculty of Nursing, Zagazig University, Egypt, 99: 53-55*

11-Ibrahim S., (2009): *Quality of Care Assessment and Adherence to the International Guidelines Considering Dialysis, Water treatment, and Protection against Transmission of Infections in University Hospital–Based Dialysis Units in Cairo. Egypt. Hemodialysis International, 14(1): 61-67. Available at http://www.interscience.wiley.com/journal/122599526*

12-International Committee of the Red Cross.,(2011): *Waste management in health care . available at shop@icrc.org www.icrc.org19,© ICRC,1202 Geneva, Switzerland.*

13-Jain A.B, (2009): *Management of hospital waste. International Journal of Occupational and Environmental Medicine. Sept; 2(3): 134-315.*

14-Madhavi K , Reddy B, Ravikumar, B., (2013): *Awareness regarding biomedical waste management among interns in a tertiary health care hospital, Khammam. Journal of Evolution of Medical and Dental Sciences, 2(29): 5360-5365.*

15-Manga V, Fortonb, O, Moforc, L, Woodardd, R., (2011): *Health care waste management in Cameroon: A case study from the Southwestern Region. Science Direct, 75(1):108-116.*

16-Mathur P., Patan S, Shobhawat S., (2012): *Need of biomedical waste management system in hospitals - An Emerging issue - A Review. Current World Environment, 7(1): 117-124.*

17-Mziray R.,(2010): *Comparative study of hospital waste management and separation at site, case study of tampere university hospital in tampere, finland and muhimbili national hospital in dar-es-salam, tanzania*

18-Nagaraju, B., Padmavathi, G. V., Puranik, D. S., (2013): *A study to assess the knowledge and practice on bio-medical waste management among the health care providers working in PHCs of Bagepalli Taluk with the view to prepare informational booklet". International Journals of Medical Biomed and Research, 2(1): 28-35.*

19-Omara D, Nazlib S, Karuppannanb S., (2012): *Clinical Waste Management in District Hospitals of Tumpat, Batu Pahat and Taiping, aFaculty of Architecture, Planning and Surveying, Universiti Teknologi Mara, Malaysia Faculty of Health Sciences, Universiti Teknologi Mara, Malaysia, 31 October , Published by Elsevier Ltd.*

20-Opekpa S., Akolate M., Isik, O ,Cimen, M.,(2011): *Evaluation level of health care professionals about medical waste management. University of Academic Health Science Journal, 2(3): 131-140.*

21-Ostafa M1, Shazly M, Sherief W., (2010): *Development of a waste management protocol based on assessment of knowledge and practice of health care personnel in surgical departments. Waste Management: 2(9): 430-439.*

22-Ozder A, Teker B, Eker, H, Altındis, S., Merve K, Karabay O., (2013): *Medical waste management training for healthcare managers - a necessity? Journal of Environmental Health Science and Engineering, 8(13): 35-39.*

23-Patway M , O'Hare T , Sarker M., (2011) : *Assessment of occupational and environmental safety associated with medical waste disposed in developing countries : A qualitative approach . Safety science. 49(8-9) : 1200-1207 .*

24-Potter P, and Perr,y A., (2009): *Fundamentals of Nursing. 7nded. Mosby. Elsevier, p293.*

25-Pruss A, Giroult E, Rushbrook P., (2013): *Safer management of wastes from health care activities. World Health Organization, Geneva.*

26-Pudussery,p.k., (2012) :A study on the medical waste management at the Norfolk and Norwich university hospital ,University of East Anglia , Master of Science,pp38-49.

27-Sağlık Ç, Tıbbi D, Değerlendirilmes I., (2014): Waste Management, University ofAcibademHealth\Sciences:.[Retrievedfromhttp://www.sciencedirect.com/science/article "Editorial Board/Aims &Scopes .Acıbadem Üniversitesiy Sağlık Bilimleri Dergisi .

28-Sandra C.L .,(2011): Sample questionnaire on solid waste management services, Sample questionnaire on solid waste management services,, PUBLIC AND PRIVATE From Part III, Annex A6; prepared by public and private, pp4-5.

29-Sarma, R., Nagarajan S. and Saini Facilities S.,(2011): Waste Attitudes and Actions.Availabeathttp://www.asianhhm.com/facilities_operations/attitudes_actions.htm

30-Shafee M, Kasturwar N, Nirupama N.,(2013): Study of knowledge, attitude and practices regarding biomedical waste among paramedical workers. Indian, Journal of Community Med; 35(23): 369-370.

31-Sharma, S., (2010): Awareness about biomedical waste management among health care personnel of some important medical centers in Agra. International journal of environmental science and development, 1(3): 251-255.

32-Sowmya .V,(2013): study to assess the knowledge, current system of practice and the problems faced regarding bio medical waste management among health care personnel working in selected PHC's in Bangalore, Master of Science in Nursing ,Dissertation submitted to the Rajiv Gandhi University of Health Sciences, Karnataka, Bangalore,PP111-112.

33-Stanley H, Okpara, K, Chukwujekwu, D, Agbozu, I, & Nyenke .,(2011): Health care waste management in Port Harcourt Metropolis. American ,Journalof Scientific and Industrial Research, 2(5), 769-773.

34-Sumi N. ,(2010): Study of bio medical waste management practices in a private hospital and evaluation of the benefits after implementing remedial measures for the same. Journal of Communicable Diseases; PP 42(1): 39-44.

35-Sz Quazia A ,Abhay G, Kanchan M, Shanbhag S, Pandit D., (2012): Universal precaution and safe waste disposal among private medical practitioners in aslum area of Mumbai. Indian Journal Of occupational Health. Apr-Jun: 21(2) 89- 94.

36-Tesfahun E.,(2015): *Health care Waste in Ethiopia A study of Waste Generation, Composition and Management in the Amhara National Regional State, Ethiopia ,School Of Public Health, College Of Health Sciences Addis Ababa University.*

37-Tsakona M, Anagnostopoulou E, Gidarakas E., (2013):*Hospital waste management & toxicity evaluation, Greece. Department of environmental engineers, Technical university of crete. 6th. AvailablefromURL http://www.ncbi.nlm.nih.gov/pubmed. Results Panel*

38-UWA(*The University of Western Australia*), C.U.,(2014):*Assessment of Health care Waste Management Practices in Enugu Metropolis, Nigeria,International Journal of Environmental Science and Development, ,5(4), 33August 2014.*

39-WHO, (1996): *Solid Waste Management Survey Guides for Municipal Solid Waste Management in Pacific Countries. Healthy Cities -Healthy Islands Document Series, N 6. World Health Organization, Western Pacific Region.*

40-WHO, (2011): *Health care waste management Availableonthe http://www.who.int/mediacentrefactsheets/Fs281/en/index.html. Retrieved at 3. Oct, 2012, 8:45pm.*

41-WHO,(1995): *Safe management of wastes from health care activities.pp25-26.*

42-Wikipedia ,(2014): *Waste management, 7th International Conference on Waste Management and the Environment , at 02:15.the free encyclopedia.*

43-World Health Organization (WHO)., (2013): *Wastes from health-care activities. Factsheet N.(253), November 2011. Available from: http://www.who.int/mediacentre/factsheets/fs253/en.*

44-World Health Organization WHO, (2012): *Water Sanitation Health: Safe management of wastes from healthcare activities .available at http://www.who.int/water_sanitationhealth/medicalwaste/wastemanag/en*