

This file has been cleaned of potential threats.

To view the reconstructed contents, please SCROLL DOWN to next page.

## Assessing Knowledge and Performance of Healthcare Providers Regarding Hospital Waste Management in Menoufia Governorate Hospitals

Amna A. Elsayed<sup>1</sup>, Manal M. Ibrahim<sup>2</sup> and Gehan M. Diab<sup>3</sup>

<sup>1</sup>B.Sc. Nursing Science, <sup>2</sup>Professor of Nursing Administration, <sup>3</sup>Assistant Professor of Nursing Administration, Faculty of Nursing, Menoufia University.

**Abstract:** The term of health-care waste includes the waste generated within health-care facilities, research centers and laboratories related to medical procedures. **The purpose** of this study was to assess knowledge and performance of healthcare providers regarding hospital waste management in Menoufia governorate hospitals. **Design:** An observational cross-sectional research design. A convenient sample of 360 staff nurses and 150 workers (Housekeepers and storage, final treatment unite and disposal workers) was selected to carry out this study. **Setting;** this study was conducted at three hospitals at Menoufia governorate, (Shebin El-Kom Teaching Hospital, Menoufia University Hospital, and El-Helal Health Insurance Hospital). **Instruments:** Two Instruments were used. Self-administered questionnaire and participant observation checklist. **Results:** Majority of nurses (89.4%) in the study settings had high level of knowledge and high performance about hospital waste management and the percentage was higher in Teaching hospital than El-Helal Health Insurance (80.0%.) and University hospital (88.3%). Most workers of the study settings had high level of knowledge and performance especially in El-Helal Health Insurance hospital than Teaching hospital and University hospital. In addition there was statistically significant positive correlation between knowledge of workers and nurses about hospital waste management and their performance. **Conclusion:** There was positive correlation between knowledge of nurses and workers about hospital waste management and their performance and awareness. **Recommendation;** hospital administration should implement Mandatory training of Health Care Personnel by a competent authority, make sure that their employees have been trained on hospital waste management system.

**Key words:** Medical Waste, Hospital Waste Management, Health Care Providers.

### INTRODUCTION

Medical waste includes all the materials used while administering treatment to patients as well as all items contaminated by hazardous fluids, for example, blood, urine, feces, and other body fluids. Medical waste poses an important global challenge because of potential hazards to the environment and public health. In the course of providing healthcare services (preventative, promotive or curative), it is inevitable that medical waste will be generated. Healthcare workers (HCWs) are exceptionally at a high risk to potential contamination from medical waste by the nature of their work and proximity to this kind of waste.(Mugabi, Hattingh and Chima ,2020).

It is estimated that 75%–95% of bio-medical waste are non-hazardous, whereas 10%–25% are hazardous waste. However, when both types of medical waste are mixed together, then all types of medical waste may become harmful

and detrimental to humans, animals, and the environment Anozie et al., (2017). Unfortunately, reports suggest that almost 80% of medical wastes are mixed with general waste, especially in developing countries.

Although the infectious and hazardous waste have a small portion in MW, improper medical waste management, and mixing infectious waste with the general waste, can lead to the entire bulk of waste becoming potentially hazardous (Ali, Wang, Chaudhry and Geng2017),(Arend, 2014) and (Baati, Mellouli, and Hachicha, 2014).

It was observed from the investigation that the hazardous waste was not treated separately in almost all of the health care services. Intervention is required at all stages of waste management from the formulation of appropriate laws, waste minimization, generation, segregation and containerization,

collection and internal transport, immediate storage, centralized storage, external transport and treatment and final disposal . The process and method adopted for waste management should be technically and financially sustainable in the long run. It has to also be ensured that there are no adverse health and environmental consequences of waste handling, treatment, and disposal activities. (Hasan, and Rahman, 2018).

Proper and adequate management of medical waste is, therefore, of great importance during healthcare service delivery. Medical waste management (MWM) is of concern to the medical and general community. Adequate knowledge regarding management of healthcare waste is an important precursor to the synthesis of appropriate attitudes and practices of proper handling and disposal of medical waste by healthcare workers (HCWs). (Nwachukwu, Chuks, Orji and Ugbogu, 2017). The lack of awareness of proper HCWM disposal and treatment procedures by healthcare workers has resulted in "hospitals becoming epicenters of spreading disease rather than working toward eradicating them," especially in developing countries around the globe (Sengodan, 2014). If we want to improve standards of waste management in hospitals it should be initiated from personnel. In other words all of the hospital personnel are considered as a team for waste management. As WHO said, Good health care waste management in a hospital depends on a dedicated waste management team, good administration, careful planning, sound organization, underpinning legislation, adequate financing, and full participation by trained staff. (Assis, Gomes, Balista and Freitas, 2017).

Using waste management strategies is the most appropriate alternative for managing waste anywhere. We especially in hospitals and all health-service employees, especially nurses and housekeepers, who have direct involvement in a majority of client care, have a role to play in this process. Nurses, housekeepers and other staffs who generate large quantities of hazardous waste in hospitals should therefore be trained in waste minimization and the management of hazardous materials. Health care personnel should become ecologically sensitive and advocate changes that reduce the quantity of waste generated while maintaining quality patient care and worker safety. (Doiphode, Hinduja and Ahuja, 2016).

If the World Health Organization (WHO) recommended measures implement well by health care providers, it will lead to the proper management of medical waste and a reduction

in the environmental and health problems. So the first step for dealing this issue is, knowing present situation and that how the hospital personnel act in daily works or to what extent they are sensible about waste reduction.(WHO, 2018).

Bio-medical waste (BMW) collection and proper disposal has become a significant concern for both the medical and the general community. Since the implementation of the Bio-medical Waste Management and Handling Rules in the National Guideline of Infection Control from the Egyptian Ministry of Health every concerned health personnel is expected to have proper knowledge, practice, and capacity to guide others for waste collection and management, and proper handling techniques (Kumar , Somrongthong and Ahmed ,2016)

Trainings of healthcare workers are essential to improve their knowledge and behavior towards hospital waste management. so it is very important to assess waste management system through health care providers' level of knowledge, awareness and performance to can improve waste management process .(Kaur et al., 2015).

## **PURPOSE**

The purpose of this study was to assess knowledge and performance of health care providers regarding hospital waste management in Menoufia governorate hospitals

The following research questions were developed to conduct this study:

- 1) What are the knowledge and skills of health care providers in relation to dealing with waste management process?
- 2) Are there differences in knowledge and performances between health care providers having different types of jobs, ages, years of experience and qualifications?

## **METHODS**

1. **Research Design:** An observational cross-sectional research design
2. **Research Setting:** This study was conducted in all inpatient departments in three hospitals in Menoufia governorate (Shebin El-Kom Teaching Hospital, Menoufia University Hospital, and El-Helal Hospital).
3. **Sample:** A convenient sample of 360 nurses and 150 health care workers was taken from all units of the hospitals. They were nurses and workers (housekeepers and storage, final treatment unit and disposal workers). They all fulfilled the eligibility criterion of working (not less than one year in the study setting)

### **Instruments:**

Two instruments were utilized for data collection:

#### **Instrument I: Self-administered questionnaire.** It consists of two parts.

**Part I:** Demographic characteristics such as age, sex, educational level and years of experiences..

**Part II:** It is developed by the investigator after reviewing the literature Abdelkader (2013), and Kumar, Khan, Ahmed, Khan, Magan, & Nousheen. (2010) to measure health care providers' knowledge regarding hospital waste management process.

**Scoring:** For each question, one point was provided for each correct answer, and zero was provided for the wrong one. The total score for all questions was 50. Healthcare workers were considered to have high level of knowledge if the percent score was 60% or more and low level of knowledge if less than 60%.

**Instrument II: Participant observation checklist** It was developed by the investigator based on, Mostafa, Shazly, Sherif(2007) to assess health care worker's skills related to waste management process based on ,Mostafa, Shazly, Sherif(2007). It consisted of 25 items It contained 4 sub items for nurses. Also, it contained other 31 items (there were 7 categories for workers). Each item will be checked as done, not done, or not applicable.

**Scoring system:** The items will be checked on a 3-point Likert scale "done, not applicable (there is no facilities to be done), not done" These will be scored 2, 1 and 0 respectively. For each area, the scores of the items were summed-up and the total divided by the number of the items, giving a mean score for the part. These scores will be converted into a percent score. Healthcare workers will have adequate practice if the percent score was 60% or more and in adequate practice if less than 60%.

**Validity:** Face validity was tested by a panel of five experts in the field of nursing administration and Medical Surgical, professors and assistant professors in Ain –Shams and Menoufia Faculties of Nursing. Necessary modifications were done. The instruments were considered valid from the experts' perspectives

### **Pilot study;**

It was carried out on 10% of the total sample (36 nurses and 15 workers) after the instruments were developed and before starting the data collection to ascertain the clarity, relevance,

applicability of the study instruments and to determine the obstacles that may be encountered during data collection. Pilot study sample was included in the studied sample.

### **Ethical Considerations:**

Approval of the Faculty of Nursing Ethical Research Committee was obtained before conducting the study. A written consent regarding their agreement to share in the study was obtained from the sample after explaining the purpose, nature, time of conducting the study, potential benefits of the study and how data were collected. The respondents were assured that the data will be treated as strictly confidential; furthermore, the respondents' anonymity was maintained as they weren't required to mention their names.

### **Procedure:**

1. An official permission to carry out the study was obtained from the directors of Menoufia University Hospital, Shebin El-Kom Teaching hospital and El-Helal Health Insurance hospital after submitting an official letters from the Dean of nursing Faculty.
2. Data was collected over three months it started from the beginning of February 2019 to the end of August, 2019 after securing necessary permission.
3. Before beginning to collect data from the study subjects, the investigator introduced herself to them, explained the purpose of the study, and informed them that their information would be treated confidentially and will be used only for the purpose of the research. Additionally, each participant was notified about the right to accept or refuse to participate in the study.

### **DATA ANALYSIS:**

Data were collected, tabulated, statistically analysed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 22 (SPSS, Inc., Chicago, Illinois, USA) where the following statistics were applied:

In which quantitative data were presented in the form of mean ( $\bar{X}$ ), standard deviation (SD), range, and qualitative data were presented in the form numbers and percentages. Chi-square test ( $\chi^2$ ): was used to study association between two qualitative variables. t-tests: is a test of significance used for comparison between two groups having quantitative variables. ANOVA (F) test: is a test of significance used for comparison between three or more groups

having quantitative variables. Pearson's correlation (r): is a test used to measure the association between quantitative variables.

## RESULTS:

**Table (1) Level of nurse's knowledge about waste management:** It shows that all studied nurses (100%) at Teaching hospital had high level of knowledge compared to nurses in University hospital (88.3%) and 80.0% in ElHelal Health Insurance hospital. Regarding the overall knowledge in the three hospitals, 89.4% of studied nurses had high level of knowledge.

**Table (2) Level of nurses' performance in relation to waste management:** It shows that performance of the studied nurses was higher in Teaching hospital (95.8) than El-Helal Health Insurance (87.5%) and University hospitals (75.8%). There was a very highly statistical significant difference between nurses in the three hospitals regarding nurses performance in relation to waste management (P value =0.001).

**Table (3) Correlation between nurse knowledge about hospital waste management and their performance** This table shows that there was a very highly statistical significant positive correlation between knowledge of nurses about hospital

waste management and their performance (p value =0.001).

**Table (4): Knowledge of workers about hospital waste management in the three hospitals.** It shows that workers in El-Helal Health Insurance and University hospitals had high level of knowledge (92%) compared to 72% of workers in the Teaching hospital. Regarding the overall level of knowledge in the three hospitals, the majority of studied workers (85.3 %) had high level of knowledge. There was a highly statistical significant difference between studied workers in the three hospitals regarding their knowledge about policy properties and management skills of hospital wastes (P=0.005).

**Table (5) Level of workers' performance in relation to waste management** illustrates the total workers' performance in waste management. It shows that there was a statistically significant difference between workers performances in the three hospitals (P value =0.022)

**Table (6): Correlation between level of workers knowledge about hospital waste management and their level of performance** It illustrates that there was a very highly statistical significant positive correlation between knowledge of workers about hospital waste management and their performance (p value =0.001).

**Table (1) Level of nurse's knowledge about waste management**

Studied variables	Elhelal hospital (N=120)		University hospital (N=120)		Teaching hospital (N=120)		Total		X2	P value
	No.	%	No.	%	No.	%	No.	%		
knowledge										
High level ( $\geq 60\%$ )	96	80.0	106	88.3	120	100	322	89.4	25.6	0.001**
Low level ( $< 60\%$ )	24	20.0	14	11.7	0	0.00	38	10.6		

\*\*High significant

**Table (2): Level of nurses' performance in relation to waste management**

Studied variables	El Helal hospital (N=120)		University hospital (N=120)		Teaching hospital (N=120)		Total (N=360)		X2	P value
	No.	%	No.	%	No.	%	No.	%		
Performance										
Adequate ( $\geq 60\%$ )	105	87.5	91	75.8	115	95.8	311	86.4	20.6	0.001**
Inadequate ( $< 60\%$ )	15	12.5	29	24.2	5	4.2	49	13.6		

**Table (3): Correlation between nurse knowledge about hospital waste management and their performance**

Studied variables	Knowledge	
	R	P value
Performance	0.596	0.001**

**Table (4): Knowledge of workers about hospital waste management in the three hospitals**

Studied variables	Workers						Total		X2	P value
	El-helal hospital (N=50)		University hospital (N=50)		Teaching hospital (N=50)					
	No.	%	No.	%	No.	%	No.	%		
Total knowledge										
High level (≥60%)	46	92.0	46	92.0	36	72.0	128	85.3	10.6	0.005**
Low level (<60%)	4	8.00	4	8.00	14	28.0	22	14.7		

\*\*High significant

**Table (5): Level of workers' performance in relation to waste management**

Studied variables	Elhelal hospital (N=50)		University hospital (N=50)		Teaching hospital (N=50)		Total (N=150)		X2	P value
	No.	%	No.	%	No.	%	No.	%		
Performance										
Adequate ( $\geq 60\%$ )	45	90	43	86	35	70.0	123	82.0	7.59	0.022*
Inadequate ( $< 60\%$ )	5	10	7	14	15	30.0	27	18.0		

**Table (6): Correlation between level of workers knowledge about hospital waste management and their level of performance**

Studied variables	Knowledge	
	r	P value
Performance	0.594	0.001**

## DISCUSSION

Waste management is one of the most important points to be considered in hospital activities Mohammadi, Rahimi, et al., (2017). These wastes are generated due to healthcare activities that can lead to disease transmission and injuries to individuals, community and environment. Management of healthcare waste means using techniques that inhibit the spread of diseases. (Sarkees, 2018). Regarding nurses' overall knowledge in the three hospitals, the result of the present study showed that the majority of nurses had satisfactory level of knowledge regarding hospital waste management system .From the investigator point of view, this may be attributed to the supervision of infection

control nurses, refreshing conferences during employment, availability of waste management handouts to be used as a nursing guide, an orientation program related to waste management and training facilities. Results of this study contradicted with a study done by Kumar( 2019) in a Study to assess the Knowledge Level Bio-Medical Waste Management among the Nurses in Tamilnadu which showed that 75% of the nurses had inadequate knowledge and 25% of the subjects had a moderate level of knowledge On the other hand , also these findings were contrasted with that of Mostafa, Shazly and Sherief (2012) who found that almost nurses 98.7% had unsatisfactory knowledge regarding health care waste management before the implementation of the educational

training program at Mansoura University Hospital .

Also, the result of the present study is inconsistent with EL-Awady(2009)who found that the minority 25% of participants had good knowledge . it was consistent with a study done by Sobh, Fakhry and Mohamed (2018) which showed that majority of nurses (80%) had satisfactory level of knowledge regarding hospital waste management system Furthermore, it was consistent with Ranu et al., ( 2016) showed that the highest proportion of nursing staff had average knowledge score regarding how to manage healthcare waste

Regarding nurses' total level of knowledge about Policy and management skills, all nurses in Teaching hospital had high level of knowledge compared to University hospital Elhelal Health Insurance hospital. From the researcher point of view this may be attributed to the continuous supervision from infection control team during morning, afternoon and night shifts and in service training but in the other two hospitals there was infrequent supervision of infection control team.

Teaching hospital is under the supervision of two organizations (Ministry of Health and the General Organization of Teaching Institutions and Hospitals). They visit the hospital once or twice per each month and evaluate the departments .Most nurses in Teaching hospital have 10-15 years of experience which make them more expertise

Everywhere in Teaching hospital there is posters and policies for waste management lectures for nurses education and training, Mohammadi, Rahimi, Dashtaleh and Sohrabi(2017) considered that education as one of the most important sectors in waste management and staff training, policies boost hospital waste management procedures as well as make it possible that employees will always be aware of the infectious waste risks. Concerning the nurses' performance level, the present study revealed that the performance of nurses was adequate in the three hospitals. From the researcher point of view these findings can be related to high satisfactory knowledge among nurses in the present study, availability of adequate resources and waste management supplies, continuous training courses, good supervision of infection control team and administrative support and policies of waste management.

This interpretation was supported by Sobh, Fakhry and Mohamed (2018) who stated that a high level of nurses' knowledge, training courses and good infection control

supervision are reasons to improve waste management practice.

It is consistent with the findings of a study done by Awodele, Adewoye and Oparah (2016) on nurses' knowledge and practices regarding biomedical waste management at Johannesburg, which showed that 90%of respondents treated biomedical wastes differently than general waste.

Another Egyptian study done at Ain Shams university regarding Knowledge, attitudes and practices of health-care personnel towards waste disposal management showed that the practice scores of nurses were significantly higher than those of physicians (84.8% versus 67.3% had overall satisfactory practice) by Hakim, Mohsen and Bakr, (2014).

Regarding the relationship between nurses knowledge about hospital waste management and their performance, the present study showed that there was a very highly statistically significant positive correlation between knowledge of nurses about hospital waste management and their performance (p value =0.001). From the researchers) point of view this may attributed to the effect of education on practice

This result agreed with Sobh, Fakhry and Mohamed (2018), Eskander, Morsy and ElFeky, Gijarii (2012) and Hassan 2012

Regarding Knowledge of workers about hospital waste management in the three hospitals most of workers in Elhelal Health Insurance and University hospitals had high level of knowledge compared to Teaching hospital.This may be attributed to that most of workers in El Helal hospital and University hospitals received inservice training in infection control and waste management in contrast to workers at teaching hospital (few of them attend training courses)

Regarding the overall level of knowledge, in the three hospitals most of studied workers had high level of knowledge and few had low level.

In contrast to the findings of the present study Paniyadi et al., (2019) who found that housekeeping staff had a poor level of knowledge as well as practice regarding BMW disposal in tertiary hospital. Respondents were not practising as per the standard guidelines. Similar findings were found in the study by Gamal, Fahmy and Elmagraby (2018) who carried out study at Main Assiut University Hospital about In-service Training Program for Housekeepers Regarding Safe Health Care Waste Management and found that the studied sample had poor knowledge about waste management in the hospital.

Regarding total worker performance in waste management the performance of workers was adequate in three hospitals this may be due to adequate training and good supervision from infection control team and availability of waste management supplies and equipment which make waste management process easier and faster. Also, Most of workers were males thereby, they were strong enough to carry up waste disposal activities and concentrate on their job,

Furthermore, Deress, Jemal, Girma and Adane, (2019) agreed with the findings of the present study in their study in Ethiopia about Knowledge, attitude, and practice of waste handlers about medical waste management in Debre Markos They found that 80.0% of the study subjects had adequate practice score. Forty-eight (87.3%) of them have been always used PPE.

In contrast with the findings of the present study Paniyadi et al., (2019) Found that housekeeping staff had a poor practice regarding BMW disposal in tertiary hospital. Respondents were not practising as per the standard guidelines. Also Gamal, Fahmy and Elmagraby, (2018) showed that most housekeepers had inadequate practices about hand washing, infection control and safe handling of hospital waste before the implementation of the educational training program.

Regarding correlation between worker knowledge about hospital waste management and their performance, there was statistically significant positive correlation between knowledge of workers about hospital waste management and their performance ( $p$  value = 0.001). In agreement with the findings of the present study there was a study by Paniyadi et al., (2019) attempted to examine the relation between knowledge and practice regarding method of BMW disposal by using Karl Pearson correlation co-efficient ( $r = .251$ ) and found that there was a positive correlation between knowledge and practice. It shows increase in the knowledge on waste disposal, will increase the good waste disposal practices. Also Gamal, Fahmy and Elmagraby, (2018) clarified that there were Strong correlations among housekeepers' knowledge, attitude and practices scores. And Kini et al., (2014) found that there is positive correlation between knowledge and practice as better knowledge can enhance attitudes and lead to better practices as well.

## CONCLUSION

On the light of the current study, it can be concluded that majority of nurses in the study settings had high level of knowledge and performance about hospital waste management and the percentage was higher in Teaching hospital than El-Helal Health Insurance and University hospital. Most workers of the study settings had high level of knowledge and performance especially in El-Helal Health Insurance hospital than Teaching hospital and University hospital. There was a statistically significant positive correlation between knowledge of nurses and workers about hospital waste management and their performance.

## RECOMMENDATIONS

1. Mandatory training of Health Care Personnel by competent personnel about hospital waste management.
2. The government should develop strategies and systems along with strong oversight and regulation to incrementally improve waste segregation, destruction and disposal practices with the ultimate aim of meeting national and international standards.
3. Facilitate nurses' access to continuing education programs on the subject of medical waste

## REFERENCES

- [1] Abd-el-Kader.(2013). Awareness and Commitment of Nurses and Workers toward Hospital Waste Management System. Thesis submitted for fulfillment of master degree in nursing administration at Banha University
- [2] Ali, Wang, Chaudhry, & Geng. (2017). Hospital waste management in developing countries: A mini review. Waste Management & Research [Online] 35, 1-12. doi:10.1177/0734242X17691344
- [3] Anozie, Lawani, Eze, Mamah, Onoh, Ogah & Anozie.(2017). Knowledge, attitude and practice of healthcare managers to medical waste management and occupational safety practices: Findings from Southeast Nigeria. Journal of Clinical and Diagnostic Research, 11(3), IC01-IC04. doi:10.7860/JCDR/2017/24230.9527
- [4] Arend. (2014). social and environmental performance at SMEs: Considering motivations, capabilities, and instrumentalism. Journal of



- Business Ethics, 125: 541-561. doi:10.1007/s10551-013-1934-5
- [5] Assis, Gomes, Balista, & Freitas . (2017). Use of performance indicators to assess the solid waste management of health services. *Anais Da Academia Brasileira De Ciencias*, 89, 2445-2460. doi:10.1590/0001-3765201720170178
- [6] Awodele , Adewoye & Oparah .(2016). Assessment of medical waste management in seven hospitals in Lagos,Nigeria.*BMC public health*, 269,DOI:10.1186/s12889-016-2916-1. Available at: <http://www.biomedcentral.com/content/pdf/s12889-016-2916>
- [7] Baati, Mellouli & Hachicha.(2014). Designing a new infectious healthcare waste management system in Sfax Governorate, Tunisia. In *Advanced Logistics and Transport (ICALT) 2014 International Conference* (p. 350-355). IEEE.doi:10.1109/icadlt.2014.6866337
- [8] Deress ,Jemal ,Girma & Adane .(2019). Knowledge, attitude, and practice of waste handlers about medical waste management in Debre Markos town healthcare facilities, northwest Ethiopia
- [9] Doiphode ,Hinduja & Ahuja . (2016). Developing a novel, sustainable and beneficial system for the systematic management of hospital wastes. *Journal of Clinical & Diagnostic Research [Online]*, 10(9), LC06-LC11.doi:10.7860/JCDR/2016/21384. 8521
- [10] El-Naggar, Abass , EL-Gohary , Bolbol & Abdel-Azem . (2017). Medical Waste Management Educational And Training Intervention Program in Zagazige university Hospital .*Egyptian Journal of Occupational Medicine*, 2017;41(3):459-474
- [11] Fayaz, Higuchi, Hirosawa, Saker, Djabbarova, & Hamajima,.(2014). Knowledge and practice of universal precautions among health care workers in four national hospitals in Kabul, Afghanistan. *The Journal of Infection in Developing Countries*, 8(4), 535–542. <https://doi.org/10.3855/jidc.4143>.
- [12] Gamal , Fahmy & Elmagraby . (2018 ).In-service training Program for Housekeepers Regarding Safe Health Care Waste Management at Main Assiut University Hospital. *Assiut Scientific Nursing Journal*
- [13] Ghareeb & Al Sadek . (2014). Assessment of Medical Waste Generation Rate at Zagazig University Hospitals and Awareness and Practices of Nurses Regarding Medical Waste Management
- [14] Gijare . (2012). Effectiveness of teaching on infection control practices among health care professionals. *Sinhgad e Journal of Nursing*, 2(2): 5-9
- [15] Hakim , Mohsen & Bakr .(2014). Knowledge, attitudes and practices of health-care personnel towards waste disposal management at Ain Shams University Hospitals. *Eastern Mediterranean Health Journal*
- [16] Hasan, & Rahman .(2018). Assessment of Healthcare Waste Management Paradigms and Its Suitable Treatment Alternative: A Case Study
- [17] Kaur , Pandey,Tekwani , Bedekar , Pai & Agarwal .(2015). Awareness of Bio-medical waste management among the health care workers in rural area
- [18] Kumar .( 2019) . A Study to Access the Knowledge Level on Bio-Medical Waste Management among the Nurses in Tamilnadu. *Acta Scientific Medical Sciences* 3.1 (2019): 78-87
- [19] Kumar , Somrong thong & Ahmed .(2016). Impact of waste management training intervention on knowledge, attitude and practices of teaching hospital workers in Pakistan . *Original Article,Pak J Med Sci*. 2016;32(3):705-710
- [20] Eskander , Morsy & Elfeky . (2013) .Intensive Care Nurses' Knowledge & Practices regarding Infection Control Standard Precautions at a Selected Egyptian Cancer Hospital. *Journal of Education and Practice* [www.iiste.org](http://www.iiste.org) ISSN 2222-1735 (Paper) ISSN 2222-288X (Online) Vol.4, No.19, 2013
- [21] Kumar, Khan, Ahmed, Khan, Magan,& Nousheen. (2010). Healthcare waste management (HCWM) in Pakistan: current situation and training options. *J Ayub Med Coll Abbottabad* 2010;22(4):101–5
- [22] Kini , Kumar , Kumar , Reddy ,Nabar , Kamath , Kamath & Eshwari .(2017). Knowledge, Attitude and Practices regarding Biomedical Waste

- Management among staff of a tertiary healthcare centre in coastal Karnataka
- [23] Mohammadi , Rahimi , Dashtaleh & Sohrabi .(2017). Studying the level of knowledge, attitude, and performance among personnel of Doctor Mohammad Kermanshahi and Hazrat Masomeh Hospitals in terms of hospital waste management. Page: 612-617. Ann Trop Med Public Health [serial online] 2017 [cited 2020 May 27]; 10:612-7. Available from: <http://www.atmph.org/text.asp?2017/10/3/612/213120>
- [24] Mostafa, Shazly & Sherief.(2009).Development of a waste management protocol based on assessment of knowledge and practice of healthcare personnel in surgical departments .Elsevier Ltd.
- [25] Mugabi , Hattingh & Chima .(2020). Assessing Knowledge, Attitudes, and Practices of Healthcare Workers Regarding Medical Waste Management at a Tertiary Hospital in Botswana: A Cross-Sectional Quantitative Study
- [26] Nwachukwu , Chuks , Orji & Ugbogu .(2017). Health Care Waste Management–Public Health Benefits and the Need for Effective Environmental Regulatory Surveillance in Federal Republic of Nigeria; Available from: <http://www.intechopen.com/books/current-topics-in-public-health>. [Last accessed on 2017 May 31].
- [27] Oli , Ekejindu , Adje & Ezeobi .(2016). Healthcare waste management in selected government and private hospitals in Southeast Nigeria. Asian Pacific Journal of Tropical Biomedicine
- [28] Paniyadi , Shetty , Minj , Varghese , Laxmi ,Nara Kumari & Upasana. (2019). Knowledge and practice among housekeeping staff on methods of bio-medical waste (BMW) management
- [29] Pullishery , Panchmal ,Siddique & Abraham.(2016). Awareness, Knowledge and Practices on Bio-Medical Waste Management Among Health Care Professionals in Mangalore – A Cross Sectional Study
- [30] Rao , Dhakshaini , Kurthukoti & Doddawad .(2018). Biomedical Waste Management: A Study on Assessment of Knowledge, Attitude and Practices Among Health Care Professionals in a Tertiary Care Teaching Hospital
- [31] Sarkees.(2018). ASSESSMENT OF NURSES' KNOWLEDGE ABOUT HEALTH CARE WASTE MANAGEMENT IN DUHOK CITY. Polytechnic Journal: Vol.8 No.2 (May 2018): Pp:35-43. Available at: <http://epu.edu.krd/ojs/index.php/Journal>
- [32] Sengodan .(2014). Segregation of biomedical waste in an South Indian tertiary care hospital. Journal of Natural Science, Biology & Medicine, 5, 378-382. Retrieved from <http://www.medknow.com>
- [33] Sobh , Fakhry & Mohamed .(2018). KNOWLEDGE AND PRACTICE OF STAFF NURSES RELATED TO HEALTH CARE WASTE MANAGEMENT.Port Said Scientific Journal of Nursing
- [34] World Health Organization (WHO). (2018). medical waste classifications. Available at: <https://www.who.int/news-room/fact-sheets/detail/health-care-waste>