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Situation analysis of the biomedical waste management in primary health care units of Ismailia district, Egypt

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Abstract
Introduction: Biomedical waste management has emerged as an issue of major concern. Advances in medical facilities and the introduction of more sophisticated instruments have increased the waste generation worldwide.
Aim: This study aimed to assess the current biomedical waste management process.
Methods: cross sectional descriptive study was conducted at the fifteen primary health care units (PHC) units affiliated to Ismailia health district. Data were collected using the World Health Organization Individualized Rapid Assessment Tool (WHO-IRAT) which takes into account biomedical waste management organizational structure, policy and planning, training, occupational health and safety, monitoring, periodic evaluation and corrective action, financing, segregation, waste generation, collection, handling, labeling, posters or signage, transportation, storage, treatment and waste disposal.
Results: The aggregate score percentage per urban PHC unit when rated using the I-RAT ranged from as low as 44.6% to 55% with a total average score percentages 51% for urban PHC unit and as low as 39.9%to 52.4% and a total average 47% score percentages for rural PHC unit. The wastes are properly segregated at the source according to different categories in 71% of urban and 62.5% in rural PHC units. The storage area meets the proper requirements according to World Health Organization standards in 86% of urban and 50%rural PHC units.
Conclusions: The baseline assessment using the individualized rapid assessment tool provides information that can be used to compare and rank PHC units for prioritizing interventions and to identify possible areas for improvement.

Keywords: Assessment, individualized, tool, biomedical waste

Introduction
Biomedical waste is any unwanted materials produced during diagnosis, treatment, operation, immunization or in research activities including production of biological. Day to day activities in health institutions generate a lot of waste which is biological in nature and are probable sources of infection transmission, especially hepatitis B and C, human immune deficiency virus, and tetanus [1].
Biomedical waste management (BMWM) includes all activities involved in waste generation, segregation, transportation, storage, treatment and final disposal [2].
According to the WHO 80% of clinical wastes are non-hazardous comparable to domestic waste, 15% are infectious and the remaining 5% is made-up of sharps (1%), toxic chemicals and pharmaceuticals (3%) and genotoxic and radioactive waste (1%) [3].
BMWM practices vary greatly from country to country, according to various factors such as socio-economic conditions, regulation, Level of education, available resources, treatment technologies, and the capacity to monitor and best manage inadequate practices [4].
Assessment studies on BMWM in some developing countries have detected that segregation; handling and storage are not appropriately conducted. Practices for waste minimization are poor; hazardous and common waste are mixed together and disposed in open dumps or landfills; and waste incinerators are not equipped with an emission control apparatus [5].
At the global level, 16-84% of the hospitals did not stick to norms. This has been attributed to lack of awareness, inadequate resources, and poor disposal mechanisms.

Around 82 per cent of primary, 60 percent of secondary and 54 per cent of tertiary HCFs have no plausible BMWM system in place [6].
The main Egyptian law and their amendments concerning the biological wastes is the law number 4 of 1994 [7].
BMWM has emerged as an issue of major concern. Advances in medical facilities and the introduction of more sophisticated instruments have increased the waste generation per patient in health-care units worldwide [8].
Literature review showed little available information that describes the actual (BMWM) practices in primary healthcare (PHC) units. Thus, the present study was designed to describe BMWM in some selected PHC units of Ismailia district, Egypt. This study aims to describe the current biomedical waste management practice.

Subjects and Methods

Study Design: Cross sectional descriptive study was conducted.

Study Setting and population: The study was conducted in the fifteen primary health care units affiliated to the Ismailia health district.

Sampling method: A comprehensive sampling method was used.

Data collection Tool: Data were collected by the Individualized Rapid Assessment Tool (IRAT) that was used for the rapid assessment of the current situation of biomedical waste management at the PHC units under study.

It takes into account biomedical waste management organizational structure, policy and planning, training, occupational health and safety, monitoring, periodic evaluation and corrective action, financing, segregation, waste generation, collection, handling, labeling, posters or signage, transport inside the facility, storage, treatment, waste disposal and wastewater management.
The tool results in an overall score (135) that can be used to compare and rank PHC units for the purpose of prioritizing interventions and identifying possible areas for improvement**.** The score was converted into percentage. Then the primary health care units were further categorized as 0-25% very poor, 26-50% poor, 51-75% good, and 76-100% excellent [9].

Ethical considerations: All ethical considerations were taken into account during the conduction of this study.

Results

As shown in table 1 and 2 the results of the WHO I-RAT in the urban and rural PHC units which revealed that there was no written training program on biomedical waste management or any plans for monitoring, evaluation and taking corrective action.
There was no annual allocation in their budget for BMWM, and the current budget is not sufficient. It was found also that there were no posters or signs showing proper segregation of BMW in all PHC units.
The wastes are properly segregated at the source according to different categories in 71% of urban and 62.5% of rural PHC units. Regarding the Waste generation data, all urban and rural PHC units showed documentation of previous measurements to the amounts of the infectious waste produced but not to the amounts of the total waste so the percentage of infectious waste relative to total waste couldn't be calculated.
The BMW is transported away from patient areas and other clean areas in all urban and 37.5% of rural PHC units. The BMW is transported in a closed, covered, wheeled transport cart in 71% of urban and 50% of rural PHC units. The storage area meets the proper requirements according to WHO standards in 86%of urban and 50% of rural PHC units. The BMW are stored more than the maximum storage time in all of them.
The study results revealed that the aggregate score percentage when rated using the I-RAT to evaluate the PHC units' current BMWM practices ranged from as low as 44.6% to 55% with total average score percentages 51% for urban PHCs and ranged from as low as 39.9%to 52.4% with total average score percentage was 47% for the rural as shown in figure 1 and 2.
Figure 3 shows that 29% of urban and 75% of rural PHC units were categorized poor according to IRAT.

Table 1: The individualized rapid assessment tool scores for current biomedical waste management practices in the urban PHC units, Ismailia district

Variable	unit 1	unit 2	unit 3	unit 4	unit 5	Health office 1	Health office 2
Part I – Initial Interview with person in charge with biomedical waste management							
Organizational structure	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Policy and Planning	2	2	2	2	0.5	0	2
Training on BMWM	0	0	0	0	0	0	0
Occupational Health and Safety	3	3	3	3	3	3	0
Monitoring, Evaluation and Corrective Action	0	0	0	0	0	0	0
Financing	0	0	0	0	0	0	0
Part I total score	11.5	11.5	11.5	11.5	10	9.5	8.5
Part II –Inspection Tour in the PHC and Interview with some of health care workers							
Classification and Segregation	7	0	7	7	0	7	7
Waste Generation Data	0	0	0	0	0	0	0
Collection and Handling	14	12	16	17	12	15.5	16.5
Color Coding and Labeling	4	1	1	4	4	4	4
Posters or Signage	0	0	0	0	0	0	0
Transportation Inside urban PHC unit	1.5	1.5	1.5	0.5	1.5	1.5	0.5
Storage	1.5	1.5	1.5	1.5	1.5	0.5	1.5
Treatment and Disposal	25	25	25	25	25	25	25
Off-site treatment	4	4	4	4	4	4	4

Waste water	4	4	4	4	4	4	4
Part II total score	61	49	60	63	52	61.5	62.5
Total I-RAT Score (Sum of Part I and Part II) (%)	72.5 (53.5)	60.5 (44.6)	71.5 (52.7)	74.5 (55)	62 (45.7)	71 (52)	71 (52)
	*good	poor	good	good	poor	good	Good

*I-RAT score percentage 0-25% (very poor), 26-50% (poor), 51-75% (good) and 76-100% (excellent).

Table 2: The individualized rapid assessment tool scores for current biomedical waste management practices in the rural PHC units, Ismailia district

Variable	unit 1	unit 2	unit 3	unit 4	Unit 5	unit 6	unit 7	unit 8
Part I – Initial Interview with person in charge with biomedical waste management								
Organizational structure	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Policy and Planning	2	2	2	2	2	2	0	2
Training on BMWM	0	0	0	0	0	0	0	0
Occupational Health and Safety	3	0	3	3	0	0	0	0
Monitoring, Evaluation and Corrective Action	0	0	0	0	0	0	0	0
Financing	0	0	0	0	0	0	0	0
Part I total score	11.5	8.5	11.5	11.5	8.5	8.5	6.5	8.5
Part II –Inspection Tour in the PHC and Interview with some of health care workers								
Classification and Segregation	7	7	7	7	7	0	0	2
Waste Generation Data	0	0	0	0	0	0	0	0
Collection and Handling	14	16	16	17	17.5	11	15	15.5
Color Coding and Labeling	0	4	0	4	4	4	4	4
Posters or Signage	0	0	0	0	0	0	0	0
Transportation Inside rural PHC unit	0	1	0	1	1.5	1	0.5	0.5
Storage	0.5	1.5	0.5	1.5	1.5	0.5	1.5	0.5
Treatment and Disposal	25	25	25	25	25	25	25	25
Off-site treatment	4	4	4	4	4	4	4	4
Wastewater	4	0	0	0	0	0	0	0
Part II total score	54.5	58.5	52.5	59.5	60.5	45.5	48.5	51.5
Total I-RAT Score (Sum of Part I and Part II) (%)	66 (48.7)	67 (49.4)	64 (47.2)	71 (52.4)	69 (51)	54 (39.9)	55 (40.6)	60 (44.3)
	*poor	poor	poor	good	good	poor	poor	Poor

*I-RAT score percentage 0-25% (very poor), 26-50% (poor), 51-75% (good) and 76-100% (excellent).

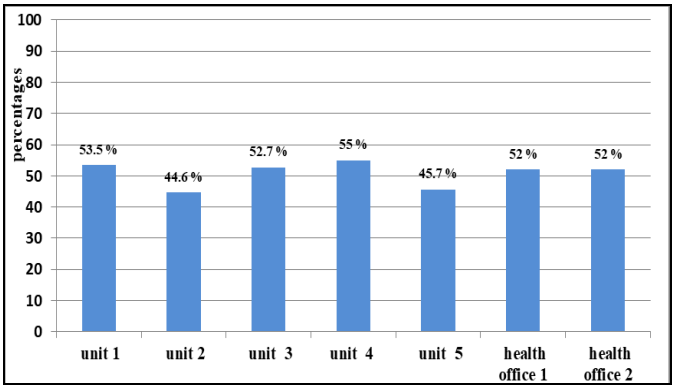

Fig 1: I-RAT for current biomedical waste management practices aggregate score percentage per urban PHC unit.

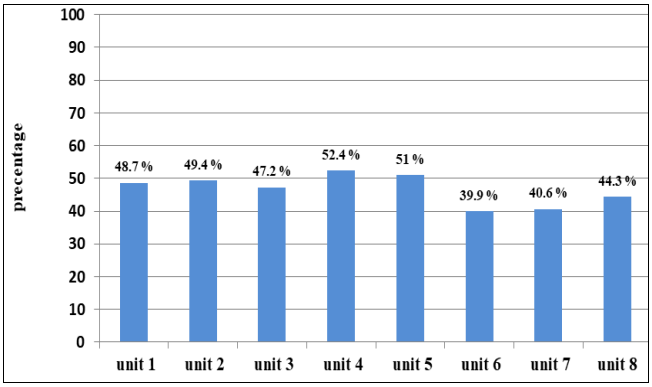

Fig 2: I-RAT for current biomedical waste management practices aggregate score percentage per rural PHC unit.

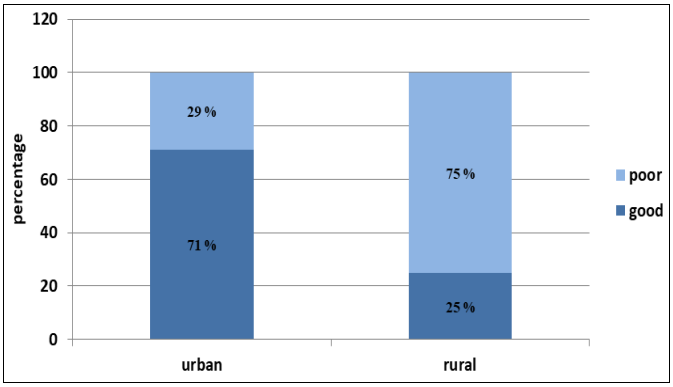

Fig 3: evaluation of biomedical management process among urban and rural PHC units according to IRAT.

Discussion

BMW can cause serious harm if not managed appropriately. The biomedical waste management (BMWM) practices are a fundamental part of a national healthcare system. However, many countries do not have minimum standards or practices, mostly in developing countries. [10] The current study was conducted to assess the current biomedical waste management process in the Ismailia district primary health care units.

The WHO I-RAT was the main tool used to evaluate the PHC units' current BMWM practices on 16 domains. The present study results revealed that the aggregate score percentage when rated using the I-RAT ranged from as low as 44.6% to 55% and 39.9% to 52.4% per urban and rural PHC unit respectively. This finding was not in agreement

with a report on the training needs assessment of HCWs on BMWM in Kenya which used the same tool and it revealed that I-RAT aggregate scores per visited facility were ranging from 60-80% [11].

Regarding the organizational structure, the present study results revealed that all the PHC units had a person in charge of BMWM who is the same focal person for infection control. It was found that an infection control committee meets on a regular basis who discusses BMWM as one of the infection control standard precautions. However, there were no written documents for the roles and responsibilities in BMWM and it was not clear to all HCWs. These was consistent with the Kenyan report, [11] and in contrast to another study conducted by Shafee *et al.,* 2013, (12) who found that more than half of health care settings had no designated person for handling of BMWM.

Regarding Policy and planning, the present study results show that 77.7% of the PHC units have written policies dealing with BMWM and there is no written plan, manual or written procedure or a written plan for recycling or waste minimization in all of them. This finding was consistent with the study done in Ethiopia [13]. This was in contrast to the Kenyan report that stated 37% of the assessed hospitals had a waste management plan; however the plan had not been revised to suit current developments in these hospitals. [11].

Regarding Training, the current study revealed that all PHC units did not have a written training program in BMWM. This is in agreement with a study conducted by Akum, 2014, [14] and another study conducted by Patwary *et al.,* 2011 [15]

Regarding the occupational health and safety measures, the current study results revealed that 85.7% of urban and 37.5% of rural PHC units have document for prevention and emergency response to needle-stick injuries. But there were no documents for the response to blood splashes. This was in agreement with the Kenyan report that stated that when asked what immediate action taken after a needle stick injury, only 30% of respondents understood the recommended immediate action as stated by the national and WHO guidelines. [11]

In the present study there was inadequate providing of waste handling staff with appropriate personal protective equipment (PPE). These findings do not comply with the Occupational Safety and Health Administration OSHA, 2016 recommendations. [16]

In the current study the majority of health workers and waste handlers (>80%) have been vaccinated against hepatitis B and only one is vaccinated against tetanus who is the incinerator operator. The results of the research conducted by Sapkota, 2014, [9] emphasized that the HCWs, should have been given hepatitis and tetanus vaccinations.

Regarding monitoring and evaluation, and corrective action the present study showed that all PHC units visited did not have plans for monitoring and taking corrective action and had not reviewed many of their policies in the last one year. This was consistent with the result of a study conducted by Opekpa *et al.,* 2011. [17]

Regarding financing the present study revealed that none of PHC units have an annual allocation in its budget for BMWM. Also they does not have long-term financing plan to cover costs for sustainable BMWM. This finding is similar to a study conducted by Sapkota, *et al.,* 2014. [9]

In the present study the wastes are properly segregated at the source according to different categories and the HCWs are familiar with the classification and segregation requirements in 71% of urban and 62.5% in rural PHC units. The results of the research conducted by Sapkota, *et al.,* 2014, [9] emphasized that wastes should have been properly segregated at source, according to different categories, to minimize the burden of the BMW.

Concerning waste generation data in the present study, all PHC units showed documentation of previous measurements to the amounts of BMW produced only. There is no documentation of previous measurements to the amounts of the total waste so the percentage of BMW relative to total waste couldn't be calculated. This finding was not in consistent with the results of a study conducted by Meleko *et al.,* 2018. [18]

On the subject of color coding and labeling, the current study found that the main segregation system being used is as follow; red bags for infectious waste, black bags for non-infectious waste and safety box for sharps. It was found that all the bags are of the correct color code in all urban PHC units and one or more plastic bags have the wrong color code in 62.5% rural PHC units. It was observed that there is no color coded bins for waste segregation in all the visited PHC units.

In the study conducted by Rn and Yahaya, 2014, [19] the major finding was that 98.4% of Primary Health Care Centres (PHCCs) segregate sharps waste, using safety box and such sharps waste is the major waste of PHCC.

Regarding Posters and signage, in the present study there are no posters or signs showing proper segregation of BMW. The same finding was mentioned in the Kenyan report. (11) The storage area meets the WHO standards in 86% of urban and 50%rural PHC units. This was consistent with the finding of a study conducted by Gao *et al.,* 2018, [20] who found that three quarters of sample town health centres had designated storage areas and not consistent with another study conducted by Akum, 2014 [14] who found that there is no special place for storing the medical waste in the hospital.

In the present study BMW are stored more than the maximum storage time in all the visited PHC units. This was consistent with Akum, 2014 findings. [14] Many studies that were conducted in developing countries by Mostafa, *et al*., 2009 [21], Coker, *et al*., 2009 [22] and Patwary, *et al*., 2011 [15] on BMWM designated that segregation, collection of BMW using recommended color coding container and storage of BMW in secured area were not satisfactory.

Concerning Treatment and disposal all PHC units in the present study treat its infectious waste at an off-site treatment facility before final disposal. Treatment is done by incineration. This finding was not consistent with Canada, United States, and Greece in which the use of the hospital waste incinerators was ceased due to the risk of air pollution, and adopted the alternative waste disposal techniques, such as autoclaving and microwave sterilization. [23]

Conclusion

From the current study findings, it was concluded that the baseline assessment using the individualized rapid assessment tool provides information that can be used to compare and rank PHC units for the purpose of prioritizing interventions. The tool can also be used as a quick tool to identify possible areas for improvement.

References

1. Nagaraju B, Padmavathi GV, Puranik DS, Shantharaj MP, Sampulatha SP. 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 journal of medicine and biomedical research. 2013; 2(1):28-35.
2. World Bank. HNP group Tools and Guidelines the Care Waste Management Guidance Note, 2010.
3. World Health Organization (WHO) Health care waste management Available on the http://www.who.int/mediacentrefactsheets/Fs281/en/inex.html, 2011.
4. Caniato M, Tudor T, Vaccari M. International governance structures for health-care waste management: A systematic review of scientific literature. Journal of Environmental Management. 2015; 153:93-107.
5. Moreira AM, Günther WM. Assessment of medical waste management at a primary health-care center in São Paulo, Brazil. Waste Management. 2013; 33(1):162-7.
6. Inclen PE, New D. Bio-medical waste management: situational analysis & predictors of performances in 25 districts across 20 Indian States. The Indian journal of medical research. 2014; 139(1):141.
7. Regional Solid Waste Exchange of Information and Expertise network in Mashreq and Maghreb countries, country report on the solid waste management, Egypt, 2010.
8. Hakim SA, Mohsen A, Bakr I. Knowledge, attitudes and practices of health-care personnel towards waste disposal management at Ain Shams University Hospitals, Cairo, 2014.
9. Sapkota B, Gupta GK, Mainali D. Impact of intervention on healthcare waste management practices in a tertiary care governmental hospital of Nepal. BMC public health. 2014; 14(1):1005.
10. Oli AN, Ekejindu CC, Adje DU, Ezeobi I, Ejiofor OS, Ibeh CC, Ubajaka CF. Healthcare waste management in selected government and private hospitals in Southeast Nigeria. Asian Pacific Journal of Tropical Biomedicine. 2016; 6(1):84-9.
11. Ministry of Health, Republic of Kenya. Training Needs Assessment of Health Workers on Health Care Waste Management in Kenya, 2017.
12. Shafee M, Kasturwar NB, Nirupama N. Study of knowledge, attitude and practices regarding biomedical waste among paramedical workers. Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine. 2013; 35(2):369.
13. Azage M, Kumie A. Healthcare waste generation and its management system: the case of health centers in West Gojjam Zone, Amhara Region, Ethiopia. Ethiopian Journal of Health Development, 2010, 24(2).
14. Akum FA. An assessment of medical waste management in Bawku Presbyterian hospital of the upper east region of Ghana. Merit Research Journal of Environmental Science and Toxicology. 2014; 2(2):27-38.
15. Patwary MA, O'Hare WT, Sarker MH. Assessment of occupational and environmental safety associated with medical waste disposal in developing countries: a qualitative approach. Safety science. 2011; 49(8-9):1200-7.
16. Occupational Safety and Health Administration (OSHA). Employer Rights and Responsibilities Following a Federal OSHA Inspection. OSHA 3000-08R 2016.US Department of Labor, 2016.
17. Opekpa S, Akolate M, Isik O, Cimen M. Evaluation level of health care professionals about medical waste management. University of Academic Health Science Journal. 2011; 2(3):131-140.
18. Meleko A, Tesfaye T, Henok A. Assessment of healthcare waste generation rate and its management system in health centers of Bench Maji Zone. Ethiopian journal of health sciences. 2018; 28(2):125-34.
19. Rn AU, Yahaya MN. Hospital Waste Management Practices**.** A Case Study of Primary Health Care Centers, In Fagge Local Government Area, Kano State, 2014.
20. Gao Q, Shi Y, Mo D, Nie J, Yang M, Rozelle S, *et al*. Medical waste management in three areas of rural China. PloS one. 2018; 13(7):e0200889.
21. Mostafa GM, Shazly MM, Sherief WI. Development of a waste management protocol based on assessment of knowledge and practice of healthcare personnel in surgical departments. Waste management. 2009; 29(1):430-9.
22. Coker A, Sangodoyin A, Sridhar M, Booth C, Olomolaiye P, Hammond F, *et al*. Medical waste management in Ibadan, Nigeria: Obstacles and prospects. Waste management. 2009; 29(2):804-11.
23. Soares SR, Finotti AR, Da Silva VP, Alvarenga RA. Applications of life cycle assessment and cost analysis in health care waste management. Waste management. 2013; 33(1):175-83.