Sudan University of science and Technology
College of Graduate Studies

Evaluation of Quality Assurance in Disposal of Medical Waste

تقويم ضمان الجودة في التخلص من النفايات الطبية

A thesis submitted for the fulfillment of M.Sc. degree in Management of Quality Excellence

By:

Manahil Babiker Hamid

Supervisor:

Prof. Mohamed Elfadil Mohamed

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Inception

بسم الله الرحمن الرحيم

قال تعالي :
قُلْ لَوْ كَانَ الْبَحْرُ مِدَادًا لِكَلِمَاتِ رَبِّي لَنَفِدَ الْبَحْرُ قَبْلَ أَنْ تَنْفَدَ كَلِمَاتُ رَبِّي وَلَوْ جِئْنَا بِمِثْلِهِ مَدَدًا)

[الكهف 109]

Dedication

To my parents God bless health and wellness
To my great and small families
To my friends
To all of them
Presented the modest effort

Abstract

Medical waste is considered one of the world's most important issues because of its negative effects on the safety of the community and the environment. The Khartoum Police Hospital has the responsibility to limit the effects of medical waste. Despite the efforts of the hospital administration to achieve a successful management of those hazardous medical wastes, these efforts did not live up to the level of great effort required to manage medical waste. The objective of the study is to evaluate the application of quality assurance in the proper disposal of medical waste in order to highlight the shortcoming . The importance of this study stems from briefly describing the management of medical waste, identifying weaknesses and strengths and making appropriate recommendations. The methodology descriptive study was chosen, the questionnaire was used as a tool to collect data and information as well as personal observation and visits to the complex of medical waste treatment generated in the hospital. Using the SPSS program in analysing data and information statistically the Chi square test was done to find the significance differences or goodness of fit for the answers; finding the following results of this study showed that 76% of the employee agree that the collection of medical waste was ideal which was general collected by worker (52%), but majority of the employee they don't know whether the a mount of medical waste per day reach one ton or more. As well the majority of the employee 74% agree or strongly agree that the time of collection for medical waste was appropriate. The knowledge about the application of quality standard was not accurate. Concerning the availability of the protective tools for workers 78% agree and strongly agree that it is available.

المستخلص

تعتبر النفايات الطبيه من القضايا التي تحظي باهتمام العالم لما لها من اثار سلبيه علي سلامة المجتمع والبيئه، ومستشفي الشرطه الخرطوم تقع عليها مسئولية الحد من الاثار التي تنتج من النفايات الطبيه ، وبالرغم من الجهود المبذوله من ادراة المستشفي لتحقيق اداره ناجحه وسليمه لتلك النفايات الخطره الا ان تلك الجهود لم ترق لمستوي المجهود الكبير المطلوب لادارة النفايات الطبيه بدأً من تولدها وتخزينها والتخلص الامن منها هدف الدارسه هو تقييم تطبيق ضمان الجوده في التخلص السليم من النفايات الطبيه من اجل تسليط الضوء علي النقص الموجود . وتنبثق اهميه هذه الدراسه في توصيف ادارة النفايات الطبيه بصوره مختصره وتحديد نقاط القوه والضعف ووضع التوصيات المناسبه تم اختيار منهج الدراسه الوصفيه واستخدم الاستبانه كاداة لجمع البيانات والمعلومات وكذلك الملاحظه الشخصيه والزيارات لمجمع معالجة النفايات الطبيه. تم تحليل البيانات احصائياً ثم إجراء اختبار مربع كاي لاكتشاف الاختلافات ذات الأهمية أو مدى ملاءمة الاجابات أظهرت النتائج التي توصلت إليها هذه الدراسة أن 76٪ من الموظفين يوافقون على أن جمع النفايات الطبية كان مثاليًا والذي تم جمعه من قبل العمال (52٪) ، ولكن أغلبية الموظفين لا يعرفون ما إذا كان وزن النفايات الطبيه يوميا تصل إلى طن واحد أو أكثر، كذلك توافق غالبية الموظفين 74٪ أو توافق بشدة على أن وقت جمع النفايات الطبية كان مناسبًا، لم تكن المعرفة حول تطبيق معايير الجودة دقيقة ، فيما يتعلق بتوافر الأدوات الواقية للعمال يوافق 78٪ ويوافقون بشدة على توفرها.

List of Contents

List of table

List of figures

List of Appendix

Appendix	Contact	Page No
Appendix A	Questioners	**36**
Appendix B	Standards answer	**37**
Appendix C	Type of medical waste and standards bags	**39**

List of photos

Chapter one

1-1 Introduction

Although of all the amazing achievement in the medical field which with no doubts had a positive influence in fighting diseases that made the people feel more healthy an safe which help them do their work and help their countries in a creative way but there is a bad influence as well because of all these progress come in high cost, the environment has been poisoned with many medical waste contaminates which itself lead to dangerous diseases that could kill if not handled in a proper way.

Quality Assurance (QA) is a way of preventing mistakes or defects in manufactured products and avoiding problems when delivering solutions or services to customers. The medical waste is a health care waste that maybe contaminated by blood , body fluids or other potentially infectious materials and its often referred to as regulated medical waste .

Every person has the opportunity to affect the quality of their work. Verifications achievement quality within medical waste is the responsibility of the waste management group system and maybe overseen by the office of contract concern, recommend solution, verify corrective action and stop work of practice that may adversely affect quality or safety.

The medical waste management group Quality Assurance Program(QAP) is an integrate parts of management system designed to insure that waste management

group activities are planned, performed, documented and verified in manner that assures a quality product .

1-2 Research problem

Medical waste is subset of waste it has a high risk in infectious diseases, if the disposal of the medical waste isn't handed properly will lead to environment contamination these contamination spread diseases all over the globe that's why there is a whole private section and containers in health ministry. At the moment the health and environment authorities are looking at this problem but no actions plan has taken place yet but trials are still going on. There might be a poor quality control over the medical waste institution that make it a posing growing problem worldwide jeopardizing the health of staff, patients, disposal workers and anyone else coming in contact with the hazardous material discarded by hospitals and other health care sites. Therefore evaluation of the current situation is important and crucial good decisions.

1-3 Research Objectives

The general objective of this study was to evaluate the application of quality assurance in disposal of medical waste in order to highlight the shortcoming.

Specific objectives

- To evaluate the method of medical waste collection
- To find out who collect Medical waste
- To identify methods of medical waste disposal including logistics
- To find the method used for personal protective tools for employees
- To find the methods of medical waste storage and time of transfer

1-4 Significance of the study

This study will provide information concerning the application of Medical waste management and generally people, who have the highest risk of being affected by the medical waste risk, are health care workers, patients, waste collection and disposal staff. Medical waste maybe poses an occupational hazard when managed incorrectly; therefore they need special precautions, treated and well trained personal to manage those medical waste to keep the risk low.

1-5 Overview of the study

This study falls into five chapters with chapter one is an introduction, which include problem of the study, objectives and significance. Chapter two include literature review while chapter three include material used, the method of data collection and analysis.

Chapter four presents the result of the study in a figures and table , finally chapter five which include the discussion, conclusion and recommendations.

Chapter two

2-1 Literature review

The waste management cycle though it is a relatively simple task for most generators to track shipments of waste in aggregate, it is more difficult to relate specific waste quantities, final treatment, and disposal method and complete management cost data directly back to the process or unit operation of origin. while the uniform hazardous waste manifest (offer for transportation hazardous waste for off –site treatment, storage, or disposal) remains the cornerstone of all off-site hazardous waste track initiative, it is but one of tool currently available to generators to track waste from their point of generation to final treatment and disposal (standard HAND BOOK of Hazardous waste treatment and disposal 1988).

A study on the management of health care waste at the medical hospital in Omdurman conducted by Mahmoud (2015) its aim was to identify the medical waste in the hospital and asses the current situation and identify the difficulties facing the achievement of integrated management and evaluation of the behavior and practices of workers with medical waste, the researcher chose the methodology of the descriptive study section of the society and used the questionnaire as a tool to collect data and information, and reach the following results: a) The Medical Hospital of the largest health institution in the country produce medical waste and the system of management of medical waste in the hospital is weak in some stages and that medical waste is transferred and disposed of with normal waste, b) There are no records of quantities of waste produced and c) There is no coordination with regard to waste management and the level of training is not enough, he recommend

the identification of integrated management of medical waste and the identification of responsibilities and support legislation and regulatory departments and the expansion of training programs.

Ahmed at (2015) studied assessment of medical waste management in Khartoum state hospitals. The aim of the study to assess Medical Waste (MW) management practices in Khartoum state. The methodology was descriptive, cross-section, consisted of used of survey, interviews with authorities of medical waste facilities and with personal involved in the management of the waste.

Samples of waste water were taken from six hospitals during periods from January to May 2009. The obtained results showed that the surveyed hospitals generated a total of (6253.8) Kg/day of wastes, of which about (5003) Kg (80%) are nonhazardous and (1250.8)Kg (20%) are hazardous. Infectious hazardous waste is mixed with general waste and disposed of in a municipal waste landfill. The finding of study showed that only (20%) of the hospitals have a waste management plan, these hospitals have no clear policy of MW. The study recommended a development and adoption of clear HCWM plans and policies, establishment of environment management systems within health care facilities, training of waste management staff, and appropriate infrastructure capable of efficient waste treatment and safe find disposal.

 Miraghani at (2016) studied medical waste management in some hospitals in Sudan; the purpose of the study was to assess qualitatively the current medical waste management hospitals in Khartoum state, and to identify the major problems and challenges facing the medical waste management system. The study methodology included field visits and gathering information from the hospitals, the ministry in health of Sudan and the land filed in Omdurman, using questionnaire

and interviews. The current medical waste management systems in the studied hospitals are not fully functional and suitable. The major problems in most of the hospitals are that concerning incineration of waste and the municipal trucks don't come at the exact time for waste collection and incinerators were located near the residential areas, also there are no strict and clear plans from the municipality and ministry of health to dispose the medical waste safely. The training programs for the medical teams with respect to medical waste handing are not efficient. There is no recurrent medical follow up and vaccination for the staff who handle the medical waste. The study concluded that the management of medical waste in the studied hospitals is very week and not conforming to WHO stander and Sudanese stander for medical waste disposal. Strong unite with qualified staff is recommended to monitor solid waste in hospital and to advice on the proper way to dispose the solid waste and to provide training to the staff and awareness programs to be arranged.

AL-Habeb (2014) studied management hospital waste in Riyadh. The aim to determine the problems associated with medical waste, the properties and management. The study was conducted in 14 hospitals, 7 government hospitals and 7 private hospitals. The study determined that the volume of the medical waste is 1347 Kg and the normal waste volume is 175.11 Kg/day. All hospitals collect the wastes daily. Government hospitals produce larger quantities compare to the private hospitals. The recommendations give properties to the management of the medical waste in hospital in all countries, continuing training of waste workers, the development of the occupational health programs is necessary to reduce the impact of injuries to employees with sharp tools contaminated and clear policy to management of medical waste.

Ali (2010) studied the environmental condition of the hospital medical waste to avoid pollution in Iraq. The purpose: Iraq is facing such dangers and risky condition in the next years due to there is no real and logical treatment for medical wastes and cabbages the coast hazardous and transferring uncured infections and the landfilling is the oldest method. Also the education is not taken its past in the real sense and we don't have special factories to recycle medical wastes. Iraq is not following EIA and ISO international organizations. The drainage system needs to be cared for. There is one bag for each coach in a hospital and weight of medical waste is huge in tunes. The aim the research tries to determine the main source of pollution in our hospitals and necessary requirement that must be done to avoid and prevent pollutions in health institutes. EIA is one of the keys to solve the current problem of pollutions. The study is a cross-sectional study in which the researcher presented a descriptive, analytical and comparative study for the data of the medical wastes. There is a comparison between two years (2010-2011) in which results reflect the huge and enormous weight ratios and numbers of waste and cabbages bags that are representing. The result: the ratio of bags using is so high and there misuse by the workers. No real understanding for medical waste treatment and separation in terms of huge rates of weight in kg especially in 2010 in hospital of (400) bed capacity. Most of crematories are broken down in 2010 that coast long period gathering and remaining in hospital until they are sent to landfilling. In 2011 the rate of weight in kg reach (14360) in December which represent the total number of medical waste for one month to 8 hospitals. It's a significant and indicative due to the unplanned method of gathering, separation, isolation and transferring. There is no clear system of EIA. Conclusion there is no real treatment for medical waste inside hospitals. There is no workable incinerators due to some are workable and other are broken down. The drainage system is not working in most hospitals of Wast. Workers are not trained well and they have no

skills and knowledge of the instruction and restriction of the (EIA and ISO). Recommendation we need to open a small factory inside one of our teaching hospitals to take benefits from our waste and cabbages. Training for workers and make availability of vehicles and stores are essential in each hospital. Drainage system is workable in AL-Zahra and AL-Krama teaching hospitals. They use biological and chemical treatment.

Daowd (2009) studied of Medical Waste Management in Shandi Hospital (Almak nemer university hospital and Shandi teaching hospital) in the period from March 2009 to March 2010 as a case study to express the reality of medical solid waste management in state of River Nile. The aim of the study to assess the management of medical waste in the hospital in term of the collection, storage, transportation and final disposal and to know the component of medical waste management to know the rule of the municipality in that and to find out the amount of waste produced, the quality and the problems caused by them and finally to propose recommendations to improve the statues. This study relied of multiple method to collect the information which include a chick list to write notes during the filed war focus group discussion with the medical staff, cleaners, drivers of vehicles and there companions in the municipality. Quantitative technique also was used. Result : A) The lack of suitable system for management of the medical waste hospitals. B) Lack of the clear concept of meaning of medical waste and risks for most workers in the hospitals. C) Lack of proper separation of medical waste from other waste, and there is no infrastructure for that. D) No proper treatment for the medical waste in the hospital, and disposed of in random landfill not appropriate for this purpose. E) The municipality is using vehicles not suitable for medical waste transporting and the protective cloths or equipment are not available for drivers and there companions. Recommendations: a) Provide the necessary infrastructure for the

management of medical waste in the hospital. b) The necessity of establishing and integrated system and secure when dealing with medical waste generated by health services. c) The need to appoint and observer of medical waste at the hospital who will be directed responsible for the collection, transportation and disposal of waste (waste management) with direct supervision of staff and workers of the hospital hygiene. d) Necessity of activating the rule of health education in medical waste management. e) Carry out health inspection and control of medical waste in hospitals with the study of possibility of applying economic instruments in the field of medical waste management.

Zerfawy and Gedi studied the management of medical waste and assessment of their environmental effects (2016). The objective: To contribute in establishing the concept of integrated management of medical waste treatment according to international standards, Assess the impacts of these wastes on the environment and Demonstrating the administrative and technical practice in the management MW generated by the activities of the public institution. Using the descriptive approach and analytical method which is based on studying the situation and analyzing the result reached also used the interviews and the observation. Their result showed that: The import ants of an independent low that governs concepts related to the management of MW, The total production of public hospital from both hazardous and non-hazardous waste contributes to environmental damage, Mixing between medical and normal waste during the transport, storage and final disposal, Vehicles not suitable for medical waste transporting and no protective cloths or equipments are available for drivers and there companions, Lack of international standards in storage of MW, Serious effect on the public health and environment from disposed of chemical waste, High costs in transfer of MW and autoclaving, Absence of direct office to supervise the management of MW and Lack of training and

education for workers. Recommendation: a) A located low governing the medical waste management system. b) Establishment of a direct supervisor of the institutions who devolvement of administrative policies for medical waste, preparation of plans, reports and statistics and follow up developed from international and legal standard. c) Provide safety equipment and clothes to drivers and workers. d) Appointment of committee concerned with application of state standards and occupational safety for public situations. e) A located of closed spaces to collect medical waste containers after sorting. f) Integrated environmental management of MW. g) Provide financial support for studies and specialized research in planning, training and awareness.

Nazli (2012) studied improper management of Medical Waste, in order to the goal that improper management of medical waste can create Many problems , especially large threats to public health and the environment (from sorting, collecting, transporting and storage then proceed to the last disposal). He used descriptive approach, 600 questionnaires to the doctors, workers and the other parterres in medical waste management, face to face and the case study and finally they statistically analysis the data. Result it was found that the management of the medical waste in the hospitals studied accordance with the international standers, but there was some weakness were recorded such as: Failure to ensure timely and proper central storage of medical waste, The composition of the hospital staff is weak in the area of improved technology and The need for innovative research and development in technology. Conclusion each step of the administration must be calibrated as the first in a series of system for the management of medical waste on the public health of the environment.

Hakim at (2014) studied determinants of administration of medical waste. The aim : to determinates anarchic management of medical waste .the descriptive approach

and case study are used at the children's hospital in Ribat .The result priority to eliminate the problems of medical waste management at the hospital level should be for training and education for all participants in the management processes.

Al Saad (2012) studied the effect of method that dealing with medical waste. The aim: To increase problems of environmental pollution hazardous medical waste that affected all the livening and damages the natural sources that threat the attainment of sustainable development. Using descriptive approach based on theoretical information, analytical approach is based on the case study (The General Hospitalization Of Gezira) and analysis of data obtaining. The result:

The collection process take place daily but it is shared with normal waste and don't have suitable place for each type of waste, 94% of general hospitalization institutions used normal vehicles to transport the medical waste to disposal place and not cleaning after used, 88% of case studies depend on burning, and 12% not have treated technics to hazardous waste and depend on the random burning, There is no medical waste management supervisor, Lack of education, training and awareness to the workers that deal with medical waste and Don't have alternative methods to take the place of the random burning waste that have a low negative effect for general health and environment

2-2 Type of Medical Waste

The World Health organisation (WHO)classifies medical waste into:
- Sharps
- Infectious

- Pathological

- Radioactive

- Pharmaceuticals

- Others (often sanitary waste produced at hospitals)

- The blood and body fluids.

- Household medical waste.

- Pathological waste and Clinical waste

Pathological waste is included in the above categories, but is designated separately because the potential psychological impact on observers. If you can recognise the waste came from a living organism, it is probably pathological waste: consists of recognisable tissues, organs, and body parts derived from animals and humans. Material removed from the body in surgery and fluids and solids removed in autopsies is pathological waste, with the exception of teeth. Pathological waste is almost always treated by incineration. Autoclaves are not used for pathological waste.

Regulated waste

In the US the term regulated waste is used in healthcare contexts mostly to refer to worker safety standards and procedures. OSHA promulgated rules for dealing with bodily fluids called the Blood borne Pathogens standard. It refers to regulated waste as blood or "other potentially infectious materials" (OPIM) and items contaminated with these materials as well as pathological and microbiological wastes containing blood or OPIM. (Feminine hygiene products do not count as regulated waste, and OSHA has ruled that bandages that are not saturated to the point of releasing fluid if compressed don't count either.)

Management of regulated waste

OSHA's Blood borne Pathogens Standard required healthcare facilities dealing with regulated waste to have an Exposure Control Plan to protect workers and minimise the chances of transmission of hepatitis C, hepatitis B, and HIV. The plan is supposed to specify which employees have routine contact with blood and blood products and what to do after an exposure. OSHA also requires that regulated waste be put in closable containers and that if there is any chance of leaks from those containers, that a second container be employed.

Mercury waste

2-3 Basic steps in minimum health care waste management programs

- define responsibilities
- Classification and assessment of waste generated
- Definition of reuse options
- Proper treatment and disposal of water
- Training of employees
- Ensuring storage
- Safety warranty
- Improving the management of chemical stocks
- Waste sorting
    - ✓ Re-medicine or expired materials to the supplier
    - ✓ General wastes include municipal wast

Treatment of medical waste

- Incineration
- Chemical Disinfection
- Utilization of Outoclave
- Severe Acute Respiratory Disinfection
- Disinfection of Cholera and Disinfection of Infectious Body Fluids

Final Disposal medical waste

- Municipal landfill
- Dumping in Hospital
- Discharge to Sewage Network

(National Routers for Waste Management Health Care)

Chapter three
Material and method

3-1 Material

The data of this study collected using questioner consisted of 12 questions build according to five levels Licker scale

3-2 Design

Non interventional, descriptive, cross sectional study, the data were collected prospectively.

3-3 population

The study group consisted of physicians, laboratory specialist, nurses; health officer, cleaning worker and other whom employed in Khartoum Police Hospital, "Omer Sawee Hospital and Saheroon Hospital" also visit Saudi Sudanese Complex for Recycling Waste and Medical Waste Treatment, during the period from 2016-2018.

3-4 sample size and type

 The sample of this study consisted of 150 employees selected conveniently as non probability quota sample method.

3-5 method of data collection and analysis

The data of this study collected using questioners and analyzed using Excel and SPSS version 21 under windows, where the median were obtained for each question and the Chi square test was done to find the significance differences or goodness of fit for the questions answers,

3-6 Study variables:

Dependent variables: methods of medical waste collection, daily production of medical waste, time for medical waste collection, who collect medical waste, usage of protective tools for employee, medical waste storage site rate of medical waste transfer, dispensing of medical waste inside the hospital, location of medical waste transfer, usage of dedicate vehicles for medical waste. *Independent variables:* it include age, job and qualification.

Chapter four
Results

Question	P_value	Chi-Square	Median
1\ The collection method of Medical Waste (MW) it is ideal method	0.0	69.5	1
2\ MW was collected by workers	00	58.2	1
3\ The amount of MW produced per day more than ton	0.04	10.0	3
4\ Time of collection MW is appropriate	0.0	25.6	2
5\ Quality assurance standards are used in the disposal of MW	0.69	2.2	3
6\ The protective tools for workers are available	0.0	33.2	2
7\ The location of storage MW is appropriate (landfill)	0.06	9.0	3
8\ Daily transported of MW	0.0	23.0	2
9\ There is a way to treat MW in the hospital	0.01	14.6	4
10\ The vehicles that transport MW are safe and have special specification	0.02	12.0	2
11\ There is a vaccination for workers that collecting and sorting MW	0.01	14.6	4
12\There is a monthly or annual report on management data of MW	0.0	66.4	5

Table 4-1 chi square test for each question with median answer and the *p*-value
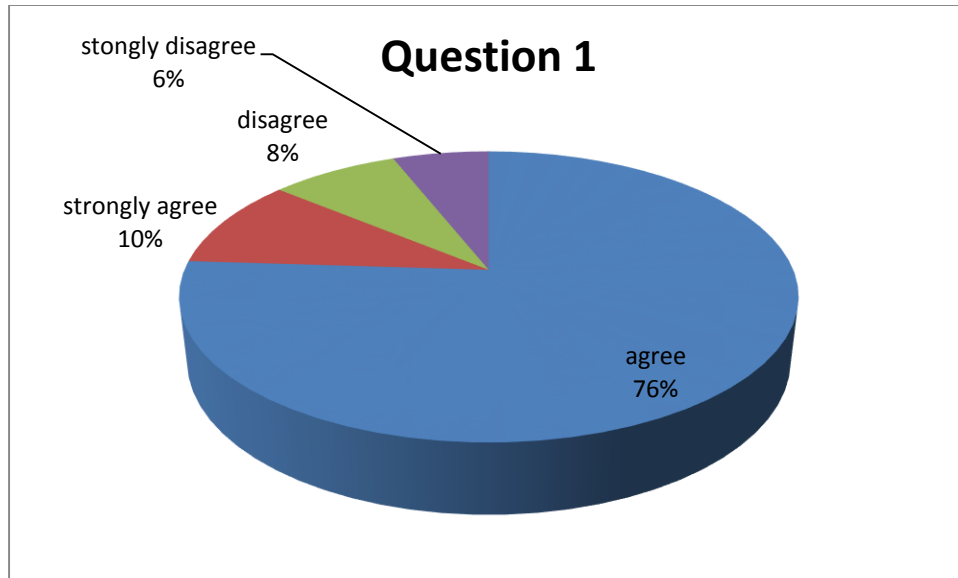
Figure 4-1 a pie graph show the answer for the method of waste collection is it an ideal method
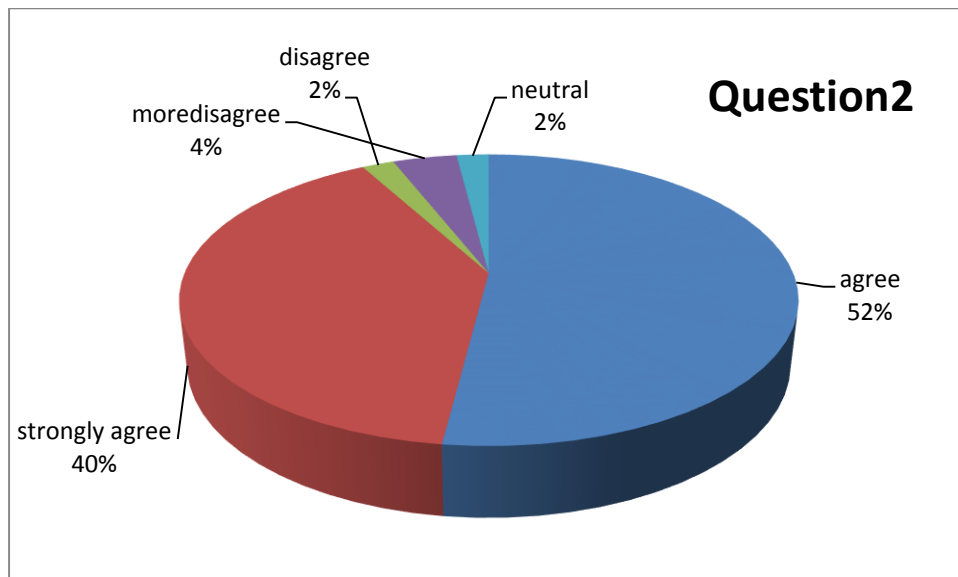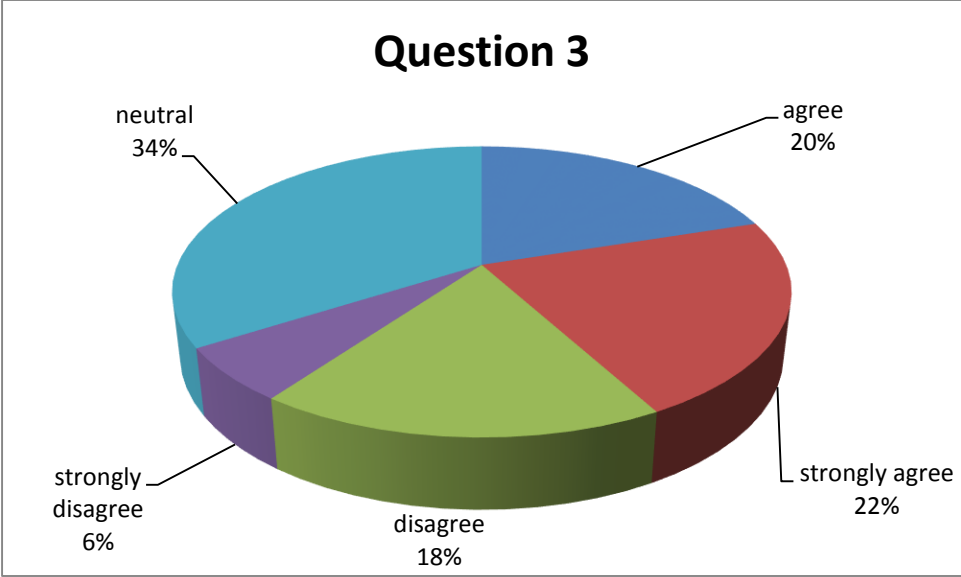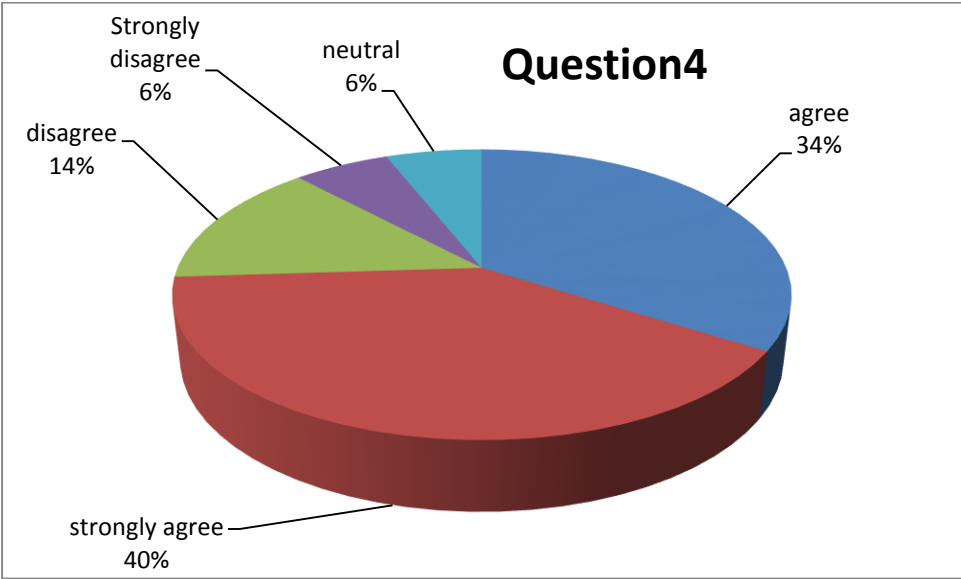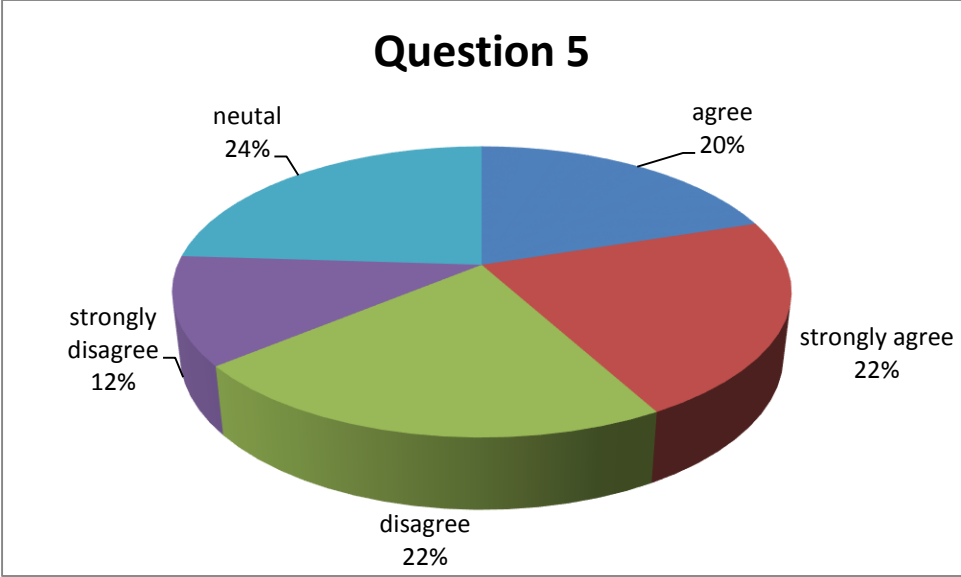

Figure 4-2 a pie graph show the answer for the Medical Waste collected by workers

Figure 4-3 a pie graph show the answer of the amount of MW produced per day more than one ton

Figure 4-4 a pie graph show the answer the time of collection for Medical Waste (MW) is appropriate

Figure 4-5 a pie graph show the answer of the used of quality assurance standards in disposal of MW.
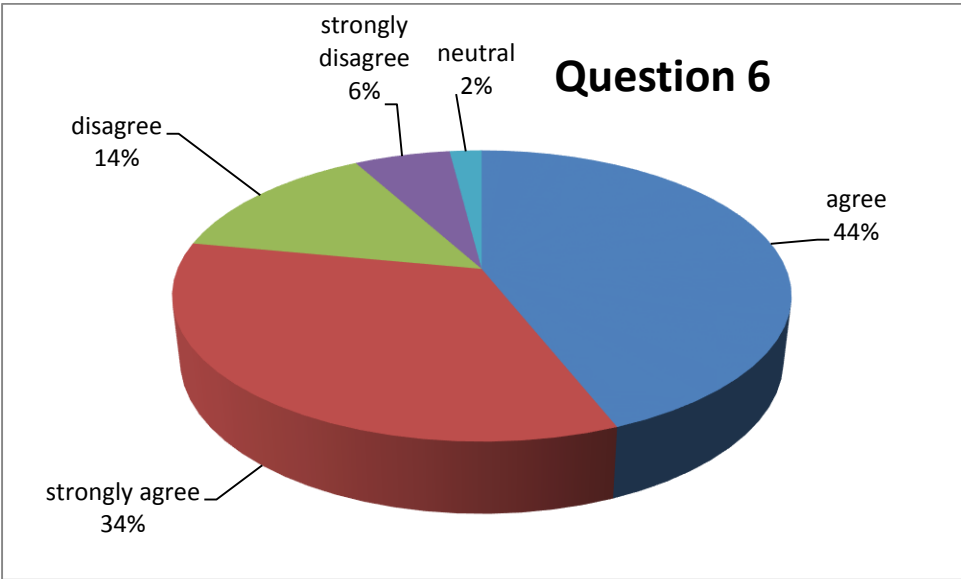
Figure 4-6 a pie graph show the answer of the protection tools for worker are available
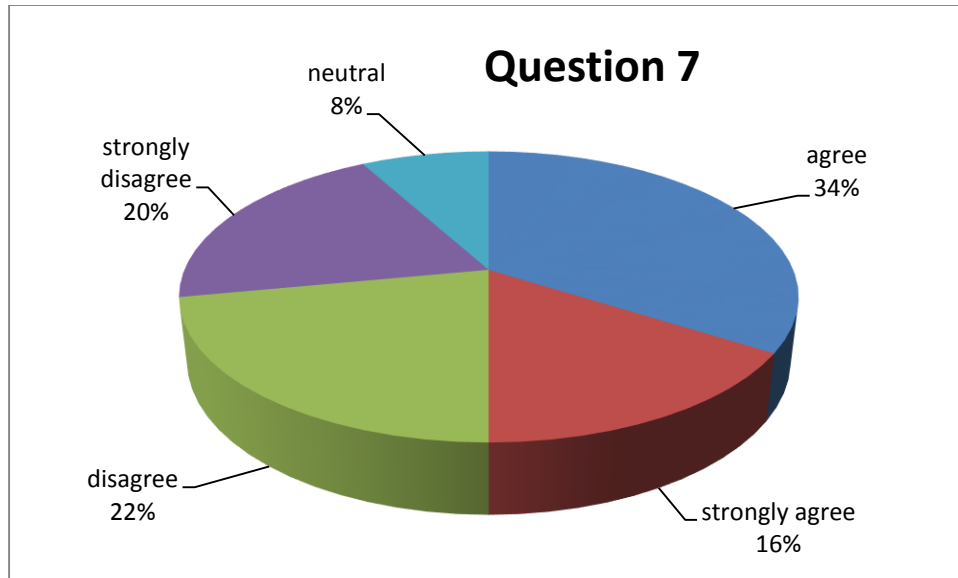
Figure 4-7 a pie graph show the answer the location storage of MW is appropriate.
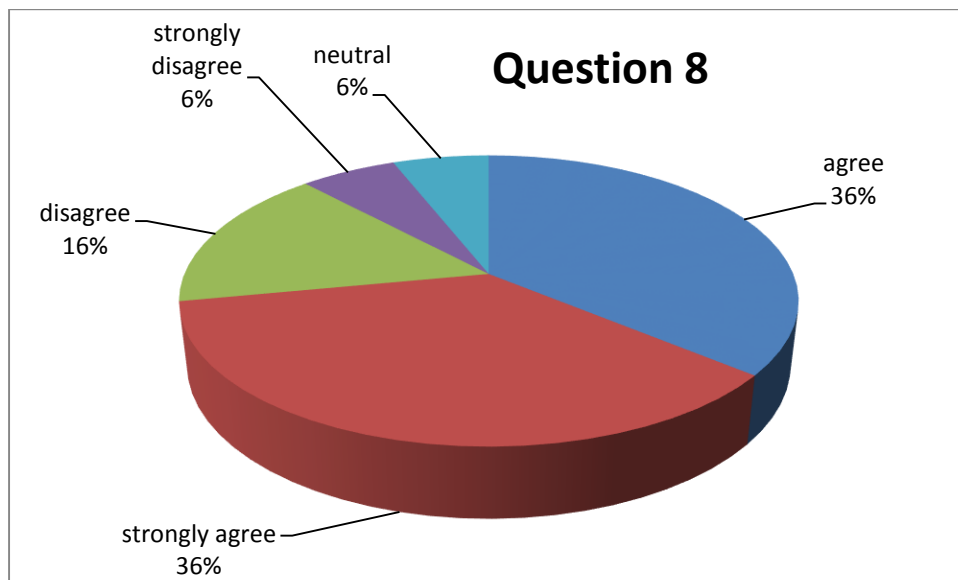
Figure 4-8 a pie graph show the answer of MW is transported daily.
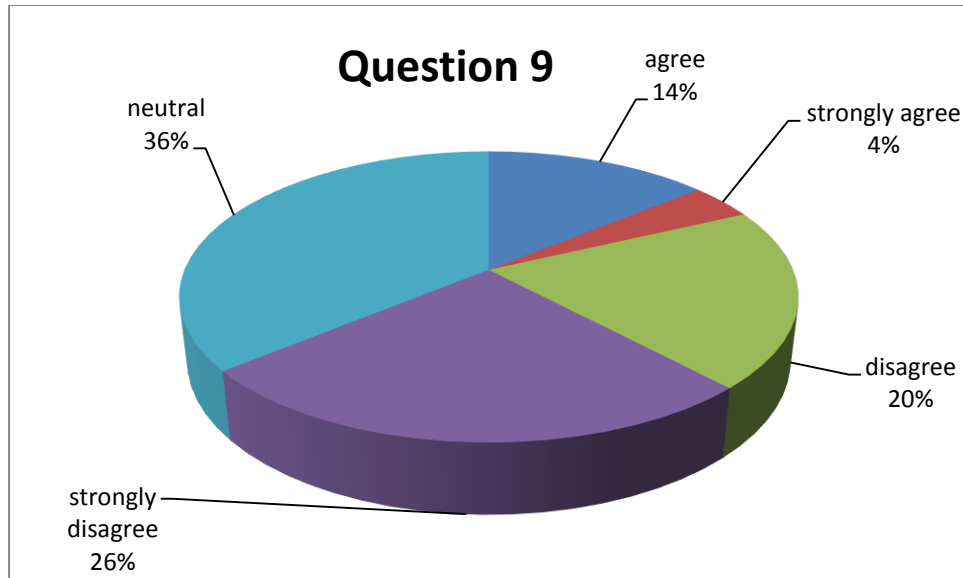
Figure 4-9 a pie graph show the answer there is a way to treat MW in the hospital.
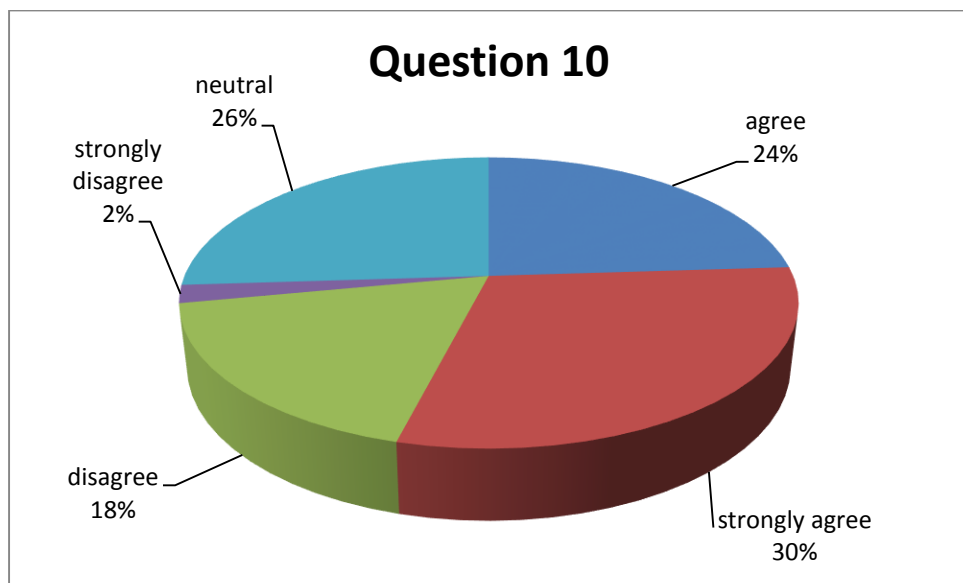
Figure 4-10 a pie graph show answer the vehicles that transport MW are safe and have special specification.

Question 11

- neutral 22%
- agree 16%
- strongly agree 10%
- disagree 12%
- strongly disagree 40%
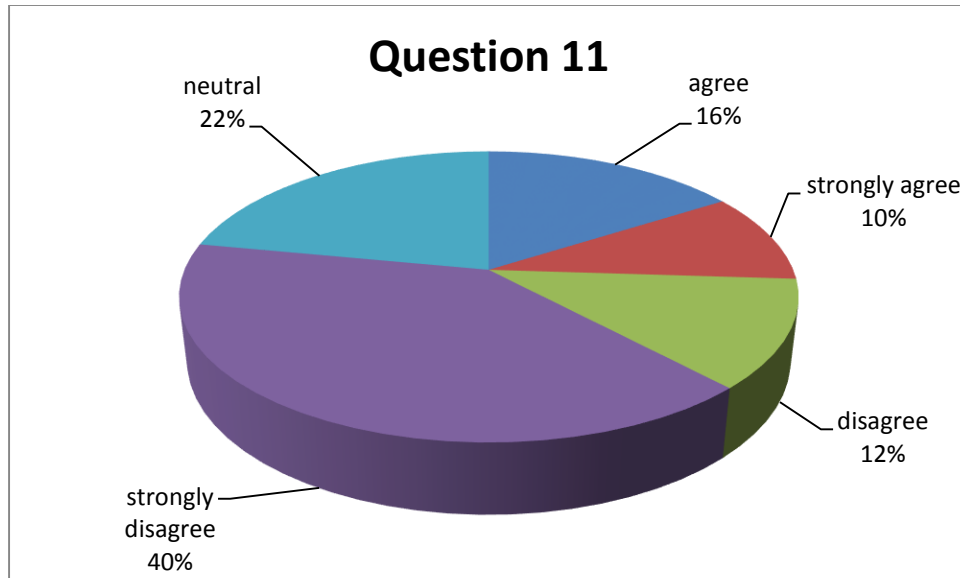
Figure 4-11 a pie graph show answer there is a vaccination for worker that collecting and sorting to MW.

Question 12

- neutral 64%
- agree 22%
- strongly agree 6%
- disagree 6%
- strongly disagree 2%
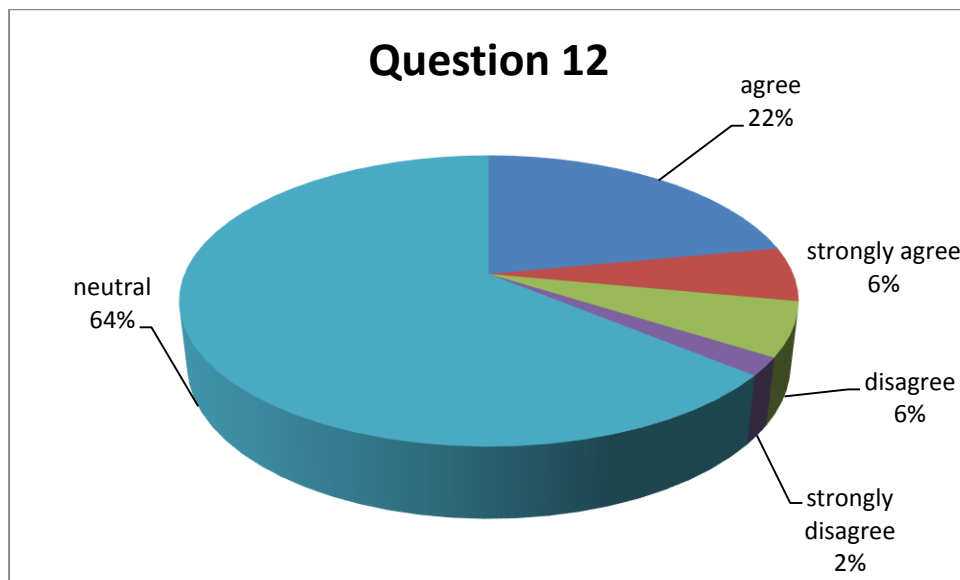
Figure 4-12 a pie graph show answer there is a monthly or annual report on medical waste management data.

Age

41_50
24%

20_30
44%

31_40
32%
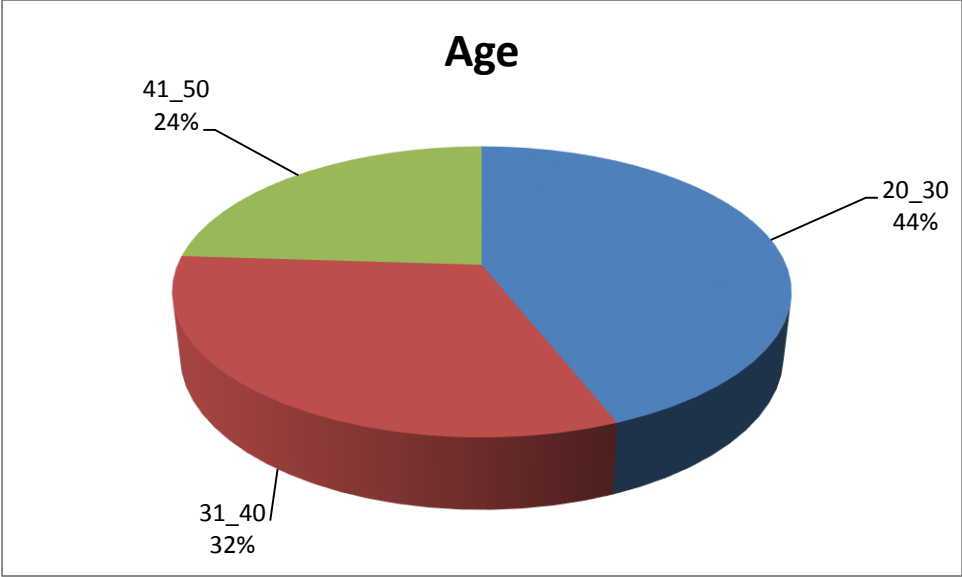
Figure 4-13 show the age of the people sample.

Gender

male
40%

female
60%
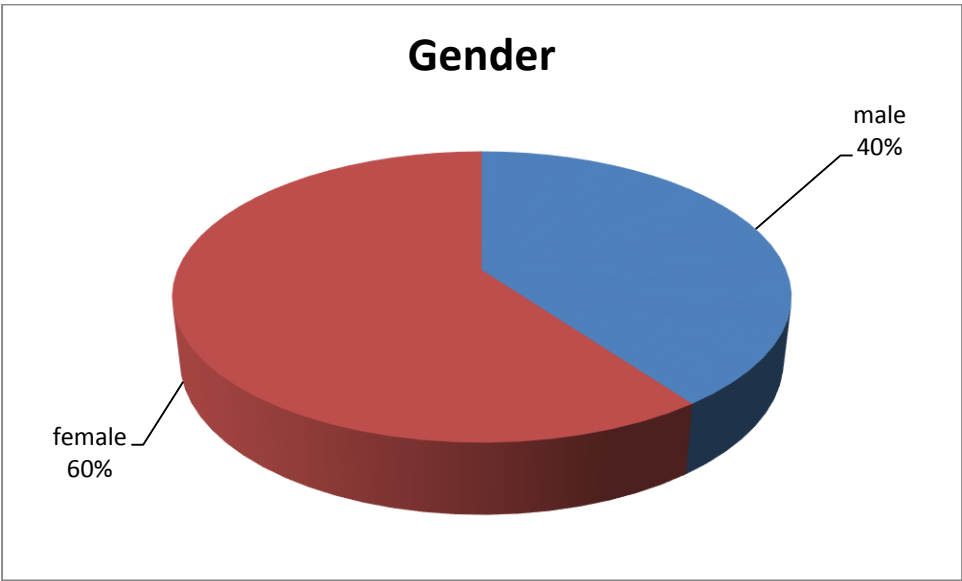
Figure 4-14 show the percentage of the gender sample.
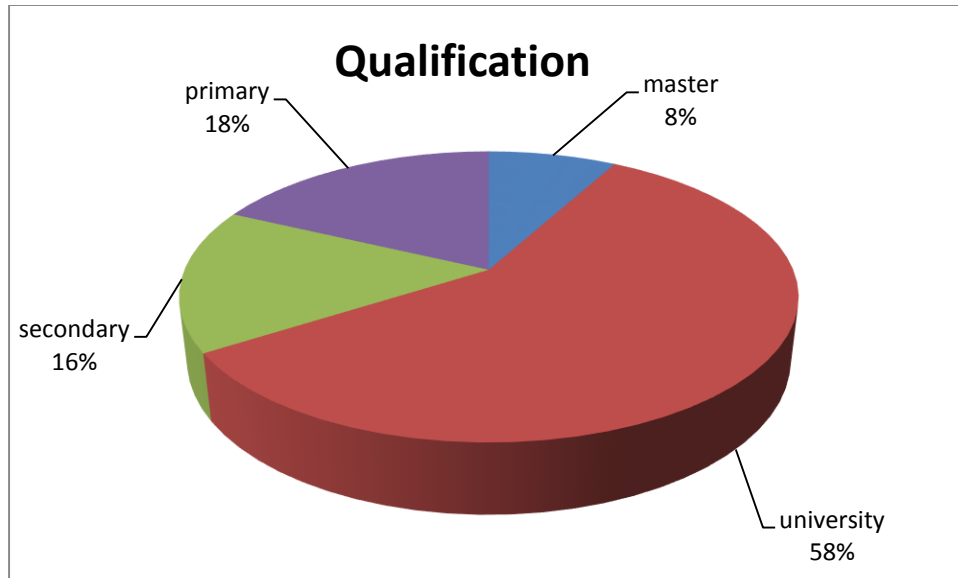
Figure 4-15 show the qualification of people
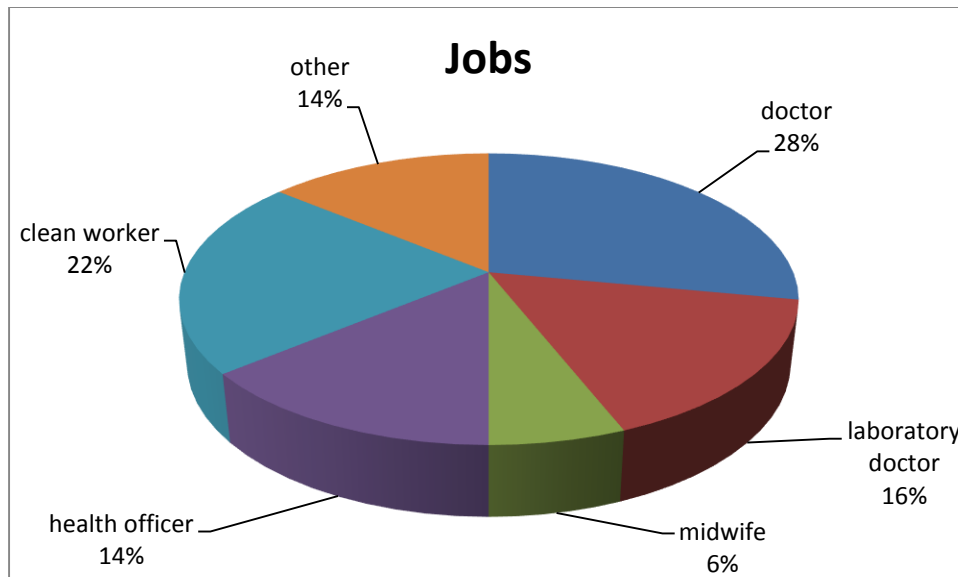
Figure 4-16 show the jobs of people sample.
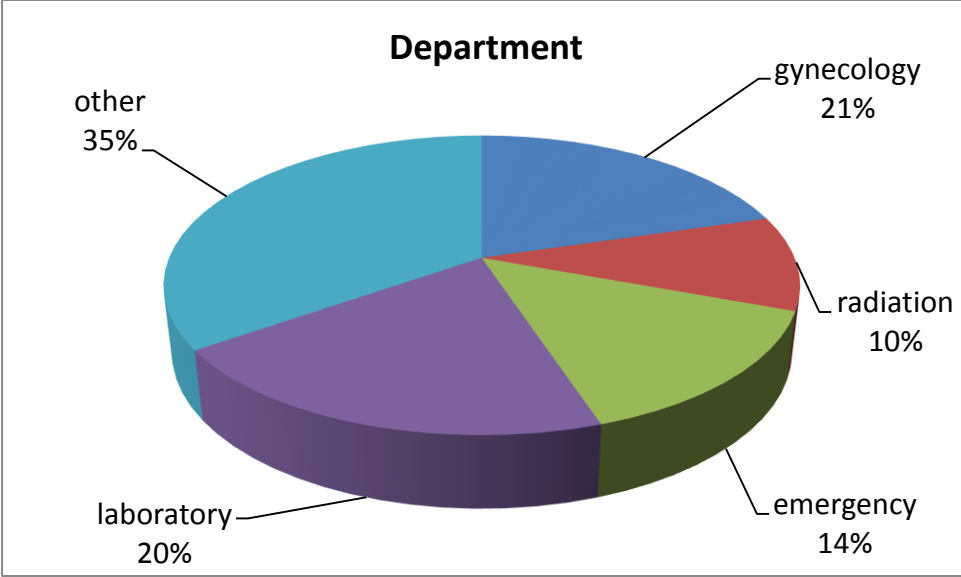
Figure 4-17 show the department that the study was done.

Chapter five

Discussion, conclusion and Recommendation

5-1 Discussion

The general objective of this study was to Identify and evaluate the current status of medical waste management in police hospital and their application of Quality assurance standards in disposal of the waste that produced by the hospital in accordance to the regulation and instructions of the competent authorities according to 12 standard which include the following points: the collection method of Medical Waste (MW), MW collected by workers, the amount of MW produced, time of collection, application of quality assurance standards, protective tools to workers, location of storage, daily transportation of MW, treatment of MW inside the hospital, specification of dedicated vehicles for MW transport, vaccination for workers and is there any monthly or annual report on management of MW; according to the answers which include the following response: agree, strongly agree, disagree, strongly disagree or neutral.

The study included 150 respondent of the employee of the hospital, they represents different profession (doctors 28%, laboratory specialist 16%, midwife 6%, health officers 14%, cleaners 22% and others 14% Figure (4-16). Most of their ages ranged between 20-30 years (44%), then 31-40 is 32% and 41-50 is 24%; which means the population of the study mostly in middle age (Figure 4- 13), where 60% of them were female (Figure 4-14) and most of them graduate from universities 53% (Figure 4-15).

The twelve standards in a form of questions which has been offered as questioner were answered by the participant; which mentioned earlier, showed that the answers regarding the method of Medical waste collection were varies but mostly they choose agree i.e. 76% of the respondents, 10% strongly agree, disagree 8% and strongly disagree 6% (Figure 4-1) using chi-square test for significance differences between the answers; the results was significant at $p = 0.05$ with chi-value of 69.5 and $p < 0.001$, the median vote agree as a result of the significance differences; which means that the collection methods of Medical Waste were agree as the value of the majority and have a significant effect (Table 4-1), the most effective group their ages ranged from 20-30, university graduate and their jobs was physicians and clean workers.

Medical Waste was collected by workers the answers were different included agree 52%, strongly agree 40% , disagree 2% , strongly disagree 4% and neutral 2%(Figure 4-2).Using the choice of chi-square test it was found that there was a significant difference between the answers at a significant level 0.05 the value of the chi-square was 58.2 with a probability 0.000 and the mean value of the median was agree which means that the collection of Medical Waste by workers agree as the value of the majority and have a significant effect (Table 4-1) and the most effective group their ages ranged from 20-30, university graduate and their jobs was physicians .

The amount of medical waste produced per day the answers were different included agree 20% , strongly agree 22% , disagree 18% , strongly disagree 6% and neutral 34% (Figure 4-3)Using the choice of chi-square test it was found that there was a significant difference between the answers at a significant level 0.05

the value of the chi-square was 10 with a probability 0.04 and the mean value of the median was disagree which means that the amount of medical waste produced strongly than ton per day were disagree as the value of the majority and have a significant effect (Table4-1), the most effective group their ages ranged from 20-30, university graduate and their jobs was physicians.

Time of collection for medical waste the answers were different included agree 34% , strongly agree 40% , disagree 14% , strongly disagree 6% and neutral 6% (Figure 4-4).Using the choice of chi-square test it was found that there was a significant difference between the answers at a significant level 0.05 the value of the chi-square was 25.6 with a probability 0.000 and the mean value of the median was strongly agree which means that the time of collection was approved strongly agree as the value of the majority and have a significant effect (Table 4-1) the most effective group their ages ranged from 20-30, university graduate and their jobs was clean workers.

The axes of used of quality assurance standards in disposal of medical waste the answers were different included agree 20%, strongly agree 22%, disagree 22%, strongly disagree 12% and neutral 24%(Figure 4-5).Using the choice of chi-square test it was found that there was a no significant difference between the answers at a significant level 0.05 the value of the chi-square was 2.2 with a probability 0.699 and the mean value of the median was disagree which means that the used of quality assurance standards was disagree as a value of minimums rang (Table 4-1) and the most effective group to this result they have age from 31-40, university and their jobs is doctors .

The protective tools for workers the answers were different included agree 44% , strongly agree 34% , disagree 14% , strongly disagree 6% and neutral 2% (Figure 4-6)Using the choice of chi-square test it was found that there was a significant difference between the answers at a significant level 0.05 the value of the chi-square was 33.2 with a probability 0.000 and the mean value of the median was strongly agree which means that the protective tools were available and strongly agree as the value of the majority and have a significant effect (Table 4-1), the most effective group their ages ranged from 20-30, university graduate and primary school certificate their jobs was physicians and clean workers.

The location storage of medical waste the answers were different included agree 34% , strongly agree 16% , disagree 22% , strongly disagree 20% and neutral 8% (Figure 4-7)Using the choice of chi-square test it was found that there was no significant difference between the answers at a significant level 0.05 the value of the chi-square was 9 with a probability 0.061 and the mean value of the median was disagree which means that the location of storage was not appropriate were disagree as the value of the majority and have a significant effect (table4-1), the most effective group their ages ranged from 20-30, university graduate and their jobs was physicians .

For the question about medical waste daily transportation the answers also were different included agree 36%, strongly agree 36%, disagree 16% , strongly disagree 6% and neutral 6% (Figure 4-8). Chi-square test it was confirm the significances differences between the answers at significant level of $p = 0.05$, the value of the chi-square was 23.0 with a $p < 0.001$ and the median value attributed to strongly agree, which means that the transportation was a daily issues (Table 4-1), the most effective group their ages ranged from 20-30, university graduate and their jobs was physicians and clean workers.

Concerning the issue of treatment of medical waste in hospital, respondent showed different answers which included; agree 14%, strongly agree 4%, disagree 20%, strongly disagree 26% and neutral 36% (Figure 4-9). Using the chi-square test it was found that there was a significant difference between the answers at $p = 0.05$ the value of the chi-square was 14.6 with a probability $p = 0.006$ and the value of the median match the answer strongly disagree which means that there is no medical waste treatment in the hospital (Table 4-1), the most effective group their ages ranged from 31-40, university graduate and their jobs was physicians and others.

Safety and dedication of the vehicles that transport medical waste issue showed different answers where agree 24%, strongly agree 30%, disagree 18% , strongly disagree 2% and neutral 26% (Figure 4-10) Using the chi-square test it confirm the significant differences between the answers at $p = 0.05$ the value of the chi-square was 12 with $p = 0.02$ and the value of median vote the answer strongly agree which means the vehicles that transport medical waste was safely and dedicated to the purpose (Table 4-1), the most effective group their ages ranged from 31- 40, university graduate and their jobs was physicians and health officers.

The safety standard of employee in a form of infection control through vaccination for workers whom collecting and sorting medical waste the answers of respondent were different included agree 16%, strongly agree 10%, disagree 12%, strongly disagree 40% and neutral 22% (Figure 4-11). Chi-square test as significance decision it confirm the significant differences between the answers at $p = 0.05$ with chi-square was 14.6 at $p = 0.006$, the median value dictate the issues of strongly disagree which means vaccination of workers were not perform satisfactory at least for more than 50% of the workers (Table 4-1), the most effective group their ages ranged from 20-30, primary school certificate and their jobs was clean workers.

The last standard was annual report for medical waste management data showed that there is different answers where agree 22% , strongly agree 6%, disagree 6%, strongly disagree 2% and neutral 64% (Figure 4-12). chi-square test confirm the significant difference between the answers at $p = 0.05$ with chi-square value was 66.4 at $p < 0.001$ the median value highlighted neutral as the significant issue which means which means there was little knowledge about report of medical waste through the general practitioners (Table4-1), the most effective group their ages ranged from 20-30, university graduate and primary school certificate, their jobs was physicians and clean workers respectively.

5-2 Conclusion

This is a descriptive study with a main objective to evaluate the appropriateness of the method of medical waste disposal within the quality assurance umbrella. The data of this study collected from 150 employees with different hospital jobs and academic qualification.

The Khartoum Police Hospital is one of the largest health institutions in Sudan that produces medical waste and the system of management of medical waste in the hospital is weak in some stages of disposal of medical waste representative in the storage location is not appropriate and no periodic vaccination For the workers that collection and sorting of medical waste and that the existing level of training is not enough.

The study validates the uses of international quality assurance standards in the proper disposal of medical waste, support of legislation and supervisory departments, and the expansion of training and periodic vaccination programs for workers.

5-3 Recommendations

Used of quality assurance standards in disposal of medical waste imply the followings:

- Improves the environmental work in all collections and storage medical waste.

- Continuing annual vaccination to workers that collecting and sorting medical waste.

- Evaluation and daily assessments medical waste to competent authorities.

- Provide red and yellow bags for the sorting of medical waste and follow up and guide the staff to carry out the sorting and the establishment of strict regulations.

- Develop a comprehensive training program on medical waste and carry out periodic training courses for doctors, nurses and workers.

- Develop guidelines and posters to awareness patients, companions and visitors about the risks of medical waste

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أم السعد ٢٠١٢ دور الاداره الصحيه في التسيير الفعال للنفايات الطبيه في ظل ضوابط التنميه المستدامه بالتطبيق علي المؤسسه الاستشفائيه الجزائريه
،، قسم العلوم الاقتصاديـة، كلية العلوم الاقتصاديـة وعلـوم التسيير والعلـوم التجارية، جامـعـة فرحات عبـاس سطيف، الجزائر ٢٠١٢

زرفاوي وجدي ٢٠١٦، ادارة النفايات الطبيه وتقييم تاثيراتها البيئيه ، جامعة العربي التبسي ، تبسه ، ١٠١ صفحه

محمود ٢٠١٥، ادارة نفايات الرعايه الصحيه بمستشفي السلاح الطبي ، امدرمان ، ١٢٢ صفحه

داؤود ٢٠٠٩، دراسة إدارة النفايات الطبية في مستشفيات مدينة شندي، مجلة جامعة شندي،العدد١١ ، ٢٠١١

الموجهات القوميه لادارة نفايات الرعايه الصحيه ، د : الفضل عبيد محمد ،مدير ادراة صحة البيئه والرقابه علي الاغذيه ٢٠٠٩

Appendix A
Questioner

	Agree	Strongly agree	Disagree	Strongly disagree	Neutral
age					
gender					
Education level					
Carrere					
Specialization					
Element	Agree	Strongly agree	Disagree	Strongly disagree	Neutral
1\ The collection method of Medical Waste (MW) it is ideal method					
2\ MW was collected by workers					
3\ The amount of MW produced per day more than ton					
4\ Time of collection MW is appropriate					
5\ Quality assurance standards are used in the disposal of MW					
6\ The protective tools for workers are available					
7\ The location of storage MW is appropriate (landfill)					
8\ Daily transported of MW					
9\ There is a way to treat MW in the hospital					
10\ The vehicles that transport MW are safe and have special specification					
11\ There is a vaccination for workers that collecting and sorting MW					
12\There is a monthly or annual report on management data of MW					

Appendix B
Standards answer

Question	Response
How to collect medical waste ?	**By cleaning workers from the source to collection sit (landfill).**
The amount of medical waste produced daily? Approximately?	**About one ton (from sau medical complex , sahron , policy hospital).**
Time collection of MW ?	**Morning and evening .**
Who collect MW ?	**Specialized cleaning workers .**
Quality assurance standards in disposal of MW ?	**Contracting with specialized bodies for disposal of MW (Saudi Sudanese medical waste complex and Khartoum state general waste cleanliness authority) .**
Do you provide personal protective tools for employees ?	**Yes available**
MW storage site ?	**Outside the hospital ,(landfill)**
Are MW transferred daily ? at what time ?	**Yes , at morning**
Is there a way to dispensed MW inside the hospital ?	**Collecting and sorting only .**
Where to send the rest of MW generated by the site ?	**The tissue sample are buried in a dedicated location far the population customized area .**
By what transporting MW to the treatment site and how much treatment per kilo ?	**Special vehicles to transport the MW .**
Monthly or annual report of MW management data ?	**Daily report .**
Is there a vaccination for worker ?	**Yes**

Section	Bag colour	Content	Safety pox	Storage time	Preventive tools
Emergency	black	Normal waste, syringe, carton ,cotton	Syringe	daily	Safety cloth , gloves and muzzle or mask
Gynecology	black	Galvez ,trail paper, injection paper ,cotton , gauze , blood ,	Syringe , Needle , Slices .		
Laboratory	black	Disposed urine sample , gloves , bags	Syringe , Needle , Slices and Sharp thing		
Surgery room	black	Cotton ,gauze , gloves, empty trail.	Syringe		

Appendix C

Type of medical waste and standards page for the waste

Type of waste	Bag or container colors
Severe infections waste	Red- characterized by severe infectious waste and have a sign of a hazardous vitality waste
Parts and human organ waste	Red- characterized by infectious waste and sign of hazardous vitality waste
Infection waste	Yellow – characterized by infectious waste and have a sign of hazardous vitality waste
Hazardous sharp waste	Yellow – written on it only sharp waste and have a sign of hazardous vitality waste
Chemical waste	Brown – characterized by a sign of hazardous vitality waste
Radioactive medical waste	Tightly closed container and have an international emblem of radiation
Non- hazardous waste	black

Appendix
(D)

Rule 1998 schedule II

Color coding	Type of container	Waste categories
Yellow	Plastic bags	Cat 1 human anatomical waste Cat 2 Animal Waste Cal 3 Microbiological Waste Cat 6 Solid Waste
Red	Disinfected container plastic bags	Cat 3 Microbiological Cat. 6 Soiled Dressing
Blue/white	Plastic bags, puncture proof containers	Cat. 4 Waste sharp Cat.7 Plastic disposable
Black	Do	Cat. 5 Discarded medicine Cat. 9 Incineration ash Cat 10 Chemical Waste

PhotoD-1 :show Type of container and Waste categories

Photo D-2: Show Safe Box

Photo D-3: Show special vehicles transport Medical Waste

Photo D-4 trolleys of medical waste

Photo D-5: Show packaging of medical waste before Autoclave process
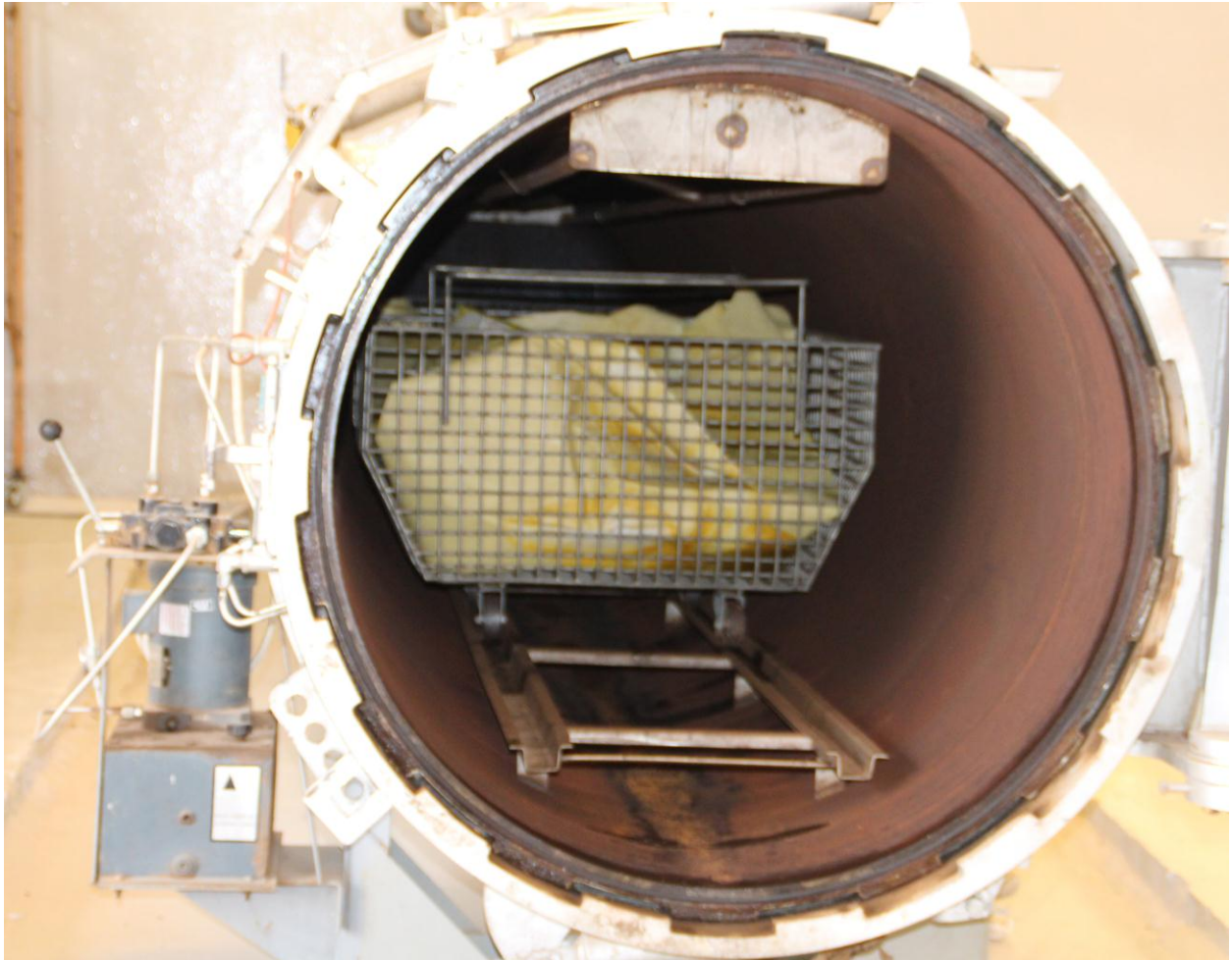
Photo D-6: Autoclave device

Photo D-7: Entering trolley of medical waste into Autoclave

Photo D-8: Show all trolleys inside Autoclave Photo 6 Show the

Autoclave device