

Efficiency and Effectiveness of Medical Waste Management Performance, Health Sector and its Impact on Environment in Jordan Applied Study

Majdi Al-Habash and Ali Al-Zu'bi

Al-Balqa' Applied University, Amman University College, Amman-11118- Jordan

Abstract: The main aim of this study is to give an idea about the medical waste management in the health sector and its impact on the environment in Jordan, the right and the safe management which include, segregate, classify, collect, processing of these waste may contribute to achieve the main goal which is to reduce the hazardous effect on the local community. For making this objective, the researcher depends on a scientific questionnaire that has been distributed and developed based on previous studies. The study population composed all (101) hospitals and (96) questionnaires were distributed on the hospitals that shows corporation with the researcher and from of which (78) questionnaires recovered: five questionnaires were excluded during the analyzing process because of insufficient data. The study was confined to analyzing (73) questionnaires or (76%) of the distributed questionnaires. The study uses the descriptive and analyzing statistics techniques to test its theories. That is the high cost and the insufficient skills of the staff and the processing may contribute to reduce the negative impact on the environment. The study recommended to: Commitment of the hospital to apply the rules and regulations of the waste medical management and to increase the focus on the training program of the staff and employees.

Key words: Jordan • Environment • Medical Waste • Management • Performance • Health

INTRODUCTION

During the past two decades, problem of medical waste is come to light as one of the most important phenomena that have played a clear negative impact on clear health and environment. However, a great concern is started to study this phenomenon for establishing health and environmental controls in order to safely eliminate these wastes from sources including different health facilities to final processing, health facilities such as hospitals, clinics, medical centers and other health facilities which producing medical waste includes infectious human parts wastes, sharp contaminated tools (medical needles, scalpels and blades), expired medicines and chemicals wastes as shown on its packaging labels. Toxicity after expiry date of some drugs and chemicals will be high. To avoid health risks, it must be on the alert when dealing with these types of waste [1].

The main purpose of controlling medical waste in hospitals is to reduce impact of these serious sources such as waste causing illness and to protect both patients

and staff and health atmosphere. Based on, this phenomenon has been seriously taken by the researcher and greatly focused on studying the efficiency and effectiveness [2].

Accordingly, a specialized unit management of medical waste has been development within the organizational structure of hospitals represented by prevention of infection unit. Medical waste management is the most important function of this unit which directly belongs to the Director of the hospital within the organizational structure of such hospital. This unit has a chief and a membership of nursing, pharmacy, radiology, maintenance, support labor and presents its regular reports directly to hospital director in order to safely eliminate these wastes from sources including different health facilities to final processing, health facilities such as hospitals, clinics, medical centers and other health facilities which producing medical waste includes infectious human parts wastes, sharp contaminated tools (medical needles, scalpels and blades), expired medicines and chemicals wastes as shown on its packaging labels.

Toxicity after expiry date of some drugs and chemicals will be high. To avoid health risks, it must be on the alert when dealing with these types of waste.

The main purpose of controlling medical waste in hospitals is to reduce impact of these serious sources such as waste causing illness and to protect both patients and staff and health atmosphere. Based on, this phenomenon has been seriously taken by the researcher and greatly focused on studying the efficiency and effectiveness.

Accordingly, a specialized unit management of medical waste has been development within the organizational structure of hospitals represented by prevention of infection unit. Medical waste management is the most important function of this unit which directly belongs to the Director of the hospital within the organizational structure of such hospital. This unit has a chief and a membership of nursing, pharmacy, radiology, maintenance, support labor and presents its regular reports directly to hospital director [3].

Study Problem and Importance: Problem of the study is to answer the following questions:

- Efficiency and effectiveness of medical waste management in hospitals generating this type of waste?
- What is the impact on environment and public health?
- Knowledge and application of best practices of safe management for the disposal of hospital's medical waste?

Study Objectives and Justifications: The main objective of this study is to focus on the need for medical waste management for reducing different effects, protecting both patients and staff working in entities generating such type of waste and protecting health of environment. Following safe manner in all stages of waste management leads to push the level of efficiency and effectiveness which contribute in achieving the objectives.

Medical Wastes: Definition: All medical, liquid or gaseous wastes which are generated from healthcare facilities, medical laboratories, research centers, pharmaceutical and veterinary factories, veterinary clinics, home nursing institutions; human and animal remnants, body fluids; blood and derivatives, human excreta, contaminated clothings, wipes, injectors, contaminated sharp tools, expired medicines and chemicals [19].

Classification of Medical Wastes:

Ordinary medical wastes: It includes the following:

- Any laboratory reagents, or lab materials non-infectious or acute and affect no on worker.
- Any waste includes no vital human blood or human or animal blood products.
- Any human discharges of urine, feces, nasal secretions and tears except if contain no human blood.

Hazardous medical waste: Part of medical waste that can cause health risks [11].

This waste is generated as a result of the following acts, such as diagnosis, processing, vaccination of humans or animals and may result from various scientific medical research, remnants of the tests such as vaccines, serums and antibodies [8].

Hazardous medical waste is classified [10] to the following types:

- Infectious waste: Waste containing, or believed to be containing microbes or organisms causing infectious diseases (bacteria), viruses and fungi.
- Anatomical waste (pathological): Wastes that are competent and directly related to the human body or tissues as sick organs have been eradicated, cut off limbs, dead embryos, or body fluids such as blood or such tissue that are sent for laboratory testing.
- Sharp waste: these tools are used by medical staff and used for medical purposes or analytical and may cause cut or puncture of human body and any sharp tool may be used in surgical operations.
- Chemical waste: Solid, liquid or gas waste resulting from diagnostics experimental, therapeutic, disinfection and cleaning.
- Pharmaceutical waste: Those expired or pharmaceutical products and non-complied with specifications, or different pharmaceutical and industrial remnants whether liquid or solid.

Mixed medical waste: A group may be a mixture of normal and medical hazardous waste and mixed waste should be classified as medical waste and can also be:

- Medical waste mixed with hazardous and infectious waste must be classified as a dangerous and contagious.
- Medical waste mixed with radioactive waste must be classified as radioactive waste and should be subject to the instructions contained in this regard.

- Waste could be mixed with the above two categories, so it must be classified as radioactive waste and followed the instructions developed in this regard. [5].

Medical waste management: What is the medical waste management?

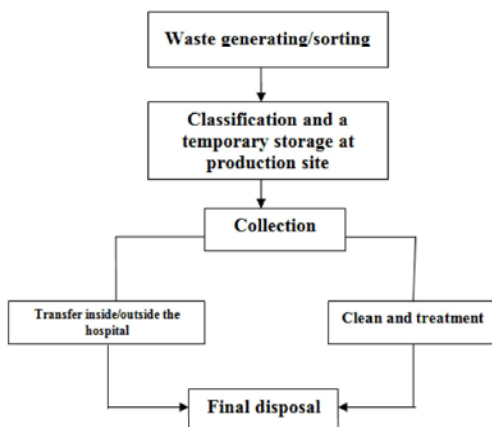
Medical waste management is a specific software and procedures taken by each person concerns in sorting, collecting, storing, transporting and processing medical waste generated in hospitals, to reduce or eliminate the risks that can occur when handling or exposing to unprocessed medical waste. Thus, it gives a guide for dealing correctly and safely with medical waste generated in hospitals which should provide proper and valid protection for all who deal with medical waste, as well as the local community and environment adjacent to hospitals to reduce environmental pollution [10].

Medical waste management can control on sorting, collecting, transporting and storing and finally the disposal of medical waste according to the best standards to protect public health and different local environmental considerations [11].

Functional Elements of Medical Waste Management:

- Sorting medical waste.
- Classification of medical waste.
- Collection of medical waste.
- Storing medical waste.
- Circulation of medical waste.
- Disinfection of medical waste.
- Processing of medical waste.
- Final disposal of medical waste. As shown in Figure (2)

Framework shows the interrelationship between the functional elements of the medical waste management



Performance of medical Waste Management

Performance: Is the final result of any activity, or that the interaction between behavior and achievement includes method and time spent to complete the work, in addition to the quantitative and qualitative results and behavior at work. Existence of an effective system of training is one of the important indicators that help in developing hospital administration. However, as performance includes the presence of individuals who are competent and are able to perform skillfully and effectively and therefore, the efficiency of the human element can be developed and strengthened through training of various types and methods and thus increase the ability to performance [8].

Measuring and Assessing Performance: Performance measuring and evaluating in one of the important task carried out by the administration in any hospital; by measuring the performance assessment, the hospital can judge the accuracy of the policies and programs adopted as training and development policies pursued by the hospital and also the worker by himself can recognizes the strengths and weaknesses points of his performance. Then, he can develop strengths and address weaknesses. This aspect is important for all levels from high management to workers at various departments, as there are advantages the hospital can take it, such as:

- Lift up the morale of the workers.
- Make them feel justice.
- Push them to hold responsibility.
- Adopt this task as serious control over workers performance [9].

Key Indicators in the Evaluation of Hospital Performance Are Efficiency and Effectiveness

Definition of Efficiency: Is a standard of maturity in the use of human, material, financial and information resources available and create the required balance between the objectives and their available various resources to raise up performance level.

Measurement of Efficiency Depends On:

- The availability of manpower, material and information available.
- Ways to use those resources to achieve goals.

Measuring the Efficiency of Performance:

- Direct standards: Measures operations by comparing outputs (services) with inputs (resources used) during a specified time, or any actual performance achieved either before, during or after implementation, but in some service activities.

Indirect criteria: measured by:

- Measure the desire to work.
- Identify the degree of satisfaction of employees.
- The morale of the workers.
- Study and analysis of potential investment.

Definition of efficiency: is being able to achieve the objectives within the requirements of environmental conditioning, as environmental community is unstable. Thus, goals achievement requires adjusting and balancing with surrounding sphere. This requires future knowledge of environmental problems and tries different adaptation [10].

Based on efficiency associated with:

- Achievement of goals.
- Adaptation.
- Development.

It is also concerns the means of using human resources, financial and information in way that can achieve goals, adaptation and evolution. Effectiveness is measured by:

- Setting all kinds of objectives and measuring its achievements.
- Measuring the adaptation ability.
- Taking substantive decision to create the required balance and achieving relative and constant stability [11].

Study Hypotheses: In this study we will try to test the following hypotheses:

Major hypothesis: There is no statistically significance relationship between the environment and the efficiency and effectiveness of medical waste management at level ≤ 0.05 . Following sub-hypotheses is emerged from such hypothesis:

- Ho1: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste sorting at level ≤ 0.05 .
- Ho2: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste classification at level ≤ 0.05 .
- Ho3: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste collection at level ≤ 0.05 .
- Ho4: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste storage at level ≤ 0.05 .
- Ho5: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste handling at level ≤ 0.05 .
- Ho6: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste disinfection at level ≤ 0.05 .
- Ho7: There is no statistically significance relationship between the environment and the efficiency and effectiveness of waste processing at level ≤ 0.05 .
- Ho8: There is no statistically significance relationship between the environment and the efficiency and effectiveness of the final disposal of waste, at the level of ≤ 0.05 .

Model of the Study: Presumptive model has been built (Figure 1) includes two variables represent management and organization of medical waste on environment and on the other hand, it was presented in accordance with the horizontal design of by way imposing the existence of mutual relations of influence between them and the model reflects the correlation between the efficiency and effectiveness of different functions of medical waste management and organization with environment and the direct impact on each other, noting that this model is the main base of study hypotheses.

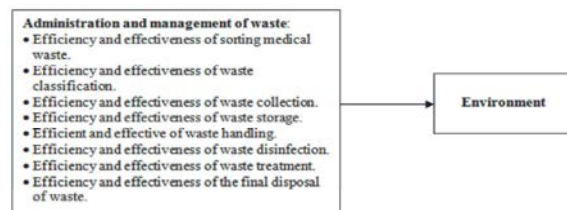


Fig. 1: Model of the study hypohese

Previous Studies and Distinguishes of Current Study from Previous: For importance, there are several international organizations that have expressed special interest in this issue and published several articles discussing the most important aspects on how to manage medical waste in safe and valid manner. Following are some of them:

- University of California, Irvine, Environmental Health and Safety Named DUC Irvine Medical Waste Management Program [2004] [12].

Irvine program (2004) of University of California aims at reducing or eliminate the risks associated with unprocessed medical waste or properly managed. It is also includes the development of appropriate procedures to be dealt with, stored, transported and completely processed in places during which this medical waste are generated. The program thus contains a guide to provide protection for all employees and customers that should be applied in conscious and within a appropriate training programs.

- Humboldt State University, Environmental, Health and Occupational Safety Named [Medical Waste Management Plan, Reviewed and Updated 2004] [13].

This plan was developed and applied in the management of medical waste, including a guide for safe and sound management of medical waste. This plan has been done by mutual cooperation of several people including the director of childhood care laboratories, assistance of Physical Education Department and there are persons of community safety.

- Bulletin of World Tuttnarer Inc. 6/2006 on its website: info@tuttnauer.com [19].

This company is well-experienced in processing and managing waste for more than twenty years, which is considered a pioneers in this administration, known these days by "Tuttnarer Inc."; a leading company in processing infectious waste, is currently publishes data on its "Autoclave Product" which matches American Society of Mechanical Engineers and also complies with FDA and German standards (German Standars For Ensure Vessels). These products are based on efficient, safe and environment friendly waste sterilization with high temperature, for sterilizing infectious medical waste.

The article is also contains the efficiency of completing process of infectious waste sterilization in safe and friendly technology for environment and concerned entities.

- New York State Department Of Environment Conseration [14].

A study was done on collection and disposal of medical waste in the city of New York (9/1996) to ensure protection of community health and safety environment. Such procedures should be in accordance with the highest degree of high-tech and within the high specifications of performance, to ensure that medical waste has been treated in an appropriate manner before the disposal. The study is also contains a user guide manual.

- "Guidance for regulated Medical, Waste Processing, Storage, Containment Transport and Deposal' [5].

It includes methods of processing depending on the type of medical waste and how to manage by using Autoclave product, incinerators, or any chemical, thermal or electrical alternatives available, within the rules and regulations approved by the state of New York.

- Toxics ALERT. An Environment new s bulletin. Waste Sage of Kochi Published in Toxics Link 29/10/2007 [9].

Bulletin about Kochi a small town has a port near New York, it has three waste dumps on instructions and laws of New York, which the management of medical waste has been handed over to a private agency within the instructions, directions and applicable laws of US Environmental Protection Agency.

Delhi High court takes notice if incineration Issue, Published in Toxics link 18/06/2004 [7].

A bulletin about a incineration in the city of Delhi, which is the largest polluter of the surrounding environment. Based on, the court has sent a notice to the Environmental Control Committee in Delhi on 21.04.2004 and against the Committee has sent a reports of inspection and control procedures for the management of these incinerators, including the report of a team monitoring hospitals incinerators, particularly those of government, as reports indicated that despite of rules and regulations, but some hospitals are still turning a blind

eye to some abuses regarding the burning and disposal of medical waste in hospitals.

- Toxics ALERT An environment news bulletin, for toxics, free world Minutes of Meeting to discuss the Draft Hazardous Waste Rules 2007 Published in Toxics link 5/12/2007 [9].

Toxics Alert has organized a meeting to study and discuss the rules and regulations applicable to the management and processing of hazardous waste "infectious and non-communicable" on 28.11.2007. The most important recommendations that have been calling for in this meeting are to gain access to more media coverage on this matter, educate the community and to push governments of different countries for taking better actions to protect the safety and health of the environment.

Toxics ALERT an environment bulletin Toxics Link for toxics, free world Poio-Medical Waste (Management and handling) Rules. 1998 [9].

The most important functions and processes used in the management of medical waste, which is the first function that when it is conducted in a valid manner will ensure the success of the rest functions to access safe, sound and healthy management for workers, community and environment is the process of sorting these wastes.

- Toxics Free Health care articles washing the dirty linen: hospital waste Management: Published in Terragreen 17/1/2008 [10].

The study showed that many diseases can be communicated by medical waste, such as viruses causing many diseases, including AIDS, hepatitis B, C, HIV virus. Until 1996, there was no clear and correct rules and instructions on how to deal with waste, But after that date there has been a new term is the incinerations.

Toxics Free Health care Medical waste incineration Articles, Alarming Articles Alarming morass of Medical waste published in Toxics link org. 01/01/2004 [11].

The study manifested that the problem of generating medical waste continues to increase, as one bed in the hospital generates 1kg of waste on usual average; 10-15% contagious waste, 5% hazardous and the remaining is a normal waste such as domestic one. Therefore, it should manage these wastes correctly and properly to protect the environment and hold training and education courses for hospital's workers and who are dealing with this waste.

- State of California, Health and Human Service Agency, Department of Health Service. Medical waste program Managers (Management of Pharmaceutical Medical waste) 15/10/2002 [12].

The program indicates that the medical pharmaceutical waste should be defined correctly and accurately to be dealt with according to classification, but the method of processing on classification above and pharmacy department's staff in a hospital have to sort and classify these materials, place a specific plan to deal with these classifications medical waste along with extensive and suitable training for the staff.

There are also some pamphlets and papers have been used to support the research, including:

- Characterization and management of solid Medical waste in federal capital Territory, Abuja, Nigeria 01/03/2006 [13].

This study was done on five hospitals located in Abuja. It was for identifying the medical waste types produced by these hospitals with the appointment of appropriate methods and daily actions on how to deal with for the final disposal, in order to reduce the risk on its workers, employees and the adjacent environment in each hospital.

The most important finding of the study was that the management staff of these wastes have not enough knowledge and training about handling and disposition methods. However, it was recommended that such hospitals' managers have to develop specific plans for how to train and rehabilitate workers for holding management responsibilities of these wastes safely and securely.

- Medical Waste Management, Issue in Asia 3R conference, 30/10/2006 Tokyo - Japan [17].
- A technical paper was issued in the third Conference of Asian countries under the auspices of Asian Institute of Technology / Management and Environment Program. This paper is concerned in the concept and medical waste definition, quantities of medical waste produced in some Asian countries and also sorting in the waste management as being the first and most important function in the management process. This paper is also discussed some procedures and techniques used to get rid of wastes,

such as burying interment and incineration and explained the environmental impact of interment and incineration used for the disposal of medical waste.

- Medical Consternation and Design, Medical liquid waste Management March, 2007 [15].

US Health and Environment Agency has developed standards to ensure the safety of workers in the health organizations when dealing with liquid and semi-liquid medical waste such as human blood and different blood fluids, where US Food and Drug Administration has developed several criteria for classifying procedures of such liquids disposal within a specific system. Based on, these liquids should be handled in appropriate ways within the current system.

- Hazardous and Medical Waste Program Fuet sheet and information papers, Regulated Medical Waste Management, By Diane Roberts 8 / 2004 [16].

Speak this worksheet for medical waste and what are defined, where its functions are generated from sorting, classification, collection, transport, processing and final disposal and gives an idea of the processing methods Aelloukh notes as well as to the training program which must be kept for workers within the hospital, with an explanation of the methods of public safety that must be followed by them, which must be monitored and confirmed by the managers and those responsible for the management of these wastes.

- Colorado Department of public Health and Environment, compliance Bulletin, Household Medical Waste Management (Januaray,2006) [17].

This article discusses "What is the medical waste and where may be produced?", then their types, classification and processing methods. In particular, this article discusses the contaminated sharps wastes, which can be a source for the spread of infectious diseases and also for medical waste pharmaceutical.

- Michigan Department of Environmental quality, waste and hazardous Materials Division, Disposal and poio Hazard waste program, Febraury, 2001 [18].

This bulletin issued by this department discusses the medical waste and how to be sorted, collected and disposed within a certain program and criteria in this

respect equipment that should be provided by hospital management in this regard and to supply materials and methods for processing and final disposal. This paper also discusses appropriate training programs and preventive and safety methods to workers' involved in these wastes and hospital staff as well.

Methodology of the Study: The study has followed the descriptive and analytical research methods. As to descriptive research method, it has depended on measures description that has been taken by hospitals in general to get safe management of medical waste. As a result, a desk survey is done to get studies and theoretical research in order to identify principles of theoretical framework, understanding the most important former studies which are the vital source in the study along with its knowledge levels.

As for field research and analysis, a comprehensive field survey is done, all data and requirements which were collected and reached through by answering the questionnaire developed by the researcher is analyzed and appropriate statistical methods for addressing all of these data and the requirements are used.

Study Society: Study society consists of all Jordan's hospitals (101 of private and public hospitals). Appendix 2 shows hospitals in each governorate.

Sample of the Study: It is all Jordan's hospitals (public and private) where a questionnaire has been given to each of them by hand; 78 questionnaire are answered by hospitals cooperated with the researcher, while 23 did not respond. After studying and examining these questionnaires, 5 of them are excluded due to lack of information therein; therefore, 73 were taken namely 72.2% of total questionnaires distributed and 93.5% of the total answered questionnaires.

Study Tool: The researcher has designed a questionnaire which its paragraphs are based on the study of literature management of different sources, Appendix 1.

Reliability and Validity of Study Tool:

Validity: It means the ability of the questionnaire to measure variables that are designed to be measured, where generality and non-duplication are relatively considered in the questionnaire's form. Therefore, it has been offered to some arbitrators specialized in management and within those involved in health.

Reliability: It indicates how to get the same results if repeated in the study in similar conditions by using the same tool (questionnaire); Cornbach alpha has been used to determine the reliability rate of the tool, which the test result was 89.49%; an excellent rate as being higher than minimum acceptable 60% percent.

Used Statistical Methods:

- Descriptive statistics (frequencies and percentages) to show and analyze the characteristics of the study sample.
- Means and Std. deviations are have been used to answer the questionnaire.
- Appropriate statistical analytical methods have been used to analyze the study data and test their hypotheses (Spss).
- Pearson's correlation coefficients has been depended on in measuring the relationship between the independent variables of the study.
- Cronbach alpha of the questionnaire has been taken out.

Procedural Definitions of the Study Variables and How to Measure it by a Question:

- Waste sorting: to place medical waste in their appropriate packages inside the hospital that this should be done at its closest production point.
- Classification of waste: to separate and arrange wastes to hazardous and non-hazardous in order to reduce costs during processing and enhance efficiency and effectiveness of waste management of the hospital.
- Waste collection: to collect waste in specific locations in the medical departments within colored and airtight containers according to waste situated away from patients.
- Waste Storage: to place waste containers in specific locations with particular specifications in summer and winter.

- Waste Transfer: to pack waste containers with label and move it to outside the hospital.
- Disinfection: necessary processing to reduce microorganisms to required levels causing no disease or poisoning.
- Waste processing: Includes initial procedures may required by certain types of waste (infectious in particular) inside medical departments by sterilizing it through certain means.
- Final disposal of medical waste: a set o f methods to be selected depending on medical waste type and content to reduce risk as much as possible including waste burning, burial, sterilization and disinfection.

Analysis and Interpretation of Results

Hypotheses Testing

First Hypothesis - Main:

HO: There is no relationship between the environment and the efficiency and effectiveness of medical waste management H0.

One sample T test has been used. We find through computer results by table (20) that the value of (T calculated = 10.428) is greater than the tabulated value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

First Sub-Hypothesis:

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste Ho.

Table 20: Test results of first hypothesis (Main)

T Calculated	T Tabulated	T SIG	Result of Null hypothesis	Arithmetic mean
10.428	1.9935	0.000	Rejection	3.7805

Table 21: Test results of second sub-hypothesis

T Calculated	T Tabulated	T SIG	Result of Null hypothesis	Arithmetic mean
18.713	1.9935	0.000	rejection	4.5589

Table 22: Test results of second sub-hypothesis

T Calculated	T Tabulated	T SIG	Result of Null hypothesis	Arithmetic mean
16.346	1.9935	0.000	rejection	4.4315

Table 23: Test results of third sub-hypothesis

T Calculated	T Tabulated	T SIG	Result of Null hypothesis	Arithmetic mean
17.186	1.9935	0.000	rejection	4.5388

Table 24: Test results of fourth sub-hypothesis

T Calculated	T Tabulated	T SIG	Result of Null hypothesis	Arithmetic mean
4.349	1.9935	0.000	rejection	3.4795

One sample T test has been used. We find through computer results by table (21) that the value of (T calculated = 18.713) is greater than the tabulated value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Second Sub-Hypothesis:

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste Ho.

One sample T test has been used. We find through computer results by table (22) that the value of (T calculated = 16.346) is greater than the tabulated value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Third Sub-Hypothesis:

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste Ho.

One sample T test has been used. We find through computer results by table (23) that the value of (T calculated = 17.186) is greater than the tabulated value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Fourth Sub-Hypothesis:

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste Ho.

One sample T test has been used. We find through computer results by table (24) that the value of (T calculated = 4.349) is greater than the tabulated value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Fifth Sub-Hypothesis:

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste.

Table 25: Test results of fifth sub-hypothesis

T Calculated	T Tabulated	T SIG	Result of Null hypothesis	Arithmetic mean
3.873 1.9935	0.000	rejection	3.589	

Table 26: Test results of sixth sub-hypothesis

T Calculated	T Tabulated	T SIG	Result of Null hypothesis	Arithmetic mean
8.37 1.9935	0.000	rejection	3.9932	

Table 27: Test results of seventh sub-hypothesis

T Calculated	T Tabulated	T SIG	Result of Null hypothesis	Arithmetic mean
0.113 1.9935	0.000	Acceptance	2.9863	

Table 28: Test results of eighth hypothesis

T Calculated	T Tabulated	T SIG	Result of Null hypothesis	Arithmetic mean
9.085 1.9935	0.000	rejection	3.7143	

One sample T test has been used. We find through computer results by table (25) that the value of (T calculated = 3.873) is greater than the tabulated value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Sixth Sub-Hypothesis:

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste.

One sample T test has been used. We find through computer results by table (26) that the value of (T calculated = 8.37) is greater than the tabulated value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

Seventh Sub-Hypothesis:

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste.

One sample T test has been used. We find through computer results by table (27) that the value of (T calculated = 0.113) is greater than the tabulated value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste management.

The reason for that is because the high cost of processing in general and also the study questionnaire is not applied in most hospitals as the process of medical waste needs materials, expensive equipments and well-qualified technical workers.

Eighth Sub-hypothesis:

HO: There is no relationship between the environment and the efficiency and effectiveness of sorting medical waste.

One sample T test has been used. We find through computer results by table (28) that the value of (T calculated = 9.085) is greater than the tabulated value, since the decision rule is to accept the null hypothesis (HO) if T calculated is less than T tabulated and null hypothesis HO be rejected if the T calculated value is greater than T tabulated. Therefore, we reject the null hypothesis (HO) and accept the alternative one (Ha) which means that there is a relationship between the environment and the effectiveness and efficiency of medical waste disposal.

Table 29: Pearson's correlation between independent variables and

Variables	Sorting	Classification	Collection	Storage	Handling	Disinfection	Processing	Final disposal	Administration & Organization of waste
Sorting	1								
Classification	0.73	1							
Collection	0.71	0.81	1						
Storage	0.47	0.45	0.36	1					
Handling	0.42	0.31	0.25	0.63	1				
Disinfection	0.47	0.37	0.37	0.65	0.73	1			
Processing	0.32	0.28	0.27	0.6	0.52	0.79	1		
Final disposal	0.47	0.39	0.33	0.1	0.05	0.00	0.01	1	
Administration & management of waste	0.75	0.55	0.57	0.35	0.38	0.39	0.26	0.78	1

For this study purposes, the researcher extracted the matrix of Pearson's correlation between independent variables and. The following table (29) shows the coefficient of Pearson's test that have been extracted and the table shows that there is a positive relationship and statistically significance up to 0.81 between collection and classification, positive relationship and statistically significance up to 0.73 between sorting and classification and a positive relationship and statistically significance up to 0.71 between sorting and collection. This means that the supervisor staff of waste sorting is classifying and collecting the waste perfectly. It is noted that the correlation coefficients between both variables of sorting, collection and classification and between management and organization of medical waste are positive correlation relationships which was up to 0.74, 0.56 and 0.54, respectively. This was due to efficiency and effectiveness of management in following up these functions as being relatively low cost operations and need no well-trained or highly-skilled workers.

The table shows that there is a positive and statistically significance relationship up to 0.78 between disinfection and processing. This may be attributed to the supervisor staff who considers disinfection as a part of processing, while Pearson's correlation coefficient for both variables disinfection and processing and between the organization management of medical waste is a weak relation with disinfection which is up to 0.38 and very weak with the processing which is 0.26. This is due to the high costs of the both operations above.

The table shows that there is a positive and statistically significance relationship between disinfection and handling up to 0.72 and 0.52 between processing and handling. This is because that the dealing with medical waste requires to be processed and disinfected and to disinfect the locations in which be placed along with transport means.

The table shows that there is a positive statistically significance relationship up 0.62 between storage and handling and a positive and statistically relationship up to 0.65 between storage and disinfection and positive statistically significance relationship up to 0.60 between storage and processing. This is attributed to the link and interference of these operations with each other.

The table shows that there is a positive and statistically significance relationship up to 0.77 between the final disposal and the management and organization of medical waste, but most hospitals are using their incineration for the final disposal or sharing of more than one hospital in one incinerator. It is noted that there is a strong relationship between the independent variable of separation and the independent variable of final disposal with the organization and management of medical waste. Variables 2, 3, 5, 6 are moderate. Variable 4 is belonged to storage, has a moderate relationship closer to weak, but variable 7 is belonged to processing, has a weak relationship.

RESULTS

- Result of study and research showed that most hospitals in Jordan have governmental instructions related to management of medical waste as the percentage achieved by the study is 98.6% and also there is about 94.5% of sample, which have been studied, are hospitals having instructions special for management of medical waste, which reflect positive indication of workers and nursing staff to perform these management functions in relatively high level of achievement.
- There is a statistically significance impact between environment and efficiency and effectiveness of

medical waste management in hospitals up to arithmetic mean of 3.78; namely moderate exercising. This is because of instructions available provided for by the Public Health Law (Environmental Health Law).

- There is a statistically significance impact between environment and efficiency and effectiveness of medical waste separation in hospitals. It is noted also that the arithmetic mean of changing separation indicates a high exercise level reflecting the good performance of medical and nursing staff, as arithmetic mean is 4.55; a positive and strong relationship links the separation variable and management and organization of medical waste in hospitals ($R=74.5\%$).
- There is a statistically significance impact between environment and efficiency and effectiveness of medical waste classification in hospitals and the arithmetic mean of classification variable, as showed by the study, is 4.43. This means a high level of exercise with moderate correlation (54.6%) between it and the management and organization of medical waste in hospitals. This may be due to the lack of management efficiency and effectiveness in correct and required ways.
- There is a statistically significance impact between environment and efficiency and effectiveness of medical waste collection in hospitals and the arithmetic mean of a collection variable, as indicated by the study, is 4.53. This means a high level of exercise with moderate correlation (56.8%) between it and the organization and management of medical waste in hospitals. This may be due to the lack of resources, whether it is human or material in some hospitals.
- There is a statistically significance impact between environment and efficiency and effectiveness of medical waste storage in hospitals and the arithmetic mean of the storage variable, as indicated by the study, is 4.43. This means a high level of exercise with moderate correlation relationship (54.6%) between it and the organization and management of medical waste in hospitals. This may be due to the lack of effective and efficient management in the correct and required ways.
- There is a statistically significance influence between environment and efficiency and effectiveness of handling medical waste in hospitals and the

arithmetic mean of handling variable, as indicated by the study, is 3.99. This means a high level of exercise with the moderate correlation relationship (37.7%) between it and the organization and management of medical waste in hospitals. This may be due to a lack of available equipment or material resources.

- There is a statistically significance influence between environment and efficiency and effectiveness of medical waste disinfection in hospitals and the arithmetic mean of the variable clearance, as indicated by the study, is (3.58). This means a level of exercise with moderate correlation relationship (38.7%) between it and the organization and management of medical waste in the hospitals.
- There is no a statistically significance impact between environment and the efficiency and effectiveness of medical waste processing i.e no relationship between environment and processing of medical waste in hospitals with low level exercise and the arithmetic average, which was found by data analysis is (2.98) as well as a weak correlation relationship (26.4%) with organization and management of medical waste in hospitals.
- There is a statistically significance effect between environment and efficient and effective of medical waste disposal in hospitals and the arithmetic.

Mean of medical waste disposal variable, as indicated by the study, is 3.71. This means a moderate level of exercise with positive strong correlation relationship (77.8%) between it and the management and organization of medical waste in hospitals.

This may be attributed to instructions of medical waste management within the applicable laws, such as Public Health Law Health / Environment Law.

Recommendations:

- To train all hospital staffs theoretically and practically on main concepts of medical wastes and their risks.
- To secure proper environment for medical waste management in any hospital.
- To lift up effectiveness and efficiency of waste management performance and organization within hospitals especially for valued functional elements such as storage, disinfection and processing.

- To activate medical waste processing inside hospitals, as waste disposal without processing may affect negatively on hospital and neighboring sites.
 - To improve and enforce regulations and laws for medical waste management in general and processing it in particular and to develop control techniques to be implemented in accordance with requirements of international standards.
 - To reflect institutional peculiarity on medical waste management includes education setting for separation, storage, processing and the final medical waste disposal.
 - To secure proper environment for medical waste management at municipal level includes containers and transportation vehicles.
 - To support and enhance scientific research centers and concerned local associations to contribute in raising education level and improving efficiency methods of integrated management of medical waste and health.
 - To recommend the Ministry of Health to assign a special budget for hospitals in order to buy equipment, machines and materials, hold training and rehabilitation programs of high-level for workers regarding the functional elements of medical waste management as being highly cost.
8. Toxics ALERTS. An environment news bulletin, for toxics, free world, Minutes of Meeting to discuss the Draft Hazardous Waste Rules, 2007 Published in Toxics 5/12/2007.
 9. Toxics ALERT. An environment bulletin toxics link for a toxics, free world Poiso-Medical waste (Management and handling) Rules, 1998.
 10. Toxics free Health care articles washing the dirty linen: hospital waste Management: published in Terragreen 17/1/2008.
 11. Toxics free Health care Medical waste incineration Articles, Alarming Article Alarming morass of Medical waste Published in Toxics link org.1/1/2004.
 12. State of California, Health and Human Service Agency, Department of Health service, Medical waste program Manager (Management of Pharmaceutical Medical waste) 15/10/2002.
 13. Characterization and management of solid Medical waste in federal capital Territory Abuja Nigeria 1/3/2006.
 14. Medical Waste Management, Issue in Asia, Asia 3R conference, 30/10/2006 Tokyo-Japan.
 15. Medical Consternation and Design, Medical liquid waste Management 3/2007.
 16. Hazardous and Medical Waste program Fuel sheet and information papers, Regulated Medical Waste Management, By Diane Roberts 8 / 2004.
 17. Colorado Department of public Health and Environment compliance Bulletin, Household, Medical waste Management 1 / 2006.
 18. Michigan Department of Environment quality, waste and hazardous Material Division, Deposal of medical and poiso Hazard waste program February/2001.
 19. Department of Health Service, 2004, Medical Waste Management Act.
 20. California Health & Safety Code.
 21. David Ragsdale & Michal Ahter, 1996, Medical Waste Management Plan, Risk Management. California Polytechnic state University.
 22. University of California, (environmental Health & Safety) 2004, UC Irvin Medical waste Management program, (Guide line).
 23. State of Wisconsin Dept of Natural Resources, 2005 & 2006, the Medical waste Reporter.
 24. E-Mail Linfo @ tuttnauer.

REFERENCES

1. Luis R. Gomez, 2004. Managing Human Routes. 4th edition.
2. Thomas L. Wheelen, 2004. Strategic Management and Business Policy 9th edition.
3. George Tchobanoglous. 1998. Integrated Solid Waste Management.
4. New York State Department of Environmental Conservation.
5. Guidance for regulated Medical Waste Processing, Storage, Containment Transport and Disposal.
6. Toxics ALERTS an Environment news bulletin, Waste Sage of Kochi published in Toxics link 29/10/2007.
7. Delhi High court takes notice of incineration Issue, Published in toxics link 18/06/2004.

Appendices - questionnaire questions:

Questions	Always	Often	Sometimes	Rarely	No
1. Medical waste is taken and separated from others.					
2. Infectious waste is taken and separated from other medical wastes.					
3. Human tissues and organs waste is separated from others.					
4. Pharmaceutical waste is separated from other medical waste.					
5. Sharp waste is separated from other waste in hospital wards.					
6. Medical waste is classified according to their toxicity in the hospital.					
7. Severe infectious medical waste is classified within wards as being high-risk waste.					
8. Medical waste is collected from wards in daily basis.					
9. Medical waste is collected separately from others in wards.					
10. Medical waste is collected in separately and alone.					
11. fully-equipped storages are available in the hospital.					
12. Temporary storage areas are available within each section of the hospital.					
13. Air-conditioned storages of human tissues and organs are available in the hospital.					
14. Time of storage is assigned in the absence of central air-conditioned storage.					
15. Period of storage is assigned in the absence of central air-conditioned storage.					
16. Hospital participates other hospitals in air-conditioned storages.					
17. Storage areas within wards and hospital are disinfected.					
18. Sufficient numbers of wheeled containers designed to medical waste transportation in the hospital are available.					
19. Medical wastes separated from others similar are carried to storage or processing sites.					
20. Medical wastes are carried by municipal vehicles from the hospital for getting rid of.					
21. Other possibilities for carrying medical waste outside the hospital are available.					
22. Severe infectious wastes are disinfected inside wards and moved to storage areas.					
23. Sharp wastes are disinfected inside wards and moved to storage areas.					
24. Liquid and contaminated human blood wastes are disinfected prior disposal.					
25. Infectious medical wastes are subjected to processing in wards by microwave.					
26. Infectious medical wastes are subjected to processing in wards by autoclave sterilization.					
27. Highly infectious wastes are subjected to processing inside wards by chemical disinfection.					
28. Medicine wastes are subjected to processing by passivation.					
29. Medicines wastes are subjected to processing by returning it to main supplier.					
30. Hospital gets rid of wastes by burying it in a special healthy site.					
31. Hospital gets rid of wastes by healthy excavation site.					
32. Hospital gets rid of highly contagious in a burial healthy site.					
33. Hospital has incinerator for medical waste disposal.					
34. hospital participates with other hospitals in incineration means.					
35. Hospital develops a plan for medical waste management.					
36. A special unit within the hospital holds medical waste management.					
37. Hospital makes training program for medical staff on how to deal with medical waste.					
38. Hospital develops a training program for hospital support groups (maintenance engineers, technicians, cleaners] on how to deal with medical waste.					