University of Khartoum  
Graduate College  
Medical & Health Studies Board  

Knowledge, Attitudes, and Practices towards Medical wastes hazards among health cleaners at Bahari and Sharq Al-neel Hospitals.

By  
Mustafa Abdel Gadir Omer Tairab  
BSc.in Public and Environmental Health (Uof K), 2003.

A thesis submitted in partial fulfillment for requirements of the degree of MPEH (Sudan) in Health Education.

Supervisor  
Dr / Abdel Wahab Mekki 
MSc.H.Ed.  U.of New South Wales 
PhD.H.Ed.  U.of Toledo-Ohio-USA  
2009
يقول الله عز وجل في محكم تنزيله:

(( إنما أمره إذا أراد شيئاً أن يقول له كن فيكون (82) فسبحن الذي بيده ملكوت كل شيء وإليه ترجعون (83)).

صدق الله العظيم

سورة يس
Dedication

To soul of my mother

To my family and relatives.

To my friends and colleagues.

To all health cleaners worldwide.

(Mustafa)
Acknowledgement

I would like to express my deep thanks and gratitude to my supervisor Dr. Abdel Wahab Mekki for his guidance, advice, and follow-up.

My special recognition to:

Staff of Health Education Department FPEH. UofK
Ustaza Fatima Almahasia Zaeim Azhari University
Mrs. Habab public health officer- Bahari Hospital
Mrs. Asia public health officer- Ahmed Gasim Hospital
Mrs. Mona public health officer- Haj alsafi Hospital
Mrs. Rihab public health officer- Albanjadeed Hospital
Mrs. Mashiar and Hasan public health officers- Umdawanban Hospital

Finally I’m indebted to express my cordial thank to all who facilitated to me.

Mustafa
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<td>KAP</td>
<td>Knowledge, Attitudes and Practices.</td>
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<td>HCW</td>
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<td>Health Care Waste Management</td>
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Abstract

Introduction:
In the past few years, public concern over the disposal of medical waste has markedly increased. The lack of policies, strategies and enforcement of legislation for handling and disposing of health care waste (HCW) in many developing countries has resulted in poor management of such waste. In 2000, WHO estimated worldwide that injections with contaminated syringes caused 21 million hepatitis B virus infections, two million hepatitis C virus infections and 260,000 HIV infections. In Sudan, according to the surveys and field visits conducted in both public & private health sector, in all the fifteen northern states, the health care delivery hasn’t adopted health care waste management system (1).

Objectives:
The objective of this study was to study knowledge, attitudes, and practices towards medical waste hazards among health cleaners at Bahari and Sharq Al-neel Hospitals during the period of 1/3 to 31/7/2009, to identify the knowledge of health cleaners related to medical waste hazards, determine the attitudes of health cleaners towards collection and keeping of medical waste, and to investigate the practices of health cleaners towards medical waste hazards.

Material and methods:
The study population was the total coverage of all health cleaners in Bahari and Sharq Al-neel localities which included (Bahari, Ahmed Gasim, Haj-alsafi, Al-banjadeed and Um-dwanban Hospitals) during the period of 1/3 to 31/7/2009, considered a size of (264) health cleaners (Excluding private and non-civilian hospitals). The data was collected
using a questionnaire, focusing on personal characteristics, knowledge, attitudes and practices related to medical waste hazards. These questionnaires were directed to all targeted population under study. The data was analyzed by a computer using (SPSS) program. Relations between different variables were done using chi- square test. The data were depicted via tables and pies figures.

**Results:**

♦ (92.4%) of study population identified medical waste types as used cotton, expired drugs and waste generated by hospitals (table 3).

♦ (98.9%) of study population separated medical wastes from general one (table 6).

♦ (99.2%) of study population used color coding containers to separate medical wastes (table 7).

♦ (93.2%) of study population have the knowledge that waste-bag should be filled to 3 quarters (table 8).

♦ (95.8%) of study population used protective measures (gloves, overalls) during their work in hospitals (table 9).

♦ (91.3%) of study population check with physicians after exposure to risk factor (table 11).

♦ (61.7%) of study population don’t receive any training in handling infectious wastes(table 13).

♦ (91.6%) of study population did not receive any vaccination services against hepatitis (B)(table 12).

♦ (74%) of study population were illiterate(figure 2).

♦ (89.4%) of study population have practices that tightly closed waste-bags after filling(table 17).
Conclusion:
The study revealed that although there was a high percentage of illiteracy among study population, still they have good attitudes, and practices towards dealing with medical waste as presented in results.
The study revealed that there was no vaccination services directed to study population against hepatitis (B), and The relation between gender and exposure to risk is statistically significant.
المستخلص

المقدمة:
في السنوات القليلة الماضية، إزداد الإهتمام العام بالتخلص من النفايات الطبية بدرجة ملحوظة. كما أن القصور في كل من السياسات، الاستراتيجيات وتفعيل التشريعات التي تختص بالتداول السليم والتخلص من النفايات الطبية في العديد من الدول النامية قد ظهر جلياً في الإدارة السئية لهذه النفايات.

في العام 2000م، قدرت منظمة الصحة العالمية على مستوى العالم أن الحقن بالإبر الملوثة تسبب في 21 مليون حالة إلتهاب كبد فيروس نعم (ب)، 2 مليون حالة إلتهاب كبد فيروس نعط (ج) و 2600 حالة إصابة بفيروس نقص المناعة البشرى المكتسب (الأيدز).

في السودان، وفقًا للمسوحات والزيارات الميدانية التي نفذت في كل من القطاعين العام والخاص، في كل الولايات الشمالية الخمسة عشر، تبين أن برامج الرعاية الصحية المعول به لم يتبن نظامًا لإدارة النفايات الطبية.

الأهداف:
الهدف من الدراسة هو دراسة المعرفة، المواقف، والسلوك تجاه مخاطر النفايات الطبية وسط عمال النظافة في مستشفيات بحرى وشرق النيل في الفترة من 1 مارس وحتى 31 يوليو 2009م، التعرف على معرفة العمال فيما يتعلق بمخاطر النفايات الطبية، وتحديد مواقفهم تجاه جمع وحفظ النفايات الطبية، والتحقق من سلوك العمال تجاه مخاطر النفايات الطبية.
منهجية البحث:

مجتمع الدراسة هو التغطية الشاملة لكل عمال النظافة في محيطى بحري وشرق النيل والتي تضم مستشفيات (بحري، أحمد قاسم، حاج الصافي، البان جداي وأم ضوا بان) في الفترة من 3/1 إلى 31/7/2009م، أعتمد عدد (264) عامل نظافة، (مع استعداد المستشفيات الخاصة وغير المدينة). جمعت المعلومات عن طريق استبيانات، تركزت في الخصائص الشخصية، المعرفة، المواقف والسلوك الذي يتصد بمخاطر النفايات الطبية. هذه الاستبيانات وجهت لكل الفئة المستهدفة للدراسة. حلت القياسات عن طريق الحساب الآلي باستخدام برنامج الحزم الإحصائي للعلوم الاجتماعية. عملت عدة علاقات بين المتغيرات المختلفة باستخدام اختبار كاي الإحصائي، كما أنه تم وصف البيانات عن طريق الجداول والأشكال.

النتائج:

♦ (92.4%) من مجتمع الدراسة تعرّفت على أنواع النفايات الطبية بأنها قطن تم استخدامه.

ادوية منتهية الصلاحية ونفايات تم إنتاجها بالمستشفيات (جدول3).

♦ (98.9%) من مجتمع الدراسة تقوم بفرز النفايات الطبية عن النفايات العامة (جدول6).

♦ (99.2%) من مجتمع الدراسة تستخدم حاويات ملونة لفرز النفايات الطبية (جدول7).

♦ (93.2%) من مجتمع الدراسة لهذا الدراسة بأن وعاء النفايات يجب أن يمثأّل ثلاث مراحل أرباعه (جدول8).

♦ (95.8%) من مجتمع الدراسة تستخدم وسائل حماية (قفازات وأوراقين) أثناء فترة عملهم بالمستشفيات (جدول9).

♦ (91.3%) من مجتمع الدراسة تقابل الطبيب حال تعرضها لعامل الخطر (جدول11).

♦ (61.7%) من مجتمع الدراسة تم تلقي أية نتائج فيما يتعلق بتبادل النفايات المعدية (جدول13).
♦ (91.6%) من مجتمع الدراسة لم تحصن ضد التهاب الكبد الفيروسي (جدول 12).
♦ (74%) من مجتمع الدراسة غير متعلماً (شكل 2).
♦ (89.4%) من مجتمع الدراسة لديها ممارسة في الإغلاق المحكم لوعاء النفايات بعد ملته (جدول 17).

الخلاصة:
أوضحت الدراسة أنه رغم النسبة العالية للأمية وسط مجتمع الدراسة، إلا أن لديهم مواقف وسلوكيات جيدة تجاه التعامل مع النفايات الطبية كما أستعرضت في النتائج.
أوضحت الدراسة أنه لا توجد خدمات تخصصية تقدم لمجتمع الدراسة ضد التهاب الكبد الفيروسي نمط (ب)، وتوجد علاقة بين النوع والخطر وفق الدلائل الإحصائية.
1-1 Introduction:
In the past few years, public concern over the disposal of medical waste has markedly increased. The lack of policies, strategies and enforcement of legislation for the handling and disposing of health care waste (HCW) in many developing countries has resulted in poor management of such waste. As a result, many health care establishments are increasingly exposing patients and medical and support staff in health care establishments to health risks. Moreover, improper management of HCW could have serious implications for public health and the general environment. (1)

Health-care medical waste is a by-product of health care that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices, and radioactive materials. In addition, if waste is not disposed of properly, members of the community may have an opportunity to collect disposable medical equipment (particularly syringes) and to resell these materials. (2) Medical waste can potentially be reused without sterilization. This reuse of unsterilized waste material causes a large portion of the diseases that develop due to poor waste management. (3)

Hospitals and other health-care establishments have consequences for the environment and for public health, and have particular responsibilities in relation to the waste they produce. The focus is on such establishments to ensure that there are no adverse health and environmental consequences of their waste handling, treatment, and disposal activities. By implementing a health-care waste management policy, including, medical and research facilities are moving toward the achievement of a healthy and safe environment for their employees and communities. (4)
1-2 Problem statement worldwide:
Health-care waste can cause serious harm if not managed properly. For example, in 2000, WHO estimated worldwide that injections with contaminated syringes caused 21 million hepatitis B virus (HBV) infections (32% of all new infections), two million hepatitis C virus (HCV) infections (40% of all new infections) and 260,000 HIV infections (5% of all new infections). In addition, health-care activities generate significant amounts of hazardous waste such as mercury and expired pharmaceuticals, as well as large amounts of general waste. The management of health-care waste is an integral part of a national health-care system. A holistic approach to health-care waste management should include a clear delineation of responsibilities, occupational health and safety programs, waste minimization and segregation, the development and adoption of safe and environmentally-sound technologies, and capacity building. Recognizing the urgency of this problem, a growing number of countries have taken initial steps to respond to this need. These include the establishment of regulatory frameworks, development of national plans, and the demonstration of innovative approaches. However, funding for health-care waste management remains very inadequate.(5)

1-3 Magnitude of the problem and justification of the study in Sudan:
According to the surveys and field visits conducted, in both public & private health sector, prior to embarking on National Action Plan (NAP), in all the fifteen northern States the health care delivery hasn’t adopted health care waste management system. All the health institutions are not having proper health care waste management guidelines established at the facilities, at federal ministry of health (FMOH) level, state ministry of health (SMOH) level, or locality
level. Consequently, they are not having any plan for management of health care waste as well. Most of the time plastic boxes are being used for the disposal of the all types of the waste. There is no separation for hazardous and serious waste from the general and other waste in separate refuse bins, general and hazardous waste are kept together at temporary storage areas. There is no central storage facility.

At most of the times, on-site treatment is not available. Where it is available it is either improper incineration or open burning of the waste. Chemical disinfection is almost non-existent. For off-site transport, open (mostly) municipality vehicles are being used. As part of the final disposal option, the HCW bags were either buried along with the municipal waste or thrown away over the municipal waste dumps. Sometimes they were burnt as well and that burning was usually open burning. Almost all of the facilities didn’t keep the record of the waste disposal. Local HCWM plan was non-existent, with the exception of a few places. No proper inspection system for HCWM was found in the hospitals. No Separate fixed budget for HCWM was allocated and neither the operational cost was being taken care off.

Of the total waste generated, it is estimated that approximately 12% is hazardous, 85% is general (non-risk) waste while a small percentage (3%) is labeled as highly hazardous. Currently, most of the hospital biomedical waste is being disposed off, without treatment along with municipal solid waste and by burning. The untreated liquid waste from the health institutions is being let into general drainage.

The status of poor waste management currently practiced in the state poses a huge risk towards the health of the general people, patients, and professionals, directly and indirectly through environmental degradation. Communicable diseases like gastro-enteritis, hepatitis – A, B and C, respiratory infections and
skin diseases are associated with hospital waste either directly as a result of waste sharp injuries or through other transmission channels. The hosts of micro organisms responsible for infection are entero-cocci, non-haemolytic streptococci, anaerobic cocci, clostridium tetani, klebshella, HIV and hepatitis B virus (HBV).

The potential risk to health care workers comes from the handling of infected sharps; 50 percent of them sustain an injury from sharps knowingly or unknowingly during various procedures. The practice of re-sheathing the needle after use is the major factor for needle stick injuries. Through poor waste management practices, all health care workers (nurses, doctors, lab technicians), service personnel, rag pickers and the general public are at risk of contracting infections while handling, storage, and treatment. Incinerators, wherever installed, are operating at sub-optimal conditions added environmental and health hazard.(6)
Objectives:-

1-4-1 General Objective:
To study knowledge, attitudes, and practices towards medical waste hazards among health cleaners in Bahari and Sharq Al-neel Hospitals during the period of 1/3 to 31/7/2009.

1-4-2 Specific Objectives:
1-4-2-1. To identify the knowledge of health cleaners related to medical waste hazards.
1-4-2-2. To determine the attitudes of health cleaners towards collection and keeping of medical waste.
1-4-2-3. To investigate the practices of health cleaners towards medical waste hazards.
Chapter one
Introduction &
Literature Review
1-5 Definition of medical waste:
Despite the attention given to medical waste by the public and all levels of government, the terms "hospital waste", "medical waste", "regulated waste" and infectious waste remain poorly defined. No standard universally accepted definition for these terms exists and there appear to be as many definitions in use as there are government agencies and other groups (1)

Waste generated by health care activities includes a broad range of materials, from used needles and syringes to soiled dressings, body parts, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices and radioactive materials.(8)

1-6 Medical waste classification:
Different authors introduce different ways of medical waste classification. These are based on medical waste state or form (solid, liquid), character, source and effects. Some of those are described below.
A-Classification of Hospital waste by Eigenheer & Zanon (1991). They classified medical waste according to their liquid and solid state. This is shown as follows:

1-7-1 Liquid Wastes
1-7-1-1 Biological waste: Blood, excrement, body fluid etc.
1-7-1-2 Chemical waste: Solutions, inorganic salts etc.
1-7-1-3 Over-date medicines: Unused drugs, over-date drugs
1-7-1-4 Radioactive waste: Wastes from radiology (iodine 125, iodine 131 etc.)

1-7-2 Solid Wastes
1-7-2-1 Perforating and cutting wastes: Needles, syringes, scalpels, blades, broken glass, vials
1-7-2-2 Non-perforating and non-cutting wastes: Wastes from treatment (dressings, stool napkins, plaster cast etc.) Parts of the body: organs,
placentas, tissue etc. Over-date medicines (Expired drugs) Household-type wastes: other wet and dry waste

B-Medical Wastes are also classified into four different categories based on their sources and Potential hazards they may cause.

1-8-1 Clinical Waste: this includes body fluid, drainage bags, blood collection tubes, vials, culture dishes, other types of broken/unbroken glassware that were in contact with infectious agents, gauze, bandages or any other materials that were in contact with infectious agents or blood, pathological waste including organs, body parts, tissues. These are potentially dangerous and present a high risk of infection to the general population and to the staff.

1-8-2 Laboratory Waste: This is also high risk category waste. This includes chemicals used in the pathological laboratory, microbial cultures and clinical specimens, slide, culture dish, needle, syringes, as well as radioactive waste such as Iodine-125, iodine -131 etc.

1-8-3 Non-clinical Waste: this includes wrapping paper, office paper, and plastic that has not been in contact with patient body fluid.

1-8-4 Kitchen waste: This includes food waste, wash and waste water. It is a potential source of pests and vermin, such as cockroach, mice and rats and is thus an indirect potential hazard to the staff and patients in a hospital.(4)

C- Another classification for medical waste:

1-9-1 Infectious waste: Waste suspected to contain pathogens e.g. laboratory cultures; waste from isolation wards; tissues (swabs), materials, or equipment that have been in contact with infected patients; excreta

1-9-2 Pathological waste: Human tissues or fluids e.g. body parts; blood and other body fluids; fetuses
1-9-3 Sharp wastes: e.g. needles; infusion sets; scalpels; knives; blades; broken glass

1-9-4 Pharmaceutical waste: Waste containing pharmaceuticals e.g. pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals (bottles, boxes)

1-9-5 Genotoxic waste: Waste containing substances with genotoxic properties e.g. waste containing cytostatic drugs (often used in cancer therapy); genotoxic chemicals

1-9-6 Chemical waste: Waste containing chemical substances e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents

1-9-7 Wastes with high content of heavy metals: Batteries; broken thermometers; blood-pressure gauges; etc.

1-9-8 Pressurized containers: Gas cylinders; gas cartridges; aerosol cans

1-9-9 Radioactive waste: Waste containing radioactive substances e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages, or absorbent paper; urine and excreta from patients treated or tested with unsealed radio nuclides; sealed sources (10).

1-10 Medical waste generation:

Several surveys have provided an indication of typical medical waste generation. Data from some of these surveys show that generation of medical wastes differs not only from country to country but also within a country. Waste generation depends on numerous factors such as established waste management methods, type of health-care establishment, hospital specializations, proportion of reusable items employed in health care, and proportion of patients treated on a day-care basis. It is therefore suggested that these data are viewed only as examples, and not used as a basis for waste management within an
individual health-care establishment. Even a limited survey will probably provide more reliable data on local waste generation than any estimate based on data from other countries or types of establishment. In middle- and low-income countries, health-care waste generation is usually lower than in high-income countries. However, the range of values for countries of similar income level is probably as wide in high income countries as in less wealthy countries. The amount of radioactive health-care waste is generally extremely small compared with the radioactive waste produced by the nuclear industry(4).

1-11 Sources of health-care waste:
The sources of health-care waste can be classed as major or minor according to the quantities produced.

1-11-1 Major sources of health-care waste:

1-11-1-1 Hospitals
— University hospital
— General hospital
— District hospital

1-11-1-2 Other health-care establishments
— Emergency medical care services
— Health-care centers and dispensaries
— Obstetric and maternity clinics
— Outpatient clinics
— Dialysis centers
— First-aid posts and sick bays
— Long-term health-care establishments and hospices
— Transfusion centers
— Military medical services
1-11-1-3 Related laboratories and research centers
— Medical and biomedical laboratories
— Biotechnology laboratories and institutions
— Medical research centers
1-11-1-4 Mortuary and autopsy centers.
1-11-1-5 Animal research and testing.
1-11-1-6 Blood banks and blood collection services.
1-11-1-7 Nursing homes for the elderly.
1-11-2 Minor sources of health-care waste
1-11-2-1 Small health-care establishments
— Physicians’ offices
— Dental clinics
— Acupuncturists
— Chiropractors
1-11-2-2 Specialized health-care establishments and institutions with low waste generation
— Convalescent nursing homes
— Psychiatric hospitals
— Disabled persons’ institutions
1-11-2-3 Non-health activities involving intravenous or subcutaneous interventions
— Cosmetic ear-piercing and tattoo parlours
— Illicit drug users
1-11-2-4 Funeral services
1-11-2-5 Ambulance services
1-11-2-6 Home treatment (11).
1-12 Infection potential
Many human pathogens can be found in health care waste items e.g. Staphylococcus sp., HIV, hepatitis B and C in blood, Salmonella, Shigella sp. in faeces and vomit and Streptococcus sp. in pus. The
transmission routes for these infection sources from waste to a patient or health care worker are still uncertain. Only puncture injuries from sharps have demonstrated a clear infection pathway. For other waste items, if not by direct contact, the potential pathways are presumed to be airborne (e.g. spores or aerosols) or vectorborne (e.g. flies) transmission. Therefore, good health care waste segregation means that:

- Wastes should be placed in containers (e.g. bins, boxes, strong disposable bags) to prevent direct contact.
- Containers should be kept covered to prevent contact with the open air.
- Sharps and potentially infectious waste should be kept in separate containers in each medical area and located well away from patients, such as behind the nurses’ station or in a treatment room. Sharps containers should be clearly labelled.
- A color coding system should be established or clear signs placed on containers and bags to differentiate between general and hazardous health care waste. It is helpful to note that the largest demonstrable cause of secondary infection is poor hand hygiene by medical staff, followed by poor disinfection of surfaces and medical equipment. Improving health care waste management in health care establishments will make a contribution to improving infection control but it is not a substitute for improvements to other aspects of infection control, especially hand and equipment hygiene(9).

1-13 Medical Waste Handling

Medical waste should be handled as little as possible before disposal. Medical waste should not be collected from patient-care areas by emptying it into open carts; this may lead to contamination of the surroundings and to scavenging of waste as well as to an increase in the risk of injury to staff, clients and visitors.
Waste and sharps containers should be discarded when they become three quarters full and at least once daily or after each shift. The reason for this is to reduce the risk of plastic bags splitting open and of an injury from a protruding sharp item in sharps containers (13).

1-14 Waste segregation:
The key to minimization and effective management of health-care waste is segregation (separation) and identification of the waste. Appropriate handling, treatment, and disposal of waste by type reduce costs and do much to protect public health. Segregation should always be the responsibility of the waste producer, should take place as close as possible to where the waste is generated, and should be maintained in storage areas and during transport. The most appropriate way of identifying the categories of health-care waste is by sorting the waste into color-coded plastic bags or containers.(4)

1-15 Packaging:
The sharps container must be displayed the International Biohazard Symbol. All sharps must be packaged in an approved sharps container. The Scientific Supply Store in the Science Center Laboratories Building carries a selection of various size sharps containers and they are available from most general scientific supply companies. The generator must ensure that the container is properly sealed and labeled. If the container is not properly sealed, or there is any doubt about the integrity of the sharps container it will not be accepted for disposal. Sharps containers should not be used for the disposal of aluminum drink cans, paper, gloves, laboratory glass, culture tubes, bodily fluids or any other similar types of materials. Sharps containers shall not be used for the disposal of chemicals or radioactive material. If the sharps have been exposed to human disease agents they must be autoclaved prior to being picked up by Risk Management and Safety(24).

1-16 What are the dangers of used sharps?
Some sharps users throw their used needles in the trash or flush them down the toilet. Used sharps left loose among other waste can hurt sanitation workers (19).
1-17 Basic risks associated with the poor management of health-care waste

Poor management of health-care waste can cause serious disease to health-care personnel, to waste workers, patients and to the general public. The greatest risk posed by infectious waste is accidental needle stick injuries, which can cause hepatitis B and hepatitis C and HIV infection. There are however numerous other diseases which could be transmitted by contact with infectious health-care wastes (14).

1-18 Infectious sharps and Occupational Risk

During the handling of wastes, injuries occur when syringe-needles or other sharps have not been collected in rigid puncture proof containers. Inappropriate design and/or overflow of existing sharps container and moreover unprotected pits increase risk exposure of the health care workers, of waste handlers and of the community at large, to needle stick injuries. Best practices in health care recommend the segregation of sharps at the point of use. Note that current WHO best infection control practices do not yet address the use of needle removal devices (14).

• Adding a step in the collection of sharps waste that could increase handling of infectious needles and thus the risk for needle-stick injuries among health care workers.
• Decreasing the volume of infectious sharps waste through disposing of syringe alone with less precautions than regular infectious waste and handling needles only as infectious sharps waste. This may result in fewer needle-stick injuries among waste handlers and the community (17).

1-19 Risk to the general public

The reuse of infectious syringes represents a major threat to public health. Based on previous estimates (Kane et al, 2000) and recent updates, WHO estimated that, in 2000, worldwide injections undertaken with contaminated syringes caused about 23 million infections of Hepatitis B and Hepatitis C and HIV. Such situations are very likely to happen when health-care waste is dumped on un-controlled sites where it can be easily accessed by the public: children are particularly at risk to come in contact with infectious wastes. The contact with toxic chemicals, such as disinfectants may cause accidents when they are accessible to the public. In 2002, the results of a WHO assessment conducted in 22 developing countries showed that the proportion of health care facilities that do not use proper waste disposal methods range from 18% to 64% .(14).
1-20 Persons at risk:

All individuals exposed to hazardous health care waste are potentially at risk. The main groups at risk are the following:
- Medical doctors, nurses, health care auxiliaries and hospital maintenance personnel
- Patients in health care establishments
- Visitors to health care establishments.
- Workers in waste handling, transportation, and waste disposal facilities.
- Rag pickers (17).

1-21 Staff:

The following safety list was published by [WWW.RCN.ORG.uk](http://WWW.RCN.ORG.uk)
- Be familiar with waste management policy and procedures for health care waste management and aware of emergency procedures.
- Report dangerous waste situation to manager as soon as they identified.
- Wear protective clothing in accordance with polices
- Be responsible for their own hygiene
- Ensure that the nature and dangers of waste to be carried are made known to the collectors, handlers and portering service through proper segregation and clear labeling.
- Only collect and transport correctly sealed and labeled waste.
- Ensure personal protection and basic hygiene precautions are adhered.
- Assist with correct classification of waste, and the reduction of waste produced.(22).

1-22 Medical staff and worker safety:

Medical and health care waste staffs are exposed to many body fluids in their daily work. The risk of contracting an infection depends on the prevalence of a disease, the presence of possible transmission routes to workers and the frequency of exposure. The most common form of occupational exposure experienced by medical staff and waste is by pathogens present in blood,
such as hepatitis B and C and HIV, through a needle-stick injury. Safety measures to protect staff focus on three topics:

• training of staff on handling wastes and used sharps, avoiding accidents and post exposure procedures;
• Provision of protective clothing and equipment;
• establishing immunization, post-exposure treatment and regular medical surveillance. Reporting, containing and cleaning up spillages of infectious materials quickly and thoroughly are essential to avoid the risk of infection in the health care establishment.(10).

Protective gloves, goggles and overalls should be provided to porters to reduce further the risk of infection and injury from handling and transferring hazardous health care waste from temporary medical storage to central storage areas.(21)

1-22-1 Workers protection
The production, segregation, transportation, treatment, and disposal of health-care waste involve the handling of potentially hazardous material. Protection against personal injury is therefore essential for all workers who are at risk. The individuals responsible for management of health-care waste should ensure that all risks are identified and that suitable protection from those risks is provided. A comprehensive risk assessment of all activities involved in health-care waste management, carried out during preparation of the waste management plan, will allow the identification of necessary protection measures.

Once the assessment is completed, personnel should receive suitable training.

1-22-2 Protective clothing
The type of protective clothing used will depend to an extent upon the risk associated with the health-care waste, but the following should be made available to all personnel who collect or handle health-care waste:

- Helmets, with or without visors depending on the operation.
- Face masks depending on operation.
- Eye protectors (safety goggles) depending on operation.
- Overalls (coveralls) obligatory.
- Industrial aprons obligatory.
- Leg protectors and/or industrial boots obligatory.
- Disposable gloves (medical staff) or heavy-duty gloves (waste workers) obligatory.

1-22-3 Personal hygiene
Basic personal hygiene is important for reducing the risks from handling health-care waste, and convenient washing facilities (with warm water and soap) should be available for personnel involved in the task.
1-22-4 Immunization
Viral hepatitis B infections have been reported among health-care personnel and waste handlers, and immunization against the disease is therefore recommended. Tetanus immunization is also recommended for all personnel handling waste.

1-22-5 Management practices
Many of the management practices recommended contribute to a reduction in risk for personnel who handle health-care waste.

1-22-6 Response to injury and exposure
A program of response should be established that prescribes the actions to be taken in the event of injury or exposure to a hazardous (4).

1-23-1 Waste disposal unit (WDU):
The safety of the WDU operator is assured by following the instructions below:
1) Wear the protective clothing provided to all operators.
2) Wash hands regularly.
3) Be vaccinated against Hepatitis B virus (HBV).
4) Have regular medical checkups (every six months) (15).

1-23-2 The waste disposal unit and its components:
The WDU has been designed to enable trained operators to safely process and dispose of infectious waste. It is made up of several elements, housed within a sheltered enclosure. These elements are:

• A De Montfort incinerator to burn and reduce waste. The incinerator destroys 6–7 kg per hour if used correctly (i.e. approximately six safety boxes per hour).
• An ash pit where residual ash, glass and metallic parts – including needles – are safely deposited after incineration. The ash pit is large enough to store incinerated residues for at least 10 years without being emptied. Residue from one incineration session weighs approximately 0.5 kg. A pit of 3.25 cubic meters stores ash from the burning of approximately 300 safety boxes per month, over a period of 12 years. The ash pit has access trap doors to allow the pile of ash to be redistributed from time-to-time.
• A waste store to securely accumulate waste that is to be incinerated. The store has the capacity to stock at least 200 neatly-stacked safety boxes.
• A fuel store to stock the fuel, such as agro residues or wood, required to preheat the incinerator. The fuel store has enough capacity to stock fuel for at least five incineration sessions, both for pre-heating and supplementing medical waste.
• A storage box to keep tools, protective clothing and records.
• **An enclosure with a lockable door** to prevent access by children and unauthorized persons, as well as scavenging animals and birds.

• **A shelter** to provide protection from the weather, particularly rain, for the incinerator, the operator and the waste to be incinerated. The shelter also protects the fuel, the operator’s tools, protective clothing and records. The shelter supports a 4-metre high chimney.

• **An access hatch through the wire-mesh wall of the WDU** to allow waste to be deposited when the WDU is locked and the operator is not present. This hatch opens into a safety-box deposit which provides a protected area where the safety boxes (and containers from needle-cutters) can be deposited temporarily(15).

1-24 Best Management Practices for Infectious Waste Disposal:

The following practices are recommended when disposing of infectious medical waste. Sharps must be disposed of in impervious, rigid, puncture-resistant containers immediately after use. All bags used for the containment of infectious medical waste must be clearly identified by label or color, or both. Rigid containers of discarded sharps must be labeled in the same way or placed in disposable bags used for other infectious waste. Vehicles transporting infectious waste should meet all requirements of transportation, and transporters must be knowledgeable in the handling of infectious waste. It is recommended that transporters use equipment that will contain all the waste to avoid releases of infectious waste to the environment and receive training in waste handling and spill cleanup methods.(16).

1-25 On-site collection, transport, and storage of waste

1-21-1 Collection

Nursing and other clinical staff should ensure that waste bags are tightly closed or sealed when they are about three-quarters full. Light-gauge bags can be closed by tying the neck, but heavier-gauge bags probably require a plastic sealing tag of the self-locking type. Bags should not be closed by stapling. Sealed sharps containers should be placed in a labeled, yellow infectious health-care waste bag before removal from the hospital ward or department. Wastes should not be allowed to accumulate at the point of production. A routine program for their collection should be established as part of the health-care waste management plan. Certain recommendations should be followed by the ancillary workers in charge of waste collection:

- Waste should be collected daily (or as frequently as required) and transported to the designated central storage site.
- No bags should be removed unless they are labeled with their point of production (hospital and ward or department) and contents.
- The bags or containers should be replaced immediately with new ones of the same type.
- A supply of fresh collection bags or containers should be readily available at all locations where waste is produced.

1-25-2 Storage
A storage location for health-care waste should be designated inside the health-care establishment or research facility. The waste, in bags or containers, should be stored in a separate area, room, or building of a size appropriate to the quantities of waste produced and the frequency of collection. Recommendations for the storage area and its equipment are listed in Box Unless a refrigerated storage room is available, storage times for health care waste (i.e. the delay between production and treatment) should not exceed the following: temperate climate: 72 hours in winter 48 hours in summer warm climate: 48 hours during the cool season 24 hours during the hot season.
Cytotoxic waste should be stored separately from other health-care waste in a designated secure location. Radioactive waste should be stored in containers that prevent dispersion, behind lead shielding. Waste that is to be stored during radioactive decay should be labeled with the type of radionuclide, the date, and details of required storage conditions. Further information is provided in section 9.7, which addresses methods of treatment and disposal of radioactive waste. (4)

1-26 Consideration for managing hospital waste:
Health care facilities, including hospitals, clinics, doctors, dentists, morgues, or veterinary offices, generate a tremendous amount of waste in the course of treating patients. They generate "regulated medical waste" or infectious waste, hazardous chemical waste, recyclable, reusable and solid waste. In order to fulfill the medical ethic to "do no harm," it is the responsibility of the health care industry to create and implement waste disposal polices for all of these waste streams that include worker safety, public health and environmental considerations, as well as regulatory compliance. Fulfilling this ethic also calls for a cultural shift to consider disposal technologies and services as part of a total waste management system. This system should include upstream waste management (elimination or minimization of some wastes, reuse and recycling of others) and the proper, accountable operation of all disposal equipment, post-treatment technology management and services (e.g., shredding, land filled material, incineration ash, air and water emissions). In the United States, regulated medical waste — about seven to fifteen percent of the total waste — must be treated in order to protect public health from the spread of potentially infectious diseases. But many facilities,
particularly those with medical waste incinerators onsite, have routinely burned most or all of their waste (with the exception of hazardous chemicals, which would be illegal). Incineration, as previously stated, has significant health and environmental impacts. There are alternative treatment technologies that render the waste non-infectious and are believed to be less harmful. Furthermore, much of the waste produced in health care facilities resembles household trash. Therefore, it is not unreasonable to expect that at least 30 percent of this waste can be recycled, reused, reduced or eliminated, and up to 50 percent reduction could be achieved with aggressive actions. Tossing resources in the trash is not only a waste of resources, but can be extremely expensive. The economic benefits to managing and reducing the waste can have a significant benefit to the health care facility’s overall costs. A case in point: Beth Israel Medical Center in New York City has found that a combination of employee education, monitoring of the waste stream and strategic placement of “red bag” waste containers has cut the facility’s medical RMW disposal costs by 60 percent. (23)

1-27 Question to ask before considering any treatment technologies:

The decision about which medical waste treatment technology to utilize is a complicated process and goes far beyond cost considerations. The following list of questions is designed to help health care decision makers identify criteria to be evaluated and information needs to be addressed when deciding what technology and/or disposal services to use.

Has your facility done a comprehensive audit of all of the various waste streams and products/supplies purchased to better identify impact on disposal systems and services?

Does your facility have or plan to implement aggressive waste and pollution prevention, reuse and recycling programs as part of this process? This includes defining waste streams, providing clearly designated waste containers and signage for different waste streams, and educating staff on the proper waste segregation.

Can your facility’s waste streams be separated by type (e.g., corrugated cardboard, office paper, aluminum cans, food waste)? Have the volume and weight of each waste stream been measured or estimated?

Can your facility’s staff identify from which departments or areas of the facility certain types of waste are more common? And which have the greatest potential for reduction or elimination?

Has your facility considered a facility-wide computerized tracking system to help identify waste streams and assist in the waste segregation program?

Are all employees trained to identify infectious and hazardous materials and dispose of them according to safety and disposal regulations?
Does your facility use mercury-containing products?
If so, what steps are being taken to ensure that mercury is not being disposed with infectious or solid waste?
Does your staff know the procedures for handling and disposal of low level radioactive wastes?
Do the loading dock and/or packaging areas have functioning equipment to detect, prior to disposal, any low-level radioactive wastes (LLRW) that were discarded?
Does your facility have a recovery program for utensils and surgical instruments? (Loss of these items can be a substantial annual avoidable cost. Some waste companies can provide this additional recovery and sterilization service.)
Does your facility have a battery recovery program?(16).

1-28 Waste minimization:
Waste minimization is defined as the prevention of waste production and/or its reduction. It involves specific strategies, changes in management and behavioral change. Methods of waste reduction include modification of purchasing procedures, control of inventory, and production of less toxic materials when discarded as wastes. No actions should however be taken that would impact on the quality and limit the access to health care(4).

1-29 Treatment of medical waste shall be by one of the following.
1-29-1 Incineration - Burning of medical waste.
1-29-2 Sterilization technology - Sterilization is the complete elimination of microbial viability. Procedures utilized must be performed properly.
1-29-3 Disinfection - a potential less lethal process compared to sterilization that eliminates or inactivates many or all pathogenic microorganisms including viruses, fungi, and bacteria (but not necessarily all their endospores) on inanimate surfaces.
1-29-4 Discharge into the collection system of a private owned treatment works (POTW) – grinding and/or flushing of waste into a POTW within the generating facility.
1-29-5 Encapsulation - complete encapsulation of medical waste in a solid matrix (e.g., plaster of paris) which will significantly reduce the possibility of exposure.
1-29-6 Other available technology (alternate technology) - technology other than listed above shall be evaluated and approved by the Department. Alternate technologies are usually approved at the manufacturer level.(20).
1-30-1 Incineration
The incineration of medical waste has many of the same advantages and
disadvantages associated with the incineration of any type of waste. That
is, advantages include significant volume reduction of the wastes, while
requiring little processing of wastes before treatment. Disadvantages
include high costs and potential pollution risks associated with
incineration processes (11).

1-30-2 Future Trends in Medical Waste Incineration:
There are a number of factors which may influence the waste disposal
practices of hospitals in the future. First, the stringency of the emission
standards that hospital incinerators will need to meet will determine the
type and cost of air pollution controls. The cost and engineering
feasibility of retrofitting existing hospital incinerators with acid gas
scrubbers and/or particulate matter controls, and computerized
combustion controls, may force many hospitals to cease on-site
incineration in favor of off-site centralized incineration. The capital costs
of larger regional incinerators are presumed to be lower per ton of waste
than smaller individual hospital incinerators. Other costs, such as
transportation, however, need to be considered. Also, generators of
wastes using a regional facility rather than incinerating wastes on-site
may not realize a cost savings. Second, increased regulation of ash
disposal may provide further impetus for hospitals to utilize offsite
management of wastes or residuals. Even those hospitals that continue to
incinerate wastes on-site may be forced to contract with a centralized ash
management facility. It is unlikely that disposal of incinerate waste on-
site and also to produce energy for heat, steam, or other hospital uses(11).

1-31 Combustion technology and its impact on the environment,
health workers and surrounding communities:
Immunization campaigns have relied on open burning and incineration
to deal with waste. However, there is extensive documentation that
combustion technology and the use of incinerators cause serious
environmental degradation and have a negative impact on health workers,
surrounding communities as well as on populations globally. While
immunization campaigns protect populations from infectious diseases,
they may inadvertently be exposing these populations to other serious
environmental health threats. The burning of medical waste is a leading
source of dioxins and mercury in the environment. Dioxins at very low
concentrations have been linked to cancer, immune system disorders,
diabetes, birth defects, and other health effects. Mercury is associated
with nervous system disorders particularly affecting developing fetuses
and small children. A number of other hazardous emissions are also
associated with burning medical waste(24).
1-32 Waste management plan for a health-care establishment
The proper management of health-care waste depends largely on good administration and organization but also requires adequate legislation and financing, as well as active participation by trained and informed staff. The head of the hospital should form a waste management team to develop a waste management plan. The team should have the following members:
- Head of Hospital (as chairperson)
- Heads of Hospital Departments
- Infection Control Officer
- Chief Pharmacist
- Radiation Officer
- Matron (or Senior Nursing Officer)
- Hospital Manager
- Hospital Engineer
- Financial Controller
- Waste Management Officer (if already designated) (4).

1-33 Eleven recommendations for improving medical waste management:

These basic recommendations are meant simply as guidelines to stimulate better and more specific planning and action programs at the municipal government level and then at the level of individual health care facilities.

1-33-1 Clearly define the problem:
Before any clear improvement can be made in medical waste management, consistent and scientifically based definitions must be established as to what is meant by medical waste and its components, and what the goals are for how it is managed. If the primary goal of “managing” waste from medical facilities is to prevent the accidental spread of disease, then it must first be acknowledged that there is only a small percentage of the waste stream that is contaminated in a manner that renders it capable of transmitting disease, and that the only documented transmission of disease from medical waste has been from contaminated sharps (syringes, etc.). Waste stream should be differentiated from medical facilities in three major categories:
(A) Hospital Waste - all waste generated from a facility (including cafeteria, office, and construction wastes).
(B) Medical Waste (A subset of hospital waste) - waste generated as a result of patient diagnosis, treatment, or immunization of human beings or animals Hospital Waste General Non-Infectious (85%) Infectious (10%) Hazardous - Chemical / Radioactive (5%).
(C) Potentially Infectious Waste (A subset of medical waste) - that portion of medical waste that has the potential to transmit an infectious disease(25).

1-33-2 Focus on segregation first:
The current waste management practice observed at many hospitals is that all wastes, potentially infectious, office, general, food, construction debris, and hazardous chemical materials are all mixed together as they are generated, collected, transported and finally disposed of. As a result of this failure to establish and follow segregation protocols and infrastructure, the waste leaving hospitals, as a whole is both potentially infectious and potentially hazardous (chemical). At greatest risk are the workers who handle the wastes (hospital workers, municipal workers and rag pickers). The risk to the general public is secondary and occurs in three ways: (1) accidental exposure from contact with wastes at municipal disposal bins; (2) exposure to chemical or biological contaminants in water; (3) exposure to chemical pollutants (e.g., mercury, dioxin) from incineration of the wastes. No matter what final strategy for treatment and disposal of wastes is selected, it is critical that wastes are segregated (preferably at the point of generation) prior to treatment and disposal. This most important step must be taken to safeguard the occupational health of health care workers. Hospitals are currently burning wastes or dumping wastes in municipal bins which are transported to unsecured dumps. The wastes contain mercury and other heavy metals, chemical solvents and preservatives (e.g., formaldehyde) which are known carcinogens, and plastics (e.g., PVC) which when combusted produce dioxins and other pollutants which pose serious human health risks not only to workers but to the general public through food supplies. Imposing segregation practices within hospitals to separate biological and chemical hazardous wastes (less than 10% of the waste stream) will result in a clean solid waste stream (90%) which can be easily, safely and cost-effectively managed through recycling, composting and land filling the residues. This resulting waste stream has a high proportion of organic wastes (food) and recyclable wastes (paper, plastic, metal) and actually very little that is truly disposable, especially given the high percentage of reprocessing and reuse of materials(25).

1-33-3 Institute sharps management:
Of the 10 percent or less portion of the waste stream that is potentially infectious or hazardous, the most immediate threat to human health (patients, workers, public) is the indiscriminate disposal of sharps (needles, syringes, lancets, and other invasive tools). Proper segregation of these materials in rigid, puncture proof containers which are then monitored for safe treatment and disposal is the highest priority for any health care institution. If proper sharps management were instituted in all
health care facilities most of the risk of disease transmission from medical waste would be solved. This would include proper equipment and containers distributed everywhere that sharps are generated (needle cutters and needle boxes), a secure accounting and collection system for transporting the contaminated sharps for treatment and final disposal, and proper training of all hospital personnel on handling and management of sharps and personal protection (25).

1-33-4 Keep focus on reduction:
Hospitals in the Third World generate significantly less volumes of waste than U.S. hospitals. In part this is a result of a decision to maintain a system that relies on reprocessing and reuse of materials. Establishing clear guidelines for product purchasing that emphasized waste reduction will keep waste management problems in focus. New emphasis needs to be put on waste reduction of hazardous materials. For example, hospital waste management would benefit from a policy of a phase out of mercury-based products and technologies. Digital and electronic technology is available to replace mercury-based diagnostic tools. This is a purchasing and investment decision. Since there is no capacity in most countries to safely manage mercury wastes, this reduction policy will make a serious contribution to cleaning up the hospital waste stream. This is one example of reduction strategies which could be identified and implemented in all countries. Practicing pollution prevention is the most cost effective way of securing public health (25).

1-33-5 Ensure worker safety through education, training, and proper personal protective equipment:
Workers who handle hospital wastes are at greatest risk from exposure to the potentially infectious wastes and chemical hazardous wastes. This process starts with the clinical workers who generate the wastes without proper knowledge of the exposure risks or access to necessary protective gear, and includes the workers who collect and transport the wastes through the hospital, the staff who operates a hospital incinerator or who take the waste to municipal bins, the municipal workers who collect wastes at the municipal bins and transport it to city dumping sites, and the rag pickers, who represent the informal waste management sector, but play an important role in reducing the amount of waste destined for ultimate disposal. Whether rag pickers are considered as part of the formal system or not, they are integrally involved in waste management and their unique role and personal safety and health needs must be considered. Proper education and training must be offered to all workers from doctors to ward boys, to laborers and rag pickers to ensure an understanding of the risks that wastes pose, how to protect themselves, and how to manage wastes (especially how to properly segregate). Education and training programs must be developed which speak to each
population in a way that will best meet the needs and build understanding and change behavior in that population. There is no “one” way to educate all workers(25).

1-33-6 Provide secure collection and transportation:
If the benefits of segregation are to be realized then there must be secure internal and external collection and transportation systems for waste. If waste is segregated at the point of generation only to be mixed together by laborers as they collect it, or if a hospital has segregated its waste and secured it in separate containers for ultimate disposal only to have municipal workers mix it together upon a single collection, then the ultimate value is lost. While worker safety may have been enhanced, the ultimate cost to the environment and the general public is still the same. In addition the very real concern of hospital administrators and municipal officials to prevent the reuse of medical devices, containers and equipment after disposal should be taken into account in any management scheme. In addition, the practice of cleaning and reselling, syringes, needles, medicine vials and bottles, is not well documented but appears to have enough informal evidence to indicate that it is a serious concern. Items that could potentially be reused illegitimately must be either rendered unusable after their use (cutting needles, puncturing IV bags, etc.) or secured for legitimate recycling by a vendor or system that can be monitored for compliance(25).

1-33-7 Require plans and polices:
To ensure continuity and clarity in these management practices, health care institutions should develop clear plans and policies for the proper management and disposal of wastes. They need to be integrated into routine employee training, continuing education, and hospital management evaluation processes for systems and personnel. Municipal governments or state governments could require waste management plans from all hospitals as a condition for operating(25).

1-33-8 Invest in training and equipment for reprocessing of supplies:
Professional health care associations should be urged to firmly support judicious reuse of materials, and should begin to set standards for reprocessing. Maintenance of this effort within hospitals will provide quality products and thwart efforts to increase reliance on disposables. Disposables are costly, increase waste generation, and do not necessarily provide for decreases in infection rates in hospitals. A reprocessing industry must however be supported with investment in proper equipment and training so that it is carried on in a safe and efficient manner(25).

1-33-9 Invest in environmentally sound and cost effective medical waste treatment and disposal technology:
The rush to incinerate medical waste in countries around the world as an ultimate solution to a problem without definition is doing a great
injustice to the community, the public health of its people, and the environment. Of the eleven recommendations that we are making, it is no accident in giving attention to treatment technologies as ninth. Without proper attention being paid to one through eight on this list, whatever decisions being made for treatment and disposal will be insufficient, if not counterproductive. The mass incineration of hospital waste given current practices of waste disposal will not reduce risk to workers (this is where the greatest risk of disease transmission or chemical exposure exists) and will actually create a greater threat to the general public as mercury and other heavy metals are spewed out into the general air, or dioxins and furans are created from the combustion of plastics such as PVC which is growing in use in medical packaging. Additionally, the ash generated from incineration of medical waste is also tainted with heavy metals and other toxic residues. Lesser risks are associated with the treatment of un segregated wastes through other treatment technologies such as autoclaving, hydroclaving, microwaving and chemical disinfection, which affect workers more than the general public, and contaminate water sources rather than air if improperly operated. Choices of treatment technologies should be made in line with a clear knowledge of the waste stream to be managed and the goal to be achieved through treatment. If the technology is to be environmentally sound, the waste stream should be able to be treated (disinfected) without creating other hazardous by-products. Incineration may be an “overkill” technology. Its goal is sterilization, not disinfection. One has to ask the question as to whether sterilization is necessary, or if the goal is simply disinfection. Is achieving sterilization worth the cost of transferring the risk from a potentially “infectious” material to a clearly hazardous chemical one? If the overall goal of waste management is to prevent disease transmission from waste products, then the emphasis should be placed on the “management” aspect of the process and not on the “technological fix” which time and again has proven to be an expensive diversion rather than an effective solution. Technology should fit the situation and work in the management system to achieve the final goal as part of the overall system, not as a replacement for the system. Technology choices will be made to meet local needs and conditions and cannot be uniformly applied throughout a state or country(25).

**1-33-10 Develop an infrastructure for the safe disposal and recycling for hazardous materials:**
There was little or no observable capacity for the management, treatment, recycling or final disposal of hazardous wastes in most countries (e.g. chemicals, mercury, batteries). Hospitals seeking to segregate hazardous wastes are left with little or no option for safe disposal. The development of an industry which is capable of managing
hazardous waste (chemicals) is essential. On-site reprocessing technology is available for hospitals for materials such as xylene or formalin, and recovery technology for silver from developing solution. These technologies may be cost prohibitive at this time. Pollution prevention and the choice of nonhazardous or less hazardous material is the only real option left to hospitals, which should be followed regardless of the existence of a hazardous waste industry(25).

1-33-11 Develop an infrastructure for safe disposal for municipal solid waste:

Improper disposal of all wastes, municipal solid waste, hazardous wastes, industrial wastes, human wastes, etc. poses a major health hazard. The development of sanitary landfills, sewage treatment plants and other waste management facilities providing for the ultimate safe disposal of those wastes which cannot be otherwise recycled, composted or reused is necessary to securing public health in the country. Studies of the municipal waste stream in many countries such as Haiti or India conclude that approximately 50% of the wastes generated are organic and could be composted. Another large segment includes easily recyclable materials, leaving a relatively small portion requiring actual disposal. Just as in the discussion of medical waste management, proper segregation and pollution prevention, combined with a clear definition of the problem and the goal will provide the best, most environmentally safe and cost-effective solution to waste disposal. Also again, proposals for large mass burn incinerators for the general mixed waste stream, not only do not address the real problem but are burdened with numerous “side effects” which render their real value as a negative. Health care facilities need to be able to tie into a municipal system of proper waste management to ensure that they are meeting their mission of providing for the public health. Until such an infrastructure exists there are numerous decisions and actions that any hospital can make (listed above) to begin the process of improving their waste management practices and ensuring public health and worker safety today. We can provide educational materials, refer experts, suggest speakers, and identify health care facilities willing to share their experience in becoming environmentally responsible(25).

1-34 Consequences of improper disposal or non-disposal of medical waste:

Medical wastes are a source of contamination and pollution to both humans and the natural environment. Improper disposal may be hazardous if it leads to contamination of water supplies or local sources used by nearby communities or wildlife. Sometimes exposed waste may become accessible to scavengers and children if a landfill is insecure. Medical wastes are potentially capable of causing disease and illness in man, either through direct contact or indirectly by contamination of soil,
groundwater, surface water and air. Windblown dusts from these dumps also have the potential to carry pathogens and hazardous materials. Where domestic animals are allowed to graze in open dumps, there is a risk of reintroducing pathogenic micro-organisms into the food chain. Medical wastes therefore pose a risk to individuals, communities, and the environment if not carefully handled. Wastes attract scavenging animals and bats. As it ferments it gives off foul odors, favors fly feeding and contaminates both water and air. Piles of refuse or landfill during its decomposition process generate several gases, the most important among which are methane (CH4), nitrogen (N2) and occasionally hydrogen sulfide (H2S). If burnt, carbon di-oxide (CO2) is released. CH4 and CO2 are greenhouse gases and have potential greenhouse effects. The soil underlying these wastes is typically contaminated by pathogenic micro-organisms, heavy metals, salts, and chlorinated hydrocarbons. These wastes also cause public nuisance by clogging sewers and open drains, encroaching on roadways, diminishing landscape aesthetics and giving off unpleasant odours and dust. Expired drugs pilfering from a stockpile of waste drugs or during sorting may result in expired drugs being diverted to the market for resale and misuse. Most pharmaceuticals past their expiry date become less efficacious and a few may develop a different adverse drug reaction profile. Medical waste incinerations are one of the largest sources of dioxin and mercury pollution in the United States. When one eats these foods, one adds to the existing dioxin and mercury body burdens. Other than these, the ash from incinerator consists of both fly ash and bottom ashes. The ash contains high levels of toxic substances such as heavy metals, dioxins and furans. Ironically, as the air pollution equipment becomes more effective in removing particulate matter, the toxicity of the fly ash increases. One of the largest hospitals in Delhi, India was found to have lead in its incinerator ash at levels which would classify the ash as hazardous. In most cases, disposal of incinerator ash in landfills without a sufficient soil or other impermeable cover may cause leachate to contaminate groundwater. Incineration has specific health concern since it not only destroys the pathogen but also the material on which the pathogen resides. Thus, those materials go under a process of transformation and dematerialization. In the process they transform solid and liquid toxic waste into gaseous emissions, particulate matters. The acid gases (e.g. hydrogen chloride, nitrogen oxides and sulphur dioxides), can cause acute effects such as eyes and respiratory irritation, can contribute to acid rain, and may enhance the toxic effects to heavy metals. Particulate matter can cause chronic health effects. Burning of chlorine made material e.g. PVC, creates dioxin, a known animal carcinogen, and considered as human carcinogen(8).
Medical Waste in Egypt previous study

Some limited reports describe the amount of medical waste generated per bed per day to be on the average of 1 kg. There are approximately 123,000 beds distributed in governmental and private health care facilities (excluding military and police hospitals). This means the total hospital waste is estimated to be on average 123 tons/day. Almost 80% of the total waste generated by health care activities is general waste (comparable to domestic waste), while the remaining 20% of waste is considered to be hazardous and may be infectious, toxic, or radioactive. 95 In other words, Egypt generates an average of 24,600 tons of hazardous or infectious waste daily.(18).
Chapter two
Material & Methods
2-1 Study design:
This descriptive study was conducted in Bahari and Sharq Alneel Hospitals which include (Bahari, Ahmed Gasim, Haj-alsafi Al-banjadeed and Um-dwanban) in Khartoum North during the year 2009.

2-2 Study area:
Hospitals in Bahari and Sharq Alneel which serve the people in both urban and rural areas. (Excluding private and non civilian hospitals).
Bahri Teaching Hospital, Ahmed Gasim, and Haj-alsafi are situated in Bahri administration unit where as Al-banjadeed Teaching Hospital is situated in Al-haj yousif administration unit and Um-dwanban in Al-reef Al-janobi administration unit.

2-3 Sanitation in the study area:
Liquid waste disposal is according to domestic septic tank for all hospitals under the study.
Solid waste is collected in private covered bins and collected by health cleaners personnel to the collective vehicles.

2-4 Study population:
The study population in this study are permanent health cleaners.

2-5 Size of study population:
Bahari Teaching Hospital = 110
Al-Banjadeed = 45
Haj-alsafi = 31
Ahmed Gasim = 49
Umdawan Ban = 29
Accordingly we considered a size of (264) health cleaners which constitute the targeted health cleaners under study in Bahari and Sharq Alneel Hospitals.

2-6 Data collection:

The data was collected using a questionnaire, focusing on personal characteristics, knowledge, attitudes and practices related to medical waste hazards. These questionnaires were directed to all targeted population under study.

2-7 Data analysis:

The data was analyzed by a computer using (SPSS) program. Relations between different variables were done using chi-square test. The data were depicted via tables and pies figures.
Chapter three
Results
Table (1) shows the distribution of study population according to hospitals
N=264

<table>
<thead>
<tr>
<th>hospital</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahari</td>
<td>110</td>
<td>41.7</td>
</tr>
<tr>
<td>Ahmed Gasim</td>
<td>49</td>
<td>18.6</td>
</tr>
<tr>
<td>Haj alsafi</td>
<td>31</td>
<td>11.7</td>
</tr>
<tr>
<td>Alban jadeed</td>
<td>45</td>
<td>17</td>
</tr>
<tr>
<td>Umdawanban</td>
<td>29</td>
<td>11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that the majority (41.7%) of study population are concentrated at Bahari Teaching Hospital whereas the minority at Umdawanban Hospital (11%).

Figure (1) shows distribution of study population according to gender
N=264

This figure shows that female constitute (75%) of study population.
Table (2) shows the distribution of study population according to age
N=264

<table>
<thead>
<tr>
<th>Age</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-29</td>
<td>25</td>
<td>9.5</td>
</tr>
<tr>
<td>30-39</td>
<td>64</td>
<td>24.2</td>
</tr>
<tr>
<td>40+</td>
<td>175</td>
<td>66.3</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that the majority (66.3%) of study population are at age (more than 40 years)

Figure (2) shows the distribution of study population according to education level
N =264

This figure shows that the majority (74%) of study population are illiterate
Table (3) shows the distribution of study population according to knowledge of medical wastes types.

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used cotton and sharps</td>
<td>29</td>
<td>11</td>
</tr>
<tr>
<td>Expired drugs</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>Waste generated by hospital</td>
<td>11</td>
<td>4.2</td>
</tr>
<tr>
<td>All above</td>
<td>201</td>
<td>76.1</td>
</tr>
<tr>
<td>Don't know</td>
<td>20</td>
<td>7.6</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that (92.4%) of study population have knowledge to identify types of medical waste.

Table (4) shows the distribution of study population according to an idea of medical wastes hazards

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes I have an idea</td>
<td>236</td>
<td>89.4</td>
</tr>
<tr>
<td>No I haven't</td>
<td>28</td>
<td>10.6</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that the majority (89.4%) of study population know the potential hazards associated with medical waste.

Table (5) shows the distribution of study population according to knowledge of hazards related to poor management of medical wastes

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injuries</td>
<td>150</td>
<td>56.8</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>12</td>
<td>4.5</td>
</tr>
<tr>
<td>Hepatitis (B&amp;C)</td>
<td>3</td>
<td>1.2</td>
</tr>
<tr>
<td>Dysentery</td>
<td>9</td>
<td>3.4</td>
</tr>
<tr>
<td>All above</td>
<td>65</td>
<td>24.6</td>
</tr>
<tr>
<td>Don’t know</td>
<td>25</td>
<td>9.5</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that more than half (56.8%) of study population know hazards that related to medical waste.
Table (6) shows the distribution of study population according to practices of medical wastes separation.

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes I used to separate</td>
<td>261</td>
<td>98.9</td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that almost (98.9%) of study population separate medical wastes from general one.

Table (7) shows the distribution of study population according to practice of using color coding containers to separate medical wastes

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>262</td>
<td>99.2</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that almost (99.2%) of study population using color coding containers to separate medical wastes.

Table (8) shows the distribution of study population according to knowledge of filling waste-bag to 3 quarters

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>246</td>
<td>93.2</td>
</tr>
<tr>
<td>No</td>
<td>18</td>
<td>6.8</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that the majority (93.2%) of study population know the knowledge that waste-bag should be filled to 3 quarters.
Table (9) shows the distribution of study population according to practices of using personal protective measures.

<table>
<thead>
<tr>
<th>Practice</th>
<th>Yes</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>253</td>
<td>95.8</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>11</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

This table shows that the majority (95.8%) of study population said that they use protective measures (gloves, overalls) during their work in hospitals.

Figure (3) shows the distribution of study population according to knowledge of personnel at risk

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Don't know</th>
<th>All true</th>
<th>Patients in hospital</th>
<th>Health cleaners</th>
<th>Nurses</th>
<th>Physicians</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>4.20%</td>
<td>6.90%</td>
<td>3.80%</td>
<td>71.50%</td>
<td>5.30%</td>
<td>8.30%</td>
</tr>
</tbody>
</table>

This figure shows that the majority (71.5%) of study population considered that health cleaners are the most people at risk.
Figure (4) shows the proportion of study population that exposed to sharps
N=264

This figure shows that only (6%) of study population have been exposed to sharps during their work in the hospital.

Table (10) shows the study population that had been exposed to hazards
N=17

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injuries</td>
<td>13</td>
<td>76.5</td>
</tr>
<tr>
<td>Chest infection</td>
<td>4</td>
<td>23.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>17</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that the majority (76.5%) of study population had been exposed to injuries.
Table (11) shows the study population that check with physicians after exposed to risk factor.
N=17

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>15</td>
<td>88.2</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>11.8</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that the majority (88.2%) of study population check with physicians after exposure to risk factor.

Table (12) shows the distribution of study population according to vaccination services against hepatitis (B).
N=264

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>22</td>
<td>8.4</td>
</tr>
<tr>
<td>No</td>
<td>242</td>
<td>91.6</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that majority (91.6%) of study population don’t receive any vaccination services against hepatitis (B).

Table (13) shows the distribution of study population according to training status in handling infectious waste.
N=264

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>101</td>
<td>38.3</td>
</tr>
<tr>
<td>No</td>
<td>163</td>
<td>61.7</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that more than half (61.7%) of study population don’t received any training in handling infectious wastes.
Table (14) shows the distribution of study population according to practices of dealing with used syringes.
N=264

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>214</td>
<td>81.1</td>
</tr>
<tr>
<td>No</td>
<td>50</td>
<td>18.9</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that majority (81.1%) of study population have practices of dealing with used syringes.

Table (15) shows the distribution of study population according to knowledge of discarding used syringes.
N=264

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>173</td>
<td>65.5</td>
</tr>
<tr>
<td>No</td>
<td>91</td>
<td>34.5</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that more than half (65.5%) of study population discarding used syringes

Table (16) shows the provision of safety boxes inside hospitals.
N=264

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>satisfactory</td>
<td>264</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that all hospitals (100%) have safe and satisfactory boxes.
Figure (5) shows the distribution of study population according to practice of sharps disposal
N=264

This figure shows that the majority (88%) of study population disposed sharps in safety boxes.

Table (17) shows the distribution of study population according to practice of closing waste-bags after filling
N=264

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>236</td>
<td>89.4</td>
</tr>
<tr>
<td>No</td>
<td>28</td>
<td>10.6</td>
</tr>
</tbody>
</table>

This table shows that majority (89.4%) of study population has practices that encompass tightly closed waste-bags after filling.
Table (18) shows the distribution of study population according to risks in over carring waste-bags

N=264

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>226</td>
<td>85.6</td>
</tr>
<tr>
<td>No</td>
<td>38</td>
<td>14.4</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that majority (85.6%) of study population have knowledge that there is a risk in over carring.

Table (19) shows the distribution of study population according to practices of medical waste collection in-site hospital.

N=264

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>264</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that all (100%) of study population collect waste daily when produced in such hospitals.

Table (20) shows the perception of study population in evaluating the benefit of raising awareness related medical waste hazards.

N=264

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>264</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
</tr>
</tbody>
</table>

This table shows that all (100%) of study population believe that raising awareness can reduced medical wastes hazards.
Table (21) shows the relation between gender and exposure to the risk
N=264

<table>
<thead>
<tr>
<th>Gender distribution</th>
<th>Exposure to risk</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>% NO.</td>
<td>%</td>
</tr>
<tr>
<td>Male</td>
<td>14</td>
<td>82.4</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>17.6</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100</td>
</tr>
</tbody>
</table>

Chi square = 32.6    PV = 0.000 significant
Table (22) shows that significant difference between gender distribution and exposure to risk.

Table (22) shows the relation between hospital and exposure to risk
N=264

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Exposure to risk</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>% NO.</td>
<td>%</td>
</tr>
<tr>
<td>Bahari</td>
<td>6</td>
<td>35.3</td>
</tr>
<tr>
<td>Ahmed Gasim</td>
<td>7</td>
<td>41.2</td>
</tr>
<tr>
<td>Haj alsafi</td>
<td>1</td>
<td>5.9</td>
</tr>
<tr>
<td>Albanjadeed</td>
<td>1</td>
<td>5.9</td>
</tr>
<tr>
<td>Umdawanban</td>
<td>2</td>
<td>11.8</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100</td>
</tr>
</tbody>
</table>

Chi square = 7    PV = 0.133 not significant
Table (23) shows that no significant difference between hospital and exposure to risk.
Table (23) shows the relation between age and the use of personal protective measures
N=264

<table>
<thead>
<tr>
<th>Age</th>
<th>Use of protective measures</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>18-40</td>
<td>80</td>
<td>65</td>
</tr>
<tr>
<td>More 40</td>
<td>173</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>253</td>
<td>11</td>
</tr>
</tbody>
</table>

Chi square = 2.5   PV =0.113 not significant
Table (25) shows that no significant difference between age and use of protective measures.
Chapter four
- Discussion
- Conclusion
- Recommendations
- References
- Appendices
Discussion

The study indicated that almost all of study population (92.4%) have the knowledge that related types of medical waste as (used cotton and sharps, expired drugs, waste generated by hospital) this finding complies with (8) waste generated by health care facilities includes abroad range of materials from used needles and syringes) whereas (7.6%) of study population haven't the knowledge of types of medical waste and the researcher attributed this to high percentages of illiteracy among the study population(74%), (table 3 and figure 2).

The study indicated that the majority of study group (89.4%) have the knowledge that poor management of medical waste can cause diseases such (HIV/AIDS, hepatitis B&C, dysentery in addition to injuries, (table 5), as pointed by (1) the greatest risk posed by infectious waste is accidental needle stick injuries, which can cause hepatitis B & hepatitis C and HIV infection).

The study indicated that almost all of study population, (98.9%) separated medical waste from general one when generated by hospitals (table 6), as pointed by (4) the key to minimization and effective management of health care waste is segregation (separation) and identification of the waste).

The study indicated that almost all of study population, (99.2%) identifying color coding containers to separate medical waste (table 7), as expressed by (5) all bags used for the containment of infectious medical waste must be clearly identified by label or color or both. Containers for collection must be labeled in the same universal colors).

The study indicated that almost of study population, (93.2%) have the knowledge that waste-bag should be filled to three quarters (table 8), this finding is in agreement with the (1) waste and sharps containers should be discarded when they become three quarters full and at least once daily or after each shift).

The study indicated that almost all of study population, (95.8%) using protective measures (gloves, overalls) during their routine work in hospitals (table 9), this finding complies with (4) the type of protective clothing used will depend to an extent upon the risk associated but the following should be made: helements, face masks, overalls, leg protectors, and disposable gloves obligatory).

The study indicated that the majority of study population, (71.5%) considered that health cleaners were most susceptible to medical waste risks (figure 3), this finding is in agreement with the (17) the main group at risks are the following: workers in waste handling, transportation, and waste disposal facilities).
The study indicated that the majority of study population, (88.2%) check with physicians after exposure to risk factor (table 11), this finding is in agreement with the (21) establishing immunization, post exposure treatment and regular medical surveillance, reporting, containing and cleaning up spillages of infectious materials quickly and thoroughly are essential to avoid the risk of infection in the health care establishment.

The study indicated that the majority of study population, (89.4%) has practices that tightly close waste-bag (table 17), as pointed by (11) waste bags are tightly closed or sealed when they are about three quarters full, light bags can be closed by tying the neck).

The study indicated that all study population, (100%) believe that raising awareness among health cleaners can reduced medical waste risks(table 20), this finding is in agreement with (21) training of staff on handling wastes and used sharps avoiding accidents and post exposure procedures.
Conclusion

The study revealed that although there was a high percentage of illiteracy among study population, still they have good attitudes, and practices towards dealing with medical waste as presented in results. The study revealed that there was no vaccination services directed to study population against hepatitis (B), and The relation between gender and exposure to risk is statistically significant.
Recommendations

1- Support capacity building to all health cleaners personnel.
2- Immunization against hepatitis (B) for all health cleaners at health care facilities.
3- Further research in this area is needed to determine appropriate methods of collection and final disposal of medical waste.
References:


3- www.drguide.mohp.gov.eg/newsite/ELEarning/InfectionControl /Part1/094WasteManagement.doc


بسم الله الرحمن الرحيم

جامعة الخرطوم
كلية الصحة العامة وصحة البيئة
قسم التنقيف الصحي

إسبيان عن دراسة معرفة وواقف وممارسات عمال النظافة بمستشفيات
بحري وشرق النيل تجاه مخاطر النفايات الطبية:

1- المستشفى:
أ- بحرى (  ) ب- أحمد قاسم (  ) ج- حاج الصافى (  )
د- البان جديد (  ) ه- أم ضوآ بان (  )

2- النوع:
أ- ذكر (  ) ب- أنثى (  )

3- العمر:
أ- 18 - 29 (  ) ب- 30 - 39 (  ) ج- 40 فما فوق (  )

4- المستوى التعليمي:
أ- أمي (  ) ب- خلوا (  ) ج- أساس (  ) د- ثانوى (  )
ب- جامعي (  )

5- أنواع النفايات الطبية هي:
أ- القطن وقطع الشاش والإبر والمحائر التي تم استخدامها (  )
ب- الع약 والأدوية منتهية الصلاحية (  )
ج- أوراق المكتب وكل ماينتج ف المستشفى (  )
د- كل ماذكر صحيح (  ) ه- أخرى حد (  ) و- لا أدرى (  )

6- هل لديك فكرة عن المخاطر المحتملة من الإصابة بالنفايات الطبية (  )
أ- نعم (  ) ب- لا (  )

7- إذا كانت الإجابة نعم ماهى:
أ- جروح (  ) ب- الإصابة بالسل (  ) ج- الإصابة بالأيدز (  )
د- التهاب كبد فيروس (  ) ه- الدستناريا (  ) و- كل ماذكر صحيح (  )
ر- أخرى حد (  ) ز- لا أدرى (  )

8- هل يتم فرز النفايات الطبية (شاش،قطن،محاقن،أنسجة بشرية) وقت إنتاجها من النفايات الأخرى مثل بقايا الأكل والورق وغيرهما؟
أ- نعم (  ) ب- لا (  )
9- هل توجد حاويات مخصصة بها علامات تفصل كل نفاية على حدة؟
   أ- نعم ( ) ب- لا ( )

10- هل لديك فكرة بأن وعاء النفايات يجب أن يملأ لثلاث أرباعه فقط؟
   أ- نعم ( ) ب- لا ( )

11- هل تستخدم أدوات الوقاية الشخصية (القفازات) عند تعاملك مع النفايات الطبية؟
   أ- نعم ( ) ب- لا ( )

12- إذا كانت الإجابة نعم هل هي واقيبة بالنسبة لك؟
   أ- نعم ( ) ب- لا ( ) ج- لا أدرى ( )

13- برأيك ما هي أكثر الفنون عرضة للإصابة جراء النفايات الطبية؟
   أ- الأطباء ( ) ب- الممرضون ( ) ج- عمال النظافة ( )
   د- المرضى داخل المستشفى ( ) ه- الزوار ( )
   و- كل ماذكر صحيح ( ) ر- أخرى حدث ( ) ز- لا أدرى ( )

14- هل سبق أن أصبت أثناء عملك بالمستشفى؟
   أ- نعم ( ) ب- لا ( )

15- إذا كانت الإجابة في السؤال السابق نعم حدد نوع المرض؟
   أ- دستانيا ( ) ب- برقان ( ) ج- تليفود ( )
   د- سل ( ) ر- جروح ( ) ز- آذان ( )
   ك- عودا صدرية ( ) ل- آخر حدث ( )

16- إذا لا سمح الله وأصبت بجرح أثناء عملك هل تقوم بمقابلة الطبيب تحوطاً للتتأكد ربما الإصابة بمرضٍ معد؟
   أ- نعم ( ) ب- لا ( )

17- إذا كانت الإجابة لا لماذا؟
   أ- المقابلة غير مجدية ( ) ب- أيمن تلافى المرض ( )
   ج- يوجد وقت ( ) د- أخرى حدث ( )

18- هل تم تطعيمك ضد التهاب الكبد الفيروسي؟
   أ- نعم ( ) ب- لا ( )

19- هل تلقيت أي نوع من أنواع التدريب أو التثقيف عن كيفية التعامل مع النفايات الطبية؟
   أ- نعم ( ) ب- لا ( )

20- هل تعيد تغطية الإبر بعد استخدامها؟
   أ- نعم ( ) ب- لا ( )
21- هل تعلم أهمية عدم إعادة تشغيل المحاكس بعد استخدامها؟
   ـ نعم ( )  بـ لا ( )

22- هل يتم إجراء فحوصات طبية دورية لكم أو حتى مرة واحدة طيلة عملك بالمستشفى؟
   ـ نعم ( )  بـ لا ( )

23- إذا كانت الإجابة نعم هل هي؟
   ـ دورية ( )
   ـ مرة واحدة ( )

24- هل توجد صناديق أمان كافية بالمستشفى؟
   ـ نعم ( )  بـ لا ( )

25- أين ترمى المحاكس والإبر المستعملة؟
   ـ في صندوق الأمان ( )  بـ في سلة الأوساخ العامة ( )
   ـ في سلة مخصصة للمحاكس ( )  بـ أخرى حدث ( )

26- هل تقوم بغلق أكياس النفايات غلقاً محكماً عند إمتلائها؟
   ـ نعم ( )  بـ لا ( )

27- برأيك هل ترى أن حمل أكثر من كيس واحد للنفايات فيه خطورة على صحتك؟
   ـ نعم ( )  بـ لا ( )

28- هل يتم جمع النفايات يومياً أو بشكل منتظم داخل المستشفى؟
   ـ نعم ( )  بـ لا ( )

29- هل ترى إن في تثبيت عمال النظافة يمكن أن يقلل من خطر الإصابة جراء النفايات الطبية؟
   ـ نعم ( )  بـ لا ( )
5Rs to manage medical waste
Bag closing and labeling by a nurse in a medical department

The three bins system: yellow bag for hazardous waste, black bag for general waste, and leak and puncture proof container for sharps with statements "Do not fill above the line" and "Sharps waste"
Lack of segregation is making whole waste stream hazardous
VULCAN incinerator
SICIN incinerator
Collection of bags from temporary storage containers