بسم الله الرحمن الرحيم

# Sudan University of Science and Technology

# Collage of Graduate Studies

# Analysis of Biosafety Performance in Selected Hospital Medical Laboratories in Khartoum State

Research is submitted to fulfill the Partial Requirement of Master Degree in Quality Management and Excellence
(2016 -2018)

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# DEDICATION

I dedicate this project:

To my parents who have given everything possible and even given up important things to make sure I achieve this feat.

To my husband who has encouraged me all the way and whose encouragement has made sure that I give it all it takes to finish that which I have started.

To my siblings and friends i cannot thank you enough for being there for me whenever my spirits need a little lift ,your prayers, words of motivation and words of comfort that come just in time, you are truly an extraordinary gifts.

To my son who had to endure so much stress and discomfort and has been affected in every way possible by this quest.

Thank you

My love for you all can never be quantified.

God bless you.

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**Abstract**

This Cross-sectional study aimed to find out the level of awareness and biosafety measures taken by hospital-based laboratory staff, Safety difference between large and small hospitals and the major gabs in safety performance in those selected hospitals. The tool used for data collection was structured questionnaire and check list, sample size was chosen by formula (N=Z2pq/d2) , 200 questionnaires distributed in 8 hospital laboratories (4 large and 4 small), Random sampling technique was used in selecting those laboratories. 150 answered questionnaires were returned by the respondents and this is what was used for the data analysis. The data was entered and analyzed using statistical package SPSS (Statistical Package for Social Science )After Analyzing the 20 determinant of safety performance in selected laboratories the results were as follow: 11 of those factors (availability of (safety manual 4% – officer 8% -cabinet 2.7%)),dealing with hazard according to MSDS 12 %,fire safety 11.3% ,safety aduit 0.7%,staff vaccination 12.3%,post exposure prophylaxis 0.7% ,biosafety training 3.3% and lab space documentation 2 % are bellow universal standers and Results are consistent with existing theories show that laboratories biosafety performance is low . there were improvement in 7 factors (handling of sharps 58% ,PPE 58%,speperated test area 91.3 % good work station72.7% ,good physical environment 58.7% use of disinfectant 72.7% and secured lab access 61.3%. About the remnant 2 factors the respondents have insufficient data about secured storage area in lab 44.7% and waste management 70 %) Also there was significant difference in safety performance between large and small hospital laboratories in the following factors ( handling of sharps p.value 0.01,PPE p.value 0.00,staff vaccination p.value 0.01,separate test area p.value 0.00,secured lab access p.value 0.00 ,use of safety cabinet p.value 0.01) in the remaining factors there were no difference in performance for those labs .The study recommend that There should be management commitment toward bio safety in order to have a working environment that is hazard free also there should be a defined training protocol at the institutional level ,Pocket-size biosafety handbooks or cards should be given to staff in order to follow these rules easily ,immunization and PEP Should be available to all staff .

مستخلص الدراسة

هدفت الدراسة لمعرفة درجة الوعي بمفهوم السلامة الحيوية ومدي تطبيقها في بعض المعامل داخل مستشفيات ولاية الخرطوم وايجاد الفجوة بين المعرفة والتطبيق لعناصر السلامة بين العاملين في هذا القطاع.تم تحديد 8 مستشفيات حكومية وتقسيم المعامل الي جزئين 4 كبيرة و4 صغيرة حسب حجم المستشفي ،تم توزيع اداة جمع البيانات (الاستبيان ) علي العاملين في هذه المستشفيات وتم اختيار حجم العينة بناء علي المعادلات الاحصائية وتم بناء علي ذلك توزيع 200 استبانة بطريقه عشوائية وبعد استيفاء مدة الاجابة علي الاستبيانات تم تجميعها من المستشفيات واستبعاد الغيرمكتملة وبعد الفرزتم الحصول علي 150 استبيان مكتمل وجاهز لعمل التحليل الاحصائي بواسطة برنامجspss.

بعد تحليل 20 عامل اداء لقياس السلامة الحيوية عن طريق مقارنه الاوساط الحسابيه واختبار كاي في هذه المعامل كانت النتيجة كالتالي:توفر كتيب سلامة محدث وموجود في مكان واضح 4%، توفر ضابط سلامة خاص بالمعمل 8%،وجود كتيب خاص بالمواد الكيميائية والتعامل مع المواد الكيميائية به 12%، التدريب علي التعامل مع الحرائق 12%،التفتيش الخاص بإجراءات السلامة 0.7%،تطعيم العاملين 12%،اجراءات مابعد التعرض لمسبب مرض اثناء العمل.0.7%،التدريب علي اجراءات السلامة 3.3%، وجود مستندات التشييد والسلامة لمباني المعمل 2%. وهنالك 7 عوامل اظهرت مستوي افضل (التعامل مع الابر والادوات الحادة 58%،توفر ادوات السلامة الشخصية 58%،اماكن اجراء الاختبارات مفصولة عن بعضها 91.3% ،بيئة عمل خالية من الفوضي 92%، بيئة فيزيائية جيدة 58.7%،استخدام المعقمات 72.7%، المعمل محصن من دخول غيرالمسموح لهم61.3% ) اما محددي السلامة المتبقيين فكانت الاجابات عليهما ب معلوماتي غير كافيه وهما كيفية التخلص من النفايات الطبية 70% وكيفية تخزين ادوات ومحاليل المعمل 44.7%.ايضا تم اختبار فرضية وجود فروق ذات دلالة احصائية بين المعامل الكبيرة والصغيرة وكانت النتيجة كالتالي بعض محددات السلامة اظهرت فروق ذات دلالة احصائية وهي: التعامل مع الابر والادوات الحادة 0.01و،توفر ادوات السلامة الشخصية0.1, تطعيم العاملين0.01, بيئة عمل خالية من الفوضي 0.00المعمل محصن من دخول غيرالمسموح لهم 0.00. اما بقية المحددات فكانت النتائج تشير الي عدم وجود فروق ذات دلالة احصائية بالنسبة للمعامل الكبيرة والصغيرة. اخيرا تشير الدراسة الي ان محددات السلامة في المعامل المذكوره كانت اقل من المتبع عالميا وكذلك الوعي بمفهوم السلامة الحيوية وتطبيقها في هذا القطاع .هذه النتائج توضح مستوي السلامة المنخفض في هذه المعامل .اوصت هذه الدراسة بضرورةالتزام الادارات داخل المستشفيات ب وضع برنامج تدريب مستمر علي الصحةوالسلامة المهنية حسب المعايير الدوليه, وكذلك وجود كتيب سلامه محدث وسهل ومتاح لجميع العاملين واخيرا توسيع برنامج التطعيمات ليشمل جميع العاملين في الحقل الطبي

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# Chapter one

# Chapter I

## 1. Introduction:

The issue of safety has always been one of the strongest of perceived human needs feeling safe is second in the hierarchy of basic needs, right after physiological needs. Safety is currently one of the most important determinants affecting quality of life this is why it is important to pay special attention to this issue, (joseph kubas & zuzana stofkov 2017).

### 1.1 Concept of biosafety:

Laboratory Biosafety is described as a safe method for managing infectious agents in laboratory environment, where they are handled and maintained . The concept of biosafety in laboratory practice is one that is of utmost important; and as such it must be given top priority at all times. There must be a continuous concerted effort on the part of laboratories to ensure that their testing procedure are safe and in line with international best practices both for the safety of staff and patients and also to safeguard the immediate environment from potentially hazardous pathogens (Muti.G 2012).

### 1.2 Safety as critical element in laboratory practice:

Biosafety is also an important element of Quality management systems in laboratory practice as it is a measuring tool for Compliance with accreditation and certification standards. The application of biosafety principles also ensures the mitigation of risk with respect to litigation as it pertains to laboratory acquired infections .The knowledge and application of biosafety principles also ensure that test methods are safe in the laboratory and that potentially infectious pathogens are handled with minimum risk to laboratory staff The field of biosafety covers risk assessment, management of such risks, the regulation, communication and mitigation of adverse events with the aim of promoting a safe environment for Clinical Laboratory testing(JM Miller ,et al 2013) the Clinical Laboratory is a potentially hazardous place to work and as a result it is essential that policies and procedures are put in place to detect and eliminate risk and errors to the barest minimum. The prevention of infections and occupational infections is therefore of prime importance in regulatory agency agendas, (Isara AR & Ofili AN 2010). Some studies have revealed that clinical laboratory personnel are 3 to 9 times more likely than general population to become infected with pathogens such as Mycobacterium tuberculosis and this reveals the extent of hazards such population Group are exposed to, (Nasim S, et al. 2014). Indeed on a daily basis laboratory workers are exposed to Sundry risk and hazards from human samples, tissues animate and inanimate Objects which they encounter in the course of their routine activities and this may Have lifelong consequences for such individuals, (Delany JR,et al. (2011). In order for a laboratory biosafety program to be successful it must be able to recognize and promptly assess risk accurately and mitigate possible hazards, It is therefore essential that biosafety measures be implemented at all times in order to reduce the risk of exposure to hazard on pathogens and possibility of laboratory acquired infections on the part of workers in the laboratory. Biosafety will also help to reduce accidental discharge(s) of such pathogens into the immediate environment, (Harding& Byers (2000). There is no doubt that a clinical laboratory in a hospital plays an important role to serve the patients. Therefore, an effective use of clinical laboratories will translate into effectiveness and efficiency of the organization. Nevertheless, although many Organizations accept this to be true; they fail to realize that as part of their clinical Laboratory management practices, there is the need for management to ensure that Workers in the clinical laboratories work in a safe and healthy environment that will promote their maximum utilization. Emphases should be made to avoid accidents that are costly to both affected staff and the organization. Consequently, management and staff should make every possible effort to avoid them from happening in the workplace. Workers' poor knowledge of health and safety measures also hinders clinical laboratories' effectiveness. Therefore, proper training of staff will be important to examine their effectiveness. Biosafety is an important issue in worldwide laboratory settings. Workers in clinical laboratories, especially those who are working in microbiology laboratories, are more susceptible to laboratory-acquired infections biosafety has become the code of practice in

microbiological and biomedical laboratories for the past 2 decades, ( Nkengasong JN et all 2009).

## 1.3 Biosafety as major factor in accreditation:

The Strengthening Laboratory Management toward Accreditation (SLMTA) programme was launched in 2009 and has been implemented in 47 countries Worldwide, (Petti CA, Polage CR & Quinn TC 2009). It is a management training programme that utilizes a series of workshops interspersed with on-site projects designed to improve laboratory quality. Evidence from other settings has shown that the SLMTA training programme yields observable and measurable laboratory Improvements. Furthermore, the training empowers laboratory staff and enhances management's ability to improve their own laboratories by making use of existing resources

There are five audit criteria for evaluation in the SLIPTA. They include:

- Laboratory test results.
- Number of tests annually: defined as total annual volume of tests performed by laboratory.
- Internal quality control procedures implemented for all testing methods used.
- Two most recent proficiency test results for each test performed.
- WHO SLIPTA Checklist for the African Region, (Datema TA et all 2012).

The WHO SLIPTA Checklist is compliant with ISO 15189/17025. The Checklist has 334 questions and a possible 258 points. The questions are organized in 12 sections. While the checklist has been constructed to prepare laboratories for International accreditation, the headings are derived from the quality system essentials (QSEs) contained in the quality management system (WHO 2008). (QMS) of the renowned Clinical and Laboratory Standards Institute (CLSI). Sections and points in the SLIPTA checklist:

Section 1: Documents and Records equal 25 point.
Section 2: Management Reviews equal 17 point.
Section 3: Organization and Personnel equal 20 point.
Section 4: Client Management and Customer Service equal 8 point.
Section 5: Equipment equal 30 point.
Section 6: Internal Audit equal 10 point.
Section 7: Purchasing and Inventory equal 30 point.
Section 8: Process Control and Internal and External Quality Assessment equal 33 points.
Section 9: Information Management equal 18 point.
Section 10: Corrective Action equal 12 point.
Section 11: Occurrence Management and Process Improvement equal 12 point.
Section 12: Facilities and Safety equal 43 point .Total score -TOTAL 258 (WHO (2011).

## 1.4 Hospital size and performance:

The most obvious measure of hospital size that comes to mind is bed capacity. However, this is not an adequate standard, if size is defined as the average number of patients for whom care can be provided in an optimal manner. Since hospital admissions (and discharges) are to a large extent randomly distributed in time, a hospital administrator must operate his institution, on the average, at a level of occupancy some what lower than maximum capacity in order foreseen variations in demand. Because the relative degree of variation in census level is greater for small hospital than it is for large institutions, small hospitals must operate at lower aver occupancy than large hospitals to maintain the same probability of having available beds.Thus, using number of beds to measure hospital size,the size of small hospitals.One solution to this problem is to use an adjusted bed size measure, which may be determined by subtracting average number of unoccupied beds at each size level from reported bed capacity figures. Another solution is to use average daily census (i.e., actual output) as an estimate of size. Each of these variables is subject to some degree of error as a measure of the capacity of a hospital to provide care for a given average number of patients in an optimal manner. The use of average daily census as a size measure involves the implicit assumption that all of the factors used in producing care, such as building space, equipment, and personnel, have been adjusted to a level appropriate to each hospital's aver -age output. Since utilization cannot be predicted perfectly and because there is an inevitable time lag between changes in average output and the quantity of productive factors utilized, some hospi tals will be operating at average output levels for which they were not design JOHN .C and PAUL .J. 2018

## 1.5 Problem statement:

A growing body of literature has examined biosafety performance around the world. In some regions, biosafety performance has significantly increased, but in Developing countries, there is still a need to improve biosafety practices, especially diagnostic laboratories in Africa, where biosafety performance has been compromised because of poor administrative controls and unavailability of Biosafety facilities. Lack of awareness of biosafety measures and practices among clinical laboratory personnel and inadequate supply of biosafety equipment are the main reasons for poor biosafety performance. Negligence with respect to all major practices, personal protective equipment (PPE), and risk assessment was observed. Moreover, there was no system of Laboratory associated infections (LAI) Reporting in place, and knowledge and training of biosafety were below the standards.

The present study attempted to examine the current situation of biosafety performance by assessing the awareness level and practices of technical staff and by inspecting the availability of biosafety facilities and equipment provided for clinical laboratory workers to keep themselves and the environment safe from Outbreaks of any occupational infection by using

WHO safety standard form for African region where safety has the higher score in who-slipta check list laboratories is divided into :large and small according to hospital size.

## 1.6 Rationale for the study:

At present in Sudan there is paucity of data on the level of knowledge and awareness of biosafety practices amongst clinical laboratories in Sudan. Laboratory practice is a novel emerging field in Sudan and it is essential that biosafety practices which are a key element of good laboratory practice be elucidated.

My aim is to assess the prevalent practices of laboratory scientists towards biosafety measures in their daily practices in their respective laboratories. This study on their practices regarding biosafety measures among laboratory scientists would serve as a baseline for their level of compliance with standard safety practices and help to design programs for training on biosafety for laboratory technicians and technologists working in clinical laboratories in Sudan.

## 1.7 Objectives:

A. The aim of this study is to find out the level of awareness and biosafety measures taken by laboratory staff in selected public diagnostic laboratories in Khartoum.
B. To analyze results and obtain the difference between large and small hospitals in applying biosafety.
C. To identify the major gaps in safety performance.
D. To recommend biosafety improvements in those labs.

### 1.8 The study hypotheses:

The study was based on following null hypotheses:

H0: There is no statistically difference in safety awareness and performance in selected hospital laboratories in (small-large) hospitals.

H1: There is statistically difference in safety awareness and performance in selected hospital laboratories in (small-large) hospitals.

### 1.9 Questions of the study:

The study tries to answer the following questions:

A. What is perception of safety among lab staff?
B. What is the degree of knowledge of universal precautions among lab staff?
C. Where are major gabs in safety performance in the lab system?

### 1.10 Scale:

A self-administered questionnaire was constructed, consisting of 2 parts.

Part I:

Collected demographic data, including age, gender, years of experience in job, level of education and occupation.

Part II:

Asked respondents if they had heard about "universal precautions", and then measured knowledge of universal precautions and investigated their practice towards universal precautions in questions about use of protective devices, disposal of sharps, and decontamination of spills and used articles. The statements measuring knowledge of and practice towards universal precautions were based on the universal precautions guidelines recommended by WHO .The content validity of the questionnaire was assessed using the ideas of WHO-Afro SLIPTA checklist.

### 1.11 Ethical considerations:

The research proposal was sent to the hospital managers for approval in order to gain access to the staff and the information about the study was provided to the participants and the anonymity and confidentiality of the responses, voluntary participation and the right to refuse participation were emphasized.

### 1.12 Limitation of the study:

a) Time frame:

This study from January to July, Such studies need long time.

b) Spatial limits:

The study conducted in only eight public hospitals.

Objective limits:

This study focus on biosafety as one factor of accreditation.

## 1.13 Terminology of the study:

a) Biosafety:

Laboratory Biosafety is described as a safe method for managing infectious agents in laboratory environment, where they are handled and maintained.

b) Universal precautions:

An approach to infection control to treat all human blood and certain human body fluids as if they were known to be infectious.

c) WHO-afro:

World health organization for African region.

d) SLAMTA:

Strengthening Laboratory Management toward Accreditation (SLMTA) is a competency-based management training program designed to bring about immediate and measurable laboratory improvement.

e) SLIPTA checklist:

Stepwise Laboratory Quality Improvement Process towards Accreditation (SLIPTA) checklist.

f) SOPs:

Standard operating procedures.

g) PPE:

Personal protective equipment's.

h) MSDS:

Material safety data sheet.

i) PEP:

Means taking antiretroviral medicines after being potentially exposed to HIV to prevent infection.

j) LIA:

Laboratory associated infection.

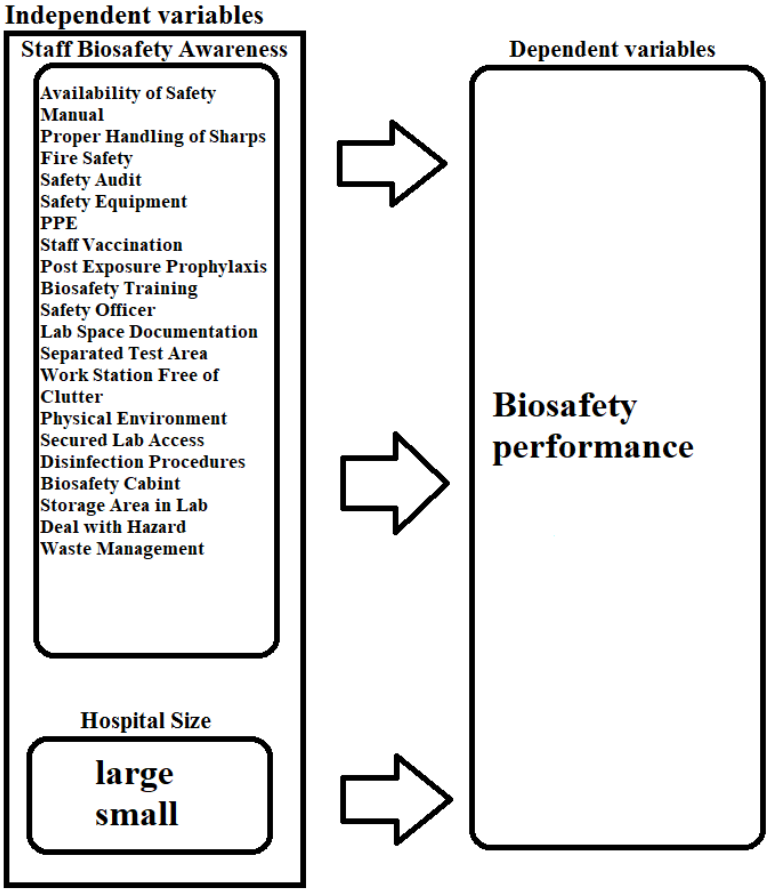
## 1.14 Conceptual Framework for Biosafety performance:

Many research studies recently examined the efficacy of biosafety systems in Sudan (alduma 2012; idresn af et all 2015 and ceza M 2016). Each study led to the development of a set of specific recommendations for enhancing the biosafety performance in sudan. The studies

reviewed biosafety performance against a concept which views biosafety as having common elements:

- the regulations or guidelines clearly define the structure of the biosafety system and the roles and responsibilities of those involved, and how the review process is to operate
- the people involved are knowledgeable and well trained

accrording to previous information 20 variables tested to measure biosafety performance they are :



# Chapter Two

## Chapter II

## 2. Literature review

2.0 Introduction: A growing body of literature has examined biosafety performance around the world. In some regions, biosafety performance has significantly increased, but in Developing countries, there is still a need to improve biosafety practices, especially diagnostic laboratories in Africa.

**2.1 Biosafety performance:**

2.1.1 Biosafety Performance in 5 Selected Hospital Medical Laboratories in Pakistan Karachi by Fahmida et al 2017 it was cross-sectional descriptive study of 120 medical laboratory staff.

The goals of the study were to:

A. Assessed biosafety performance.
B. Assessed the supply of biosafety facilities and equipment to keep lab workers and surrounding environment safe from an outbreak of infectious diseases.

The results of the study were:

A. Biosafety awareness recorded among 5 laboratory technical staff was moderate 72%.
B. Major gaps identified with reference to biosafety measures were in administrative controls, standard microbiological practices, and facility design Secondary barriers.
C. There is an adequate supply of simple personal protective equipment like gloves, goggles, masks, and lab coats. However, complex equipment, such as eyewash stations and biological safety cabinets, is not available in many laboratories.
D. In Karachi, Pakistan, biosafety performance is compromised in most of the laboratories, but better performance also is demonstrated by laboratories that are accredited and certified.

**2.1.2** Standard precaution knowledge and adherence:

Do Doctors differ from Medical Laboratory Scientists? Nigeria Anne C. Ndu1 Sussan et al 2016

it was a cross sectional study done at University of Nigeria Teaching Hospital, A semi structured pre-tested questionnaire was the study instrument. This study is aimed at comparing adherence and knowledge of standard precautions (SP) among Medical Laboratory Scientists (MLSs) and doctors. General knowledge of SP was high,76.2% in doctors and 67.6% in MLSs although there were differences between the two groups on the knowledge of components of SP. Safe injection practices, use of personal protective equipment as well as safe handling of contaminated equipment or surfaces was higher amongst doctors. Even though more than half of respondents in groups, 53.1 % among doctors and 58.1% among MLSs had received training on standard precautions, this did not reflect in the practice. MLS reported more use of personal protective equipment such as gloves and coveralls (100% in MLS and 35% of doctors), $P<0.001$.

Recapping of syringes was higher amongst doctors (63.6%) than MLS (55.1%).The doctors practiced better hand hygiene than MLS (P<0.001). Constraints that affected SP included non-availability of PPEs and emergency situations for both groups

**2.1.3** Compliance with Universal Precautions among Nurses and Laboratory Technicians in Mansoura International Specialized Hospital Egypt Sahar Mamoud Sayed Ahmed et al 2008

A cross-sectional descriptive design was used for conducting this study, data were collected using questionnaire and an observation checklist, compliance with universal precautions by nurses and laboratory technicians in hospitals is very important because it prevent cross infection and decrease costs of antibiotics and antipyretics. Also, it decreases spread of infection, which leads to decrease morbidity and mortality. The study revealed that majority (86.66%) of the studied sample of nurses and lab technicians aged less than 30 years. Also, majority of the studied sample have poor knowledge about sign and symptom and transmission of AIDS. In addition, about 94% of the studied samples have poor knowledge about signs, symptoms and mode of transmissions of hepatitis B and C virus infection. All of the studied sample reported that there are no eye protections in the hospital. Positive correlations between nurses' and lab technicians' practice and available supplies in the hospital were found, but the relations were not statistically significant. The exception was the item of the infection prevention ways which has a significant statistical relation. Also, positive correlations between lab technicians' and nurses' practice and their attending for training courses about infection control were found, but the relations were not statistically significant.

**2.1.4** Assessment of biosafety precautions in Khartoum state diagnostic laboratories:

A total number of 190 laboratories were surveyed about their compliance with standard biosafety precautions. These laboratories included 51 (27%) laboratories from government, 75 (39%) from private sectors and 64 (34%) laboratories belong to organization providing health care services. This study was conducted to evaluate the biosafety precautions that applied by diagnostic laboratories in Khartoum state. The study found that 32 (16.8%) of laboratories appointed biosafety officers. Only, ten (5.2%) participated in training about response to fire emergency, and 28 (14.7%) reported the laboratory accident occurred during work. 45 (23.7%) laboratories had a written standard operation procedures (SOPs), and 35 (18.4%) had written procedures for the lean-up of spills. Moreover, biosafety cabinet was found in 11 (5.8%) laboratories, autoclave in 28 (14.7%) and incinerator in only two (1.1%) laboratories. Sharp disposable containers were found in 84 (44.2%). Fire alarm system was found in 2 (1.1%) laboratories, fire extinguisher in 39 (20.5%) laboratories, and fire emergency exit found in 14 (7.4%) laboratories. Furthermore, 19 (10%) laboratories had a hepatitis B virus vaccination

program, 5 (6.2%) applied BCG vaccine, and 2 (1.1%0) vaccinated the staff against influenza. (Sudan Adel Hussein Elduma 2012).

**2.1.5** Knowledge and practices of healthcare workers and medical students towards universal precautions:

This was a cross sectional survey. The sample was  medical staff 540 health care workers investigated knowledge and practices towards universal precautions among 540 health care workers in 2 university hospitals in Mazandaran Province, Only 65.8% and 90.0% staff in the 2 hospitals and 53.5% of medical students had heard about universal precautions. Overall, there was a low understanding of precautions, except disposal of sharps, contact with vaginal fluid, use of mask and gown or cleaning spilled blood. Good practices were reported regarding hands washing, disposal of needles, and glove, mask. (Hospitals in Mazandaran Iran N. Mohamed et al 2008).

**2.1.6** Evaluation of Laboratory Biosafety in Khartoum State Primary HealthCare Centers:

Prospective Cross-sectional study, this study was designed to assess the biosafety precautions in primary care health centers in Khartoum state. Diagnostic laboratories in seven localities were selected by stratified simple random sampling technique.

Among 33 laboratories, 0 (0.0%) were appointing a biosafety officer. 0 (0.0%) supplied with an alarm system, have trained personnel, and have fire exit. Provision of personnel protection, 12 (36.4%), always wearied laboratory coat, 6 (18.2%) personnel used gloves with every procedure, 25 (75.8%) washed their hands regularly. All laboratories, 33 (100%) have cleaning personnel, and in 21 (63.3%) removal of infectious material waste was done daily. Vaccination program for hepatitis and tuberculosis were identified in 16 (48.5%) of the laboratories. (Sudan Idris AF et al 2015).

**2.1.7** Assessment of facilities and safety in national public health laboratory:

Descriptive case study conducted in national public health laboratory Assess the quality management system in facilities and safety in the laboratory and assess lab design, safety equipment, Personal safety, chemical safety and waste management system The study conducted that some variables were well established such as bench design easy to clean, other variables are not well established such as adequate illumination some variables are not available such as radioactive waste containers. (Ceza mukhtar obied 2016).

**2.2 study of bio-medical waste management:**

Cross sectional study was carried out in rural hospital, Delhi on 155 health care workers and the objective of the study was to find out level of knowledge, attitude and practices of health care workers (HCWs) about bio-medical waste management the researcher found that Almost all (97.4%) HCWs aware of bio-medical waste management rules and have very positive attitude. Practice of HCWs regarding bio-medical waste management was relatively poor. (India by Gajanan C. Soyam et al 2017).

**2.3 A step towards health care worker safety by reducing the risk of sharp injuries:**

The researcher used The PDSA Plan-Do-Study-Act model, continuous quality improvement (CQI) tool was used to decrease the preventable ex-posure to sharp injuries. (Pakistan Zohra R. Rafique Iqbal et al 2017).

2.3.1 The objectives of the study:

A. Reduce number of exposure from sharp injuries by educational training and safeguard interventions.
B. Decrease exposure of sharp injuries from unknown source which will automatically decreases cost of hospital and stress of HCW The data was analyzed by interviewing all exposed staff and identified the loop hole to prevent sharp injuries. Educational sessions were conducted

**2.4 Training improve biosafety practices among health care workers:**

Conduct a 36 questions survey in 2013 (before training session) to gather information about biosafety awareness. Questionnaire consists on basic questions related to general laboratory practices, biosafety levels and waste management. Afterwards, conduct surveys after training sessions and workshops in 2014 and 2015.

The objective is to carry out inter-departmental surveys in lab regarding the awareness of biosafety practices before and after biosafety training sessions during last three years. The results showed that before training session 32% of the participants were aware of biosafety level being used in their lab whereas after the session this percentage increased to 72% in 2014 and 80.9% in 2015. Awareness regarding proper management of hazardous waste increased from 32% to 64% and in 2015 it increase to 71%. The incident reporting, proper disinfection, usage of PPE and hand hygiene was previously reported to be 40%, 65%,48% and 52% that increased to 80%, 85%,76% and 88% in 2014 and 95%,86%,90%,90%in 2015 respectively after the training sessions. (a three years personal experience: Pakistan amna sheerin et al 2016).

## 2.5 Risk assessment:

**2.5.1** Risk assessment in laboratories:

The development of the risk assessment tool was based on the BMBL, WHO, CDC, and CWA 15793. This tool was distributed and tested in 10 governmental hospitals. Data was analyzed to determine a risk ranking for each laboratory. The objective of this project was to develop a risk assessment tool to use in Jordanian governmental hospital labs, analyze the data to identify areas of improvement, and base future field visits on risk ranking of laboratories to monitor implementation. Labs were ranked on risk from high (10) to low (1) in the following areas: facilities, hazard communication, lab acquired infections, risk of agents processed, and policies. An overall risk ranking was assigned to each laboratory by averaging the risk ranking in all categories. Results indicated that laboratories with the highest risk ranking were those where lab accidents and lab acquired infections had been reported. The lab with the lowest risk ranking was an accredited laboratory by the Health Care Accreditation Council showing that QA/QC accreditation may play a role in enhancing laboratory safety. (Jordan ghaya alwahdani 2016).

**2.5.2** Knowledge of Hepatitis B Transmission Risks among Health Workers:

HBV paper survey in two northern Tanzanian hospitals

Evaluation of HBV knowledge among health-care workers in rural Tanzania by distributing an HBV paper survey in two northern Tanzanian hospitals. There were 114 participants (mean age 33 years, 67% female). Of the participants, 91% were unaware of their HBV status and 89% indicated they had never received an HBV vaccine, with lack of vaccine awareness being the most common reason (34%), whereas 70% were aware of HBV complications and 60% understood routes of transmission. There was a significant difference in knowledge of HBV serostatus and vaccination between participants with a medical background and others, P = 0.01and 0.001, respectively. However, only 33% of consultants (senior medical staff) knew their HBV serostatus. There was no significant difference between knowledge of HBV transmission routes and occupation. Our study reveals low knowledge of HBV serostatus and vaccination status among hospital workers in Tanzania. (Tanzania Jose D. Debes et al 2016).

**2.5.3** Bio risk Assessment of Medical Diagnostic Laboratories:

A total of 80 diagnostic laboratories in biosafety level 3 were assessed for the presence of biosafety equipment, devices, and compliance rate with biosafety practices. A detailed questionnaire and checklist was used to obtain the relevant information from enlisted laboratories. The aim of this study was to assess public and private medical diagnostic laboratories in Nigeria for the presence of biosafety equipment, devices, and measures. The results showed the presence of an isolated unit for microbiological work, leak-proof working benches, self-closing doors, emergency exits, fire extinguisher(s), autoclaves, and hand washing sinks in 21.3%, 71.3%, 15.0%, 1.3%, 11.3%, 82.5%, and 67.5%, respectively, of all laboratories surveyed. It was observed that public diagnostic laboratories were significantly more likely to have an isolated unit for microbiological work (p ¼ 0.001), hand washing sink (p ¼ 0.003), and an autoclave (p 0.001) than private ones. Routine use of hand gloves, biosafety cabinet, and a first aid box was observed in 35.0%, 20.0%, and 2.5%, respectively, of all laboratories examined. Written standard operating procedures, biosafety manuals, and biohazard signs on door entrances were observed in 6.3%, 1.3%, and 3.8%, respectively, of all audited laboratories. No biosafety officer(s) or records of previous spills, or injuries and accidents, were observed in all diagnostic laboratories studied, (Nigeria Bankole Henry Oladeinde et al 2013)

**2.6 Evaluation of Hospital Laboratories :**

A cross-sectional study design, quantitative method and direct observation were conducted in five public and private laboratories in Addis Ababa and Adama, Ethiopia between 2015 and 2016. To evaluate the existed hospital laboratories design setup and proposed new laboratory design in Addis Ababa and Adama, Ethiopia Floor plan was available and posted in all laboratories. Three of labs were not initially designed for the laboratories. The adjoining and adjacent matrix principles were not documented in assessed laboratories. The laboratory design didn't have proper exist doors and show the direction of evacuation plan during emergency situation and fire extinguisher were not strategically placed and free of obstruction. Laboratories did not have any mechanical ventilation system. Laboratory and non-laboratory activities were not separated. The exited lab design didn't accommodate future demands. (Ethiopia Eshetu LH et al 2017).

**2.7.1** Assessing the outcome of Strengthening Laboratory Management towards Accreditation (SLMTA):

The study used an Institutional based cross sectional study design that employed a secondary and primary data collection approach on the participated institution of medical laboratory in SLMTA. The aim of this study is to assess the outcome of SLMTA on laboratory quality management system included implantation of biosafety in labs in Addis Ababa, Ethiopia The assessment finding indicate that there was a significant improvement in average scores (141.4;

range of 65-196, 95%CI =86.275-115.5, p = 0.000) at final with 3 laboratories become 3 star, 6 laboratories were at 2 star, 11 were 1 star. Laboratory facilities respondents which thought getting adequate and timely manner mentorship were found 2.5 times more likely to get good success in the final score(AOR= 2.501, 95% CI= 1.109-4.602) than which did not get it. (Addis Ababa Ethiopia Abay Sisay et al 2015)

**2.7.2** Assessment Criteria for Accreditation of Government Hospitals' Laboratories in Sudan according to the international standards.

The present study designed descriptive Series of case studies in thirty eight Government Hospitals' Laboratories located in Khartoum state, the intervention application of Continuous Quality Improvement techniques to assess laboratories processes; total Quality Systems standards into laboratories were measured by Checklist contain standards elements and score of each element was conducted according to their importance of international standards. The quality control in this study was carried out for 15 tests, used control sera. The study aimed to assessment Governmental hospital's laboratories situation and their performance according to international standards scale. -Results availability of international standards for total quality management implementation in the laboratories is between 36% -86% the mea 65%, the safe laboratory design and organization 77.5%, laboratory organization 48.5%, document and management system 45.5%, quality of personnel management 55.5%.

The observed errors of laboratories in the pre-analytical phase of testing were 60% and 37% in analytical phase, only 3% errors was reported in the post- analytical phase, continual improvement for laboratories auditing 26% . The quality control program 67% had internal quality control, 33% had national quality control, and the acceptability of quality control results for all laboratories was 72%, total absolute error 55.56%, inaccuracy (variation) 11.5%, imprecision CV 25.1%. (Khartoum State – Sudan. Abdalla Eltoum Ali et al 2015).

# Chapter Three

# Chapter III

## 3. Methodology

### 3.1 Study design:

Cross-sectional study.

### 3.2 Study setting:

The study was conducted in Khartoum state in 8 chosen hospital laboratories.

### 3.3 Study period:

January 2018 – July 2018.

### 3.4 Study subject:

Diagnostic laboratories in Khartoum state represented as study subject which included laboratories belonged to government.

### 3.5 Sampling Plan:

Technical staff from 8 different public-sector hospital medical laboratories was selected for data collection those hospital laboratories located in Khartoum Bahry, Khartoum and Omdurman. Hospitals were selected considering feasibility and responses from management. Among those 8 hospitals (large and small laboratories from each) simple random sampling of staff randomly select 150 technical staff from laboratories.

### 3.6 Sample size:

Sample was calculated according to the sample size equation

N = Z2pq/d2, n = number of study population participated in the study,

Z = constant, p= previous data, q = 1-p, d = level of confidence

### 3.7 Sampling technique:

Stratified simple random sampling technique was used in selecting laboratories.

### 3.8 Data collection and analysis:

A designed questionnaire and checklist were used to collect data from laboratories. Many variables were involved in these two data collection tools. Variables were characterized in to; variables for safety precaution measures at workplace, variables for personal protection equipment, and variables for services provided inside laboratory. In addition to that, variables of essential biosafety equipment, risk determination, fire prevention and vaccination programme were also included in data collection tools. Data entered and analyzed by statistical package SPSS (Statistical Package for Social Science)

# Chapter Four

# Chapter IV

## 4. Results

### 4.0 Introduction:

Safety awareness from a personnel safety point of view may be explained as being responsible, not overestimating one's own self-confidence, and taking a cautious attitude to control one's behavior. The eight hospitals are subdivided into (large and small) according to size, departments and number of patients

### 4.1 Demographic:

Among 150 studied laboratory personnel, most of the staff was technologists/scientists (97.3%) with mean age –less than 25 years (49.3%), The proportion of female staff was high(84%) compared to male staff .Experience of- less than 5 years -was predominant at (70.7%).Most staff had completed graduate degrees and post graduate degree (75.3%and 22 %, respectively) the. about (70%) of the studied staff worked in the morning shifts (33.3%) work full time (table 1). Further details are presented below:

### 4.2 biosafety performance:

After Analyzing the 20 determinant of safety performance in selected laboratories the results were as follow: 10 of those factors (availability of safety manual 4% –safety officer 8% -safety cabinet 2.7%,dealing with hazard according to MSDS 12 %,fire safety 11.3% ,safety audit

0.7%,staff vaccination 12%,post exposure prophylaxis 0.7% ,biosafety training 3.3% and lab space documentation 2%) Results are consistent with existing theories show that laboratories biosafety performance in Sudan is low. the other 7 factors are much better than the previous factors (handling of sharps 58% ,PPE 58%,speperated test area 91.3 % suitable work station72.7% ,good physical environment 58.7% use of disinfectant 72.7% and secured lab access61.3%.the respondents said they have insufficient data about the 3 remaining factors (waste manage 70% and secured storage area44.7% use of safety equipment's 68.7% )tables 7-46

**4.3 test of hypothesis:**

The data was analysed using the chi-squire Pearson correlation. Decision rule for acceptance or rejection of hypothesis was to accept alternative hypothesis and reject the null hypothesis if returned p-value of correlation test (r) is <0.05 (0.05 being the level of significance) and vice versa.

4.4 test hypothes: there is no statically difference in safety performance between large and small hospitals? the returned p-value for the first hypotheses

Results: there is statistically difference in large and small laboratories in handling of sharps (P value: 0.001),use of PPE p(0.01),Staff vaccination p(0.01), pointed of safety officer p(0.0),separated test area p(0.00) and secured lab access p(0.0).

There is no statistically difference in safety performance between large and small hospital: in availability of safety manual p.value 0.7,fire safety p value 0.6,safety audit p.value 0.2 ,availability of safety equipment p.value 0.8 ,deal with post exposure prophylaxis p.value 0.9,have documentation for biosafety training p.value 0.6, laboratory space documentation p:0.2, neat work station p:0.5,acceptable physical environment p:0.8 and availability of biosafety cabinet 0.6.

**Results**

Test of Honesty and Consistency:

**Table 1:** Reliability Statistics

| Cronbach's Alpha | N of Items |
|---|---|
| .947 | 76 |

As the above shown table, the value of Alpha Coefficient is acceptable to judge the reliability of the questioner

**Table 2:** Demographic: Age

| | Frequency | Percent |
|---|---|---|
| Less than 25 | 74 | 49.3 |
| 25 To 30 | 43 | 28.7 |
| More Than 30 | 33 | 22.0 |
| Total | 150 | 100.0 |

**Table 3:** Demographic: Sex

| | Frequency | Percent |
|---|---|---|
| Male | 24 | 16 |
| Female | 126 | 84 |
| Total | 150 | 100 |

**Table 4:** Demographic: Years of Experience

| | | Frequency | Percent |
|---|---|---|---|
| Valid | Less Than 5 | 106 | 70.7 |
| | 5 To 10 | 21 | 14.0 |
| | More Than 10 | 23 | 15.3 |
| | Total | 150 | 100.0 |

**Table 5:** Demographic: Job Description

| | | Frequency | Percent |
|---|---|---|---|
| Valid | Full Time | 50 | 33.3 |
| | Part Time | 35 | 23.3 |
| | Other | 65 | 43.3 |
| | Total | 150 | 100.0 |

**Table 6:** Demographic: Certificates

| | | Frequency | Percent |
|---|---|---|---|
| | Bachelor | 113 | 75.3 |
| | Post Graduate studies | 33 | 22.0 |
| | Diploma | 4 | 2.7 |
| | Total | 150 | 100.0 |

Table 7: availability of safety manual Frequency

| | Frequency | Percent |
|---|---|---|
| yes | 6 | 4.0 |
| no | 92 | 61.3 |
| In .Data | 52 | 34.7 |
| Total | 150 | 100.0 |

Table 8: availability of safety manual Frequency Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 0.549 | 2 | 0.760 |
| N of Valid Cases | | | 150 |

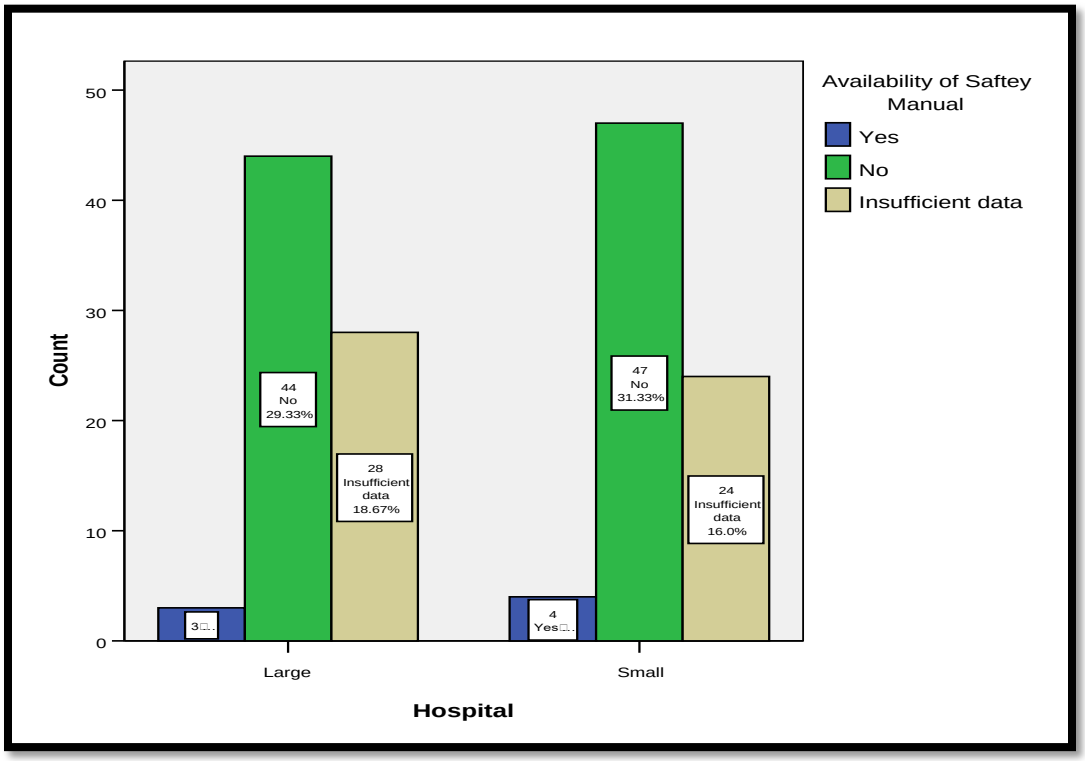



*Figure 2:* Availability of Safety Manual

Table 9: proper handling of sharps frequency

| | Frequency | Percent |
|---|---|---|
| yes | 88 | 58.7 |
| no | 10 | 6.7 |
| In.Data | 52 | 34.7 |
| Total | 150 | 100.0 |

Table 10: proper handling of sharps Chi-Square Tests:

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.072(a) | 2 | 0.001 |
| N of Valid Cases | | | 150 |

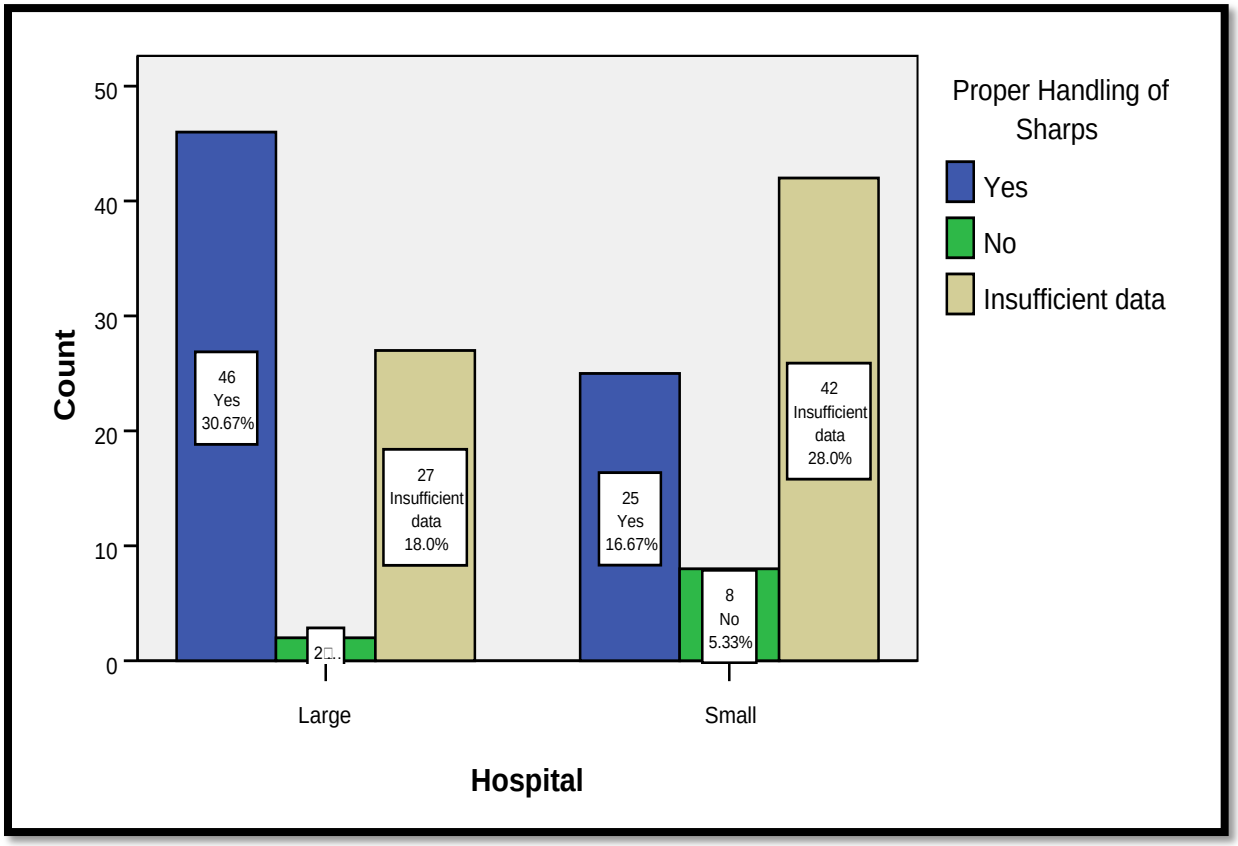



***Figure 3:*** Proper Handling of Sharps

Table 11: fire safety frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 17 | 11.3 |
| | no | 86 | 57.3 |
| | ID | 47 | 31.3 |
| | Total | 150 | 100.0 |

Table 12: fire safety frequency Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.009(a) | 2 | 0.604 |
| N of Valid Cases | | | 150 |

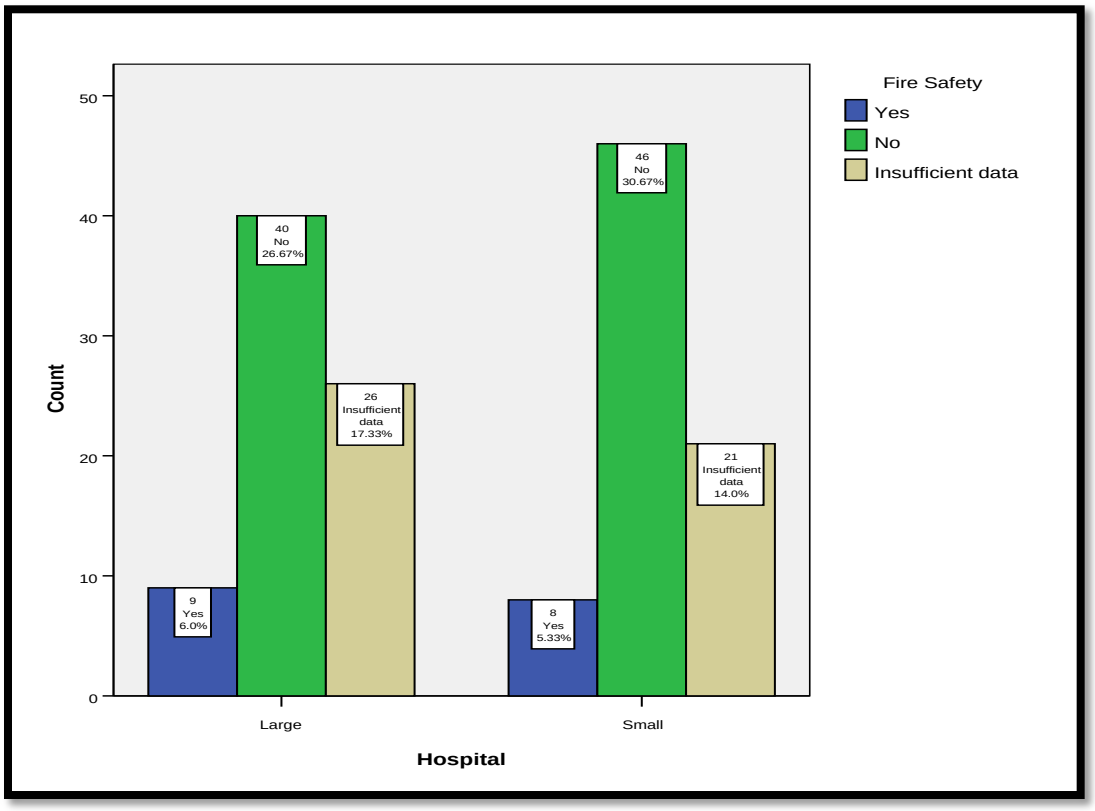



***Figure 4:*** Fire Safety

Table 13: safety audit frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 1 | 0.7 |
| | no | 124 | 82.7 |
| | ID | 25 | 16.7 |
| | Total | 150 | 100.0 |

Table 14: safety audit Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 3.183(a) | 2 | 0.204 |
| N of Valid Cases | | | 150 |

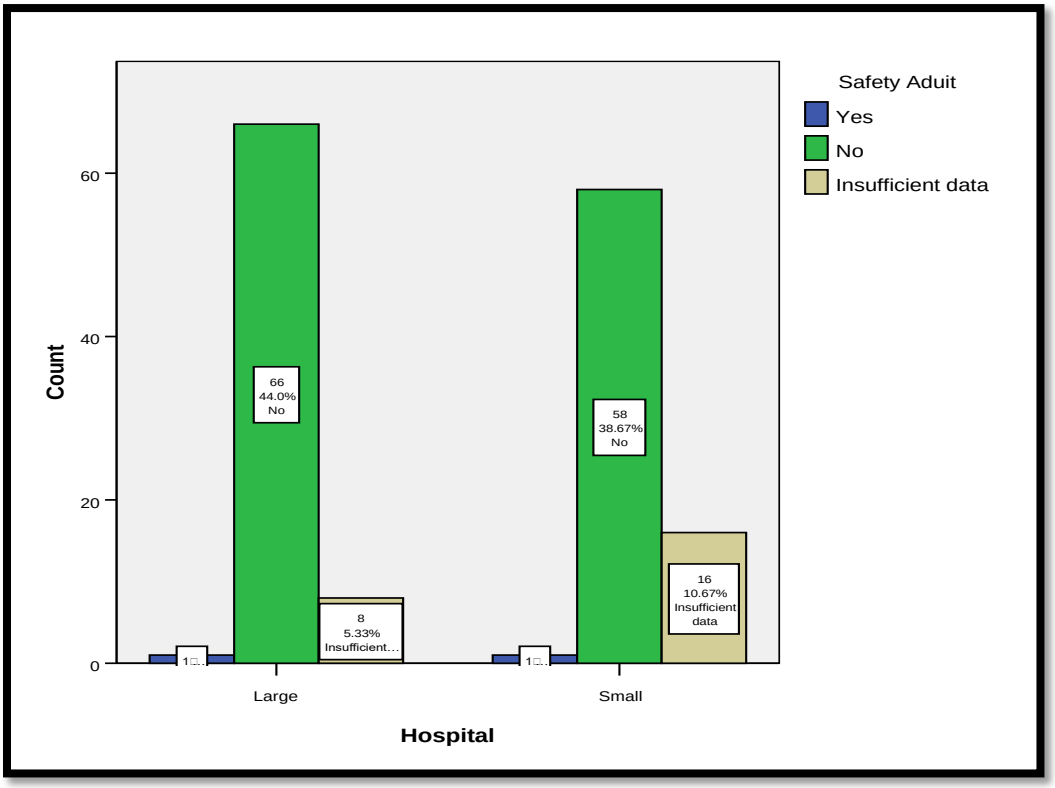



***Figure 5*:** Safety Audit

Table 15: safety equipment uses frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 37 | 24.7 |
| | no | 10 | 6.7 |
| | ID | 103 | 68.7 |
| | Total | 150 | 100.0 |

Table 16: safety equipment uses Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .884(a) | 2 | .643 |
| N of Valid Cases | | | 150 |

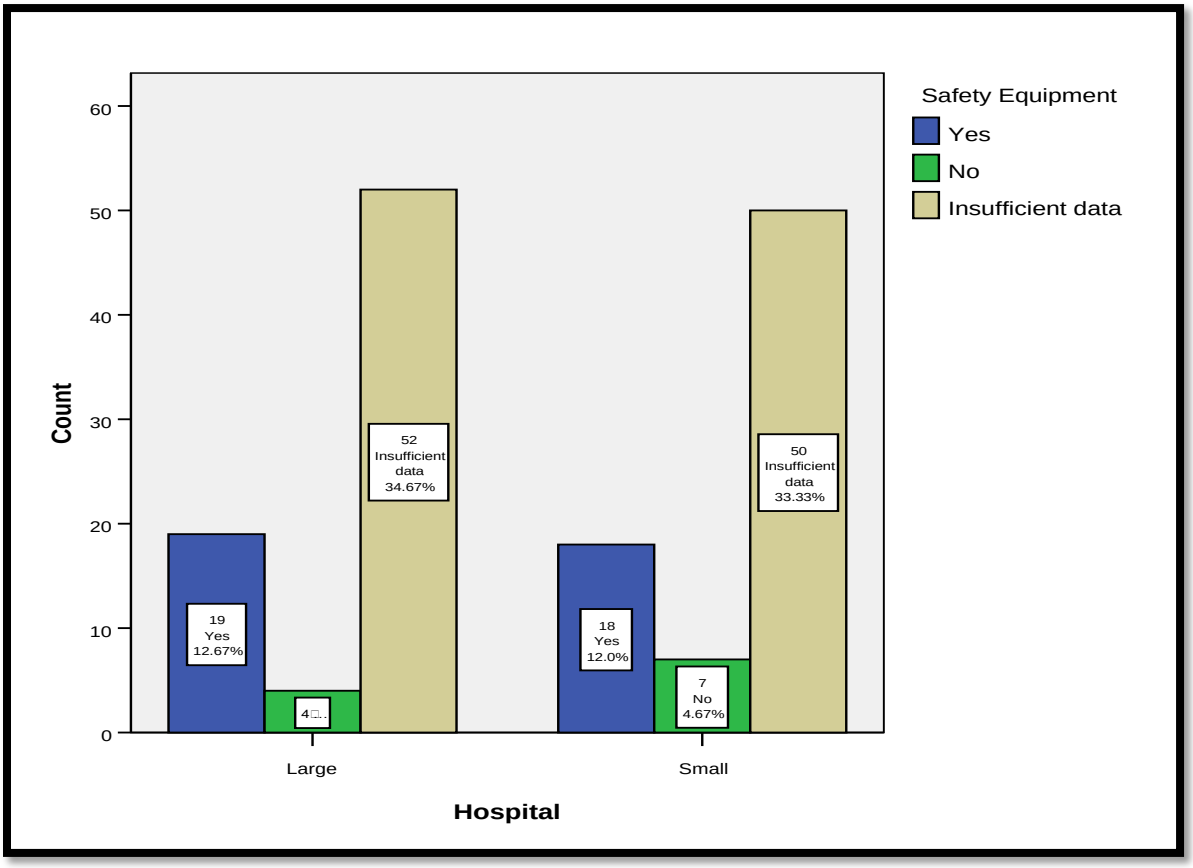



**Figure 6:** Safety Equipment

Table 17: PPE frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 87 | 58.0 |
| | no | 19 | 12.7 |
| | ID | 40 | 26.7 |
| | 4 | 4 | 2.7 |
| | Total | 150 | 100.0 |

Table 18: PPE Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 14.902(a) | 2 | .001 |
| N of Valid Cases | | | 150 |

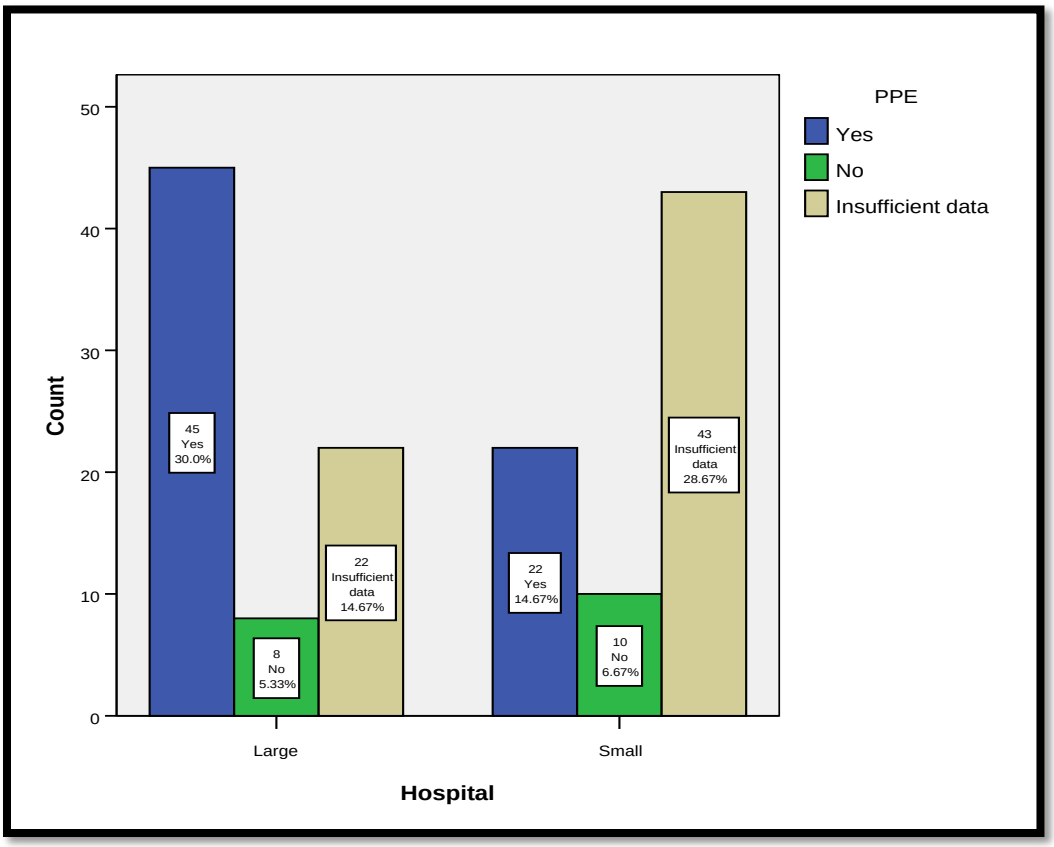



**Figure 7:** PPE

Table 19: staff vaccination frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 18 | 12.0 |
| | no | 92 | 61.3 |
| | ID | 40 | 26.7 |
| | Total | 150 | 100.0 |

Table 20: staff vaccination Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 8.795(a) | 2 | .012 |
| N of Valid Cases | | | 150 |

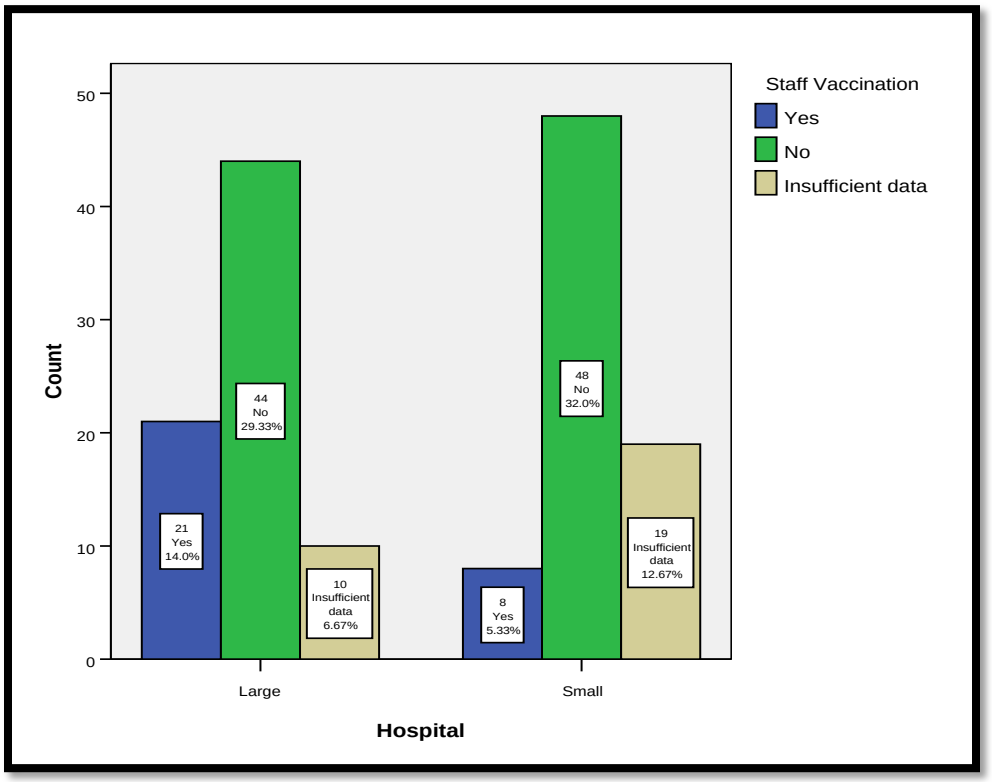



Figure 8: Staff Vaccination

Table 21: post exposure prophylaxis frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 1 | .7 |
| | no | 130 | 86.7 |
| | ID | 15 | 10.0 |
| | 4 | 4 | 2.7 |
| | Total | 150 | 100.0 |

Table 22**:** post exposure prophylaxis Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .060(a) | 2 | .970 |
| N of Valid Cases | | | 150 |

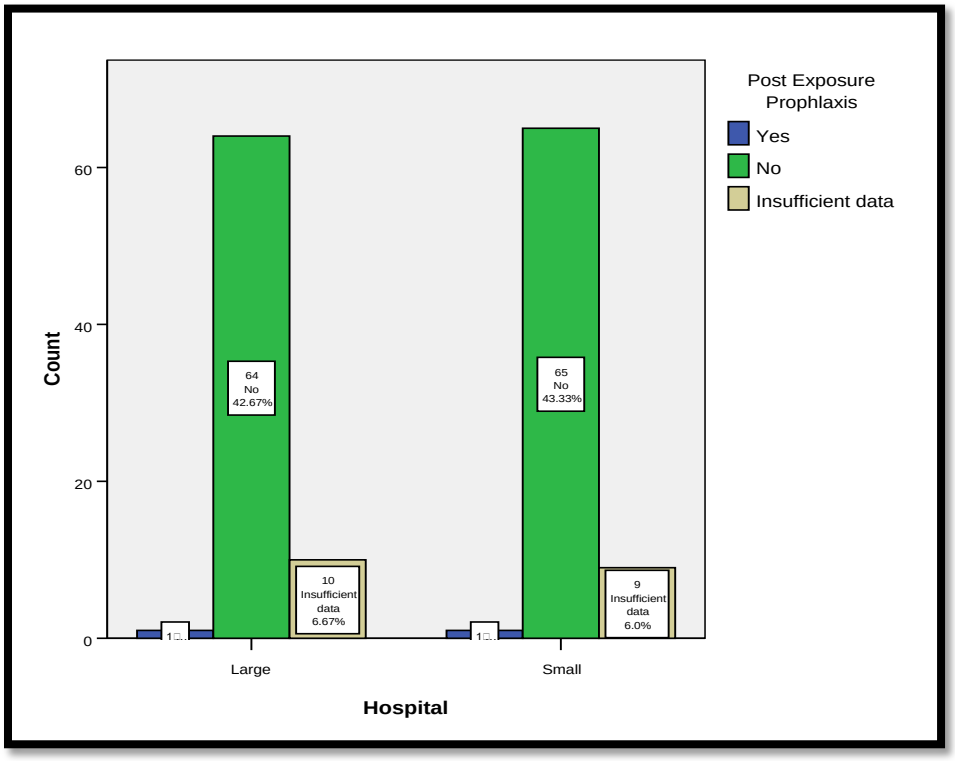



Figure 9: Post Exposure Prophylaxis

Table 23 :bio safety training frequency

| | | Frequency | Percent |
|---|---|---|---|
| Vad | yes | 5 | 3.3 |
| | no | 127 | 84.7 |
| | ID | 18 | 12.0 |
| | Total | 150 | 100.0 |

Table 24 biosafety training Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.016(a) | 2 | .602 |
| N of Valid Cases | | | 150 |

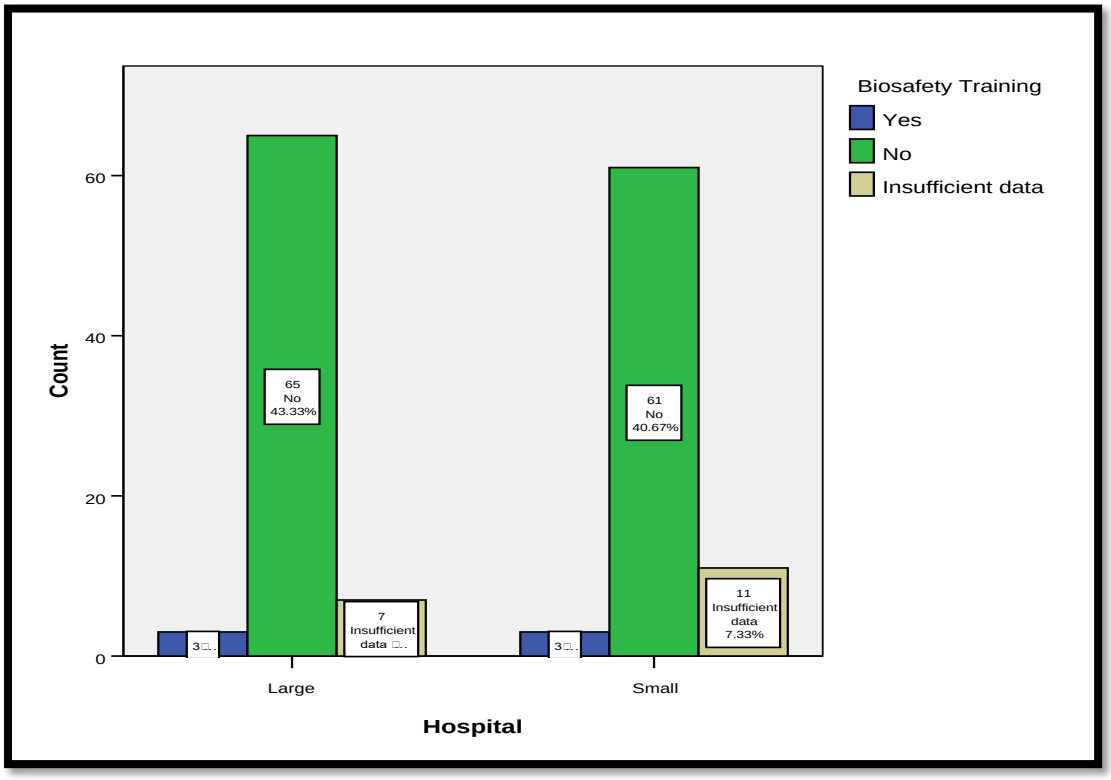



Figure 10 Biosafety Training

Table 25 biosafety officer frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 12 | 8.0 |

| | | |
|---|---|---|
| no | 72 | 48.0 |
| ID | 66 | 44.0 |
| Total | 150 | 100.0 |

Table 26 biosafety officer Chi-Square Test:

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 26.554(a) | 2 | .000 |
| N of Valid Cases | | | 150 |

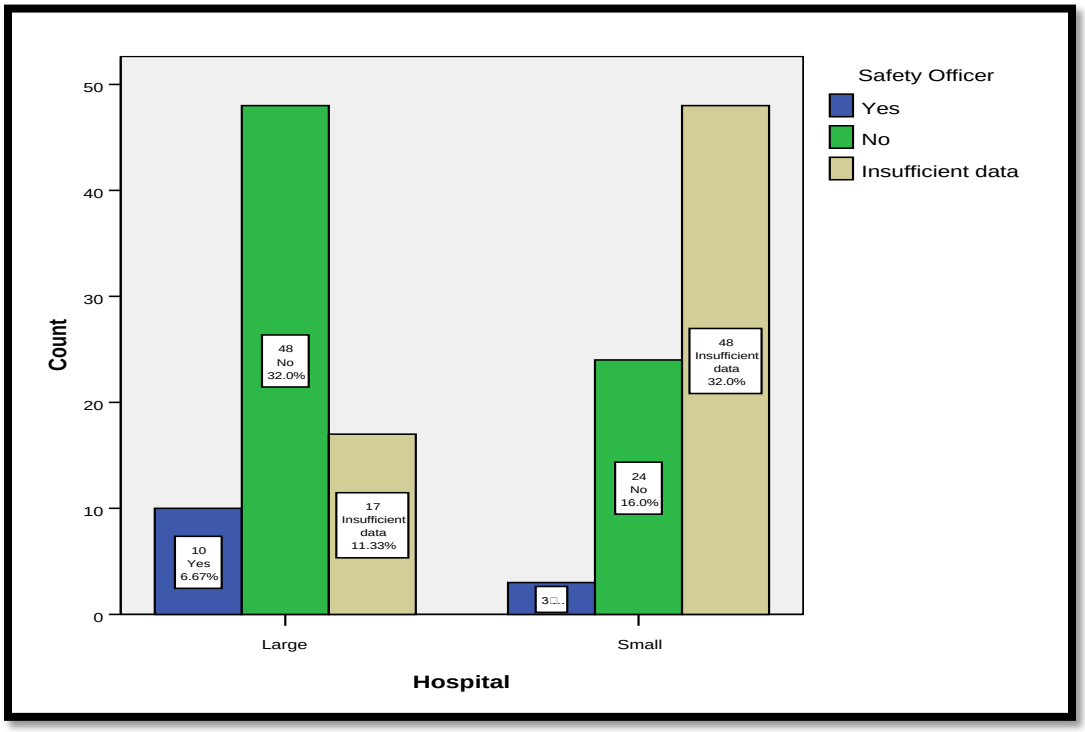



Figure 11 biosafety Officer

Table 27 lab space documentation frequency:

| | Frequency | Percent |
|---|---|---|
| yes | 3 | 2.0 |
| no | 122 | 81.3 |
| ID | 25 | 16.7 |

| | | |
|---|---|---|
| Total | 150 | 100.0 |

Table 28 lab space Chi-Square Test

| | Value | | df | Asymp. Sig. (2-sided) |
|---|---|---|---|---|
| Pearson Chi-Square | 2.818(a) | | 2 | .244 |
| N of Valid Cases | | | | 150 |

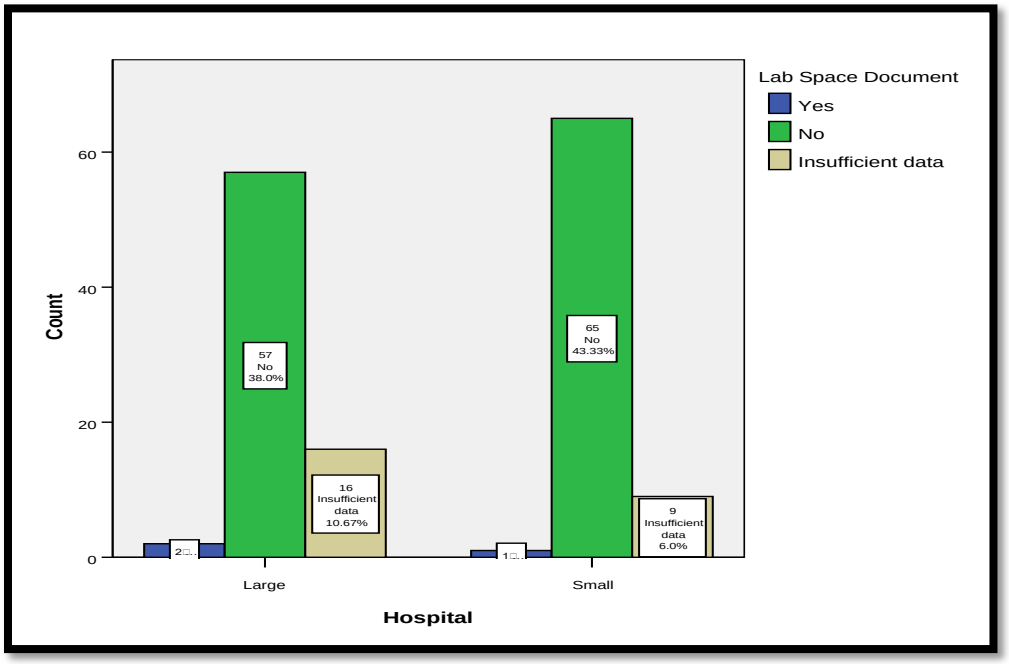



Figure 12 Lab Space Documentation

Table 29 separated test area frequency:

| | Frequency | Percent |
|---|---|---|
| yes | 137 | 91.3 |
| no | 6 | 4.0 |
| ID | 7 | 4.7 |
| Total | 150 | 100.0 |

Table 30 Separated test area Chi-Square Test

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 18.664(a) | 2 | .000 |
| N of Valid Cases | | | 150 |

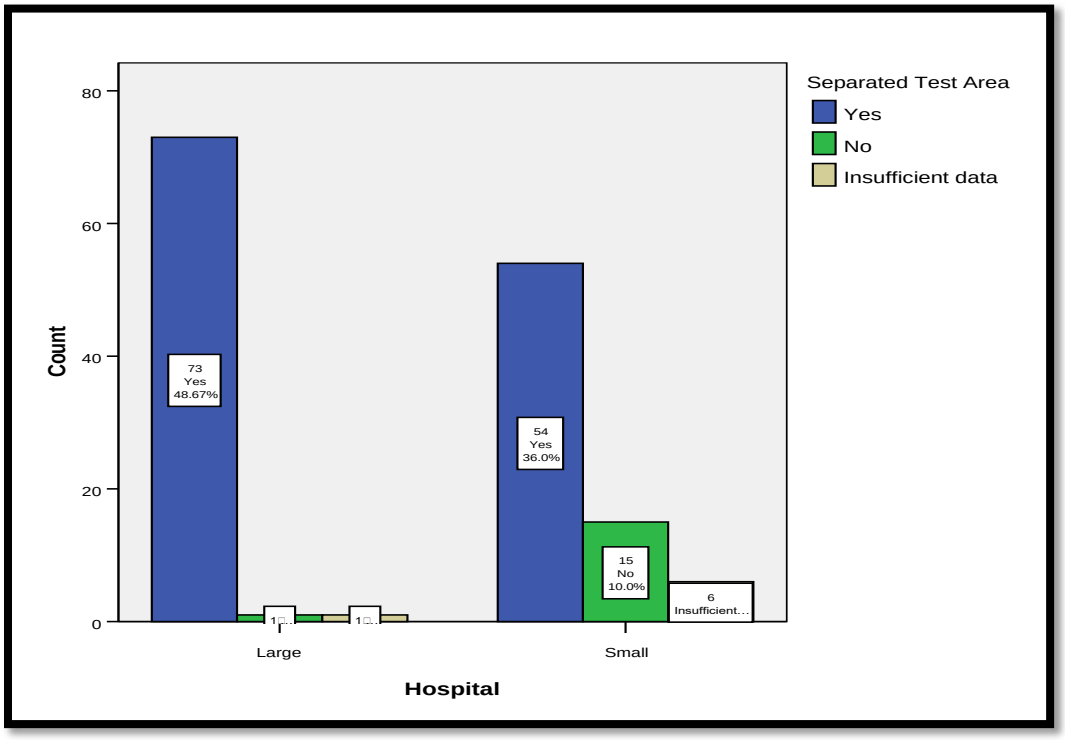



Figure 13 Separated Test Area

Table 31 work station free of clutter

| | Frequency | Percent |
|---|---|---|
| yes | 109 | 72.7 |
| no | 13 | 8.7 |
| ID | 28 | 18.7 |

| | | |
|---|---|---|
| Total | 150 | 100.0 |

Table 32 work station Chi-Square Test

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.317(a) | 2 | .518 |
| N of Valid Cases | | | 150 |

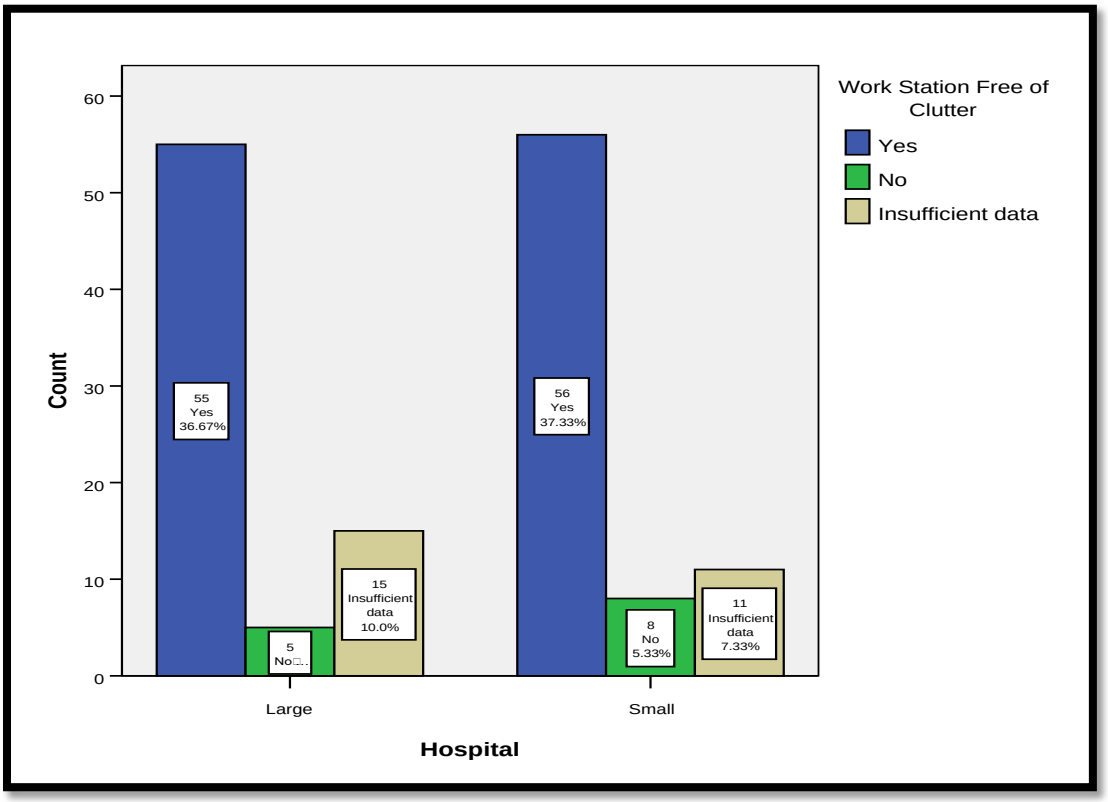



Figure 14 Work Station Free of Clutter

Table 33 physical environment frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 88 | 58.7 |
| | no | 18 | 12.0 |
| | ID | 44 | 29.3 |
| | Total | 150 | 100.0 |

Table 34 physical environment Chi-Square Test

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .251(a) | 2 | .882 |
| N of Valid Cases | | | 150 |

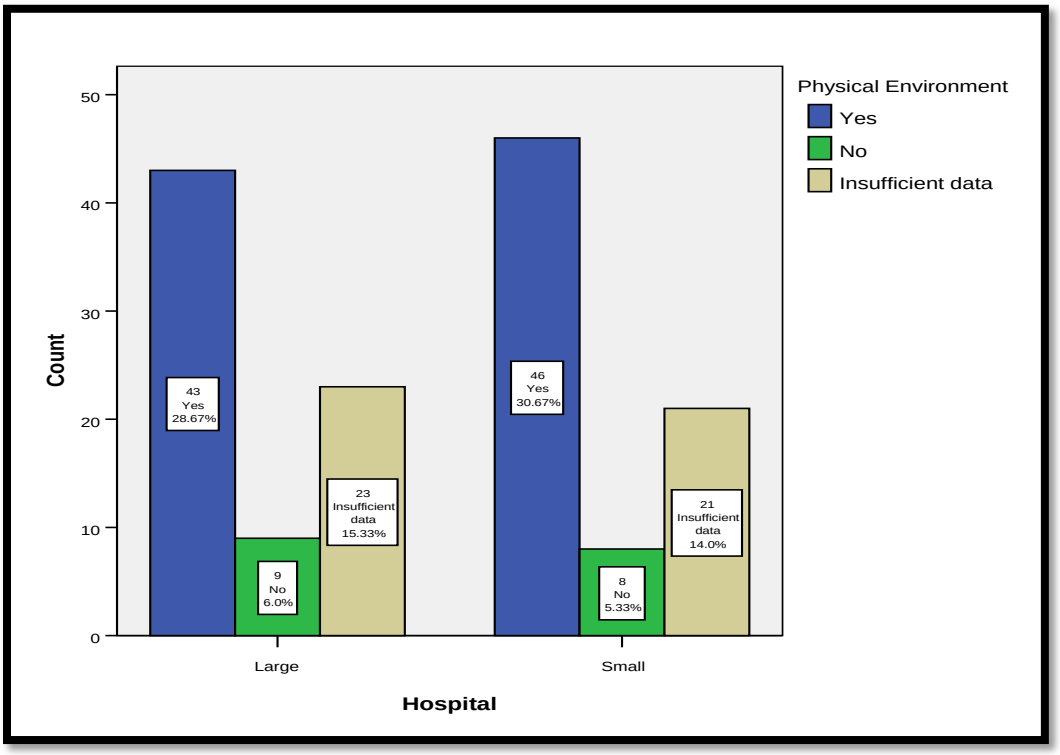



Figure 15 Physical Environment

Table 35 secured lab access frequency:

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 92 | 61.3 |
| | no | 17 | 11.3 |
| | ID | 41 | 27.3 |
| | Total | 150 | 100.0 |

Table 36 secured lab access Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 21.179(a) | 2 | .000 |
| N of Valid Cases | | | 150 |

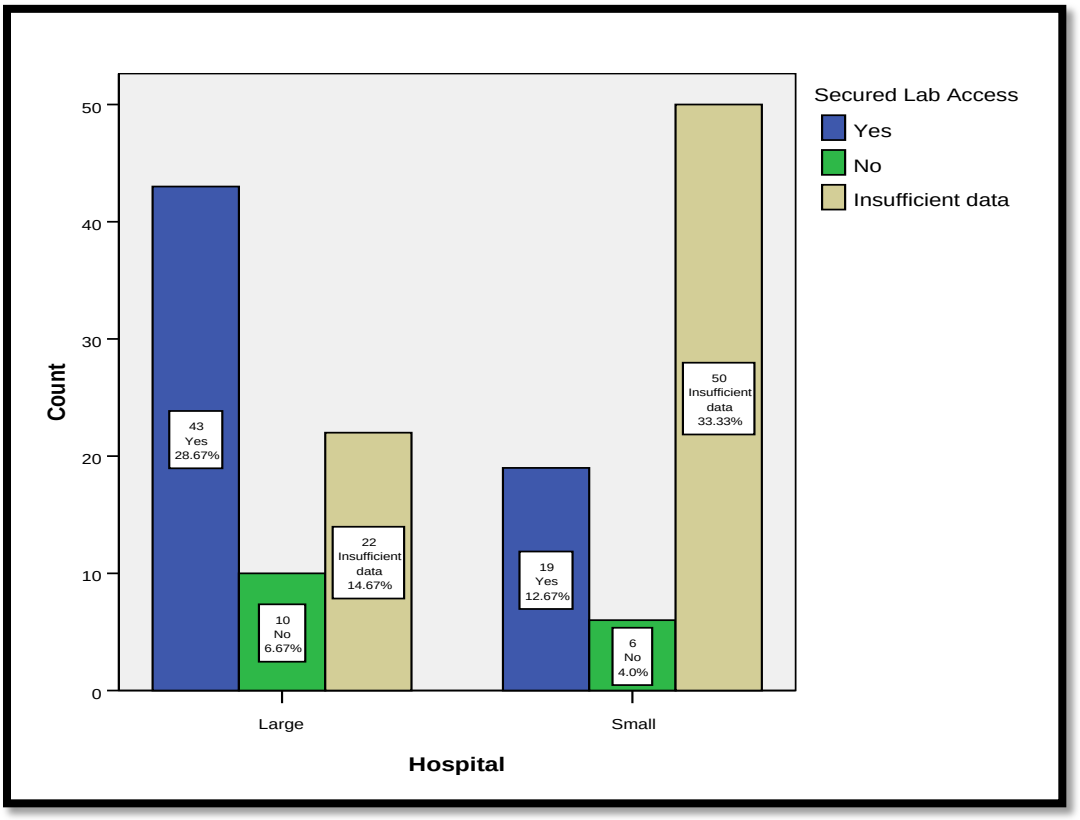



Figure 16 *** Secured Lab Access**

Table 37 frequency disinfection procedures

| | Frequency | Percent |
|---|---|---|
| yes | 109 | 72.7 |
| no | 3 | 2.0 |
| ID | 38 | 25.3 |
| Total | 150 | 100.0 |

Table 38 Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 2.125(a) | 2 | .346 |
| N of Valid Cases | | | 150 |

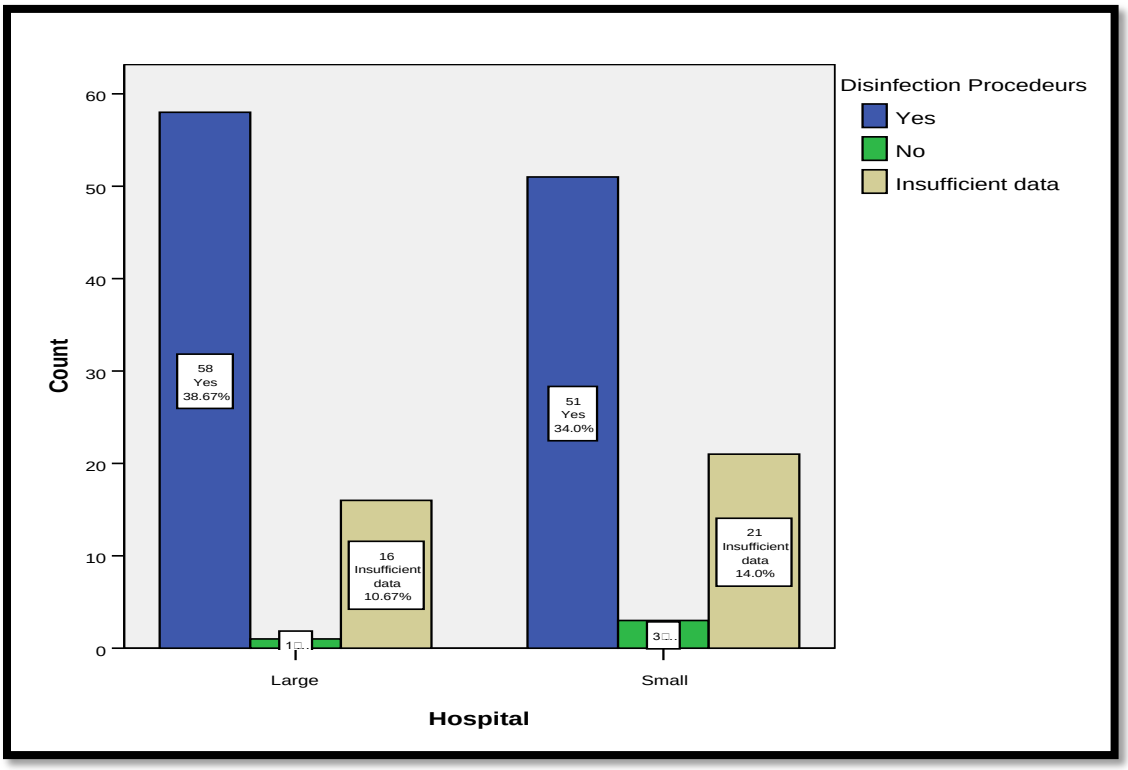



**Figure 17 Disinfection Procedures**

Table 39 bio safety cabinet frequency

| | Frequency | Percent |
|---|---|---|
| yes | 4 | 2.7 |
| no | 129 | 86.0 |
| ID | 17 | 11.3 |
| Total | 150 | 100.0 |

Table 40 bio safety cabinet Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 10.107(a) | 2 | .006 |
| N of Valid Cases | | | 155 |

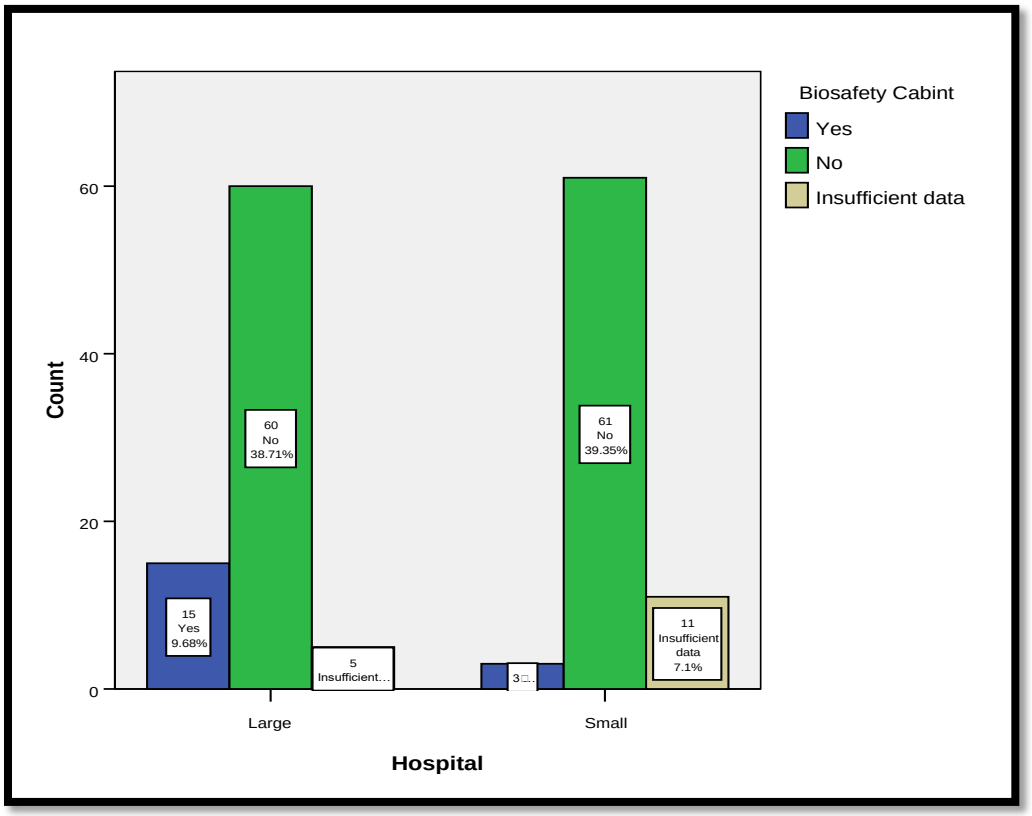



**Figure 18 Biosafety Cabint**

Table 41 storage area in lab frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 67 | 44.7 |
| | no | 16 | 10.7 |
| | ID | 67 | 44.7 |
| | Total | 150 | 100.0 |

Table 42 storage area in lab Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 2.802(a) | 2 | .246 |
| N of Valid Cases | | | 150 |

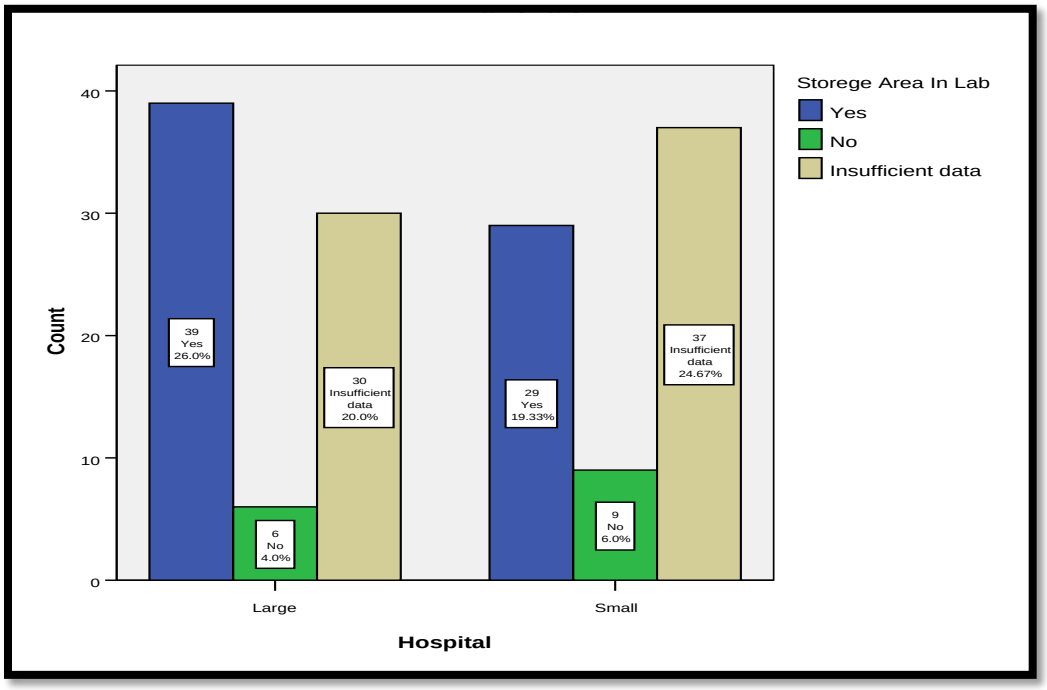



figure 19 **Storage Area in Lab**

Table 43 deal with hazards chemical according to MSDS frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 18 | 12.0 |
| | no | 94 | 62.7 |
| | ID | 38 | 25.3 |
| | Total | 150 | 100.0 |

Table 44 deal with hazards chemical Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .324(a) | 2 | .851 |
| N of Valid Cases | | | 150 |

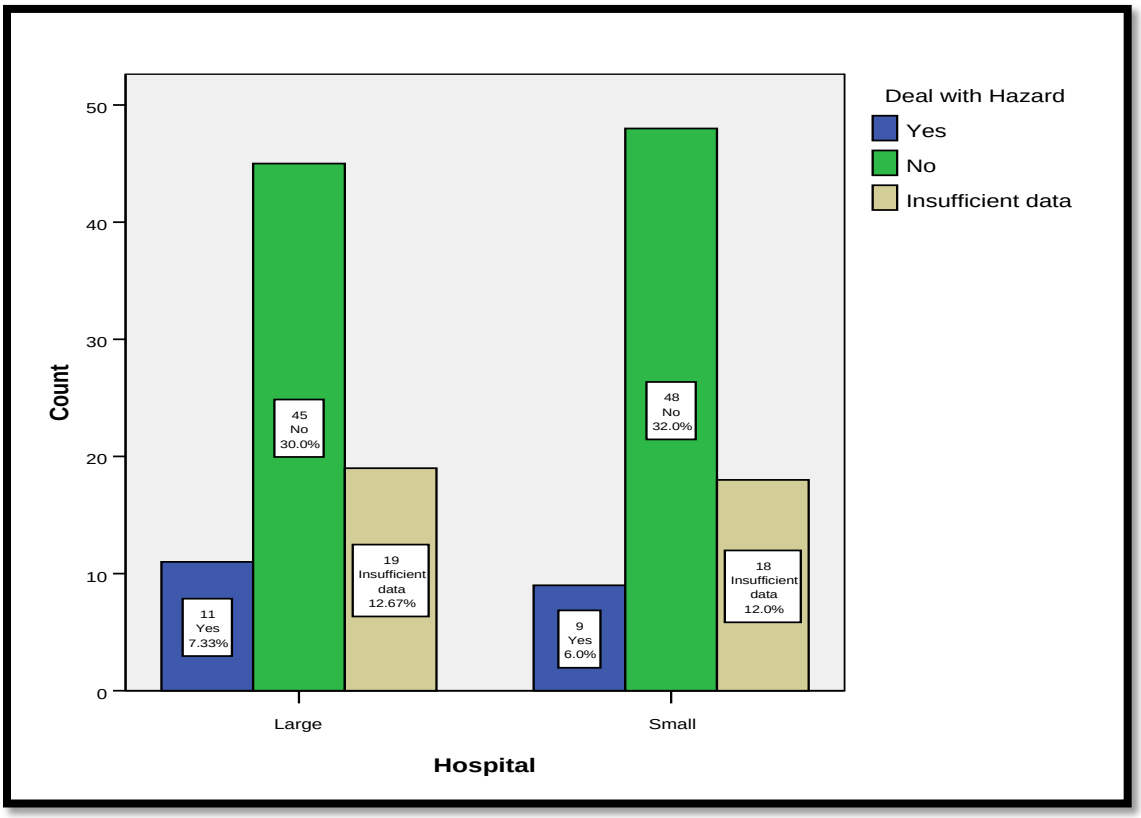



Figure 20 Deal with Hazard

Table 45 waste management frequency

| | | Frequency | Percent |
|---|---|---|---|
| Valid | yes | 32 | 21.3 |
| | no | 13 | 8.7 |
| | ID | 105 | 70.0 |
| | Total | 150 | 100.0 |

Table 46 waste management Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Pearson Chi-Square | 4.044(a) | 2 | .132 |
| N of Valid Cases | | | 150 |

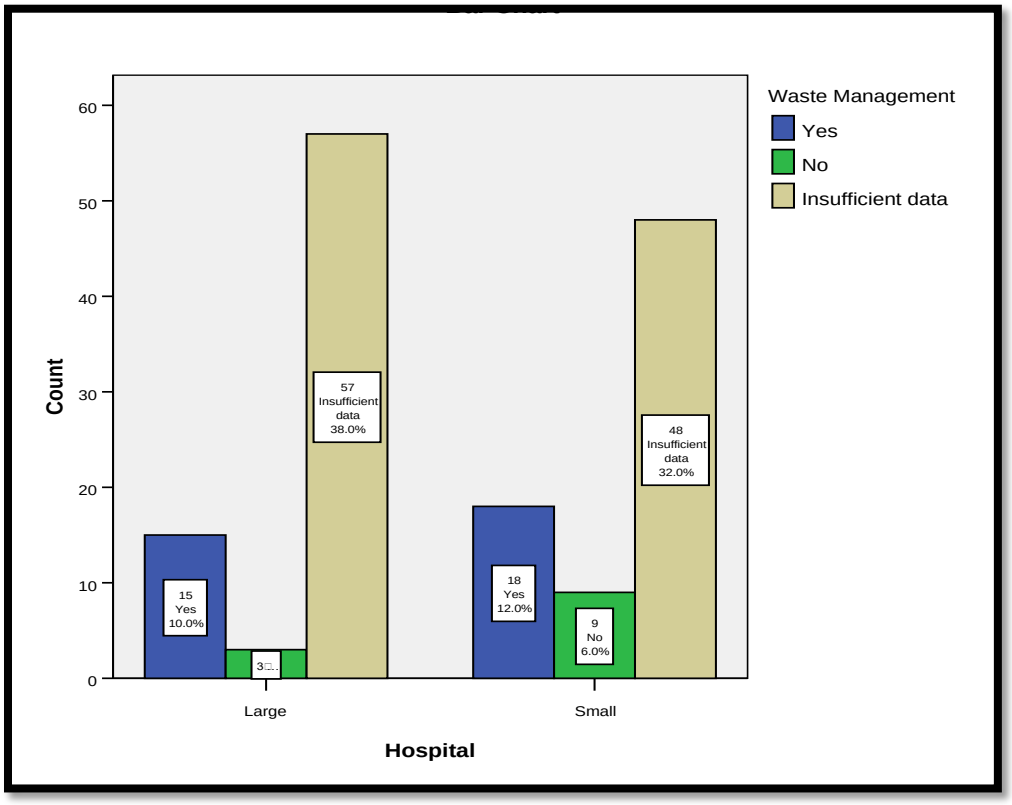



figure 21 Waste Management

# Chapter Five

## Discussion, conclusion and recommendation:

### 5 Discussion:

I undertook this study to evaluate the current situation of biosafety performance among 8 different public hospital medical laboratories in Khartoum through a structured questionnaire and checklis.there were 150 respondents in the study. the study revealed a few improvements with regard to the awareness level of technical staff and supply of simple PPE in comparison to previous studies conducted in Khartoum compared to Adel Hussein Elduma et al 2012 & Idris AF et al 2015 and However, major deficiencies were also found in critical areas of biosafety measures, indicating a compromised situation of biosafety Khartoum state.

It is evident from my study that relevant safety protective equipment are lacking in government hospitals 5 % ,and 7% in aduma 2012 and as a result of this standard operating procedures need to be put in place to address this. the initial phase in establishing a biosafety program in any laboratory is the development of standard operating procedures (SOPs) that will act as a guide. Such SOP's will dictate practices pertaining to the handling of human samples, disposal of wastes generated in the laboratory and also the use of personal protective equipment Alduma et al 2012,Adballa Altom 2015,Idris Af et al 2015 and Ciza mukhtar 2016.

the cross sectional study conducted by Elduma and his colleagues in 2012 on biosafety practices in teaching hospitals, they discovered that these was a low rate of reporting laboratory accidents(14.7%) , which was disturbing In addition in their study they observed that only 7.35 % of laboratories involved in the study used syringes and needles that had safety lock devices but the results of the determinant dealing with hazard is12% in this study . Furthermore it was discovered in that study that 10% of laboratories had Hepatitis B Virus program in comparison to this study vaccination become 12% there is improvement .

According to Ozsakin and his colleagues and who conducted a study on safety awareness among laboratory workers in Turkey , several respondents still did not know to correctly dispose laboratory waste this study reval same results 48% .the result from their study revealed

that laboratory workers would benefit greatly from educational initiatives that are targeted towards promoting Laboratory safety Ozsakin A, et al 2006

Also study of bio-medical waste management in India by Gajanan C. Soyam et al 2017 Delhi on 155 health care workers and the objective of the study was to find out level of knowledge, attitude and practices of health care workers (HCWs) about bio-medical waste management the researcher found that Practice of HCWs regarding biomedical waste management was relatively poor in this study also show only 21% . Also study from Pakistan by Nasim S and Shahid A (2012) found that there was no record keeping with respect to accidents in 83.4%.the summary of that no formal biosafety training had been provided in 82.4% of the respondent's practice in this study 65%. another study Assessment of facilities and safety in national public health laboratory in sudan Assess the quality management system in facilities and safety in the laboratory and assess lab design, safety equipment, Personal safety, chemical safety and waste management system The study conducted that some variables were well established such as bench design easy to clean, other variables are not well established such as adequate illumination some variables are not available such as radioactive waste containers. Ceza mukhtar obied 2016 Provision of personal protective equipment is very important. Attitude like wearing lab coats, using gloves, hand wash, safety glasses, face shields and close-toed foot wear will help to protect workers and decrease injuries and infection in the working area. the current situation tells that the personnel protections is minimal for staff as there is no safety glasses, face shields nor clothes for chemical and radioactive materials if there is applicable investigations required Delany JR,et all 2011

The absence of appropriate biosafety policies and practices is one of challenges facing laboratory personnel in sudan. There is the need for biosafety to be placed in the front burner of issues in laboratory practice in over respective facilities.

Also about Safety performance in laboratories:

From the findings large hospital perform better in some safety issues, there is statistically difference in large and small laboratories in: handling of sharps (P value: 0.001),use of PPE p(0.01),Staff vaccination p(0.01), pointed of safety officer p(0.0),separated test area p(0.00) and secured lab access p(0.0).

There is no statically difference in safety performance between large and small hospital: in availability of safety manual p.value 0.7,fire safety p value 0.6,safety audit p.value 0.2 ,availability of safety equipment p.value 0.8 ,deal with post exposure prophylaxis p.value 0.9,have documentation for biosafety training p.value 0.6, laboratory space documentation

p:0.2, neat work station p:0.5,acceptable physical environment p:0.8 and availability of biosafety cabinet 0.06. tables and figures (4.2.1 to 4.2.21).

**4.6 conclusions:**

The results of this study provided valuable information regarding the laboratory biosafety implementations in governmental hospital laboratories, in Khartoum state. The standard of laboratory biosafety at the included labs identified a low level of biosafety procedures, due to absence and/or not appointing a biosafety officer the personnel lack training in this field and laboratory accidents are not properly reported

This study indicated that the standards biosafety precautions adopted by the diagnostics laboratories in Khartoum state was low. In addition to that, awareness of laboratory personnel towards biosafety principles implementation was low too.

4.7 Recommendations:

1-Improve working environment conditions and provide services to staff

1-Expand in immunization programme to include all laboratories in Khartoum state

3-Frequent training with respect to adherence to biosafety practices is very important. Therefore, there should be a defined training protocol at the institutional level.

4-There should be a trained biosafety officer who is familiar with modern biosafety training aspects, especially a behavioral expert who not only trains staff according to safety manual but also is able to change staff behavior toward biosafety, as well as be able to look after all biosafety-related issues of laboratories in collaboration with management.

5-There should be a regulatory body at the national level that will be responsible for all biosafety issues, define rules for biosafety, and have authority to punish those not complying with these laws.

6-There should be management commitment toward bio safety in order to have a working environment that is hazard free. It is important for management to have a serious attitude toward biosafety, records should be maintained for an incident or accident, proper safety manuals should be maintained, and policies should be in place and implemented.

7-There should be a system to check that a sufficient number of staff are working in the laboratory and enough workload has been provided for employees, as heavy workload is one of the important factors for ignoring biosafety rules among laboratory workers.

8-Pocket-size biosafety handbooks or cards should be given to staff so that in case of a spill or accident, staff can follow these rules easily.

9-Spill kits and a written spill management plan should be placed at the national and institutional levels for all laboratories to handle biological spills.

10- Further researches should be performed to evaluate more laboratories to identify deficiencies in biosafety performance.

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