HEALTH AND SAFETY MANAGEMENT IN MEDICAL LABORATORIES

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Development of a System Based Approach for Strategic Implementation of Occupational Health and Safety Practices in Health Care Organizations

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Abstract

This thesis aims at investigating the importance of effective implementation of health safety and hygiene legislations and practices in Health Care delivery systems. A new System Based Approach for Strategic Implementation of Occupational Health & Safety Practices is proposed in this thesis. The underlying principle of the approach is based on involvement and inputs from staff and management rather than by pre-specified requirements and objectives. Furthermore, the development process is a closed loop process that provides a mechanism for continuously evaluating system performance and monitoring activities that have considerable impact on health and safety practices. A case study was conducted in the medical laboratories of five major hospitals in the Emirate of Abu Dhabi. Data were collected through questionnaires, staff interviews, and reviewing laboratory safety reports compiled over a three years period. The main conclusions from this study are:

1. The proposed approach has proven to be useful in analyzing existing health and safety systems. The methodology and tools proved to be instrumental in defining inefficiencies and determining the status of the Health & Safety policies & practices in the selected medical laboratories.
2. Effective implementation of the proposed approach has shown improvements in productivity, operational cost, service quality, staff and management satisfaction.
3. The case study has demonstrated that a developing country such the UAE, with no previously existing Health & Safety legislation and little risk prevention culture, can rapidly and effectively introduce effective industry specific H&S by adopting an integrated systems based approach.
4. UAE has highly advanced and economically developing base, there is a general willingness at senior level within the UAE to achieve high levels of competence and standards in all industrial sectors.
5. CAP is a system based management tool which has been implemented globally, but only limited in the gulf region; CAP has been implemented by the author and colleges within Zayed Military Hospital between 2003-2007.

Forward

My name is Mattar Al-Hassani. I have attained the position as Colonel in the UAE Army. I currently manage n=98 clinical, technical and support staff at the Zayed Military Hospital in Abu Dhabi, UAE which is my office base. I am also responsible for the management of an additional 58 staff in 23 small satellite military laboratories throughout UAE. My original training was in blood banking, and I worked over seven years as bench worker before being promoted to my current management position. During my time working in laboratories I became aware of accidents and exposures at the workplace and I developed an interest in occupational health and safety. Though H&S is not my specific field, it remained an interest throughout my career and the persistent lack of occupational health and risk management programs is a long-time personal concern. The implementation of CAP within my hospital offered a opportunity to introduce H&S management and improve worker conditions within the laboratories I supervise. The senior hospital management's drive to attain CAP accreditation provided the momentum and resourcing to improve working conditions. Today in the laboratories, after implementation of CAP, there is a widespread and clear improvement in H&S which is enjoyed by all staff. It is my sincere wish and aspirations that we can introduce these H&S improvements to other hospitals within the UAE.

This thesis formally describes the challenges and processes of introducing and developing H&S in my working environment.

While Arabic is my native language, I present this thesis in English with some editing support from my supervisor(s). I apologize in advance for any awkward phrases or use of words.

TABLE OF CONTENTS

Chapter 2

Literature Review

Introduction

Chapter 3

Theory and Description

Chapter 4

Methodology and Experimental Design

Chapter 5

Results and Discussion

Chapter 6

Conclusions and Recommendations for future work

List of Figures: page

List of Tables: Page

List of Photos: Page

List of Appendixes : **Page**

Dedication

This thesis is dedicated to my parents, dear family, and all my colleagues working in the medical field especially in the Health, safety, and hygiene sector wishing that my research will be beneficial to them.

Acknowledgments

I would like to express my deep gratitude to my supervisor, Dr.John Dennis, for his inspiration, expert guidance and advice. I am grateful for all the time he gave me, for the suggestions he put forward and for always being very supportive at difficult moments. I could not have been better assisted.

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Finally, special thanks go to lab directors, health safety officers, infection control coordinators, and all members of staff in the unit of Medical Laboratory at Zayed Military Hospital, Tawam Hospital, Al Ain Hospital, and Khalifa Hospital, Abu Dhabi, U.A.E for their support in facilitating the data collection process.

DECLARATION

I declare that this thesis constitutes a record of research carried out by myself. It is my own composition and has not been submitted previously for a higher degree. This work has been carried out in the School of Geography and Environmental Sciences, Department of Environmental Science, University of Bradford, under the supervision of Dr. John Dennis.

MATTAR SAEED SAIF AL HASSANI

Abbreviations:

AAMI = American Association of the advancement of Medical Instrumentation

AAOHN = American Association of Occupational Health Nurse

AFE = American Fire Equipment, Inc

AFGE = American Federation of Government Employees

AFSCAME = American Federation of State, Country and Municipal Employees

AHA = American Hospital Association

AMC = Al Ain Medical Centre

AOMA = American Occupational Medical Association

ASEAN = The Association of South East Asian Nations

ASHW = The European Agency for Safety and Health at Work

ASTMD = American Society for Testing and Materials

BSI = Body Substance Isolation

CAP = College of American Pathologist

CCOHS = Canadian Centre for Occupational Health and Safety

CDC = Centre for Disease Control

CHP = Chemical Hygiene Plan

CLSG = Clinical Laboratory Safety Guidelines

CLSI = Clinical Laboratory Standards Institute

CME = Continued Medical Education

CMS = Centres for Medicare and Medicaid Services

COSH = Committees on Occupational Safety and Health

Dhs = Dirhams

DNA = Deoxyribonucleic acid

DOHMS = Department of Health and Medical Service

DOLE = The Department of Labour and Employment

E/A = Emergency / Accident

EDTA = Ethylenediaminetetaacetic Acid (Edathami Editic Acid)

ENT = Ear, Nose and Throat

EPA = Environmental Protection Agency

EU	=	European Union
FAA	=	Federal Aviation Agency
FAH	=	Federation of American Hospital
FDA	=	Food and Drug Administration
SMC	=	Sharjah Medical Centre
FMHS	=	Faculty of Medicine and Health Services
HAAD	=	Health Authority of Abu Dhabi
GHQ	=	General Head Quarters
GI	=	Gastro Intestinal
HBV	=	Hepatitis B Virus
HCV	=	Hepatitis C Virus
HEPA	=	High Efficiency Particulate Air Filter
HIV	=	Human Immunodeficiency Virus
HOD	=	Head of Department
HSC	=	Health and Safety Committee
HSE	=	Health and Safety Executive
HSH	=	Health, Safety, and Hygiene
IARC	=	International Agency for Research and Cancer
IC	=	Infection Control
ICC	=	Infection Control Committee
ICU	=	Intensive Care Unit
IEC	=	The International Electro Technical Commission
ID	=	Number and Name
ILO	=	International Labour Organization
ISO	=	The International Standardization Organization
IOSH	=	Institution of Occupational Safety and Health
IV	=	Intravenous
IVF	=	In Vitro Fertilization
JCAHO	=	Joint Commission on Accreditation of Health Care Organization
JCI	=	Joint Commission International

JCIA	=	Joint Commission International Accreditation
LAB	=	Laboratory
LAP	=	Laboratory Accreditation Program
LMIP	=	Laboratory Management Index Program
LPN'S	=	Licensed Practical Nurses
LVN'S	=	Licensed Vocational
MLSO	=	Medical Lab and Safety Officer
MOH	=	Ministry of Health
MOI	=	Ministry of Interior
MRI	=	Magnetic Resonance Imaging
MSC	=	Medical Services Corps
MSDS	=	Material Safety Data Sheet
MSDs	=	Musculoskeletal disorders
NCCLS	=	National Commission for Clinical Laboratory Standards
NEC	=	National Electric Code
NFPA	=	National Fire Protection Association
NHTSA	=	National Highway Transportation Safety and Administration
NIOSH	=	National Institute for Safety and Health
NRC	=	Nuclear Regulatory Commission
NSC	=	National Safety Council
NTP	=	National Toxicology Program
NTSB	=	National Transport Safety Board
OHS	=	Occupational Health and Safety
OSHA	=	Occupational Safety and Health Administration
PCR	=	Polymerase Chain Reaction
PI	=	Performance Improvement
PPE	=	Personal Protective Equipment
POCT	=	Point Of Care Testing
PT	=	Proficiency Testing
QA	=	Quality Assurance
QC	=	Quality Control

QI	=	Quality Improvement
QM	=	Quality Management
RN'S	=	Registered Nurses
SCD	=	Self Closing Doors
SEIU	=	Service Employees International Union
SKMC	=	Sheikh Khalifa Medical City
TB	=	Tuberculosis
U.N	=	United Nations
U.A.E	=	United Arab Emirates
US	=	United State
UV	=	Ultra violet
WHO	=	World Health Organization
ZCMH	=	Zayed City Military Hospital
ZMH	=	Zayed Military Hospital

Chapter 1 Introduction

The World Health Organization (WHO, 1999) defined environmental health as; “aspects of human health, including quality of life, that are determined by physical, chemical, biological, social and psycho-social factors in the environment. It also refers to the theory and practice of inspecting, assessing, correcting, and preventing those factors in the environment that can potentially affect adversely the health of present and future generations”.

Park (2001).reviewed several studies that were performed in an attempt to develop occupational health and safety system as a general system. The focus of these studies addressed: the need to establish occupational health and safety departments, the economic benefits of establishing and maintaining such a department, and occupational incident (i.e. injury or illness) costs. Other studies related to individual health and safety system have focused mainly on the hospital and/or individual hospital departments. These and other studies have identified the Health and Safety (H&S) issues in healthcare, and have investigated hazard mitigation and prevention methods, costs of ill-health, incidents, and economic benefits (Park, 2001).

Common hazards in the healthcare industry have long been known to include radiation, toxic chemicals, biological hazards, heat, noise, dust, and stress (AMA, 1958) and more recently additional hazards have been identified as understanding of occupational health and safety develops (section 1.2).

Consequently, in the area of work environment and staff safety, Gun (1983) noted an excessive incidence of some chronic conditions among hospital workers. After allowance was made for this factor, six conditions of interest were found;

1. Hypertension, among both clinical service personnel (nurses, doctors, technicians) and blue collar workers (maintenance, orderlies, etc).
2. Varicose veins, among nearly all categories of hospital workers.
3. Anaemia,
4. Diseases of the kidney and urinary system.
5. Eczema, dermatitis, and urticaria.
6. Displacement of intervertebral disc (low-back injury), mostly among females (166% relative risk).

No data were provided on the risks of diseases such as cancer or reproductive impairment (Gun, 1983). Respiratory problems accounted for more than half of all acute conditions in both hospital workers and all workers. The incidence of every major category of acute condition was higher in hospital workers than in all workers. The risk for hospital workers was about 1.5 times greater than that for all workers. And it was statistically significant for all conditions, including infectious and parasitic diseases, respiratory conditions, and digestive system conditions and "other" conditions (diseases of the ear, headaches, genitourinary disorders, problems associated with childbirth, disorders of pregnancy and the puerperium, and diseases of the skin and musculoskeletal system). The risk of injury for hospital workers was only slightly greater than for all workers. In all, it was concluded that hospital workers had a significantly greater incidence of occupationally related ill-health in all categories of sex, race, age, and occupational status (Gun, 1983).

Occupational ill-health within the health-care industry and its research work seeks investigation potential for effective H&S management in a local hospital setting in the United Arab Emirates (UAE). The chapter layout of this thesis is as follows:

Chapter 1 includes an introduction, scope of work, research objectives and area background profile.

Chapter 2 provides an overview of general health, safety, and hygiene issues, including the concept of health and safety and health related incidents. Also discussed are areas related H&S research studies, including: economics of H&S systems, loss and hazard control programs, and the need for establishing quality management system and its benefits to improve the practice in the medical laboratory.

Chapter 3 introduces the need to establish and methods to implement an effective health and safety program specifically for a local UAE medical laboratory. An existing system based approach for establishing and implementing policies including protocols for health, safety and hygiene in medical laboratories is presented.

Chapter 4 describes research methodology and experimental design, and introduces the tools used for experimentation, which include: surveys of laboratory directors and health and safety officers, survey of staff and work force satisfaction, and summarize findings from site visits.

Chapter 5 presents and summarizes results of management staff surveys, and focus groups.

Chapter 6 summarizes the contents of this thesis along with the general result of the College of American Pathologists (CAP) implementation. An overall conclusion is presented along with recommendations for future work.

Lastly, because the united Arab Emirates UAE is largely influenced by US industrial development partners and commonly adopts North American systems rather than European ones, Johns Hopkins, Harvard university, and Medical College of Georgia are establishing policies, procedures, and training for the health care services in UAE. Many of the analogies made in this thesis relate more to the US policies and legislations than European ones. US legislation and influence is more prominent within the UAE and therefore, it was more appropriate to base comparisons on USA literature references.

1.2 History of H&S in Medical Laboratories

As reviewed by Furr (1995) health and safety issues in different industrial organizations began to be addressed early in the 20th century. In the US, organizations and corporations started to create internal safety units to comply with the regulations set in the early 1970's in the Federal Occupational Health and Safety Act which established the minimum standards. Support for these regulations came from firms that realized the importance of keeping their employees safe and healthy. Some firms made lesser commitment to safety. Early on, laboratory workers were not covered by the safety standards. Likewise, some educational institutions and several smaller schools and laboratories have had only minimal safety programs, often limited to fire safety. Many students graduated without having received formal safety training or practice. This leads to prevailing attitude that safety is of secondary importance (Furr, 1995).

Attention to occupational health of laboratory personnel was heightened by the introduction of the nuclear regulatory commission (NRC) requirements in the 1940's. In recent years, additional regulations were passed that covered other laboratory operations, including; exposure to human blood, tissue and other body fluids; infectious waste disposal, handling of chemicals and hazardous materials and work involving Deoxyribonucleic acid (DNA) manipulation. In 1991, Occupational Safety and Health Administration (OSHA) set standards that mandated protection of laboratory employees. This was followed in 1992 by the blood borne pathogen standard which affects hospital laboratories as well as laboratories performing basic research in life sciences OSHA, 29 CFR parts 1910.1450, Fed, Reg., 52 (163), 1987.

The attitude of a laboratory worker is an important factor in health and safety standards implementation and practice. This can be seen as more important than the quality of the equipment, regulations, policies and the risk associated with the activities carried out OSHA, 29 CFR parts 1910.38,1910. 120, 1910. 1200, 1910. 1450 and 1910. 1500, as amended.

The medical laboratory, as a department, has its own myriad range of occupational hazards. Although, the hazards listed here are not exhaustive, they demonstrate the variety of hazards that exist in a hospital laboratory environment (NIOSH, 1988) and (Office of the Surgeon General, 1999). These include:

- Physical Hazards: ionizing and non-ionizing radiation, noise, vibration, heat, sharps, burns, and electrical hazards.
- Chemical Hazards: a long list of chemicals used such as reagents or emitted as products or by-products of laboratory tests including: carcinogens (e.g. Benzene), fixation, fluorocarbons (e.g. formaldehyde), xylene, phenols, and other solvents.
- Biological agents: bacterial and viruses from patients' samples.
- Accident Hazards: needle-sticks, falls, sprains, muscular-skeletal, etc.
- Psychosocial: emotional stress, shift work, and job security.

1.3 Scope of Work

This research aims to address the need for establishing and implementing an effective and locally implement able health & safety program specifically for medical laboratory personnel by:

1. Reviewing the international standards and practices in H&S as it relates to laboratory staff, with a view to critically assessing how established standards can be applied to health, safety, and hygiene (HSH) in UAE.
2. Establishing the current status of H&S in the military hospitals and health authority of Abu Dhabi medical laboratory in the United Arab Emirates.
3. Proposing a strategy for HSH for laboratory staff tailored to fulfil the needs for the medical laboratory at Zayed Military Hospital (ZMH) which may extend to the rapidly growing health care system in the UAE as a whole.
4. Evaluating the effectiveness of College of American Pathologists' (CAP, 2003) implementation by surveying management and workforce.

1.4 Rationale

Nowadays, many healthcare organizations have to deal with an increasing demand for services with insufficient resources, which is forcing them to make maximum use of their existing resources. The relationship between healthcare performance and occupational health and safety (OHS) interventions aimed at reducing accidental injury can be debated: on one side, there is the view that good health and safety practice is important for business and productivity; on the other side, there is the view that OHS interventions are costly and interrupt the flow of work activity, and that regulations impose a non-productive investment. This study is looking at the relationship between productivity and medical laboratory health and safety. Previous studies found strong evidence suggesting that more attention needs to be given to occupational health in order to improve health outcomes and

productivity in many sectors. Evidently, inadequate workplaces and lack of safety rules and regulations do more than just threaten an organization's productivity and competitiveness. They also put workers' health and safety at risk. To summarize, the avenues of this research and results can serve as guidelines for preventive actions not only for medical laboratories but for other departments in health care institutions.

In general, the area of health and safety has been detailed in this thesis for the following reasons:

1. The health and safety system has a high sensitivity to errors and there are major risk factors associated with system failure due to the unavailability of certain resources.
2. There is growing interest in many countries for directing research efforts to find effective and efficient health and safety practices in health care organizations in an attempt to reduce operational cost and improve the quality of the health care services provided.
3. The importance of time value cannot be overlooked, an efficient time utilization system is expected to add to the cost effectiveness of the process.

Overall, this thesis seeks to investigate the management efficiency of human and capital resources in the hospital setting. Specifically, the impact of such practices on health and safety is investigated.

1.4.1 Health Care Cost

Nowadays, healthcare institutions are under the challenge of controlling operational costs while providing quality of services to gain an edge in today's healthcare competitive

market. An example of rapidly increasing cost is the case in UAE. According to the Ministry of Health, the budget allocated for health increased from Dhs 1.67 billion in 2003 to 1.725 in 2006 (UAE, 2006). In an attempt to face the challenges of satisfying rising demands for higher quality of services while having limited resources, hospitals tend to focus on finding the most effective management practices in allocating and managing their available resources and revising rules, guidelines, and regulations accordingly.

1.4.2 Complexity

According to Thomas (1989), hospitals deal with a wide range of social, financial, political, regulatory and cultural challenges. In addition, the delivery of healthcare is in itself quite a complex system; it is largely driven by rapidly changing technology and information, requiring input from different healthcare professionals. Furthermore, system components are interrelated and are driven by rapidly changing healthcare environment. Changing in technology also makes it possible to produce worse test results faster than ever. To achieve improved quality management, laboratory scientists continue to play an active role in assuring the analytical quality of test results (Westgard, 2009).

1.4.3 Health Legislations

It is highly agreeable that costly lawsuits resulting from failing to provide health care services at the right time are another challenge for healthcare organization. According to Bowen (1999), the legal concept used heavily in industrial/organizational psychology and

organizational behavior is applicable to health care organizations, especially in the area of treatment, service delivery, and service recovery of patients. Moreover, the patient-physician relationship revolves around economic, social, legal and institutional factors, which are also affected by decisions made internally within healthcare systems. Similarly, occupational health and safety Acts set out the rights and duties of all parties in the workplace. Their main purpose is to protect workers against health and safety hazards on the job. Generally, the Acts establish procedures for dealing with workplace hazards, and they provide for enforcement of the law where compliance has not been achieved voluntarily.

Lastly, fulfilling social, ethical, legal obligations and attempting to gain an edge in today's competitive market are real challenges for health care organizations. Moreover, failing to provide health care services at the right time is costly and can mean a difference between life and death.

1.4.4 Sustainability

Sustainability is ensuring that sufficient resources are available over the long term to provide timely access to quality services that address the evolving health needs. Health, safety, and hygiene in health organizations specifically in medical laboratories are sustainability of human and facility resources to ensure personnel safety and well- being at their working environment. The health organizations are required to provide continuous medical education (CME) and training programs, including safety to support safe behaviours within the laboratory and other departments as well (JCI, 2008). Also, the laboratory should be equipped with necessary engineering controls supported by personal

protective equipment and other safety tools (i.e. fire alarms, first aid kits, fire extinguishers, etc) to facilitate safe practices. These resources require dedicated committee to regularly evaluate and assess the assets needed to sustain the health and safety system provided for personnel. The institution should not reach a point where the safety tools go scarce; therefore, annual assessment and evaluation should be conducted. With the rising number of different skilled personnel and the multiple hazards associated to the use of some instruments/ analyzers or implementing certain procedures' there is a growing need to continuously upgrade the safety practices and resources. The upgraded safety system would assure sustaining high quality resources for safer working environment.

In summary, the decision makers need to allocate attention to find the optimal strategic planning that provide sufficient and quality safety tools at minimal cost to encourage safety behaviours and practices` among staff.

1.5 Research Objectives

The research described in this thesis is primarily directed at developing a general proposed approach to support resource management decisions making (planning and allocation) in service organizations with end-user and management involvement throughout the approach development process. The application of this approach is directed at specific health care setting (medical laboratories).

The research under study will ascertain the need for optimum management system, and model the benefits of establishing and maintaining such standards at zayed military hospital medical laboratories. Then these standards will be implemented in the other 23-satellite labs that are under Medical Services Corps (MSC) leadership.

The specific stated objectives of this research are:

1. Introduce and implement College of American Pathologists (CAP) in local medical laboratories. Use CAP to enable health & safety legislations and practices.
2. Improve the health and safety incident reporting mechanism and establish an extensive related database at hospital setting.
3. Recommend corrective measures that will reduce the recognized and anticipated health and safety risks.
4. Establish a health and safety committee within the department to review H&S policy and practice.
5. Improve health care services by implementing H&S policies and guidelines through CAP to identify occupational hazards and control risks by initiating a safer work environment.

To achieve the stated objectives, this research program aims to:

1. Analyze the existing health, safety and hygiene system in medical laboratories at Zayed Military Hospital in the United Arab Emirates;
2. Evaluate health and safety systems applied in other UAE medical laboratories.
3. Implement H&S aspects of CAP;
4. Observe the consequence of changes in resources planning polices prior to decisions actually being implemented;
5. Demonstrate how to enhance the effectiveness and efficiency of the services provided;
6. Develop service performance measures and quality indicators;
7. Enhance and improve communication among management, workforce, service end-users, and the analyst; and
8. Reshape end-users and workforce perceptions about health and safety.

1.6 Area Profile

1.6.1 Introduction and Background

The United Arab Emirates (UAE) was formally proclaimed as an independent state in December 2nd 1971(UAE, 2004).UAE is part of the greater Arab nation and member of the United Nations. UAE is situated along the south eastern tip of the Arabian Peninsula between 22.50 and 26 N, and between 51 and 56.25E.It is surrounded by Qatar to the west and northwest, Saudia Arabia to the west and south and Oman to the northeast and southeast. Occupying a total area of about 83,600 square kilometres (32,400 square miles), the UAE has 700 kilometres of coastline, 600 kilometres a long the Arabian Gulf and 100 kilometres bordering the Gulf of Oman.

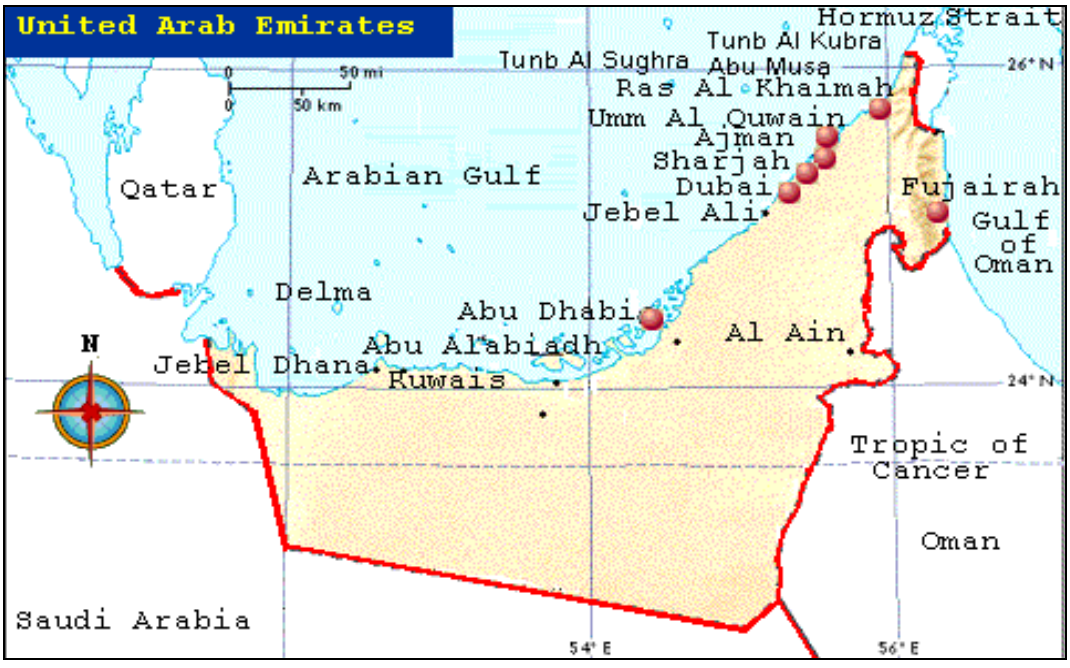

Figure 1.6.1 United Arab Emirates map (UAE, 2004) annual report

The United Arab Emirates is a federation of seven sheikhdoms or emirates, namely Abu Dhabi, Dubai, Sharjah, Ajman, Ras Al Khaimah, Umm Al Quwain and Fujairah.

The emirate of Abu Dhabi occupies over 80 percent of the country‘s total landmass; it is the largest of the seven emirates that constitute the federation. The city of Abu Dhabi is the capital (UAE, 2004).

UAE is a well-developed country in many aspects; economically, socially, and medically. We have been successful in establishing contemporary healthcare services in the country through extensive public health interventions and a wide network of primary, secondary and tertiary medical facilities today. Our people enjoy a quality of life and status of health attained only by the most advanced industrialized countries of Europe and North America. At the same time, UAE maintained its culture and customs (Division of International Health Dept. of public health Science. May 1999).

A wide network of healthcare institutions serves the 4,320,000 population of the UAE, geographically well distributed over 83,300 square kilometre area. In Abu Dhabi, the capital city, there are about ten hospitals (beds capacity range from 200 to 500 beds) providing tertiary healthcare service (MOH, 2003).

The quality and extent of the health service are not separable from the level and quality of the medical laboratory service that witnessed a comparable hike in progress.

Chapter 2 Literature Review

Introduction

This chapter aims to review topics relevant to this thesis and is organized as in table 2.1 below:

Table 2.1 summary of Literature Review

Section	Description
2.2	A brief history of occupational health, safety, and hygiene.
2.3	Provides the definition of health, safety, and other related terms used in this study.
2.4	A review of concepts on health and safety in the work place. Topics on safety-related incidents, types of injuries and types and estimates of costs of accidents will also be discussed under this section.
2.5	Stresses the importance of hazard/loss control programs and the components incorporated in such programs
2.6	The economics of health and safety systems is presented in this section
2.7	Existing health and safety legislations and practices in work place in general will be elaborated
2.8	Addresses the status of health and safety in the medical laboratories. This is one of the essential sections of this chapter because the context is brought in the locality of UAE.
2.9	Further discusses the UAE Health Care system, medical services in Military hospitals, Health and Safety legislation and practices of this country, and the section culminates with the topic on medical laboratory services in Abu Dhabi.
2.10	Stresses the need for establishing quality management system and its benefits to improve the practice in the medical laboratory.
2.11	Quality Assessment Tools
2.12	A conclusion of the related studies and summary of literature review in this chapter is presented.

2.2 History

The issue of workplace safety has been addressed since as early as two thousand years ago (Barth, 2002). In the first century AD, Pliny the Elder, a Roman scholar, in his Historian Naturalis describes how workers were instructed to wear masks in order to shield themselves from toxic fumes and substances (OSHA, 1998). In the second century AD, the Greek physician, Galen, described the pathology of lead poisoning and also recognized the hazards of exposure by copper miners to acid mists (OSHA, 1998). The practice of addressing and improving health and safety conditions has been shown time again throughout the ages as industry and technology advances. For example, during the middle ages, Agricola (1556) the German scholar, in his book *De Re Metallica*, described the diseases of miners, discussed mining accidents, described diseases associated with mining occupations such as silicosis, and prescribed preventive measures. The suggestions included mine ventilation and worker protection (OSHA, 1998).

In 1700, Bernardo Ramazzini, known as the "father of industrial medicine," in his book *De Morbis Artificum Diatriba (The Diseases of Workmen)*, addressed occupational diseases of most of the workers especially miners (Barth, 2002).

In England, in the 18th century, Percival Pott, as a result of his findings on the insidious effects of soot on chimney sweepers, represented a major force in getting the British Parliament to pass the *Chimney-Sweepers Act of 1788.* The passage of the English Factory Acts beginning in 1833 marked the first effective legislative acts in the field of industrial safety. These Acts were meant to provide compensation for accidents rather than to control their causes. Later, various other European nations developed workers' compensation

legislations, which lead to the adoption of increased factory safety precautions including the establishment of medical services within the workplace (OSHA, 1998).

During the first part of the 20th century, industries in the United States developed rapidly. Along with this, started the advancement of machineries, technologies, computers, and other digital equipment that aid man to make their usual work faster and yield more precise and accurate results. Due to this, increasing reports of work-related accidents and even deaths occurred. In 1970, the law had been passed ensuring health and safety of American workers. Such law required employers to provide and ensure workers of a safe environment, safe handling of equipment or machineries, equipment that would help prevent risk to workplace accidents to avoid injury to themselves, their co-workers, their employers or family members (Barth, 2002). However, in these early provisions, the law caused left and right controversies before it gradually set into place and was embraced by different American industries.

The current practice of having inspectors look over premises to ensure compliance with health and safety standards was initiated by insurance companies for their policyholders because, as stated by H.W. Heinrich, in 1931; “Accidents result from unsafe actions” and “unsafe conditions” (O’Brien, 1999). Later, federal bodies were set up and, through legislative acts, other health and safety standards have been made mandatory in various states in the US such as fire safety, good housekeeping, machine guarding, and guarding of floor openings shafts. This highlights the need for governments to be involved in the process of setting up health and safety rules and protocols where all sectors are forced to comply with by the law. Since health and safety concept and issue are very broad, it is essential that many federal bodies have to be set up or established. Some examples of such bodies are as in the US, including: the National Transportation Safety Board (NTSB),

Nuclear Regulatory Commission (NRC), Occupational Safety and Health Administration (OSHA), Federal Aviation Agency (FAA), Food and Drug Administration (FDA), Environmental Protection Agency (EPA), and National Highway Transportation Safety and Administration (NHTSA).

Correspondingly, in 1950 international regulating bodies such as the World Health Organization (WHO) on its joint committee with International Labour Organization (ILO) strengthened its campaign on OSH. As a result, WHO/ILO established the internationally compiled definition of OSH which reads; "Occupational health should aim at: the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention amongst workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological capabilities; and, to summarize, the adaptation of work to man and of each man to his job" (Ladou, 2006). This internationally accepted definition became the basis for various legislations, laws or regulations applied all over the world. Different countries created different laws regarding OSH. Today, with global harmonization, the enforcement of OSH is unified by a set of standards compiled by a group of countries in European Union, United States, Asia and others.

One of the largest and leading organizations for health and safety in Europe which is slowly making its way to the globe is the UK-based Institution of Occupational Safety and Health (IOSH). This international organization aims to unify countries to one common goal of further improving OSH in all industries and fields.

Recently, IOSH started to boost health and safety in the Middle East particularly in the UAE. As it held its 2008 conference in Dubai, it aims to expand quickly its advocacies and further bring together experts from around the world to help companies meet legal and moral obligations in achieving safety standards (Golden, 2008).

2.3 Definitions

2.3.1 Health

Man's constant and continuous search for good health and its definition goes further back in history. In Greek mythology, the Goddess Hygeia represented the idea that humans could remain healthy if they lived rationally. In today's holistic health promotion strategies (Larson, 1999) a simplified if not naïve definition of health being simply the absence of symptoms is inadequate.

In past times, health was defined holistically and thought to be influenced by one's habits of living, exercise, environment, and food (Stanhope and Lancaster, 2000). In the West, this definition has later changed people to a state where the focus was primarily on physical health. It was only prior to 1900 that the definition of health moved from emphasis on physical wholeness and progressed to include mental health. Being Free from disease, both physical and mental, then became the typical definition for health as medical science evolved through the 1900s with effective treatments for many diseases (Larson, 1999).

The World Health Organization (WHO) in 1946, defined health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

By this definition, health is not merely being free from pain or disease but also the ability to attain and maintain one's optimal functional capacities through an interaction of genotype and environmental factors (WHO, 1975).

2.3.2 Safety

Safety is considered to be a commonsense approach to removing or eliminating causes of injury (Raouf and Dhillon, 2001) defined safety as the conservation of human life and its effectiveness and the prevention of damage to items as per mission needs.

Safety is the state of being safe, the condition of being protected against physical, social, spiritual, financial, political, emotional, occupational, psychological or other types or consequences of failure, damage, or any other events that could be considered dangerous.

2.3.2.1 Safety Climate

Steven Yule (2003) cited Zohar's Seminal (1980) defined the safety climate as a summary of moral perceptions that employees share about their work environment. Niskanen (1994.b) defines safety climate as a set of attributes that can be perceived about particular work organizations and which maybe induced by the policies and practices that organizations impose upon their workers. Lindell (1994) as cited by Varonen and Mattila (2000) defined the safety climate in terms of workers' interpretations of features, events, and processes in the work environment that were relevant to their safety. These dimensions include material factors, policies and practices, safety related conditions and level of

concern by the different people involved at the work place. The material factors may include design, production equipment, and personal protective equipment. Policies and practices may include safety priorities, training, enforcement, daily routines, or housekeeping. Safety related conditions are work conditions and social relation with co workers and the level of concern and action by different people in the workplace include management, supervisors, safety specialists, government inspectors, safety committees and workers in general. On the other hand, Seppala (1992) as cited by Varonen and Mattila (2000) indicated that the safety climate is dependent on the following factors: 1) organizational responsibilities, 2) workers' concern about safety, and 3) the level of safety precautions in a given company.

2.3.2.2 Safety Incentives

Safety incentives are reward techniques used by organizations/departments to improve their health and safety outcomes. They are used to reinforce safe behaviour and counter the natural incentives to unsafe acts. These techniques are expected to reduce time loss due to accidents and improve safety behaviours (Haines, 2001). Mcfee and Winn (1989) as cited by Haines (2001) showed that incentives or feed back enhanced safety and reduced accidents in the work place, at least in the short run. Sulzer-Azaroff (1994) as cited by Haines (2001) found that training, feedback, positive reinforcement, and safety incentives lead to desirable safety performance outcomes.

Safety incentives do not always produce the desired result (McAfee and Winn, 1989) as cited by Haines (2001). Some efforts have been made to identify the characteristics of the most successful incentive programs. Wilde (1994) as cited by Haines (2001) offered a list

of conditions to maximize incentive program efficacy, which includes: managerial vigour, rewarding the bottom line, attractiveness of the reward, simple rules, equity, attainability, and rewarding all levels of the organization.

Other factors that will lead to an effective safety incentive program include: managerial involvement, delegation of authority for safety, briefing on safety, consistency of safety practices, leadership, role modelling, communication, priority given to safety, and coordination between all levels of management (Harper, 1996) as cited by Haines (2001).

2.3.2.3. Safety Behaviour

The relationship between leaders and their work group members is of high importance. It is through this relationship that safety behaviours are encouraged and rewarded. Simard and Marchand (1997) as cited by Haines (2001) found that cooperative supervisor-subordinate relationships promote increased employee involvement in safety related activities. In a safety context, good supervisor-subordinate relationships should therefore lead to safety compliance. The combination of high group cohesion, and strong safety oriented norms will produce a more positive reaction to safety incentive programs (Haines, 2001).

Good practice guidance (HSE, 1999) as cited by Vassie and Lucas (2001) advocates that the active involvement of all employees and the importance of visible leadership are considered essential aspects of total quality management and health and safety management. Accountability, empowerment, and competency are seen as essential precursors for improving health and safety management and business management (Wright, 1996) as cited by Vassie and Lucas (2001). Lack of effective communication on

health and safety matters may become a barrier to employee involvement and detracts from the development of positive safety culture (Stranks, 1994) as cited by Vassie and Lucas (2001).

According to Geller (1998) as cited by Williams and Geller (2000) employees face numerous instances where they have to choose to work safely or at risk. At the same time, environmental factors like work place, equipment design deficiencies, and improper tools will definitely affect workers' safety behaviours. Moreover, workers are often rewarded for performing tasks in an at-risk manner because doing so is typically faster, easier, more comfortable, and more efficient or convenient than following safe procedures. The antecedent-behaviour- consequence model of applied behaviour analysis has been frequently and successfully used to prevent occupational injuries. Antecedents or activators (e.g. safety signs) direct one's focus and attention on relevant safety behaviours needed for a given task. Also activators monitor consequences (e.g. rewards) for following safety behaviour and motivate the future occurrence of the rewarded behaviour (Williams and Geller, 2000).

2.3.3 Hygiene

Hygiene is the science of health (White, 2000) and may be defined as the preservation and restoration of health (Bosquet, 2008). Nowadays, the term of hygiene is often refers particularly to cleanliness and sanitation (Tillman, 2007). Superficially, good hygiene is gauged by the absence of things such as dust and stains on clothing and a malodorous scent. In fact, since the development of the theory that links levels of germs to disease,

hygiene has quintessentially came to be defined as any action that leads to the absence of harmful levels of germs.

Hygiene is commonly achieved through disinfections using materials such as soaps or detergents and water. The soap or detergent binds oil and dirt helping to break up so as to be washed away. Man is constantly trying to either prevent or keep in-check diseases caused by microbes in- check or under strict surveillance. Proper hygiene practices such as washing one's hands after using the bathroom and before handling food greatly reduce the spread of pathogens such as *E. coli* and Hepatitis (A), both of which are known to be spread by poor hygiene practices.

2.3.4 Hazards

Generally refer to exposure to loss or any injury, risk or peril. It is a situation or condition wherein a life or one's health is at a threat of any risk or harm which also applies to any property, environment or anything that is cared for. In healthcare, a health hazard is anything or anyone that is foreseen to impede one's health and failure to address this hazard correctly enables it to be active which could lead to an 'emergency' situation.

Types of Hazards

Physical

Physical hazards include excessive levels of noise, vibration, illumination and temperature, and ionizing and non-ionizing electromagnetic radiation (Nims, 1999).

Chemical

Harmful chemical compounds in the form of solids, liquids, gases, mists, dusts, fumes and vapors may exert toxic effects by inhalation (breathing), absorption (through direct contact with the skin) or ingestion (eating or drinking) (WHO, 1999) and (Nims, 1999).

Biological

Biological hazards include a wide range of nature's destructive ailments, from microbes and microbiology to animal vermin (MacCollum and Hughes, 2005). Biological hazards exist in exposure to microbial agents, e.g. bacteria, viruses, fungi, rickettsia and parasites that can cause acute and chronic infections by entering the body either directly or through breaks in the skin. An infection is described as occupational when some aspect of the work involves contact with a biologically active organism.

Effective personal hygiene, particularly proper attention to minor cuts and scratches especially on the hands and forearms, helps minimize risks. In occupations where there is

potential exposure to biological hazards, workers should practice proper personal hygiene, particularly hand washing.

Hospital should provide effective ventilation and hazard containment (e.g. fume cupboards), effective and appropriate personal protective equipment such as gloves and respirators, effective infectious waste disposal system and appropriate controls including isolation in instances of particularly contagious diseases, e.g. tuberculosis, viral hepatitis B and C.

Ergonomic

Ergonomics include full range of tasks, and not limited to lifting, holding, pushing, walking and reaching. Some ergonomic problems result from technical changes such as increased assembly line speeds, adding specialized tasks, and increased repetition. In addition, some ergonomic problems arise from repetitive motion, fatigue, and monotony (Nims, 1999).

2.4 Health and Safety in the Work Place

Health and safety in the workplace generally refers to occupational safety and health which is an area or field of science that basically promotes protection of health, safety and the total welfare of every human being as they do their respective work or job. It further applies to employment as employees perform their assigned jobs which may also affect

their co-workers or colleagues, other work departments, employers, clients, suppliers and their families as well (Ladou, 2006).

Because of the vast applicability of occupational safety and health (OSH) in different industries of health and medicine, engineering, pharmaceuticals, psychology, physics, agriculture, economics, ergonomics, politics, etc, the World Health Organization (WHO) together with the International Labour Organization (ILO) in their joint committee of promoting OSH, implied to the world that the total well-being of every worker of all occupations should be protected by employers from any health hazards or risks from their working environment or employment in general (Ladou, 2006).

With this definition of WHO and ILO of occupational safety and health as a basis for international legislation, diverse states took their own different interpretations, thus creating different approaches in implementing OSH laws (Ladou, 2006). Aside from WHO and ILO, several international regulating and accrediting bodies today have emerged to enforce occupational health and safety in general. The International Standardization Organization (ISO) had established a set of standards that has to be complied with to promote total quality management in every industry where OSH is a main quality indicator.

Focusing on OSH, in the United States, lawmakers started off by creating the Occupational Safety and Health (OSH) Act of 1979 which eventually gave birth to Occupational Safety and Health Administration (OSHA), an agency of the U.S. Department of labor in charge of developing and enforcing regulations on health and safety of workers in their work place or employment. On the other hand, the National Institute for Occupational Safety and Health (NIOSH) which also emerged out of OSH Act of 1979, took charge for OSH training, research and development (OHSAS 18000 series).

In Europe, member states of the European Union (EU) established the European Agency for Safety and Health at Work (ASHW) in 1996 (OHSAS 18000 series). Due to the strong relationship between employers or business owners and employees and work unions in various EU countries, this European ASHW was created as it was believed to give mutual benefits to both employees as it provides protection of health and employers for improved efficiency and quality of services and products. In the United Kingdom, this occupational safety and health is enforced under the 1974 Health and Safety at Work Act by both UK executives and local council of health and safety (OHSAS 18000 series).

In EU, the IOSH today is the fastest growing organizational body that aims at bringing the world together to enforce and improve OSH around the globe. It has recently conquered UAE through its 2008 Dubai conference for Dubai is the largest state of tourism and commerce in UAE. It has been established in 2006 and has seen outstanding growth in members.

In UAE, there are actually two-tiered structure comprising of federal law on health and safety of workers. The Department of Municipal Affairs in Abu Dhabi has adopted a Code of Practice for Construction Projects which introduces new and significantly more detailed obligations in respect of construction site health and safety, including training, reporting procedures and the appointment of safety engineers (Shepherd, 2008).

Their Labour Law speaks of the protection on the rights of workers or employees that include guidelines and standards with the use of health and safety facilities like personal protective equipment and medical first aids facilities. For example, the relevant provision

dealing with first aid supplies states that: “Each employer shall provide one or more first aid boxes containing medicines, and the Ministry of Labour and Social Affairs may prescribe bandages, antiseptics and other first aid materials” (Shepherd, 2008).

Consequently, vast application and relevance of OSH is seen in the field of medicine. Institutions like hospitals as well as those independent or privatized medical laboratories comply with these set of standards for OSH to attain quality services and results. Hospitals and medical laboratories do establish a set of laws, regulations and policies to enforce OSH within their area. These laws and policies are also governed by the federal state’s laws on OSH in cooperation with the state and local governments.

Correspondingly, enforcement of health and safety in general promotes total well being of workers in their work environment. This is just the same with medical professionals like doctors/physicians, nurses, medical technologists, chemists, biologists, microbiologists and also with other professionals working in a hospital institution or medical laboratories out there. In complying with OSH laws and policies, medical professionals are protected as they treat their ill patients, perform examinations on infected patients, perform analysis of blood and other biological products which may sometimes be contagious, got exposed to certain hazardous chemicals in the laboratory, and so on.

With this law on OSH, process owners or the management are required to provide their medical workers with sufficient protection for their total well-being, like vaccination, medical assistance, personal protective equipment (PPE), infrastructure control, etc. In doing so, this would not only promote welfare of workers, rather it can greatly affect their patients positively as well as processing laboratory analysis and test results.

In Canada, there are federal legislations presented in the Canadian Labour Code to cover workers in "federal" industries such as mining and transportation. In addition there are provincial legislations to cover health and safety in different provinces. The health and safety come under the umbrella of the Canadian Center of Occupational Health and Safety (CCOHS) which was created in 1978 as an agency of the Canadian government (OHSAS 18000 series).

Similarly in Asia, OSH has also been enforced differently by different states like in the large group of the Association of South East Asian Nations (ASEAN). The countries established also a set of directives to be followed which are all rooted with the ILO and WHO definitions of OSH.

In Malaysia for example, OSH is enforced through Occupational safety and Health Act of 1994 and Factory Machinery Act of 1969 under the government's department of OSH (OHSAS 18000 series). In the Philippines, OSH is enforced by the democratic government under the department of labor and employment (DOLE) which covers all workers of all occupations and sectors.

In 1974, Taiwan enacted the labour safety and health law that defines the occupational health and safety legislation. The main purpose of this law was to prevent occupational hazards and ensure worker's safety and health. This law stipulates that the employers should conduct periodical health check up for workers and establish worker's health documentation while employment continuous in especially hazardous operations. In Lebanon, Occupational health and safety (OHS) is a relatively new concept. Legislation on occupational health and safety (OHS) as a separate law does not exist. However, OHS regulation can be found as apart of the 1946 Act. There are increased labour protection

concerns for women, juveniles, and people with disabilities. It constitutes a set of legal norms intended to prevent occupational hazards. The labour law (1946) defines the type of labour, hours of work, and physical examination, fitness and ability for working women and children. Another decree that is important to OHS is occupational accidents decree number 136 (1983). This decree provides a certain measure of income protection to the worker who is unable to work because of job related disability or to the family if the worker is killed (Lebanese Official Gazette).

Correspondingly the development of OSH, the health of the work force also varies from one country to another. The health of workforce is indeed an important component in the development of a nation which is related to the environment (economic) from one developing country to another. Rampant and uncontrolled development measures purely in terms of economic expansion could greatly affect health (Stellman, 1998). Health as specified by life expectancy has a significant relationship to a nation's economic status.

Developed nations could easily develop or create administrative and legal structure of health and safety to keep it at par with the advancements in technology and economics. On the contrary, developing countries would access these technologies and other advancements from developed nations without even having their own infrastructure. Often developing nations would also adapt the legislations and standards of the developed nations causing imbalance in technological development as well as health, legal and administrative developments. The countries investing more on OSH usually show higher productivity and stronger economy and vice versa (Stellman, 1998).

The set of directives or legislations to enforce OSH varies all over the world. However, with the dawn of global harmonization, north, south, east and west have met to form the

ISO and the EU which created these sets of standards for global compliance on total quality management to enforce OSH in different industries like environmental, statistics, health or medical laboratories, calibration laboratories, manufacturing, mining, and so on and so forth. For whatever language the aim is still the same and all rooted in the definition of WHO and ILO on OSH.

A healthy economy, high quality of products or services and long- term productivity are difficult to achieve in poor working conditions where workers are exposed to health and safety hazards (WHO, 1999).

During the first time of establishing UAE as a federal state and in spite of the lack of legislations and laws which organize the occupational safety and health in all fields, the federal government hospital started to implement good working conditions for the workers through introducing modern technology, instruments and procedures. Therefore, attention has been focused on creating positive business environment and adopting best practice methods.

In UAE, the General Industrial Authority (local Agency), in co-operation with the Federal Environmental Agency, plays an important role in applying the international labour organization's (ILO) policies and procedures. In addition, the General Industrial Authority monitors and controls the municipalities and chambers of commerce & industry by forcing the companies to provide the workers with safe working conditions and supply them with necessary personal protective equipment.

In summary, working conditions within UAE working sectors usually incorporate some health and safety policies and regulations, but how effective these policies and regulations are depend largely on training strategy, principles, and enforcement within the various working sectors.

2.4.1 Safety Related Incidents

Millions of workers die, get injured or become ill every year as a result of workplace hazards (ALLI, 2001). Occupational incidents (fatalities, injuries, illnesses) are health issues as well as economic issues since they originate from work, which is an economic activity.

An accident may be defined as something that is unplanned, uncontrolled, and in some way undesirable. Accident prevention is one of the main objectives or practices of health, safety and hygiene section/committee. Moving from at risk to safe work habits is a key to prevent injuries (Williams and Geller, 2000). Brun (2002) after revision of literature, divided prevention activities into two tiers; strategic and operational. Prevention activities are said to be strategic when the main elements involve occupational health and safety policies, safe work organization, activity monitoring, and the distribution of occupational health and safety (OHS) tasks and resources. While the operational activities focus on prevention and may include carrying out preventive maintenance, inspecting the workplace, analyzing risks, providing training, and investigating accidents.

Although occupational injuries and diseases are largely seen as preventable, it has become increasingly difficult to have either government or enterprises pay for preventive and curative occupational health services in all developed, developing, and under-developed countries due to the increasing healthcare costs. These costs are recognized to have a significant economic and political impact in most developed countries (Park, 2001).

Perhaps, in many workplaces the greatest hazard may be due to human error and mistakes, which account for more accidents than any other single factor, hence, from the corporate as well as human point of view; it pays to have workers adequately trained and safety

oriented. The cost of accidents is high in terms of medical insurance costs, lost time on the job, legal fees for court cases, workers compensation, disability insurance, and unemployment compensation. The cost of preventing occupational accidents and illnesses has been argued to be much less than the cost of treatment of workers compensation (Gloss and Wardle, 1984).

The case in the UAE is no different. However, UAE is in deficiency of comprehensive and standardized data relevant to the number and the type of occupational incidents, as well as the cost associated with them. Occupational injuries and illnesses can be prevented with the development and implementation of a proactive, well managed, cost-efficient, and compliant safety and health program (Larry R. Collins, 2001) and (Thomas D. Schneid, 1989).

2.4.2 Accidents and Injuries

An unsafe condition is any condition, which in the right set of circumstances, will lead to an accident. On the other hand, unsafe acts are those carried out under less than safe conditions, and are responsible for most work related disabling injuries and death (Gloss and Wardle, 1984). There are several types of injuries that are possible to take place in the laboratory environment; those are listed in (Table 2.4.2.A**)** below. In this study we have focused on needle stick injuries as they predominantly affect health care workers themselves, including laboratory staff. The failure to prevent or control accidents adequately will result in injuries to workers and damage to equipment. It is anecdotally estimated that for every accident, 10 near-misses had occurred.

Table 2.4.2.A Types of Injuries

INTRAVENOUS	EQUIPMENT	BURN	INJURIES
• Infiltrate/ extravagate • Disconnected • Air embolus • Not given • Solution Identification • Infusion rate • Blood product or blood difficulty • Contrast media reaction • Site.Red.Sore • Other	• Elecro-cautery • Anesthesia equipment • Heart/lung machine • Monitors • Ambulance • Catheters • Tract • Tubes • N/G tube • Restrains • Bed • Equipment taken out of service • Syringes • Sutures/needles • Sponge • Port. Commode • Wheel chair • Walker • Forceps • Crutches • Thermometer • X-ray/Diag • X-ray/Therapeutic • Respirator • Needle • Other	• Electrical • Chemical • Heating • Appliance • Spills • Fire • Radiation • Other	• Infection • Reaction • Puncture • Hearing loss • Loss of sight • Hematoma • Ecehymosis • Blister • Laceration • Amputation • Fistula • Abrasion • Ulceration • Drainage • Fracture • Dislocation • Damage teeth • Sprain • Necrosis/ Sloughing • Needle stick • Other
MEDICATION		HAZARD	
• Order not followed • No order • Patient identification • Route • Medication omitted • Incorrect medication • Outdated • Transcription error • Adverse reaction		• Glass • Hazardous • Chemical spill • Gas • Other	
		FALL	
		• Found on floor • Out of bed • While walking • While sitting • Off table/Equipment • While standing	

There are more than 250 million work-related accidents every year. Workplace hazards and exposures cause over 160 million workers to fall ill annually, while it has been estimated that more than 1.2 million workers die as a result of occupational accidents and diseases (ALLI, 2001). The annual losses resulting from work-related diseases and injuries, in terms of compensation, lost work-days, interruptions of production, training and retraining, medical expenses, and so on, are enormous; Table 2.4.2.B shows figures for such expenses.

Table 2.4.2.B - Estimates of costs of accidents in two European countries in 1995*

Country	Lost workdays	Damages	Medical Cost	Number of Workers (X1000000)	Reference	Remark
United Kingdom	739	9-58	77-337	25	† 1	Costs/ Million EUR
Netherlands	158	363	122	6	†3	

* Reproduced with modification from European Agency for Safety and Health at Work, 1995.

† (1) HSE statistics (www.hes.gov.UK/statistics/dayslost.htm).

† (3) Bundesanstalt für Arbeitsmedizin, Dortmund (www.baua.de/info/statistik/stat_ 1998/kost 98.htm).

In the USA, in 1992, the total direct and indirect costs associated with work-related injuries and diseases were assessed to be US$ 171000 million. Whereas in the UK, the overall cost to the British economy of all work accidents and work-related illnesses in 1994 was estimated to be between £6000 million and 12000 million (European Agency for Safety and Health, 2002). In the United States, injuries are measured in three ways: in terms of frequency rate, severity rate, and the average days charged for each disabling injury (Gloss and Wardle, 1984).

2.5 Importance of Hazard/ Loss Control Program

A hazard in workplace is any existing or potential conditions that can result in deaths, injuries, property damage, or other losses. Hazards are grouped into three categories: those dealing with safety and injuries, those dealing with health and illnesses, and those dealing with property and environmental damages (Krieger and Montgomery, 1997). Hazard

control program should include several primary components such as a written program and policy statement, hazard anticipation and recognition, hazard evaluation and exposure assessment, hazard control, employee training, and record keeping. There is no definite formula for the development and implementation of such a program. The structure of hazard control program depends on several factors such as type and size of the organization, its management philosophy, the magnitude of workplace hazards, and the resource devoted to the program (Koren and Bisesi, 1996). Implementation of successful occupational health and safety program depends on the health commitment of higher administration. Serious commitment is demonstrated when senior management is directly involved and provides the resources and the authority to carry out the program. Occupational and safety should be given the highest level of importance and accountability in the management hierarchy.

The main objectives of health, safety and hygiene section/committee loss/hazard control program are protection of workers against health and safety hazards in the work environment, maintenance of a healthy work environment, safety education of employees, and identification, prevention and /or elimination of hazardous conditions in workplace. A good hazard control program not only benefits the worker, but also the organization. It improves health, moral, and productivity of employees and reduces the costs associated with occupational injuries, workers compensation, medical costs, absenteeism, and other turnovers as well.

2.5.1 Written Program and Policy Statement

The main objectives of a written occupational health and safety program for hospital laboratories are to provide a general statement of occupational health and safety policy program authority and responsibilities, and to establish an operating procedure for the program components. The written program should include policy, which should be approved by the Medical Services Corps (MSC) or the commander of the hospital, and it should state the purpose of the program. The statement should reflect the commitment of upper management to health and safety, the importance of health and safety of employees to upper management, and the organization guarantee to comply with all regulations and standards related to health and safety. The written program should include the health and safety committee and their responsibilities. In addition, the objectives of the program should be stated clearly. Each part of the program should have standard operating procedures.

2.5.2 Hazard Anticipation and Recognition

The prevention of occupational illnesses, injuries, and any other incidents in hospital laboratory is an important issue. Accordingly, occupational health and safety principles and practices are emphasized to identify, evaluate, and control sources and causes of hazards in the workplace environment and in turn, decrease the risk of illness and injuries to workers. Inspection of the workplace is the best source of directly relevant data about health hazards (WHO, 1999). The hazards include chemical, physical, biological,

ergonomics, mechanical, electrical, and physiological agents or factors that can potentially cause injuries or illnesses to workers (Koren and Bisesi, 1996).

2.5.2 Hazard Evaluation and Exposure Assessment

Evaluation is a very necessary phase to determine overall effectiveness and identify deficiencies. Anticipation and recognition continue during the evaluation phase that consists preliminary of surveys and inspections, which include visual and instrumental monitoring of a site or an operation. Visual monitoring refers to observation, such as using checklists of processes or conditions at a site and identifying potential and actual hazards.

2.5.4 Hazard Control

Establishing a control measure is an essential part of developing hazard/loss control program. Effective measures for controlling hazard and exposures in work places involve developing and implementing administrative controls such as the development of health safety management plans and strategies, development of standard operating procedures and regulations, and promoting the use of less hazardous materials. The idea here is to control the hazard at its source. The second important incentive is to control the hazard along its path. This can be accomplished by adequate infrastructure and engineering controls. This step includes appropriate and clear process descriptions and design, guarding, shielding, grounding, and proper ventilation system. In the case where engineering controls are inadequate, a third alternative is to direct effort toward workers.

This can be achieved by personal protective equipment (PPE) control which provides barriers between workers and the hazard (Koren and Bisesi, 1996) and (Krieger and Montgomery, 1997).

2.5.5 Employee Training

Training is one of the most important tasks to be carried out by employers. Workers need to know not only how to do their jobs, but also how to protect their lives and health and those of their co-workers while working. Within enterprises/organizations, managers and supervisors are responsible for ensuring that workers are adequately trained for the work that they are expected to undertake. Such training should include information on the health and safety aspects of the work and on ways to prevent or minimize exposure to hazards (ALLI, 2001). Training benefits the organization and the workers in terms of reinforcement of operational goals, improved performance, fewer work- related incidents and accidents, and reduces costs.

In this respect, Management concern for safety appears to be a motivating factor (Gloss and Wardle, 1984). Safety- training programs are needed for a variety of reasons:

1. To introduce newly hired employees to relevant safe working practices.
2. For employees reassigned to other jobs to introduce safe practices they may not be familiar with.
3. For employees returning to work after an extended lay-off period or medical leave.
4. When new equipment or processes are introduced or installed in the workplace.
5. Whenever the need arises to improve and update safe work practices and procedures.

In medical laboratories specifically, staff training should always include information on safe methods for highly hazardous procedures that are commonly encountered by all laboratory personnel and which involve:

a) Inhalation risks when using loops, streaking agar plates, pipetting, making smears, opening cultures, taking blood/serum samples, centrifuging, etc.

b) Ingestion risks when handling specimens, smears, cultures.

c) Risks of percutaneous exposure when using syringes and needles.

d) Handling of blood and other potentially hazardous pathological materials.

e) Decontamination and disposal of infectious material.

2.5.6. Record keeping

Health, Safety and Hygiene documentation must be maintained to demonstrate that the work has been conducted in accordance with professional standards. Records should include all relevant data, such as details of the site, products, manufacture and methods of use, including the availability and wearing of personal protective clothing or equipment (ALLI, 2001). Many organizations have developed their own forms, record keeping procedures, and data basis to efficiently handle the large amount of documentation that is generated (Huey, M, 1997). Accident investigation records are also a tool for measurement. This form of record should serve two purposes: to determine the causes of an accident and to evaluate the supervisor's ability to prevent accidents.

2.5.7 Risk Assessment

Risk assessment is a careful examination of what, in the work, could cause harm to people with the purpose of taking sufficient precautions to prevent occupational accidents or excessive exposures. Risk assessments have been used for many years by the industry to rank different risks in order of importance. This allows priorities to be set for the implementation of control measures. Such ranking by risk takes into account the consequence/severity, the probability, and the exposure. Severity considers the potential losses, whereas Probability considers the probability of a loss occurrence, and exposure considers the number of employees performing a job and/or the number of times an individual employee performs a certain task (Krieger and Montgomery, 1997). Whereas Donoghue (2002) identified the risk of a hazard as the probability that it will result in an undesired event and the consequences that such an event would have.

2.6 The Economic Perspective of Health and Safety System

Occupational incidents can cause immense economic impact that may lead to serious social burden in many countries, thus affecting occupational health, which in turn leads to economic loss. Such loss will increasingly affect the economic development (WHO, 1999).

Occupational incidents (fatalities, injuries, illnesses) are not only issues, but they are also economics once, since they stem from work, which is an economic activity. The economic perspective on occupational safety and health encompasses both causes and effects: the

role of economic factors in the etiology of workplace ill-health and the effects this has on the economic prospects for workers, enterprises, nations, and the world as a whole.

There are general purposes that economics can serve for occupational health and safety. Identifying and measuring the economic costs of occupational injury and disease can motivate the public to take these problems more seriously.

Higher management commitment to health, safety, and hygiene program is imperative for its success.

To gain their support both social and economic, benefits should be made apparent. Some of such benefits are presented hereunder:

- Health, Safety, and Hygiene offer a workplace environment that is protected from known occupational hazards.
- Occupational injuries and illnesses are reduced, thus decreasing direct and record keeping costs associated with them.
- Productivity is usually increased by the improved working conditions that reduce lost time from occupational accidents, reduce absenteeism, and improve moral between the staff.
- Anticipating and controlling potential occupational hazards reduce operating costs.
- The program provides an important source of health and safety information and training for employees.

Perception and understanding of risk in occupational health and safety among employers and employees influence the control of risks at work (Holmes *et. al*., 1998). They concluded that OHS management and promotion programs that are based on perceived qualities or social understanding of risk alone would be in danger of being rejected or ignored by participants, may aggravate risk controversies, and lead to unsafe work. They

also deduced that risk perception that focuses solely on employees can have limited implications for the practice and management promotion in OHS.

2.7 Health and Safety in Hospitals

Hospitals usually provide the basic health care needs for a large number of people. They often are teaching and research centers as well. Thus, potential hazards in hospitals settings may include radiation, toxic chemicals, biological hazards, heat, noise, dust, and stress. According to Health Care Worker Guidelines published by (NIOSH, 1988), hospital employees are exposed to various degrees of these hazards, which are summarized below:

a) **Maintenance workers** are potentially exposed to solvents, asbestos, and electrical hazards. Persons working in or around boiler rooms are regularly exposed to high levels of noise and heat.

b) **Housekeepers** are exposed to detergents and disinfectants that can cause skin rashes and eye and throat irritations. They are also at risk to Hepatitis, HIV and other infectious disease exposures as a result of hypodermic needles that have not been discarded properly. Sprains and strains are other common problems for housekeepers.

c) **Food service** workers face problems such as cuts from sharp-edged equipment, burns from hot surfaces and steam lines, falls on slippery floors, and fatigue and stress from long periods of standing on hard surfaces. No ionizing radiation from improperly maintained equipment is a potential hazard. Skin rashes from fresh foods, detergents, and humidity are also common, and excessive exposure to noise has been documented.

d) **Registered nurses** (RNs), nurse practitioners and vocational/licensed practical nurses (LVNs /LPNs) confront such potential problems as exposure to infectious diseases and toxic substances, back injuries, and radiation exposure. Nurses also deal with less obvious hazards resulting from stress and shift work.

e) **Radiology technicians** are potentially exposed to radiation from X-rays and radioactive isotopes. Even with the adequate maintenance of equipment, risks can result from incorrect work practices (such as holding infants under a radiation beam without adequate self-protection) or from infectious diseases transmitted by patients. Radiology staff may also be exposed to chemical hazards.

f) **Operating-room workers** may face the increased risk of reproductive problems as a result of exposure to waste anaesthetic gases. They are also subject to cuts and puncture wounds, infection, radiation, and electrical hazards.

g) **Laboratory staff** are potentially exposed to solvents, electrical hazards, detergents, disinfectants, cuts from sharp-edged equipment, burns from hot surfaces, falls on slippery floors, and fatigue and stress from long periods of standing on hard surfaces. They are also exposed to Hepatitis, HIV, and other diseases from hypodermic needles which have not been properly recapped or discarded. More on this category of work is discussed below (section 2.8) as it constitutes the main focus of the study.

To be able to protect themselves from further damages, hospitals are giving enough training and education to their employees on working safely inside the hospital. The basic goal is for them to have a thorough understanding of how they can most possibly help in maintaining and promoting a safe working environment which can benefit the whole workforce in the hospital (Valley View Hospital, 1998).

Hospital-acquired infections, also known as health-care-associated infections, encompass almost all clinically evident infections that do not originate from a patient's original admitting diagnosis (Kumarawat, 2009). This kind of infections can possibly be due to improper hospital management activities such as those with regards to the disposal of hazardous wastes.

There is some personal protective equipment (PPE) that hospital staff can use to be able to prevent risk that they may get. First, lab coats should be worn in the laboratory area and removed before leaving. Plastic or rubber aprons should be worn when there is a potential for splashing. Second, Gloves should be worn when performing tasks such as handling hazardous chemicals, specimens, or hot materials. Third, rubber-soled shoes should be worn to prevent slips and falls. Rubber-lined shoe coverings may also be used to protect against spills or dropped objects. Fluid-proof shoes must be worn if there is a possibility of leakage to the skin. Forth, Protective eyewear or shields should be used if splashes of a hazardous substance are likely to occur. Goggles that are tight-fitting may prevent irritation of the eyes if aerosolized chemicals are present. Goggles that protect the cornea, conjunctive and other ocular tissues are required for all personnel in the operating room during laser surgery. The wavelength of the laser output is the most important factor in determining the type of eye protection to be used. Opaque goggles are to be worn if in the direct x-ray field. Fifth, impervious or low permeability gowns should be worn when in contact with antineoplastic drugs, ribavirin and blood/body fluids. These gowns should be properly stored in the area of use if contaminated. Soiled gowns should be washed or discarded. Lead-lined aprons are to be worn if in the x-ray field. Last, respirators may be required in case of emergencies, such as accidental spills and/or exposure to specific chemicals, e.g., formaldehyde and ethylene oxide (Barbara, 2002).

2.8 Safety Policy/Procedure at Pathology and Medical Laboratories

UAE is highly concerned about the occupational health and safety, thus ensuring the safety of workers and others who are affected by their activities (MOH, 2004).

Local legislation 1991/61UAE Official Gazette (1991) for occupational health and safety concentrates on the requirement of essential personal protective equipment such as:

- Head, face, and ear protection.
- Protective clothes to keep the whole body and limbs safe from chemical reagents, fluids, evaporation, heat and cold.
- Gloves to protect the arms and hands from chemicals, physical and biological hazards.
- Security belts to prevent the occurrence of accidental falls.
- Protective shoes.
- Shields and facemasks to protect the respiratory system.
- Furthermore, structures such as staircases at working sites should have high edges to act as safety barriers.

It is the employer responsibility to ensure that all necessary safety and warnings signs are appropriately marked and placed. These signs would warn of dangerous areas, show the location of safety equipment such as fire extinguisher, and where applicable direct flow of traffic to prevent accidents. Electric connections should be placed in a proper way to prevent fires, explosions and electric shocks. The regulation also insists that the responsible authority should investigate and inspect the commercial and industrial stores to ensure their compliance with all safety regulations and procedures by using proper equipment to ensure the highest safety levels (UAE, 2004).

In any organization, occupational health and safety concerns are considered as the responsibility of managerial planning. It also reflects the public awareness towards the importance of the safety procedures and their role (Abdel Majeed, 2001). The following factors must be taken into consideration when reviewing or establishing occupational health and safety standards:

- Personnel, raw materials, production equipment, instruments, and working environment.

Taking the above-mentioned factors into consideration it would be advisable that the following recommendations be used as a spring board towards the final objective:

- Effective scientific planning.
- Research current practices and review them to fit-in with your environment.
- Match current practices and make a commitment towards upgrading.

Laboratories in general, and especially medical laboratories, are considered to be potentially high-risk work environments due to exposure to dangerous fluids, solid materials and radiation. Therefore, certain guidelines to increase the workers' awareness level with regards to the hazardous of the working environment are essential.

An occupational safety authority is highly required if injury and illness are to be avoided in the laboratory. Implementing policies and procedures to regulate the occupational health and safety is essential and can be achieved through making a thorough study of the workers and working environment and applying programs aimed to protect the workers from hazardous incidents (WHO, 1999).

These programs differ from one lab to another, due to the nature of working sites, types of analysers and competency of the workers. In addition to this, there are further factors, which would affect implementation of adequate policy. They are as follows:

1. The position of the administration:
    - The success of the occupational health and safety programs depends on the administration interest and concern.
2. Work environment.
    - The organization building design should take into consideration the nature of the work and the variety of safety procedures.
    - Specifying all kinds of hazards and advising the employees about them.
    - Selecting suitable workers for certain jobs.
    - Providing the safety procedures and training the staff on these procedures.
    - Regular maintenance for the safety instruments.
    - Cleanliness and sanitation.
3. Supervision and training:

Ignoring the safety procedures during the work is the major reason for accidental incidents and may be attributed to lack of the training and /or supervision.

4. The importance of teamwork in implementing and achieving occupational safety:

The responsibility of achieving and applying the safety procedures at the work site is an administrative level task. They should carry out the responsibilities as follows:

a. Attend laboratory safety training.

b. Review the chemical hygiene plan and the laboratory safety manual.

c. Follow procedures and laboratory practice outlined in the chemical hygiene plan and laboratory manual as provided by supervisors and principal investigators.

d. Report all incidents, accidents, potential chemical exposures and near miss situations to the principal investigator and the chemical hygiene officer.

e. Use engineering controls and personal and protective equipment, as appropriate.

f. Document specific operating procedures for work with particularly hazardous substances, including carcinogens, reproductive toxins and chemicals with high acute toxicity.

The goal of the laboratory safety program is to minimize the risk of injury or illness to laboratory workers by ensuring that they have the training, information, support and equipment needed to work safely in the laboratory. The three basic elements of the laboratory safety program are:

1- The departmental safety program led by the chemical hygiene officer.
2- The laboratory safety support and training by environmental health and safety officer.
3- Instruction and oversight by an individual supervisor or principal investigator.

2.9 The UAE Health Care System

Since the discovery of oil in the mid 1950s, UAE has witnessed tremendous economic and social development. The annual reports of the Ministry of Information and Culture describe the UAE's infrastructure, banking, telecommunications and healthcare facilities as among the best in the world (UAE, 2004).

Health care services, in the UAE, are represented and offered by six medical sectors;

1) Ministry of Health (MOH) renders its services through governmental hospitals (14 hospitals) and (61) primary health care centres in 5 of the 7 emirates (Abu Dhabi and Dubai excluded).

2) Health Authority of Abu Dhabi (HAAD) limits its services to the Emirate of Abu Dhabi comprising 33 hospitals, 389 centres and 188 clinics.

3) Department of Health and Medical Services in Dubai (DOHMS) offers its services within the Emirate of Dubai through 20 health care centres. In addition, to several private health care institutions.

4) Private medical sectors (the number of private health institutions have reached 869 (MOH, 2004) distributed throughout the country. Eighty-seven of these institutions are hospitals and the rest are health centers and general clinics.

5) Ministry of Interior (MOI) runs several polyclinics and Paramedical Out-Patient Clinics in Abu Dhabi and Sharjah. In addition, the MOI operates a rescue and emergency air wing service.

6) Medical Services Corps for the Ministry of Defence (MSC). The section below gives detailed description of the health care system within the UAE Armed Forces.

2.9.1 Medical Services Corps (MSC) of the UAE Armed Forces

2.9.1.1 MSC Community

Medical Services Corps (MSC) community is a military one. The population of this community is about 3400 staff, comprising Medical Services Corps main building, Zayed Military Hospital, MSC nursing school, public health building and other facilities such as medical store, medical workshop, and staff accommodations. ZMH is the main part of this community comprising physicians, medical staff, admin staff, visitors, patients and students under training. The labor force of ZMH is comprised of two categories: full time employees and contract workers. Full time employees are employed by UAE Armed Forces GHQ on full time basis where they receive their commands and instructions, and

they receive full benefits of medical insurance, worker compensation and end of service indemnity as well as other allowances and benefits. On the other hand, contractors (about 18 contracts, such as maintenance, housekeeping, guards supply, transportation and material handling) who provide ZMH services, employ contracted workers, pays their salaries including medical insurance, and handle their legal affairs. Contract workers (casual) work alongside with full time employees day by day (24 hours/7 days a week), and they receive their commands from the employer in accordance with the commanding officer of Zayed Military Hospital.

2.9.1.2 Military Hospitals

All the military hospitals and medical centers operate under the supervision of the Medical Services Corps (MSC) that is related directly to UAE Armed Forces GHQ. These hospitals offer free medical services for the military personnel and their family members (MSC/Policy & Procedure/Updated 1999) they comprise four main hospitals; Zayed Military Hospital (ZMH), Al Ain Medical Centre (AMC), Sharjah Medical Centre (SMC), and Zayed City Military Hospital (ZCMH). The capacity ranges from 100 to 300 beds, 6 medical centers (27 to 50 beds), and other 14 satellite clinics with 10 to 15 beds. MSC is the health authority figure in the UAE Armed Forces. It aims to apply international standards in order to provide preventive, curative and primitive health services to the community by utilizing the best technology and human resources.

2.9.2 Coverage and Applicability

There is a continuous two-way interaction between a person and the physical and psychological working environment. The work environment may influence the person's health either positively or negatively, and productivity is, in turn, influenced by the worker's state of physical and mental well being.

The systematic and accurate flow of patient test requisition forms and samples through a hospital system is one of the most important processes in any health care centre, irrespective of size or level of automation. Over the years, the main laboratory at ZMH has established several sections, which perform a large array of tests. The laboratory is subdivided into a number of sections, namely: reception, phlebotomy, biochemistry, special chemistry, haematology, serology, Molecular Biology (PCR), microbiology, and Blood bank. The main laboratory also monitors and supports several satellite clinics, which vary in size and range of tests offered on site. These satellite clinics often send their reference tests to the main laboratory using a military driver.

2.9.3 Interaction between Staff and Machines

In any hospital laboratory, there are many types of machine-staff interaction. This kind of interaction can be categorized according to many factors, including: Methodology of the machine, size of the machine, specimen types, how much hazard this machine can produce, noise and heat produced by the machine, and frequency of maintenance for this machine.

Those are some examples, but there are many others. In order to optimize this interaction, the person who is using any machine should be familiar with it and should know how it works. Also he/she should know the hazard that might be produced by this machine, how to maintain it, how to keep the result within the standards and how to interpret the results.

In order to understand the interaction between staff and machines in hospital laboratory, I will take a very common medical laboratory machine: Serology ELISA machine. This machine uses the serum samples to determine the known antibodies or antigen or both in the serum, this Ab, Ag can be for HCV, HIV, HBV or any other infection.

The person who is using this machine should know the following:

1. How this machine works and the methodology of ELISA.
2. Sample loading and the protection needed.
3. Reagents and standards.
4. Troubleshooting during operation.
5. Get the result and check if the result within the QC standards.

So as we see, continuous interaction and personal knowledge about the machine are the backbone of this process.

The safety issues are very important in this interaction, to keep the person and his environment away from any expected hazard. In the previous example there are many safety issues; some of these are:

1. Using personal protection during loading and unloading samples and reagents.
2. Droplets may splash and infect any person near the machine.
3. The machine waste may cause infection if not probably secured.

2.9.4 Interaction between Staff and Specimens

In the outpatient clinic, the patient is sent to the laboratory along with his/her requisition form. While in in-patient (wards), a unit assistant/medical tubing system delivers the patient sample and requisition form to the laboratory central processing area. The requisition form must be completed with all patient information and clinical data clearly entered in-order for it to be accepted for processing. In cases where the requisition form and sample are delivered from wards, the sample is also checked for the correct corresponding military ID number and name.

Reception

- The Patient is sent to phlebotomy to have the appropriate sample drawn or to be provided with stool/urine container.
- Samples and requisition forms are sent to the laboratory.
- Rejected requisition forms or the requisition forms of rejected and discarded samples are sent back to the wards or clinics. However, when necessary, the wards or clinics may be informed via the telephone/medical tubing system facility.

Phlebotomy

- Patient is bled and all tubes are labelled with the patients' first name and military number. Urine and stool containers are labelled before being given to the patient using an indelible ink marker. All samples are treated as biohazards and all needles/syringes are discarded in sharp containers.
- Samples and requisition forms are sent to the laboratory.

Photo 2.9.4 Phlebotomy (Main Laboratory at ZMH*)* photo by author

2.9.5 Safety Policy/Procedure at Pathology and Medical Laboratories in ZMH

Prior to the introduction of CAP-CLSG the author was appointed as chief medical laboratory and safety officer (Chief MLSO) (part time) and acted as the management representative responsible for health and safety within the laboratory. The roles and responsibilities of the Chief-MLSO and all hospital employees are described in the hospitals laboratory and procedure documents. The relevant portion of this document is reproduced in Appendix (B) (ZMH, 1999). It is the responsibility of each employee to take care, as much as possible, of their own safety and health and that of other people affected by their acts or omissions at work. Employees should use equipment correctly, observe laboratory safety guidelines and make use of personal protective equipment and safety devices. Any incident or situation, which represents a danger to health and safety, should be reported to the Chief MLSO. A first aid box and eyewash are provided and situated in the main laboratory. Staff may use this box to attend to minor injuries or to cover cuts etc.

In the event of serious injury, first aid should be given immediately and the injured person is taken to staff clinic or emergency room as appropriate.

2.9.5.1 General Process Description

In our laboratory, specimens are received by the central accessing area where they are processed, logged into the computer, and given a specimen number before being distributed to the specific section for testing. Each section then checks that it's the correct sample for the test requested, that it's the correct volume, and is not degraded i.e. haemolysed, lipemea, clotted EDTA samples etc. Sections also ensure that each sample has its corresponding correct requisition form. Samples that are rejected based on the above criteria are discarded and requisition forms with comments are sent back to the reception. Processed and completed requests are sent back to the reception for distribution.

In some cases samples are sorted and sent for reference testing to either the main ZMH laboratory in Abu Dhabi or via local agency (Gulf Drugs Est.) to bioscientia Laboratories in Germany. The results for these tests are sent back to the lab and onto the reception.

2.9.5.2 Interaction between Staff and Chemical Reagents

Routine maintenance of equipment is categorized as daily, weekly and monthly, and is determined by the instruction from the instrument manufacturer. Furthermore, the more complex procedures of instrument servicing are left solely to either the more experienced technicians or the companies' biomedical engineers. This is part of a stringent internal and

external quality control (QC) and quality assurance (QA) program. The technicians deal with basic troubleshooting. However, in major or complicated cases they may call in a service engineer. The technicians prepare the reagents, check the expiry dates and when necessary calibrate it in the instrument. If the reagent has not been previously used i.e. fresh, the date it has been opened is clearly marked in indelible ink.

Sample Processing

The technician programs and processes the test samples. He/she then evaluates the results and where indicative repeats the test or dilutes and re-runs the test. All panic results are reported via telephone to either the doctor or nurse in-charge. The test is deemed completed when the technician has validated the results and signed off. He/she also makes sure that the work area is adequate and disinfected, and all waste material has been discarded according to health and safety protocol. The results are then passed on to the pathologist/lab in-charge for further evaluation and recommendation of further testing where necessary, and are then released to the receptionist for distribution to wards/clinics or units accordingly.

2.10 Improvement of Practice in Medical Laboratory

The expenditure on health care services delivery is increasing worldwide (The Conference Board of Canada, 2001 report) and (Willerson, 2007). In recent years, the cost of health care and its quality become the major challenges facing the health sector around the world (Plebani, 2003). In the recent year 2000, laboratory charges made up 20, 4, 5.2 and 7- 10

% of total hospital care accounts in the United States, United Kingdom, Australia and Canada, respectively (Plebani, 2003).

Medical laboratories witnessed several technological and organizational changes. These included automation, information systems, and incorporation of new diagnostic tests to meet the increased demand for laboratory services. This is done while ensuring high quality standards. However, laboratory staff are required to make an effort to optimize their resources and avoid increase in overall costs (Garcia, 2008).

Quality measurement and management is one of the most important topics in medical laboratory practice today.

To meet the higher standards, it is crucial to implement strict regulations and requirements that determine the efficacy of any health care laboratory. The major players in setting international health care laboratory standards today are the College of American Pathologists (CAP), the International Organization for Standardization (ISO), and the International Electro technical Commission (IEC).

In their effort to improve quality of practice in a cost-effective fashion, many laboratories world-wide are seeking accreditation by any of these organizations through the adoption of their respective standards.

2.10.1 What is an Accreditation Laboratory?

An accredited laboratory is one that is inspected by a private non-profit accrediting organization that has been approved by the Centres for Medicare and Medicaid Services (CMS) and its requirements deemed as equivalent to or more stringent than CMS's

regulatory requirements. Our laboratory has elected to adopt the CAP standards and seek its accreditation.

The goal of the CAP Laboratory Accreditation Program is to improve patient safety by advancing the quality of pathology and laboratory services through education, standard setting, and ensuring laboratories meet or exceed regulatory requirements. Upon successful completion of the inspection process, the laboratory is awarded CAP accreditation and becomes part of an exclusive group of more than 6,000 laboratories world- wide that have met the highest standards.

There is ample evidence that CAP-LAP ranks high as a top performed in the field (Rundell, 2006). At least one hospital in UAE (American Hospital in Dubai) selected CAP-LAP as their yard stick in lab quality achievements. There are several benefits from introducing CAP:

1) CAP evaluation helps to maintain a consistently high level of services.
2) The CAP Laboratory Accreditation Program utilizes multi-disciplinary teams of practicing lab professionals as inspectors who are uniquely qualified to provide thorough inspection that is specific for each section of the lab.
3) The CAP Laboratory Program helps meet the requirements of national and state regulatory bodies.
4) There is always a healthy exchange of ideas and discussion of the latest lab techniques between lab staff and inspectors that go beyond regulatory requirements.
5) The inspection checklists reflect current practices and technologies and therefore serve as living documents on good laboratory practice.
6) Over 83% of the top major teaching and large community hospitals choose CAP as their accreditation agency (Modern Healthcare, 2004).

2.10.2 The College of American Pathologists (CAP)

The College of American Pathologists (CAP) was formed in 1946 to foster and advocate excellence in the practice of pathology and laboratory medicine. In 1959, it established laboratory standards, and in 1961, the Laboratory Accreditation Program (LAP) was established. The CAP received approval from the US Department of Health and Human Services in 1995 as an accrediting organization. The CAP Board of Governors approves the "Standards", which are the basis of the accreditation decision. The Primary goal of the CAP-LAP is laboratory improvement through professional peer-review, education and compliance with established performance standards (CAP, 2003).

Clinical Laboratory Safety Guidelines (CLSG)

The College of American Pathologists CAP-CLSG (2003) comprises an extensive body of written material designed to increase and assure quality and efficiency within hospital laboratories. It is not feasible to reproduce the guidelines within this thesis. However, the author considers that a summary of the most relevant areas of the CAP-CLSG is important in understanding the context of this thesis. For this reason, the following sections summarize selected areas of CAP-CLSG.

The accreditation programs examine pre-analytical, analytical, and post- analytical aspects of quality management (QM) in the laboratory. This includes the performance and monitoring of general quality control (QC), test methodologies and specifications, reagents, controls and media, equipment, specimen handling, test reporting and internal performance assessment, and external proficiency testing, In addition, personnel requirements, safety, document management and other management practices are included

in the inspection process. Laboratories that meet accreditation requirements distinguish themselves as quality laboratories (CAP-CLSG, 2005). In Zayed Military Hospital the steps taken to implement CAP-LAP standards are described in section (2.10.3).

A. Introduction.

As part of their accreditation programs, the CAP-CLSG provides detailed questions covering the general safety program of the entire laboratory. They must be answered by all laboratory sections. Non-compliance with any of these questions in any of laboratory sections represents a deficiency for the entire laboratory.

Safety features unique to individual laboratory sections are addressed in that section's checklist. Inspection for safety hazards in any section is the responsibility of the CAP-CLSG team member inspecting that portion of the laboratory.

B. General safety

1. "The clinical laboratory should have, and make readily available to all employees, detailed complete laboratory safety procedures and manual."
2. "As part of their orientation, new employees should receive instruction in safe work practices. Such instruction should be documented."
3. "Laboratory employees should be knowledgeable about laboratory safety issues. Such knowledge should be demonstrable in random interviews with employees during inspection for laboratory accreditation."
4. "A system should be in place to report to OSHA, within 8 hours, all serious accidents in fatalities or in hospitalization of three or more employees."
5. "As part of the laboratory QI program, reports of occupational injuries or illnesses requiring medical treatment or resulting in time loss from work should be reviewed in order to avoid recurrence. This includes every needle stick or sharps injury."
6. "All laboratories personnel performing patient blood collection should receive adequate training in the proper selection and use of equipment, supplies and collection techniques. The laboratory should maintain records documenting such training."
7. "Employers should select safer needle devices and involve employees in the identification and selection of the device."

8. “Employers are required to maintain a log of all injuries from contaminated sharps.”
9. “Policies should be in place to prevent or reduce UV light exposure from instrument sources. Suitable personal protective equipment should be provided and appropriate signage displayed.”
10. “Policies should be documented for fire protection, electrical, chemical, microbiological, and radiation hazards, waste disposable, universal precautions, disaster preparedness and ergonomics.”

C. Fire safety

The publications of the National Fire Protection Association (NFPA) address the issue of fire prevention and preparedness.

C.1. CAP-accredited Laboratories must comply with one of the following:

(1) “Have an automatic fire extinguishing system.”
(2) “Be separated from adjacent inpatient facility by fire-resistant construction with minimum rating of two hours in addition to class B self-closing door assemblies rated at three-quarter hours.”
(3) “Be located in buildings classified as ‘business occupancy.”

C.2. “The laboratory must have an alarm system that is audible in all the sections, including lavatories, darkrooms, storage areas, and offices.”

C.3.” All laboratories personnel should attend fire drills at least once per year.”

C.4. “Portable fire extinguishers (class B) must be located in areas of the laboratory where flammable or combustible liquids are stored or handled.”

C.5. Laboratory staff should receive proper training in the use of portable fire extinguishers. Such training should be documented.

C.6. Flammable liquids must be properly stored in safety cabinets or safety cans.

D. Electrical hazards

Many accidents occur due to defective electrical apparatus, especially portable electrical apparatus, e.g. sockets, plugs and flexible cable. All switches must have approved voltage

and amperage rating compatible with intended use. Circuit breakers should be used when needed. All electrical equipment must be inspected and maintained regularly.

All laboratory equipment should be adequately grounded at their initial installation; they should be checked for current leakage whenever there is malfunction and after each repair. Documentations of checks and repairs should be readily available at the time of CAP inspection.

E. Chemical hazards

Harmful chemical compounds in the form of solids, liquids, mists, dusts, fumes and vapours exert toxic effects by inhalation(breathing), absorption(through direct contact with the skin) or ingestion(eating or drinking).The degree of workers risk from exposure to any given substance depends on the nature and potency of the toxic effects and the magnitude and duration of exposure.

Hazards associated with all chemicals present must be evaluated and documented by the laboratory. A comprehensive signage and labeling system must be in use throughout the laboratory. Measures to be taken in case of accidental contact must be shown on the label. Material Safety Data Sheet (MSDS) for each hazardous chemical must be kept on file, either electronically or on paper OSHA, 29 CFR 1910, 1200.

Whenever applicable, a documented Chemical Hygiene Plan (CHP) is required. This CHP should indicate all chemicals regardless of type of risk, volume or concentration 29 CFR 1910, 1450 as per OSHA regulations. The laboratory must conduct and document an annual survey for the presence of carcinogenic and potentially carcinogenic chemicals e.g. formaldehyde, ethylene oxide, Benzedrine, etc. as mandated by OSHA, 29 CFR 1910, 1001-1047. Personal protective equipment (PPE) should be provided and its use mandated whenever necessary. These include face shields, aprons and appropriate gloves. Chemical fume hoods must be periodically checked for proper function. Piped eyewash fountains should be present and easily accessible.

Universal Precautions:

Also known as standard precautions, these constitute a system for protection against the infectious hazards of blood and body fluids. The system includes employee education and the use of appropriate personal protective devices as part of the laboratory's practice.

Microbiological Hazards:

The laboratory should establish policies and procedures for assessing risk associated with exposure to infectious agents and bio safety levels and engineering and work controls practice appropriate for implementation.

Functional biological safety cabinets must be used when culturing mycobacterium, fungi and viruses. These must be inspected and checked annually.

Waste Disposable:

Disposable of solid and liquid waste must be in compliance with established regulations. Bio hazardous waste should be incinerated or disinfected before sanitary burial. Sharps should be discarded in puncture-resistant containers. Waste should be segregated at point of generation to hazard class. Documented policies and procedures should be present and comprehensive.

Radioactive Waste:

The use of radio nuclides and the handling of specimens containing radioactive material should follow appropriate procedures. The radioactive waste is divided into two categories, low-level waste and high-level waste. Low-level waste includes items that have become contaminated with radioactive material .Such contaminated items include protective shoe covers, clothing, wiping rags, mops, filters, equipment and tools, medical tubes, swabs, injection needles and syringes. High-level radioactive wastes are the highly radioactive materials produced as a by-product of the reactions that occur inside nuclear reactors.

Disaster Preparedness:

The laboratory must have a series of policies and procedures to be followed in the event of a catastrophe, disaster or mass-casualty situations. These should be part of the laboratory safety manual. The lab must also have a comprehensive practical evacuation plan covering all staff, patients and visitors. Inadequate plans are not acceptable.

Ergonomics:

Ergonomics is the study of the complex relationships between people, physical and psychological aspects of the work environment such as facilities, furniture, machines, tools and job demands (WHO, 1999). The aim of ergonomics is primarily to optimize, first and foremost, the comfort, as well as the health, safety and efficiency of the workers.

A documented Ergonomic plan must exist which trains employees about risk factors of musculoskeletal disorder hazards. Laboratory workplace and equipment should be designed to reduce the risk of distress and accidents.

Employers can set up procedures to correct or control ergonomic hazards by:

1- Using the appropriate engineering controls, e.g. designing or redesigning workstations, lighting, tools and equipment.
2- Teaching correct work practices, e.g. shifting workers among several different tasks, reducing production demand and increasing rest breaks.
3- Providing and mandating personal protective equipment where necessary.

2.10.3 Road Map of the CAP- LAP Accreditation Process in ZMH

With guidance from the laboratory accreditation consultant, the author, who was then the laboratory director, started the implementation by taking the following steps:

1. Participation in an external proficiency testing program.

2. Adoption of the standards spelled out in the checklists for various laboratory sections.
3. Orientation of the laboratory staff on their roles in the process.
4. Renovation of the laboratory, to meet the set requirements.
5. Writing of the necessary policies, procedures, job specifications, and responsibilities mandated by the CAP standards.

The details of the requirements for compliance with the CAP standard are outlined in chapter three (section 3.3.3).

2.11 Quality Assessment Tools

Evaluating the quality of services delivered is a multidimensional process that requires consideration of hundreds of variables. The result of such evaluation process will then be used as the basis for understanding the current problems in the quality management system processes at the organization and defining valid objectives and requirements for the proposed quality management system. Moreover, the resulting deficiencies from the internal assessment can be used to establish the need and basis for the proposed quality system. There are a variety of tools that can be used to directly or indirectly measure employee perception and satisfaction (Shelton, 2000). These include:

1. Open-ended questionnaire which is a valuable source of qualitative information;
2. Objective survey questionnaire is considered the best instrument for obtaining quantifiable responses data;

3. End-user focus group, which consists of a group of end-users who are representatives of the entire organization and are led through a group discussion that is structured to evoke suggestions and perceptions.
4. Reviewing safety reports
5. Measurement of productivity indicators such as proficiency testing, productivity, repeated tests, cost of absenteeism from work, and needle-prick injuries.

2.12 Summary of Literature Review

Studies reported in this literature revealed that occupational health and safety legislation, practices, and problems differ among countries depending on the degree of development, culture, and types of industries present in the country. Occupational Health and Safety (OHS) is practiced more widely and the relevant laws and regulations are enforced more strictly in developed than developing or less developed countries. Likewise, OHS problems in developed economies vary from work related psychological stress and feeling of insecurity, repetitive strains, allergies, back pain to conventional work related problems of handling and lifting, trips and falls, and mechanical hazards. On the other hand, OHS problems in the less developed or developing countries manifest themselves as poor working conditions, lack of personal protective equipment, poor enforcement of regulation, in addition to the regular occupational problems such as mechanical risks, material handling, falling from heights, and other problems.

Although UAE has the financial resources to establish a high OHS standard, there are still vast differences in the levels of compliance across the country, which need to be addressed. This may be largely attributed to the fact that the system is still in its infancy

stage, and progress is compounded from a lack of trained and qualified H&S personnel. Further preventative risk assessment and controls are new to the regional culture, not only in H&S laboratory but also across the industry; e.g. construction, manufacturing, etc. Despite these great advancements, there is still a wide range of fluctuations when it comes to standards and implementations of health and safety practices. This can be attributed to the infancy of the advancement of the country as a whole in respect to the establishment of health institutions. Recommendations for improvements from such studies lack an overall prospective since optimal solution (s) lack the ability to be generalized. Another limitation of the reviewed studies is that they do not give much attention to the involvement of management and health care professionals in the stage of problem formulation. The involvement of both health care professionals throughout the proposed process is a key factor in defining the safety factors and enhancing communication and collaboration among all parties.

Lastly, the literature review presented in this chapter has shown that most of the deficiencies and limitations facing the department of laboratory in carrying out its mission and duties are due to external (outside the hospital) factors and internal ones, such as shortage of manpower, space and facilities. The department of laboratory is short of full time health safety officer and technicians to execute inspections and surveys for all the sections within the department and to follow up on these surveys and to handle hazardous material. Currently we don't have inspection discipline because of the mentioned shortages. In addition, there is a shortage of trained trainers in health and safety.

In summary, potential as an adequate tool for improving health and safety programs, such an approach is effective in overcoming implementation barriers by addressing the real problems and concerns that have the most impact in delivering quality of health care services at a lower cost.

Reflecting on the above issues, a useful approach to solving these limitations, with the involvement of both staff and management can be achieved through the implementation of health safety standards embodied within CAP-CLSG. The fact that senior management has a drive to achieve a high degree of recognized operational competence provides the resources to develop effective H&S as a consequence. The implementation and effectiveness of CAP-CLSG is the central thesis of this work.

Chapter3 Theory and Description

3.1 Introduction

This chapter presents the theory of establishing and implementing the College of American pathologist's (CAP) health, safety, and hygiene program, specifically for medical laboratory as a quality support component. When organizational problems, such as health and safety related problems, are studied in an effort to find the optimal strategies and practices, it is important to view these problems from several different perspectives. Some examples include workforce, management, end-user of the services, and the analyst. In this chapter, theory description is not only regarded as an adequate tool for deriving solutions to well-defined problems, but also as an active key driver in understanding the health and safety system aspects ,concerns, and problems and in enhancing communication. An important consideration in the new proposed strategy is directed towards the need for gaining an understanding of how the health and safety system works and identifying redundant and non-value added activities incorporated in the current health and safety measures as a result of inappropriate safety practices. This can be accomplished by identifying the factors that have the greatest probability of solving the problem and affecting the productivity of the medical laboratory.

3.2 Background

Internationally developed safety standards for healthcare facility laboratories constitute an important practical tool to promote the essence of good laboratory practice for the

protection of laboratory workers from major safety hazards, including biological, physical, electrical and other hazards. These include not only those agents that pose a risk that is both common and grave, such as HBV, HCV, and HIV, but also other agents that may be associated with laboratory- acquired infection involving aerosols, droplets, or other potentially infectious materials. Exposures occur through needle- sticks, cuts from sharp instruments, or contact of the eye, nose, mouth and skin with infected patients' blood or body substances. As an example, transmission of at least 20 different pathogens by needle-sticks and sharp injuries has been reported (Collins CH, Kennedy DA, 1987). Although most exposures do not result in infection, the risk of a laboratory or healthcare worker acquiring HBV, HCV, or HIV following needle-sticks or cuts via percutaneous exposure, being the most frequently cited mode of transmission, is estimated to be 6 to 30%, 1.8% and 0.3%, respectively (CDC, 1998:1-8).

3.3 The Hypothesis

Medical laboratories around the world are varied on their adoption of health and safety standards, policies and practices. The rationale for implementing such health and safety measures is based on the assumption that those would lead to improvement in many aspects of medical laboratory functions and outcomes. The proposed hypothesis of this thesis will test the difference in such functions and outcomes when measured before and after implementation of the College of American Pathologist (CAP) health and safety standards. The alternative hypothesis states that a significant difference in functions and outcomes will be observed when the CAP standards are adopted.

3.3.1 The Null Hypothesis

Under the conditions of our experimental design for the field study assessing the impact of implementing CAP safety standards, the Null hypothesis stipulates that there will be no change in the risk estimates of exposure to the selected safety hazards, nor would there be any change in the number of safety incidents, as result of implementing the CAP safety standards.

3.3.2 The Comparative Study

The CAP safety requirements outlined below form the basis for the comparison between the pre-and post-study risk assessment and actual exposure results. The indicators to be used for such assessment will include level of safety awareness among laboratory staff, number of incidents, documentation and legislations and other factors as detailed in the methods section.

3.3.3 CAP Safety Requirements

The College of American Pathologists CAP-CLSG describes the implementation and maintenance of a prestigious laboratory accreditation program (LAP) that is peer-review-oriented. The LAP program addresses several areas of laboratory activities that in turn are governed by international standards. Safety is an important component of the LAP. The

LAP safety requirements are outlined below as excerpted from the relevant CAP documents and are divided into two parts;

- **Part 1**:

  Manuals and records; these are related to documentation. The laboratory should gather these documents together for review by the LAP inspectors.

- **Part 2:**

  Physical inspection of the laboratory which requires direct inspection of the various laboratory areas to observe environmental safety compliance and actual employee practices.

With respect to fire safety, CAP has given precedence to local authorities, it states that, if there is any conflict with regulations of the Authority having Jurisdiction (i.e., state and local fire codes), the regulations of the Authority having Jurisdiction take precedence.

Each part comprises one set of standards that must be in place; these are referred to as "Phase II" requirements. Another set of standards is "Phase I" requirements, which are not mandatory, but only recommended. As these requirements are central to the understanding of this thesis, they are summarized below.

Part 1: **Manuals and Records**

A. Phase II requirements

The following stipulations (A01 through A35) are mandatory**.**

A 01. "Safety policies and procedures should be posted or are readily available to all personnel"

A system to ensure that all personnel have read the procedures, policies and recommendations is required and must form a portion of the orientation program for new personnel. Posting of specific warnings or hazards as appropriate is urged.

A02. "There should be documentation of at least annual review of safety policies and procedures by the current laboratory director or designee"

A single signature on a title page or index of all procedures is not sufficient documentation that each procedure has been carefully reviewed. However, signature or initials on each page of a procedure is not required.

A03. "The director or designee should review and approve all changes to the safety policies and procedures before implementation"

A04. "Policies and procedures should be developed regarding the documentation of all laboratory accidents resulting in property damage or involving spillage of hazardous substances"

A05. "Policies and procedures should be developed regarding the reporting of all occupational injuries or illnesses that require medical treatment (except first aid)"

For U.S. laboratories, all serious accidents resulting in fatalities or in the hospitalization of 3 or more employees are required to be reported to the Occupational Safety and Health Administration (OSHA) within 8 hours.

A06. "An evaluation of these occupational injury/illness reports should be incorporated into the laboratory's quality management program to avoid recurrence"

A07. "Policies and procedures should be documented and adequate for fire prevention and control"

A08. "Fire drills should be conducted periodically"

Fire exit drills must prepare employees to respond safely in the event of fire. Announced or unannounced drills must be held in the laboratory. The purpose of a fire exit drill is to educate the occupants in the facility's fire safety features and exits, and to test the ability

of institutional personnel to implement the facility's fire emergency plan. It also is an evaluation of the escape routes, especially in larger buildings. The fire exit drill will ensure that fire exit corridors and stairwells are clear and that all fire exit doors open properly (i.e., not rusted shut, blocked or locked). For these reasons personnel must actually exit the area. Paper or computerized testing of an individual's fire safety knowledge is not sufficient. All personnel must participate at least once a year, but a single drill may involve only a subset of the personnel in attendance. Interruption in essential laboratory services is not required.

A09. "Personnel should be instructed in the use of portable fire extinguishers"

There must be documentation that laboratory personnel have been trained to use fire extinguishers. It is strongly recommended that instruction include actual operation of extinguishers that might be used in the event of a fire, unless prohibited by the local fire authority.

A10. "Policies and procedures should be documented and adequate for the safe handling of electrical equipment"

Policies must specify that portable patient care electrical equipment is inspected before initial use, after repair or modification, and when a problem is suspected.

A11. "The laboratory must have a Chemical Hygiene Plan (CHP) that defines the safety procedures for all hazardous chemicals used in the laboratory"

The laboratory director or designee must ensure that the laboratory has a documented chemical hygiene plan (CHP) that defines the safety procedures for all hazardous chemicals used in the laboratory. The purpose of OSHA regulations is to ensure that the hazards of all chemicals are evaluated, and that information concerning their hazards is transmitted to employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, material safety data sheets and employee training. An acceptable CHP contains the following elements:

1. Responsibilities of the laboratory director and supervisors
2. Designation of a qualified chemical hygiene officer
3. Policies for all operations that involve hazardous chemicals
4. Criteria for the use of personal protective equipment and control devices

5. Criteria for exposure monitoring when permissible levels are exceeded
6. Provisions for medical consultations and examinations
7. Provision for training employees in the elements of the CHP
8. A copy of OSHA Laboratory Standard

A12. "There should be an annual review and evaluation of effectiveness of the laboratory's Chemical Hygiene Plan"

A13. "There should be documentation that each of the chemicals in the laboratory has been evaluated for carcinogenic potential, reproductive toxicity, and acute toxicity; and does the policies and procedure manual define specific handling requirements for these chemicals"

OSHA defines the substances of special interests (select carcinogens) as any substance that is:

1. Regulated as a carcinogen by OSHA, has been classified as "known to be carcinogenic" by the NTP, or listed as a group I carcinogen by the IARC
2. Has been classified as "reasonably anticipated to be carcinogenic" by the NTP or listed as a group 2A or 2B carcinogen by the IARC if it meets the toxicological criteria listed in the January 31, 1990 Fed Register, pages 3319-3320. OSHA also requires special containment procedures for substances that are reproductive toxins or are acutely hazardous. There must be specific handling requirements defined for each chemical in use that is potentially carcinogenic.

A14. "Policies and procedures should be documented and adequate for hazardous waste disposal"

The laboratory is responsible for all real or potential hazards of wastes at all stages of disposal including transportation and final disposition.

A15. "The method for the disposal of all solid and liquid wastes should be in compliance with local, state and federal regulations"

Whether or not laboratory management is responsible for waste disposal, the laboratory should have documentation that the facility is in compliance with all applicable regulations. Prevailing local, state and federal (EPA) regulations should be reviewed by

the laboratory director, safety officer or hospital engineer to be sure that the laboratory is in compliance with regulations.

A16. "Policies and procedures should be documented and adequate for internal and external disaster preparedness"

A17. "A comprehensive, documented and workable evacuation plan for the laboratory should be in place, including specific plans for any persons with disabilities"

This plan must cover all employees, patients and visitors, and should address the special needs of persons with disabilities. Evacuation routes must be posted.

A18. "There should be a documented ergonomics program to prevent musculoskeletal disorders (MSDs) in the workplace through prevention and engineering controls"

A comprehensive ergonomics program to prevent the occurrence of work-related MSDs may include training of employees about risk factors, identifying physical work activities or conditions of the job commonly associated with work-related MSDs, and recommendations for eliminating MSD hazards. Laboratory activity, workplace and equipment (e.g. chairs, laboratory workstations, computer keyboards, and displays) should be designed to reduce the risks of ergonomic distress disorders and accidents.

A19. "Policies are documented to prevent or reduce ultraviolet light exposure from instrument sources"

UV light may cause corneal or skin burns from direct or deflected light sources. Wherever UV light sources are used, suitable and adequate personal protective equipment must be provided, and appropriate approved signage displayed. Laboratories may obtain information on safety from manufacturers of devices that emit UV light. A suggested sign for display is: Warning: This device produces potentially harmful ultraviolet (UV) light. Protect eyes and skin from exposure.

A20. "Policies and procedures should be documented and adequate for radiation safety"

A21. "Specific policies and procedures should be in place for the safe handling of tissues that may contain radioactive material (*e.g.*, sentinel lymph nodes, breast biopsies, prostate "seeds", *etc.*)"

These procedures should be developed in conjunction with the institutional radiation safety officer, and must comply with any state regulations for the safe handling of tissues containing radio nuclides. The policy should distinguish between low radioactivity specimens such as sentinel lymphadenectomy and implant devices with higher radiation levels.

A22. "The laboratory should have a documented policy for infection control that complies with the OSHA Standard on occupational exposure to blood borne pathogens and to the institution's exposure control plan"

Universal or standard precautions must be used when handling all blood and body fluid specimens. The term "universal precautions" refers to a concept of blood borne disease control requiring all human blood and other potentially infectious materials to be treated as if infectious for HIV, HBV, HCV or other blood borne pathogens, regardless of the perceived "low risk" status of a patient or patient population. Alternative concepts in infection control are called Body Substance Isolation (BSI) and Standard Precautions. These latter terms define all body fluids and substances as infectious. All health care workers must routinely use appropriate barrier precautions to prevent skin and mucous membrane exposure when contact with blood or other body fluids is anticipated. Policies must comply with the OSHA Standard on Blood borne Pathogens.

A23. "There should be documented procedures detailing procurement, transportation, and handling of patient specimens (blood, body fluids and tissue) to ensure that all specimens are submitted in an appropriately labeled and well-constructed container with a secure lid to prevent leakage during transport"

Specimens sent through pneumatic tube systems should be sealed in fluid-tight bags. If pneumatic tube systems are used for transporting specimens, the laboratory must have procedures to respond to a spill within the tube, including appropriate decontamination measures.

A24. “There should be documented procedures for handling spills of blood and other body fluids”

A25. “The laboratory should evaluate the effectiveness of its engineering and work practice controls in significantly reducing or eliminating exposure to blood borne pathogens during phlebotomy and laboratory testing”

"Engineering controls" means controls that isolate or remove the blood borne pathogens hazard from the workplace (e.g., needleless devices, shielded needle devices, blunt needles, plastic capillary tubes, etc.). "Work practice" controls are those human activities that reduce exposure risk (e.g., no-hands procedures in discarding contaminated sharps, not directly transferring a sharp from one person to another, etc.). The application of engineering and work practice controls can significantly reduce or eliminate exposure to blood borne pathogens during phlebotomy and laboratory testing. As stated by the U.S. Occupational Safety and Health Administration, preventing exposures requires a comprehensive program, including engineering and work practice controls.

A26. “Personnel should be instructed in the proper use of personal protective clothing/equipment (*e.g.*, gloves, gowns, masks, eye protectors, *etc.*)”

Appropriate personal protective equipment (PPE) are items that do not permit blood or other potentially infectious material to pass through to the skin. Open-toe footwear does not provide adequate protection and should not be worn in the laboratory.

A27. “All personnel reasonably expected to have direct contact with body fluids should receive education on precautionary measures, epidemiology, modes of transmission and prevention of human immunodeficiency virus (HIV), hepatitis C virus (HCV) and hepatitis B virus (HBV) and the application of "universal precautions" or "standard precautions" to their work practices”

A28. “Personnel reasonably expected to have direct contact with body fluids should be identified and offered hepatitis B vaccinations free of charge”

A29. "There should be a program for follow-up procedures after possible and known percutaneous, mucous membrane or abraded skin exposure to HIV, HBV, or HCV that includes the following elements"

1. **HIV, HBV, and HCV testing of the source patient after consent is obtained.**
2. **Appropriate clinical and serologic evaluation of the health-care worker.**
3. **Follow-up procedures including consideration of appropriate prophylaxis for personnel; acutely exposed to HIV, HBV or HCV, based upon medical indications, the serologic status and the informed consent of the health-care worker.**
4. **Reporting of the exposure as required by law.**

A30. "The laboratory should have a documented tuberculosis exposure control plan"

This plan must include an exposure determination at defined intervals for all employees who may have occupational exposure to tuberculosis. Additional elements of the plan include engineering and work practice controls for hazardous procedures that potentially may aerosolize Mycobacterium tuberculosis. Such procedures include the handling of unfixed tissues in surgical pathology or autopsies, and processing of specimens in the microbiology section from patients with suspected or confirmed tuberculosis.

A31. "There should be a documented policy that prohibits smoking, eating, drinking, application of cosmetics and lip balm, manipulation of contact lenses, and mouth pipetting in all technical work areas"

A32. "There should be a documented policy prohibiting the recapping, purposeful bending, breaking, removing from disposable syringes, or other manual manipulations of needles"

Resheathing instruments or self-sheathing needles may be used to prevent recapping of needles by hand.

A33. "There should be a documented periodic review (at least annually) of safe work practices, *e.g.*, by a safety committee"

This review may be documented by safety committee minutes or by the records of regular safety inspections.

A34. "A function verification program for chemical fume hoods required by the laboratory's Chemical Hygiene Plan should be in place"

A35. "All sterilizing devices should be monitored periodically with a biologic indicator (or chemical equivalent) for effectiveness of sterility under conditions that simulate actual use"

Each sterilizing device must be monitored periodically with a biologic indicator to measure the effectiveness of sterility. Chemical indicators that reflect sporicidal conditions may be used. The test must be performed under conditions that simulate actual use. One recommended method is to wrap the Bacillus stearothermophilus spore indicator strip in packaging identical to that used for a production run, and to include the test package with an actual sterilization procedure. Weekly monitoring is recommended.

B. Phase I requirements

The stipulations in B01 through B06 are not mandatory; however, medical laboratories are urged to adapt them.

B01. "The laboratory is expected to have a written plan to reduce or eliminate mercury"

The Environmental Protection Agency (EPA) and the American Hospital Association have recently announced an agreement on mercury reduction, with the goal of eliminating mercury from hospitals by the year 2005. In addition to the mercury in thermometers and sphygmomanometers, small quantities may be found in some fixatives (e.g., B-5), and mercury may be used in parasitology concentration procedures. Substitutes for mercury in these applications are encouraged.

B02. "Adequate policies, procedures, and practices should be in place for the use of liquid nitrogen"

Procedures for the safe handling of liquid nitrogen include:

1. The mandatory use of appropriate gloves, shielding of all skin and the use of a face shield when decanting or entering an open container of LN
2. Storage and use of all containers of LN only in well-ventilated areas
3. Availability of a Material Safety Data Sheet

B03. "A program should be in place to reduce the volume of hazardous waste that is generated by the laboratory"

This includes any activity that reduces the volume of hazardous waste generated or the degree of hazard that is posed by that waste to the environment. In general, there are 5 methods for a laboratory to consider:

1. Acquisition constraints (e.g., purchase reagents in small quantities; minimize specimen volumes taken from patients)
2. Process changes (e.g., substitute less hazardous reagents for more hazardous ones; adopt techniques that require smaller reagent volumes; avoid excessive specimen retention times)
3. Recovery (e.g., silver recovery from darkroom fluids; heat recovery from the combustion of waste solvent)
4. Recycling (e.g., distillation and reuse of xylene or formalin)
5. Redistribution (e.g., relocating surplus or unwanted chemicals to laboratories that can use them)
6. Eliminating the practice of disposing non-hazardous waste in hazardous waste containers. The goal should be to generate less hazardous waste each year than was generated in the preceding year. This may not always be achievable, but accredited laboratories are urged to make this effort.

B04. "The laboratory should have a policy to protect personnel from excessive noise levels"

The laboratory should provide protection against the effects of noise exposure when sound levels equal or exceed an 8-hour time-weighted average sound level of 85 decibels. The laboratory should monitor noise exposure if there is an indication that excessive noise levels are present (for example, when noise levels exceed 85 decibels, people have to shout to be heard).

B05. "The laboratory should discontinue the use of plain glass capillary tubes for specimen collection and specimen handling"

To reduce the risk of injury due to breakage of glass capillary tubes, laboratories should adopt blood collection devices that are less prone to accidental breakage, including:

1. Capillary tubes not made of glass
2. Glass capillary tubes wrapped in puncture-resistant film
3. Products that use a method of sealing that does not require manually pushing one end of the tube into putty to form a plug
4. Products that allow the haematocrit to be measured without centrifugation

B06. "The laboratory must have a documented program to protect personnel and patients from allergic reactions from exposures to natural rubber latex in gloves and other products"

The latex program should address at least the following elements:

1. Selection of products and implementation of work practices that reduce the risk of allergic reactions. If latex gloves are used, the employer should provide reduced protein, powder-free gloves to protect workers from infectious materials
2. Provision of education programs and training materials about latex allergy
3. Evaluation of current prevention and control strategies whenever a worker is diagnosed with latex allergy

Part 2: Physical Inspection of the Laboratory

A. Phase II requirements

A36. "The laboratory should be properly separated from inpatient areas and/or provided with automatic fire extinguishing (AFE) systems"

For those facilities with no inpatients, or those separated by 2-hour construction (rated at 1.5 hours) and Class B self-closing doors (SCD), no AFE system is required. An AFE system is required for those laboratories separated from inpatient areas by 1-hour construction and class C SCD if flammable and combustible liquids are stored in bulk. An AFE system is always required if there are unattended laboratory operations employing flammable or combustible reagents. "Stored in bulk" means more than 2 gallons of Class I, II, and IIIA liquids in safety cabinets and safety cans per 100 ft2, or half that amount if not in safety containers. The following are the definitions of these Classes: Class I flammable: any liquid that has a closed-cup flash point below 37.8°C and a Reid vapor pressure not exceeding 2068.6 mm Hg at 37.8°C as determined by ASTM D 323 Class II combustible: any liquid that has a flash point at or above 37.8°C and below 60°C Class IIIA combustible: any liquid that has a flash point at or above 60°C but below 93°C

A37. "Each room larger than 1000 ft^2, or in which major fire hazards exist, should have at least 2 exit access doors remote from each other, one of which opens directly into an exit route"

A38. "There should be an automatic fire detection and alarm system"

The system must connect to the facility's overall system, where such a system exists. It should sound an immediate alarm in the event of smoke or fire.

A39. "The fire alarm should be audible in all parts of the laboratory, including storage areas, lavatories, and darkrooms"

Laboratories employing hearing-impaired persons must have other means to alert these individuals, such as a visual alarm system.

A40. "A fire alarm station should be present in or near the laboratory"

OSHA and National Fire Protection Association (NFPA) Standards require fire alarm facilities in every building where a fire may not itself provide adequate warning. Fire alarm systems should be reliable and meet NFPA Standards. A telephone network is inadequate in most situations.

A41. "Appropriate portable fire extinguishers should be provided for all areas in which flammable and combustible liquids are stored or handled"

If gallon bottles of such materials are used, the minimum rating for Class B extinguishers is 10-B or higher. These are best located near or outside of doors leading to the area having solvent fire hazards.

A42. "Emergency lighting should be adequate for safe evacuation of the laboratory"

A43. "Supplies of flammable and combustible liquids are reasonable for the laboratory's needs, and are properly stored"

In each laboratory area, up to 1 gallon of Class I, II, and IIIA liquids may be stored outside of fire-resistant cabinets for each 100 ft2 of space defined by fire-resistant walls/doors. Up to 2 gallons of Class I, II, and IIIA liquids may be stored in safety cans and safety cabinets

for each 100 ft2. These amounts may be doubled if there is an automatic fire suppression system (e.g., sprinklers).

A44. "Storage areas and/or rooms where volatile solvents are used should be adequately ventilated"

Areas where flammable liquids are used must be ventilated for protection of employee health, as well as fire prevention. Areas where flammable liquids are stored should be ventilated primarily for fire protection. Storage cabinets do not need to be vented, but if they are vented the duct system must be explosion proof.

A45. "Flammable or combustible liquids or gas cylinders are positioned well away from open flame or other heat sources, not in corridors and not within exhaust canopies"

A46. "There should be no more than one extra cylinder of compressed, flammable gas (other than those actually connected for use) at any one workstation"

As an exception, small cylinders (e.g., propane), may aggregate to a 2-day working supply at the workstation.

A47. "Compressed gas cylinders are secured to prevent accidental falling and damage to the valve or regulator"

A48. "Emergency eyewash should be present within 100 ft. or 10 seconds travel distance from every area of the laboratory in which hazardous chemicals (irritating, corrosive, or toxic by contact or absorption) are used and the eyewash is tested regularly"

The eyewash solution must be sterile saline, an antiseptic ophthalmic solution within date, or fresh running tap water. The system must provide lavage solution free of contaminants. Plumbed equipment must be activated weekly to verify proper operation.

A49. "Appropriate personal protective equipment (gloves, gowns, masks and eye protectors, *etc*.) are provided and maintained in a sanitary and reliable condition in

all technical work areas in which blood and body substances are handled and in circumstances during which exposure is likely to occur"

Appropriate personal protective equipment (PPE) are items that do not permit blood or other potentially infectious materials to pass through or reach the employee's work clothes, skin, etc. In addition to fluid-resistant gowns, aprons may be required if exposure to large volumes of body fluids is anticipated. If respiratory protection is needed because of potential exposure to an infectious agent by aerosol or droplet, personnel should use either a properly fit-tested NIOSH-approved filter respirator (N-95 or higher) or a powered air-purifying respirator (PAPRS) equipped with high efficiency particulate air (HEPA) filters. Accurate fit testing is a key component of effective respirator use.

A50. "Gloves are provided, readily made available and mandatory for use by phlebotomists"

OSHA requires gloves to be worn with each patient contact and changed after contact when performing vascular access procedures, except when drawing voluntary blood donors.

A51. "All personnel should be instructed in the proper use and care of disposable gloves and the need for hand decontamination after glove removal"

The required elements of education include:

1. Properly fitting gloves
2. Replacing gloves immediately when torn or contaminated
3. Not washing or disinfecting gloves for reuse
4. Using hypoallergenic gloves when indicated by patient or healthcare provider history
5. Decontamination of hands after glove removal

To prevent the transmission of potentially infectious agents, OSHA requires hand washing or antisepsis after glove removal. The CDC has published guidelines for hand hygiene. If hands are visibly dirty or contaminated with blood or proteinaceous material, the CDC recommends that the individuals wash their hands with soap and water. If hands are not visibly soiled, an alcohol-based waterless agent may be used for routinely decontaminating hands.

A52. "Personnel should use the proper personal protective devices when handling corrosive, flammable, biohazardous, and carcinogenic substances"

Such devices may include gloves of appropriate composition, aprons, and eye protection. Open-toe footwear does not provide adequate protection and should not be worn in the laboratory.

A53. "Bottle carriers are provided for transporting all glass containers larger than 500 ml that contain hazardous chemicals"

A54. "Explicit instructions are posted and appropriate supplies available, for the emergency treatment of chemical splashes and injuries and the control of chemical spills wherever major chemical hazards exist"

A55. "Precautionary labels are present on the containers of all hazardous chemicals (flammable liquids Classes I, II, and IIIA; corrosives; irritants; asphyxiants; potential carcinogens; *etc*.), indicating type of hazard and what to do if accidental contact occurs"

A56. "Vacuum breakers (anti-siphon devices) are provided on water outlets where necessary"

This is necessary only if the spigot or an extension extends below sink level, or if the outlet has a suction apparatus attached.

A57. "Laboratory employees should have access to all of the following documents:

1. Current Material Safety Data Sheets and other references that list the details of hazards and the precautions for safe handling and storage

2. Chemical Hygiene Plan of the laboratory

3. *Code of Federal Regulations.* Title 29, part 1910.1450 and its appendices"

It is acceptable for MSDS information to be electronically available to users, rather than in book format; there is no requirement for paper-based information. Indeed, electronic manuals have the advantage of more accurately reflecting current requirements. The central point is immediate availability to all personnel at all times.

A58. “All infectious wastes (*e.g.*, glassware, blood collection tubes, microbiologic and tissue specimens) and other solid or liquid waste or refuse should be discarded into "biohazard"-labeled containers that do not leak and have solid, tight-fitting covers that are applied before transport from the laboratory work area for storage and disposal”

All infectious wastes must be incinerated or appropriately decontaminated before being sent to a sanitary landfill. Stool and urine waste may be discarded into the sanitary sewerage system.

A59. “All corrosive, ignitable, and toxic wastes are disposed of safely in labeled containers”

A60. “Sterile syringes, needles, lancets, or other blood-letting devices ("sharps") that are capable of transmitting infection are used once only, and all waste sharps are discarded in puncture-resistant containers that are easily accessible, and are located in areas where needles are commonly used, and properly labeled to warn handlers of the potential hazard”

Under U.S. law, shearing or breaking of contaminated sharps is prohibited. Bending, recapping, or removing contaminated needles is prohibited as a general practice. Needles are expected to be used and immediately discarded, un-recapped, into accessible sharps containers.

B. Phase I requirements

B07. “Documentation should be there that both the laboratory director and the institutional safety committee have approved a program to ensure that all laboratory instruments and appliances are adequately grounded and checked for current leakage before initial use, after repair or modification, and when a problem is suspected”

Exceptions to these requirements are as follows:

1. Devices protected by an approved system of double insulation or its equivalent. Such devices must be distinctively marked
2. Equipment operating at 240 volt must be checked for ground integrity only. In addition, the U.S. Occupational Safety and Health Administration (OSHA) require that power cords of portable electrical equipment be visually inspected for external

defects whenever relocated. Grounding configurations may not be bypassed by, for example, an adapter that interrupts the continuity of the grounding.

B08. "Safety cans are used instead of glass bottles for volumes of flammable solvents larger than one quart (or larger than one pint for solvents that are highly volatile such as isopentane) if the purity required does not mandate glass storage"

Safety cans should be used for bulk storage of flammable and combustible liquid (National Fire Protection Association classes I and II). Metal or DOT-approved plastic containers provide an intermediate level of hazard containment between glass and safety cans. One pint of a highly volatile solvent, such as isopentane, stored in glass has about the same ignitability risk as 2 gallons stored in safety cans. Safety cans should be used instead of glass bottles if the purity required does not mandate glass storage.

B09. "Supplies of acids and bases are stored in separate cabinets near floor level"

Acids and bases should not be stored under sinks, where contamination by moisture may occur.

B10. "If flammable or combustible solvents are transferred to or from bulk containers, the primary (source) and secondary (receiving) containers should be electrically connected and grounded"

Transfer of flammable liquid from bulk storage containers should be made in storage rooms as described in NFPA 30. If both the source and receiving containers are made of conductive material (e.g., metal), they should be electrically connected (bonded), and the combination grounded, to prevent static electrical discharge.

B11. "Flammable-gas cylinders, if inside a health care facility, are stored in a separate, ventilated room or enclosure, reserved exclusively for that purpose, and which has a fire-resistance classification of at least two hours"

3.4 Hypothesis Test Parameters

Several parameters are being used in order to test the proposed hypotheses including, adoption of CAP standards, issue of local and federal legislations, hospital and lab-based regulations, implementation of requirements, and evaluation of compliance (section 3.3). The adoption of these measures should impact the following areas: number of incidents, productivity and quality of service, operational cost, and staff satisfaction. The impact on each area will be assessed separately and will be classified as positive, negative or no impact. An over all assessment will be derived to indicate the way in which the applied safety standards have impacted the areas described above.

3.5 Hypothesis Analysis

This research work involves investigation of health and safety within the five major hospitals in Abu Dhabi area, Zayed military hospital, Al Ain hospital, Tawam hospital, Khalifa hospital, and Al Mafraq hospital. Analysis methods include response to questionnaires, interviews and site visits. Separate interview questions were designed for three management groups: heads of medical laboratories, Infection control coordinators, and safety officers in each hospital laboratory. The natures of these questions are identified in the compliance survey (Appendix C). There are n=24 areas included in the compliance survey and each will be discussed in detail in chapter four (section 4.3.1). The staff survey (Appendix D) was designed to evaluate employee's knowledge and understanding of health and safety at work.

3.6 Implementation and Post-Evaluation

The new CAP-CLSG approach is expected to identify health and safety system inefficiencies and bottlenecks. In order to improve the provision of level of H&S identified by the CAP-CLSG approach, systematic recommendations and changes in policy and procedure will be identified and must be implemented. Following this, system performance should be monitored and evaluated under the new operating conditions and policies.

The post evaluation process refers to the performance evaluation of the health and safety system under the new policies. The purpose of this post evaluation process is to collect data related to delivery system performance at a sufficient point of time after the implementation process to compare and validate the initial model requirements, workforce and end-user satisfaction, and the quality of services provided. This includes a comprehensive assessment of the extent to which the modelling process objectives have been achieved. Furthermore, the evaluation process is intended to assess the effectiveness of the processes and methods incorporated in the proposed approach for the purpose of ongoing continuous data collection improvement.

An important aspect of this process is the timing of the post evaluation process. Post evaluation needs to be undertaken when the implementation process is fully completed and normal operating conditions are established. Specifying the post evaluation period and time after the implementation process is essential in maintaining the balance between realizing changes in health and safety system performance and being close to the development process to have relevance and adequate data. Given the circumstances of this research, the author determined that a period of six month to one year was adequate to realize changes and collect relevant data that would allow measurement of the

effectiveness and efficiency of the new approach identified through the CAP-CLSG process. Lastly, by comparing the satisfaction surveys results before and after implementation, the approach then can be categorized. After some internal discussions between the author and hospital colleagues, the author determined that the final overvaluation categories would be simply judged as: generally successful, partly successful, or unsuccessful.

To conclude, post evaluation should provide insight into important issues affecting the implementation performance, system operations, and long-term success and sustainability of the methods embodied in CAP-CLSG. Major consideration in this step is directed towards identifying significant key issues to improve the effectiveness and efficiency of the H&S system within the medical laboratories under study. Implementation of CAP-CLSG and evaluation of the resulting impact should be associated with lower operational costs and efficiencies. While this is important, it is beyond the immediate scope of this research and forms part of the recommendations for future work (section 6.2).

3.7 Summary

It is widely agreed that there is complexity and uncertainty in managing health and safety resources (section 3.1). Furthermore, there is also considerable agreement on the factors that contribute to the initiatives that need to be undertaken if an effective and efficient health and safety mechanism is to be implemented (section 2.4). The proposed management approach embodied in CAP-CLSG involves stakeholders in the stage of problem formulation and structuring (section 2.10.2). A detailed description of health and safety system processes, activities, and available resources for use is an essential factor

towards solving the problem and identifying areas for improvement (section 1.4). A defining aspect of CAP-CLSG is that it directs attention toward the post evaluation of optimal solution(s) and the need for effective measures for monitoring impacts and control after implementation. Ensuring the effectiveness and efficiency of CAP-CLSG to solve real H&S problems can be achieved only by enabling management and staff to communicate feedback and lessons learned to analysts who can then refine optimal solution(s).Moreover, this post evaluation process contributes to the value and usefulness of the overall effectiveness of H&S program model by ensuring the real problems and concerns are addressed.

To summarize, the main characteristics that define the benefits (section 1.4) of introducing, implementing and evaluating proposed CAP-CLSG are:

1) Accounts for problems owner's involvement and input in the modelling process by enhancing the understanding and collaboration among them.
2) The modelling process is a closed loop iterative process that is adaptive to changes rather than a step based process based on predetermined objectives and requirements.
3) Allows identifying underlying reasons contributing to problems such as a non value-added activities that consume resources and time and are of no benefits to the organization;
4) Provides a measure for evaluating the effectiveness and efficiency of implementing new health and safety system policies through post evaluation.
5) Incorporate a continuous data improvement process for ensuring data reliability, relevancy, and accuracy.
6) Can be used as an adequate control and monitoring tool in developing appropriate solutions to well-defined problems; and

7) Minimizes the modelling variables by focusing only on variables that best describe problem owners' concerns.

More-over, CAP-CLSG offer an opportunity to implement an established H&S system into a UAE workplace, where no previous established H&S policies were present in any enforceable legislation.

Chapter 4 Methodology and Experimental Design

4.1 Type of Study

This is a retrospective evaluative study designed to assess the impact of implementing the safety standards embodied in the College of American Pathologists (CAP) Clinical Laboratory Safety Guidelines (CLSG) on parameters related to: productivity, health safety, and employee satisfaction.

4.2 Sample Selection

4.2.1 Hospitals

Five general hospitals in the Emirate of Abu Dhabi including, Zayed Military Hospital, Sheikh Khalifa Medical City, Al Mafraq Hospital, Al Ain Hospital, and Tawam Hospital were selected for this study. Table 4.1 shows the type and capacity of the selected hospitals. The main reasons for selecting these hospitals are:

1- The selected Hospitals' healthcare setting in the departments of Pathology and Laboratory Medicine in these hospitals is relatively advanced and envisaged to benefit from the result of such study.

2- Hospital management from each of the five hospitals agreed to cooperate fully in all phases of this study, assuring access to information and data required to estimate appropriate parameters in this study.

3- Management in each hospital was seeking means to increase efficiency and improve health, safety, and hygiene in department of pathology and Lab medicine and aims to achieve world-class performance and quality of services.

4- Staff was willing to support the data collection process which assured reliable and accurate data.

Table 4.2.1 the Type and Capacity of the Selected Hospitals

S.N	Site/ Hospital	Affiliation	No. of bed	Hospital Employee	Lab. Employee	Hospital Type	Est.
1	**ZMH**	Military	337	1580	86	General	1979
2	**SKMC**	HAAD	222	4555	189	General	2000
3	**Tawam**	HAAD	470	1955	136	General	1983
4	**Mafraq**	HAAD	370	2200	84	General	1979
5	**Al Ain**	HAAD	500	1800	80	General	Early 1970s

Zayed Military Hospital

Zayed Military Hospital (ZMH) is the oldest and the largest military hospital in UAE. ZMH was founded in 1979 with 400 beds, 1580 full time employees and approximately 200 physicians. The hospital is situated in Abu Dhabi, the capital city of UAE. The mission of the hospital is to serve the military and their families. It has now several specialties, clinical departments such as General Surgical; The Medical department includes specialists in Neurology, Endocrinology, Gastroenterology and Infectious Diseases, and non clinical department like Radiology department, which has advanced

equipment. The laboratories are well equipped with the most modern facilities to provide a fast and efficient service to the hospital. It is a tertiary referral institute for the other military hospitals.

The department of pathology and laboratory medicine at ZMH has achieved excellence in-patient care through commitment, integrity and continuous improvement. The mission of the department is to contribute to the prevention, diagnosis and treatment of human illness by providing the highest quality services in anatomic and clinical pathology. Towards this end, the department aims to attract and retain Laboratory Professionals of the highest character and skill and to provide a work place that nurtures and enhances these qualities.

The department of Pathology at ZMH is a multicultural and multinational group of 105-professionals. Fifty-four of them are UAE military personnel and the remaining are expatriate employees. Pathology is a full service Department with expanding testing responsibilities performed over clinical Pathology samples and examined surgical and cytology specimens. During the year 2003, the Department was re-organized into nine functional sections represented by surgical pathology and cytopathology, Microbiology, Haematology, Serology, Blood Bank, Biochemistry, Special Chemistry, Molecular Microbiology (PCR) and Phlebotomy. Additional functions include the areas of Reception, Inventory Management & Store-keeping, Secretarial & Clerical Services and Couriers Services.

Photo 4.2.1 Zayed Military Hospital / main building
(Photo by the Author / June 2006)

Sheikh Khalifa Medical City

The main mission of Sheikh Khalifa Medical City (SKMC) is to provide complete and comprehensive health care services in all of the areas relevant to the requirements and priorities of the community.

The concept of SKMC is to visualize as the 'State of the Art Centre' in the United Arab Emirates and aims to practice 'contemporary medicine' comparable to the best Medical and Health Care Facilities world wide.

In order to achieve the above Objectives, the Medical Centre establishes and always updates; clinical protocols, policies, procedures and guidelines to attain the highest standards of clinical result and quality in the delivery of health care. Operating Policies and management systems are to attain the top level of efficiency and economy in the management and operation-of-the Centre.

Sheikh Khalifa Medical Centre was established in the year 2000. It is one of the best and most recognized specialized hospitals in the UAE. The Health Authority of Abu Dhabi places the hospital at a high priority in order to make it one of the best medical centres in the world, similar to what Mayo clinic in USA offers besides other international reputed medical establishments. The external design of the building reflects the Islamic monument. The hospital consists of 222 beds with rooms facing vast green areas, bringing back to memory the glory of Muslim Arab achievements in medical sciences.

Accordingly, to offer one of the best of care in the world, the Authority has provided the centre with highly professional staff specialized in all areas of medical occupations.

The medical database, which connects specialized clinics to the hospital, is considered to be the remarkable specialization of Sheikh Khalifa Medical Centre. The database is built as a unique source of information that contains all required medical documents of patients.

The hospital is equipped with state-of-the-art equipment and tools for diagnosis, treatment and analysis. SKMC has earned the title of being the best specialized hospital in the UAE for the treatment of trauma, injuries, emergencies, general and specialized surgery, all through an accomplished group of units and clinics offering international quality services.

The hospital offers consultation as well as treatment services. It also has an efficient department for emergencies, along with specialized departments and units in osteology, neurology, paediatrics, burn care, chest and kidney surgery, lithotripsy (the destruction of kidney stones by shock waves), cardio treatment procedures, sectional radiation, ultrasound and x-radiation.

Sheikh Khalifa Medical Centre entertains a complete laboratory consisting of a wide range of units for different categories of analysis, such as organic analysis, blood and hormonal tests, genetic and immunogenic tests. Therefore, it is the major reference for special diagnostic requirements in the UAE.

Al Mafraq Hospital

The mission of Al Mafraq Hospital (the Common Hospital) is to provide a wide range of medical services for Abu Dhabi and the United Arab Emirates citizens and dwellers.

Al Mafraq hospital was opened in August 1983 and it lies about 35 Km away from the city of Abu Dhabi, the capital of the UAE. It is among the first referential hospitals in the country and is considered as the general hospital for Abu Dhabi city by the Ministry of Health .Most of the medical clinics in Abu Dhabi recommend it for their patients in order benefit from the services provided by its highly expertise staff. The hospital contains 36 different departments and units, some of which are specialized in unique medical fields.

Photo 4.2.1 Al Mafraq Hospital/ Abu Dhabi

Al Mafraq hospital has a capacity of 470 beds and receives more than one thousand patient everyday. 1,000 patients undergo surgical procedure every month in the general surgery department, with an average of 35 surgeries a day.

The hospital has acquired its internationally recognized reputation from its history in performing successful complicated surgeries from kidney transplant to open heart surgeries, cancer treatment, and eardrum transplant and reconstruction that require highly trained staff as well as advanced medical equipment and special medical care post operatively.

The hospital is equipped with the most modern medical sets and equipment needed for treatment and diagnostic purposes. In order to assure quality medical services, a new research department has been added to the hospital for medical research purposes along with a diagnostic centre consisting of x-radiation unit and laboratory. The homeopathy division was added recently under 'Chinese Acupuncture' title.

Tawam Hospital

Tawam hospital task and mission is to provide a wide and full range of medical services to UAE citizens within the Al Ain district, and specialized services for the UAE which include; Primary Health Care Units, Sub-Specialty Clinics, Tertiary Inpatient Acute Care, Specialized Services in Oncology, IVF (in vitro fertilization), Trauma Emergency Services and Care to expatriates provided in specialized areas based upon referrals from other Emirates and Gulf countries.

Tawam Hospital objectives are:

1- To provide medical and surgical care that is relevant to the community needs.
2- To provide the appropriate educational and research environment in collaboration with UAE University, Faculty of Medicine and Health Sciences (FMHS).

3- To be committed to continued education and improvement in order to improve the quality of services.

4- To achieve and maintain a Joint Commission International (JCI) standard of care.

Tawam Hospital was inaugurated in 1979 in the city of Al Ain. It started with 250 beds, reaching 370 beds by the year 2000. It is deemed to be a specialized hospital due to some of its unique services, such as in vitro conception, x-radiation treatment for tumors, ultrasound and magnetic resonance imaging (MRI), kidney stone destruction facility and open-heart surgery.

Tawam hospital is a major centre for cancer research, neurology and pediatrics surgery in the UAE, which led UAE University to establish its science and pharmacology departments within its facility

The hospital, in cooperation with other medical institutions in the area, provides special services to the growing number of population exceeding 325,000.

Photo 4.2.1 Tawam Hospital / Main building/Emergency Unit

The Health authority of Abu Dhabi is currently planning to expand Tawam Hospital that will become a complete medical city, consisting of a medical college, a section for external clinics, staff dormitory of 460 units, and a pediatrics and obstetrics hospital (400 beds).

Tawam Hospital has currently 13 departments, offering services in dermatology, emergencies, general surgery, laboratory, obstetrics and gynecology, psychiatry, tumors treatment, x-radiation, pediatrics, sexually transmitted diseases treatment, neurology and nuclear medicine.

The clinical laboratory department was established in October 1979 within Tawam hospital's main building but now it is located in the ground floor of the Polyclinic. The laboratory has been recently certified to ISO 9002(*together with IQ Net Certificate*) and is planning to apply for accreditation by CAP.

Al Ain Hospital

Al Ain Hospital mission is to provide continuous optimal health services through effective, coherent and congenital health system that meets the needs and expectations of Al Ain city patients.

Al Ain hospital, formerly known as Al Jimi hospital, has 461 beds. The health authority of Abu Dhabi is working to increase the hospital capacity to 500 beds, with a view of maintaining the hospital position as the major health institute in Al Ain city.

In addition to the Emergency and accidents (E/A) services, Al Ain hospital provides medical and health services to national and expatriate residents of the city and its suburbs. It also serves as an educational institution for UAE University's medical and science students. The hospital further serves as a training source for physicians seeking

membership in Arab and British associations in various specializations. Both Al Ain and Tawam hospitals are considered to be the major hospitals in Al Ain medical district, covering an area of 11,750Kms with a population of more than 325,000 people.

They provide medical services in collaboration and integration with two other small hospitals, as well 21 primary health care centers, a preventive medicine complex, a school health centre, and a number of other specialized centers. The collaboration and integration are exercised by a referral system and transfer of patients through different units when necessary. Al Ain hospital consists of 22 departments, which include Emergency and Accidents, Anesthesia and Intensive Care Unit, Cardiac Surgery, Dermatology, ENT, General Surgery, Dental Surgery, laboratory Analysis, Neonatal Intensive Care Unit, Obstetrics and Gynecology, Facial Surgery, Ophthalmology, Orthopedics, Hematology, Oncology-radiation, Psychiatry, Plastic Surgery, Venereal Diseases, Pediatrics, Pharmacology and Neurosurgery.

The American Hospital in Dubai

The vision and purpose of the American hospital is to be the best private healthcare institution in the Gulf Region operating under internationally accredited standards.

The American hospital in Dubai city is a 120 bed acute care hospital that provides multidisciplinary medical services to the people of Dubai, the UAE and the surrounding Gulf states. The facilities and equipment are constantly expanded and upgraded to meet the highest standards and quality of American healthcare criteria, and because of that, the hospital was recognized by the Joint Commission International Accreditation, (JCIA) a

subsidiary operation of the Joint Commission on Accreditation of Healthcare Organizations, JCAHO, and the United States.

The American hospital in Dubai is the first hospital in Middle East to be awarded accreditation by JCIA; in May 2000. In May 2003, the hospital was reaccredited and was the first in the world to be accredited under the new and revised Joint Commission International Accreditation (JCIA) Standards for 2003. The JCI process provides the hospital with an integrated, quality driven set of organizational standards for optimal patients care, thus blending quality improvement methods with critical and administrative management activities. It also focuses on optimally achieving American standards of care with measurable evidence to continually evaluate its performance over time, and to benchmark with other similar organizations worldwide. In addition, the medical laboratory department received CAP accreditation in 2001; being the first in the Middle East.

The hospital offers medical and surgical specialities such as: diabetes /endocrinology, endoscopy, family medicine, gastroenterology/hepatology, nephrology, chemotherapy, sports medicine, pathology and laboratory medicine, etc.

To maintain high standard and to accommodate the needs and expectations of the patients, the hospital is extended with new facilities that would provide services such as dialysis and chemotherapy with private rooms, lithotripsy services, ICU, radiology department with new multi slice CT, MRI and Nuclear Medicine, beds for child friendly paediatric suite, and beds for endoscopy suite. Furthermore, the hospital offers an outstanding customer service to patients through professionals (Westerners) who are North American Board certified. The staff utilizes up to date equipment and other resources within the facilities to provide the optimal healthcare. An example is the medical laboratory department which consists of highly qualified personnel who employ modern technology to assist with diagnosis. The department is made up of different divisions including phlebotomy, blood

bank, hematology, biochemistry, microbiology, molecular microbiology and histology. Each of the divisions offers administrative and technical laboratory services to help management of patients.

4.2.2 Subjects

For each of the five selected hospitals, a clinical laboratory director, a health safety officer and an infection control coordinator were selected for the compliance survey. In addition, all the 525 employees in the laboratories in the selected hospitals were also selected for the staff satisfaction survey. The distribution of the selected 525 employees by hospital is shown in table 4.2.2.

Table 4.2.2 Distribution of Laboratory Staff between Five Hospitals

Hospital	**No. of Laboratory Staff**
ZMH	76
SKMC	189
Tawam	81
Al Mafraq	95
Al Ain	84
Total	**525**

4.3 Questionnaires

This study comprises four methodologies including: compliance questionnaire, staff satisfaction questionnaire, personal interviews (discussion group) with staff, and safety reports. The overall objectives of these methodologies were:

1. To develop and administer means of measuring current health, safety and hygiene that are health care-centred, and department and provider specific.
2. To include the satisfaction elements of the health safety policies and strategies.
3. To identify 'dissatisfaction areas' for elimination or improvement.
4. To identify strong satisfaction determinants to establish the need and basis for implementation of health, safety, and hygiene policies and procedure.

4.3.1 Compliance Survey

In order to assess the hospital compliance with the health and safety standards required for medical laboratory accreditation, a questionnaire was developed by the author (Appendix C) and distributed to the heads of laboratory departments in the five hospitals under study. The compliance questionnaire covered 24 safety areas as summarized in Table 4.3.1. These areas were adopted from those identified in CAP-CLSG (2000), NIOSH (2006) and CLSI (formerly NCCLS, 2003). Before filling the questionnaire, the author interviewed each of the heads of departments from the five hospitals. The purpose of this interview was: a) to ensure that the heads of medical laboratory understood the purpose of the survey and to answer any queries that they might have about the questionnaire ; b) to provide the

author the opportunity to have first-hand knowledge of the existing resources for occupational H&S in the five hospitals. Thus, a laboratory tour was taken by the author to personally observe resources, and practices and to evaluate H&S standard procedures (safety measures, fire systems, smoke detectors, eye washes, exits, evacuation plans, and safety manuals) and to review the documentation regarding incidents and safety reports.

It is worthwhile noting that the management staff involved in this survey each had acquired skills and knowledge from a minimum of five years work experience, and each individual was actively involved in the strategic planning and decision making process within their respective hospitals. As such, each was able to appreciate the author's research intentions and realize the potential benefits of introducing the CAP-CLSG within their work environments to promote effective health and safety.

The same heads of departments responded to all the questions in the same survey after implementing the CAP health and safety standards. A comparison of compliance of each hospital with the CAP standards, before and after implementation, was then made.

Table 4.3.1 Summary of Areas Addressed in Compliance Survey (Appendix C)

S.N	Area	Phase II	Phase I	Total
1	Laboratory Safety Programs	12	-	12
2	Safety Policies and Procedures	5	-	5
3	Hospital Safety Programs	10	-	10
4	Hospital Emergency Procedures	5	-	5
5	Fire Protection and Disaster Response	12	-	12
6	Computer Safety Procedures	5	-	5
7	Laboratory Equipment	10	-	10
8	Laboratory Acquired Infection Activities	11	-	11
9	Aerosol- Reducing Practices	7	-	7
10	Needles and Sharp Instruments	3	-	3
11	Obstacles Broken Objects	6	-	6
12	Electrical Hazards	8	-	8
13	Other Hazards	5	-	5
14	Physical Exertion	7	-	7
15	Emotional Stress	14	-	14
16	Work Practices	5	-	5
17	Labelling	9	-	9
18	Chemical, Physical & Biological (Common Agents)	5	-	5
19	Chemical, Physical & Biological (other Agents)	2	-	2
20	Biological Samples	6	1	7
21	Office Area	-	12	12
22	Responsibility of the Department Head	4	-	4
23	Responsibility of the Employees	7	-	7
24	General Area	5	6	11
	Total	163	19	182

The areas of H&S identified in Table 4.3.1 were chosen as relevant indicators of health and safety. Specific end-user health and safety indicators were identified for each area and these are detailed in Appendix (C).

Health and safety policies, procedures and practices survey (compliance survey) were distributed on site of the five selected hospitals and departments. Each administrator was an individual with professional and long experience in medical laboratories. The individuals were briefed on the survey objectives and how to manage the process of survey administration. Surveys were completed throughout three weeks time based on demand. Upon completion, surveys were returned by laboratory heads to the author for evaluation.

Each questionnaire returned was inspected by the author to ensure each page and section was completed and to determine the respondent followed instructions and recorded responses in the proper places.

Photo 4.3.1 compliance survey (the author with Head of Pathology at ZMH, 2006)

4.3.2 Staff Questionnaire (Risk Assessment)

Questionnaire survey is the best measurement tool to describe employees' perception attitude and beliefs about risk and safety (Kathy J and Rhona Flin, 1999). The staff questionnaire was administrated to assess the availability of resources, knowledge and the necessary implementation tools to develop and maintain an efficient health, safety, and hygiene system in the medical laboratory. The rational for developing the detailed staff questionnaire and the questions it contained are provided in Appendix (D). Table 4.3.2 summarizes key areas which were addressed within the staff questionnaire.

Table 4.3.2 Summary of Key Areas within Staff Questionnaire

Question No.	**Question Name**	**Variable Name**
Question 1	Risk Assessors have the necessary time, resources, training and authority to carry out Risk Assessment	Resources
Question 2	Risk Assessors have the knowledge and understanding of work involved, of the principles of Risk Assessment, prevention and control, and the current health and safety applications	Knowledge
Question 3	Assessment practices don't cover all the hazards and risks at work	Domain; hazards
Question 4	Assessment practices cover all those who could be affected	Domain; personnel
Question 5	Existing preventive measures are misused	Misuse
Question 6	All control measures are being implemented	Implementation
Question 7	Control measures lack the proper identification of risks to health and	Identification
Question 8	All control measures are monitored	Monitoring
Question 9	Risk assessments practices aren't kept up to date	Updating

4.3.3 Discussion Group (Focus group)

Focus groups have been employed in social market research (Morgan, 1988); more recently, they have been used in medical research (Powell and Single, 1996). The focus group is widely used as a tool for increasing the understanding of users and their requirements, and identifying potential solutions for these requirements. Its main value lies in the conveyance of less tangible information that can not be obtained using more traditional methods. Eliciting user needs beyond the functional is crucial for effective system development. This approach offers one way in which such needs may be elicited.

In this part of the author's research, focus groups were formed usually involving n=8 staff; and multiple groups were formed in each hospital-eventually involving some 525 employees. The focus groups were used to obtain an opinion based survey on the quality of environmental safety in each department studied. The author personally facilitated each of these focus group discussions – a total of some 40 sessions.

Photo 4.3.3 Focus group session (open discussion was carried out at ZMH)

Forty five minutes opened discussion secessions were carried out at each lab during staff working hours. These secessions were carried out mainly to understand the concerns and important issues related to health and safety at these labs. The questions posed were to address the important aspects of health and safety including training, work schedule, policy and procedure, space and infrastructure requirements, and psychosocial factors.

1- **Training**: training should be an integral part of a person's introduction into a new environment. The following aspects of training were discussed and explored in details. Adequate training leads to higher competency in staff and a sense of personal empowerment in the work place, availability of training policies and procedures in lab, availability of adequate training practices, leadership support and availability of safety control and monitor mechanisms.

2- **Work Schedule**: the quality and quantity of rest a person receives greatly affects their work output and safety. These issues should be taken into close consideration during work scheduling. To evaluate the effect of current management practices in planning and allocating resources, the following issues were raised and discussed during sessions; current workload and effect of current work schedule on staff performance and as a result on lab productivity.

3- **Policy and Procedure**: the need or availability to be a standard way in which laboratory matters are handled in both an average day and in emergencies. Policy and procedure protocols not only shield staff from liability but further add a sense of safety during decision making processes. For this purpose the need was discussed.

4- **Space and Infrastructure**: space availability can have a huge effect on both safety and work quality. The importance and effect of work space were explored in all sessions.

5- **Psychosocial Factors**: staff should be able to work in an environment where they feel appreciated and unexploited. Moods are a personal human condition, but a general good morale amongst staff is primarily the management's responsibility.

While these five areas were the intended focus of discussion groups, many other issues were discussed which were largely beyond the scope of this research (e.g. personal issues, lockers, cafeteria, etc).

The focus group discussion provided the author with useful guidance on staff issues. Its primary purpose was to share knowledge throughout the hospitals on the potential benefits of introducing CAP-CLSG during a one-group session to allow each participant an opportunity to ask questions and learn about the program to be implemented. The results of the author's efforts to organize and conduct focus group sessions are presented in chapter five.

By sharing the author's interest and enthusiasm for introducing CAP-CLSG H&S processes with many staff and colleagues, the efforts required to implement CAP-CLSG throughout the five hospitals would be more accepted by staff and colleagues.

4.3.4 Safety Reports

As part of data collection and analysis effort, safety and safety-related documentation in the hospitals under study were reviewed. Those included safety reports and charts generated periodically reflecting safety-related activities. Summaries of safety incidents, exercises, drills and in-services were reviewed and critically evaluated.

4.4 Statistical Analysis of Compliance and Staff Questionnaire Results

The data analysis process involved the transformation of raw data accepted for the purpose of this study into a form, making this data easy to understand and interpret. This stage included data analysis to provide descriptive information.

The data was entered manually into MS Excel spread sheet. Each hospital data was written in a separate worksheet" Survey" and was imported into SPSS package. For the staff satisfaction survey which consisted of nine questions, answers were coded as follows; completely disagree (1), somewhat disagree (2), somewhat agree (3), completely agree (4), not applicable (missing value).

4.5 Analysis of Indicators of CAP Standards Implementation

4.5.1 Proficiency Testing (PT)

CAP evaluations of test performance on samples provided by CAP to Zayed Military Hospital during 2005-2007 were tabulated to detect change in proficiency during this period in the different laboratory sections. The Proficiency Testing (PT) programs allow laboratories to regularly evaluate their performance and improve the accuracy of the patient results they provide. Through this program, CAP provided individual laboratories with unknown specimens for testing. Samples were transported by courier service in cardboard boxes with cool packs along with instructions to keep the specimens at 40C immediately after receiving and processing them as early as possible, and to send the results within ten days to CAP for evaluation. In turn, each participating laboratory receives a report of its performance as well as a report summarizing the results of all participating laboratories (CAP, 2008).

4.5.2 Productivity

Productivity was measured by calculating the average annual number of tests performed per technician during the years 2004-2007, in different sections of the laboratory. The sections included were; biochemistry, haematology, special chemistry, microbiology, blood bank, serology, and histopathology. The monthly statistical data of the total number of patients and the total number of tests performed was collected and an annual cumulative report was derived.

4.5.3 Repeated Tests

The monthly number of repeated tests was calculated in two ways, depending on the type of analyzers in each laboratory section during the years 2005-2007;

1. In haematology, biochemistry, special chemistry, and serology sections, the total number of repeated tests was given by the analyzer used.
2. In microbiology, blood bank, and histopathology sections, the total number of repeated tests was calculated manually from the test log books.

These repeated tests were performed to check abnormal and erratic results before reporting those to physicians. The percent of the number of tests repeated in each section, in one year is calculated as follows:

$$\% \text{ tests repeated} = \frac{\text{Number of repeated tests}}{\text{Total annual number of tests}} \times 100$$

4.5.4 Cost of Absenteeism at Work

Sick laboratory employees report to Zayed Military Hospital out-patient clinics for medical care. Sick-leave days granted are logged in the medical record department files. The number of sick-leave days granted to laboratory testing staff was calculated from the sick-leave log book on annual basis. The total cost of absenteeism for the years 2004-2007 was calculated as follows;

Total cost of absenteeism = total sick-leave days for lab staff x 560*

* The 560 Dirham being the average daily pays for the laboratory testing staff.

4.5.5 Needle-Prick Injuries

Coordination with the Infection Control Coordinator in the five hospitals namely; Zayed Military Hospital, Shaik Khalifa Medical City, Al Mafraq, Tawam, and Al Ain was done in order to obtain the monthly reports of needle-prick injuries. These reports were submitted by health and safety officers in different departments, the infection control nurse, and the quality assurance departments. The annual number of incidents during the years 2004-2007 was calculated and compared within the five hospitals under study.

4.6 Constraints and Obstacles

A period of three weeks was given to the chosen personnel to complete the survey and all the selected institutions adhered to the designated deadline. The survey questions were clear, and no one had queries or doubts regarding their content. Some limitations of this survey included: obtaining an official approval for conducting the survey within the institution and the limited time dedicated for survey completion because of other commitments. Extra time was needed to raise awareness for the need and importance of conducting such study. In some selected locations, lab director and his staff did not welcome the idea of completing these surveys, and considered them an extra work, while the majority looked at them as the first opportunity to voice their concerns and perceptions and contribute to overall improvement efforts**.**

4.7 Summary

Table 4.6 Summary of the major milestones in the development of this research program coupled with PhD registration milestones

Date	Activities
July 2000	Formation of H & S Committee for ZMH
January 2001	Formation of Infection Control Committee
September 2001	Policy for HIV & HBV
August 2002	Proposal to develop extra-mural PhD program at UoB with Dr.John Dennis as supervisor.
January 2003	Initiative of CAP
January 2003	Nomination of CAP consultant
January 2003	Formation of H & S committee for the Lab, Appendix F
April 2003	Formation of lab divisions (see organization chart, Appendix E) - meeting with lab supervisors - Requesting GHQ approval. - Filing application with CAP
July 2003	Acquisitions of NCCLS guidelines
July 2003	Start of renovations (department re-engineering), see section 2.13.3
July 2003	Review of CAP checklist per lab division
August 2003	Registration for higher degree by research (Mphil leading to PhD)
September 2003	Start of implementation of CAP :- Determination of requirements Renovations Proficiency testing Procedure manuals Safety manual & requirements
1 October 2003	Approval of research plan
January 2004	Author's visit to UoB
February 2004	First proficiency testing requested from CAP
February 2004	Dr. John Dennis visited UAE to meet with the author and approved the first year report. The progress made on the research project over the first year including literature on:- - health, safety & hygiene - health, safety & hygiene in medical laboratories - organizations involved - health, safety & hygiene in selected countries - health, safety & hygiene in the UAE - methodology for PhD - Special attention was given to legislation & policies currently applied in my home country, UAE.
February 2004	Fire extinguishers installed. See section 2.13.3

February 2004	Organization of POCT
March 2004	Start writing first draft
February 2005	Start first round of Proficiency Testing (PT)
March 2005	Discussion of first draft with supervisor
Feb 2006	Second PT round testing
May 2006	Transfer of registration to PhD
May 2006	a) finalization of the research methodology (five general hospitals in the Emirate of Abu Dhabi including, ZMH, SKMC, Al Mafraq hospital, Al Ain hospital & Tawam hospital were selected for the study.(section 4.2.1) b) Four types of methods including compliance survey, staff satisfaction, interviews and safety reports were used to meet the objectives of this study (section 4.2.2).
June 2006	Start compliance survey in each hospital. Three weeks time was given to complete the survey.(section 4.3.1)
August 2006	Change of Supervisor (new Supervisors: Dr J H Dennis, professor C P Heron).
September 2006	Start staff satisfaction Questionnaire (525 employee, section 4.3.2)
October 2006	Transfer to writing up
November 2006	Focus group meetings (section 4.3.3)
January 2007	Analysis of surveys (section 4.3.4)
Feb-June 2007	Several visits to American hospital in Dubai (section 4.4)
March 2007	Study of TB microbial susceptibility pattern in a UAE hospital
November 2007	Dr. John Dennis visited UAE to meet with the author for follow up and approved the yearly progress report.
April 2008	Submission of thesis to UoB
2008- onwards	Future Activities : - invite other hospitals to tour & share the experience - include satellite labs in H&S coverage - invite other departments, e.g. pharmacy, radiology, physiotherapy to share experience - involve other military clinical facilities - communicate with HAAD, DOHMS, Police and private hospitals to share lessons & experience

Chapter 5 Results and Discussion

5.1 Introduction

This chapter discusses and summarizes the results of the assessment of Health, Safety and Hygiene policies and practices in selected hospitals and laboratories in the UAE. Four tools were used in this assessment, namely; compliance questionnaire, staff risk assessment survey, interviews and discussion with laboratory staff, and review of safety reports. The assessment was carried out twice; before and after CAP adoption.

The outcome of the assessment was used to assist Zayed Military Hospital management to improve their Health Safety System, by identifying inadequacies and gaps in their current Health and Safety system.

5.2 Compliance Survey

Results of Statistical Analysis

In order to assess the hospital compliance with the health and safety standards required for medical laboratory accreditation, a questionnaire was developed by the author (Appendix C) and distributed to the heads of laboratory departments, the safety officer, and the Infection control coordinator in the five hospitals under study. The compliance questionnaire covered 24 safety areas as summarized in Table 4.3.1.These areas were adopted from those identified in the College of American Pathologists-Clinical Laboratory Safety Guidelines (CAP-CLSG, 2000), NIOSH (2006) and the Clinical Laboratory Standards Institute (CLSI formerly NCCLS, 2003). Before filling out the questionnaire,

the author interviewed each of the heads of departments from the five hospitals. The purpose of this interview was: a) to ensure that the heads of laboratory departments understood the purpose of the survey and to answer any queries that they might have about the questionnaire ; b) to provide the author with the opportunity to have first-hand knowledge of the existing resources for Occupational Health and Safety in the five hospitals. Thus, a laboratory tour was taken by the author to personally observe resources and practices, and to evaluate H&S standard procedures (safety measures, fire systems, smoke detectors, eye washes, exits, evacuation plans, and safety manuals) and to review the documentation regarding incidents and safety reports.

This analysis attempts to assess the availability of different safety policies, procedures and practices in medical laboratories. The statistical analysis was performed on the questionnaire distributed to the fifteen respondents from the five hospitals in Abu Dhabi, UAE.

To minimize the probability of different interpretations of the questionnaire questions by separate institutions, an interview was made with the responding leading staff in each hospital (sections 4.3.1, 4.5 and 5.2). This interview addressed the content of the questionnaire and answered any queries about its questions. Moreover, it was made clear that the golden standard of laboratory standards was the CAP checklists which identified the detailed requirements.

In the analysis of the questionnaire data, the response of the laboratory directors in the five hospitals was recorded. These individuals, by virtue of their positions, were better equipped to know what each question meant.

Tables 5.2.1 through 5.2.24 below summarize the findings of the questionnaire.

Table 5.2.1 Comparison of Compliance with Standards for Laboratory Safety Programs assessed before and after CAP Implementation in Five UAE Hospitals.

S. N	Items	Phase *(1)	Total Parameters		
			Before	After	Concordance *(2)
1	Emergency eyewashes and showers	II	2/ 5	4/5	12/ 15
2	Chemical hygiene plan	II	2/ 5	4/5	10/ 15
3	Chemical fume hoods	II	2/ 5	4/5	12/ 15
4	Biological safety hoods	II	5/5	5/5	14/ 15
5	Formaldehyde programs	II	1/ 5	4/5	4/15
6	Vacating premises	II	1/5	4/5	2/ 15
7	Compressed gas cylinders	II	3/ 5	5/5	13/ 15
8	Blood borne pathogens exposure	II	3/ 5	4/5	11/ 15
9	Incident reporting and investigation program	II	2/ 5	5/5	12/ 15
10	Anthrax and other biological agents threat plan	II	1/ 5	3/5	1/ 15
11	Fire safety program	II	4/ 5	4/5	14/ 15
12	Personal protective equipment	II	4/ 5	4/5	14/ 15
Total			**31/ 60**	**50/60**	**119/ 180**
percent			**51.7%**	**83%**	

*(1): The classification of College of American Pathologists (CAP) was implemented in categorizing the questionnaire's items into two requirements level referred to by CAP as phases ; Phase II denotes standards that must be complied with, while phase I denotes recommended standards. According to CAP, laboratories failing to comply with any phase II standards will not be accorded or granted the accredited laboratory status.

*(2): Concordance is a term applied to reflect agreement between the CAP standard requirements and the responses given by the senior hospital administrator to each item of the standards areas.

Medical laboratories are complex environments. Staff is surrounded by chemicals, equipment, specimens, and technology. The goals of the laboratory safety program should be protecting those working in the lab, and others who may be exposed to hazards from the laboratory environment (McClatchey, 2001).

Table (5.2.1) above shows the rate of compliance of the five hospitals with the CAP requirements in the area of laboratory safety as assessed before and after implementation of CAP standards. The following observations are made;

1. The five hospitals have 100% compliance in item four (bio-safety hoods) even prior to the implementation of CAP. OSHA (2007) found that the preferred method to reduce exposure to chemical and biological hazards is by the use of fume hoods and ducted biological safety cabinets.
2. Compliance improved in nine items (items # 1, 2, 3, 5, 6, 7, 8, 9 & 10) out of the 12 items constituting the standards in the area of laboratory safety programs.
3. Emergency showers and eyewash stations (item one) provide on-site-spot decontamination, as they allow workers to flush away hazardous substances that cause injuries (CCOHS, 2005). Compliance improved from 2/5 to 4/5 and the concordance was (12/ 15).
4. The goal of the chemical hygiene plan (item two) is to promote the combination of engineering controls and safe work practices that best protects laboratory staff from the chemicals that they are using (McClatchey, 2001). Compliance improved from 2/ 5 to 4/ 5 after CAP adoption and the concordance was (10/ 15).

5. Exposure to formaldehyde (item five) can result in severe health effects, including allergic sensitivity and cancer. Therefore, each location where formaldehyde is stored or used must develop spill plan (OSHA, 2007).Compliance improved from 1/ 5 to 4/ 5, but the concordance was low (4/15).
6. In an effort to protect the medical personnel, OSHA published the occupational exposure to blood borne pathogens (item eight), standard 29 CFR 1910. 1030. It state in the regulation that (PPE) must be used to prevent blood or other infectious fluids from passing through to or contacting the employees' work or street clothes, undergarments, skin, eyes, mouth or other mucous membranes. Using personal protective equipment (PPE) (item # 12) can dramatically reduce exposure (OSHA, 2007).
7. Improvement in compliance ranged between 0% (item four was already in full compliance) and 80% (from 1/5 to 5/ 5 for item seven compressed gas cylinders).
8. Three items reached full compliance, while eight items reached 80% and one item reached 60%.
9. Overall compliance for the area of laboratory safety programs was 31/ 60 (51.7%) before CAP implementation. This increased to 50/ 60 (83.3%) after CAP implementation.
10. The area of laboratory safety programs comprises 12 items, all designated by CAP as phase II, i.e. compliance with each of these is mandatory.
11. The item that had the least rate of concordance was the anthrax plan (item # 10).Compliance was 1/5 before CAP implementation and the concordance was 1/15. This could be due to the feeling among hospital administrators of its declining threat to their institutions.

12. In items four, 11 and 12 in the table, the concordance amongst all three has elevated. This suggests that preceding or existing programs in these areas correspond with and conform to that of CAP and international safety laboratory standards. Additional explanations for this could be that there was a higher practice of these safety programs through daily laboratory tasks and that they were easy to follow.

In items five, six, and 10, the concordance is insignificantly lower, suggesting that preceding laboratory safety programs in these areas were inadequate, employees' awareness was less, and more complexity was experienced towards familiarization of the CAP safety programs. More in-depth education and practical programs are needed in these areas to achieve a higher concordance.

In order for a laboratory to run smoothly and efficiently, it is paramount that a successful safety program is implemented. This requires full cooperation of all laboratory staff (McClatchy, 2001).

Table 5.2.2 Comparison of Compliance with Standards of Laboratory Safety Policies & Procedures assessed before and after CAP Implementation in Five UAE Hospitals.

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance *(2)
1	Laboratory safety policy	II	3/ 5	5/5	13/ 15
2	Laboratory safety committee	II	3/ 5	4/5	13/ 15
3	Laboratory safety officer	II	3/ 5	5/5	13/ 15
4	Laboratory safety manual	II	3/ 5	5/5	13/ 15
5	Laboratory safety Accident Report Form	II	2/ 5	5/5	13/ 15
Total			**14/ 25**	**24/ 25**	**65/ 75**
percent			**56%**	**96%**	

(1) &(2): See legend in Table 5.2.1

The result presented in Table (5.2.2) indicates the following;

It is lamentable to say that before CAP implementation, there was no single item that was in full compliance with the standards. However, after the implementation, there was a tremendous improvement in all five items.

Improvement in compliance ranged between 20% (item two; laboratory safety committee) and 60% (item five; laboratory safety incident report form) from 2/ 5 to 5/ 5.

The table shows that out of the five items, four reached full compliance and one item reached 80% compliance; laboratory safety committee.

The overall compliance was 56% (14/ 25) before CAP implementation; which increased to 96% (24/ 25). Lastly, it is noticeable that concordance was high at about 87% on all items.

The fact that all the five hospitals have complied with all but one of the five components in this area is worth high-lighting. The deficiency was noted in one hospital in the area of

formation of laboratory safety committee. This committee usually monitors and regularly inspects the safety rules and regulations and the extent of compliance by all in the lab.

Every laboratory hazard can be contained. No clinical laboratory can afford to operate without a safety program, and the best build safety into the cultural of the laboratory. The organized safety program begins with a written plan. One of the most practical ways to ensure regular reviews of one's safety program is the establishment of laboratory safety committee (McClatchy, 2001).

The appointment of a safety officer is appropriate for laboratories and may be required by regulation. Compliance with the appropriate and established safety policies of the facility should limit the risks that are associated with clinical laboratory practice.

The concordances amongst all items are elevated. This suggests that prior or existing guidelines in these area of safety match up and similar to that of CAP and international safety laboratory requirements.

Table 5.2.3 Comparison of Compliance with Standards for Hospital Safety Programs assessed before and after CAP Implementation in Five UAE Hospitals.

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance *(2)
1	A safety or health & safety committee	II	2/ 5	5/5	12/ 15
2	An infection control committee	II	4/ 5	5/5	13/ 15
3	Accident Report Form	II	4/ 5	5/5	13/ 14
4	Needle stick Form	II	4/ 5	5/5	13/ 14
5	Medical Waste disposal policy	II	4/ 5	5/5	13/ 14
6	Nosocomical infection control policy	II	4/ 5	3/5	13/ 14
7	An infection control Nurse/ coordinator	II	5/ 5	5/5	13/ 14
8	MSDS sheets for all commonly used lab reagents	II	1/ 5	5/5	6/ 12
9	The safety manual and update are reviewed annually	II	1/ 5	4/5	12/ 14
10	Familiarity with manual's contents is monitored by checklist	II	1/ 5	5/5	1/ 14
Total			**30/ 50**	**47/50**	**109/ 140**
percent			**60%**	**94%**	

*(1) & *(2) See legend in Table 5.2.1

Table (5.2.3) displays the results of compliance with CAP standards in the area of hospital safety programs before and after CAP LAP implementation. The following observations were made;

1. It is observed that the five hospitals prior and after CAP implementation have already 100% compliance in item seven (an infection control Nurse/coordinator). On the other hand, compliance was improved in eight items except item six which remained the same (Nosocomical infection control policy). Only three hospitals showed compliance on this particular item.
2. Improvement in all compliance ranged between 20% (item two, laboratory safety committee) and 60% (item five, laboratory safety incident report form) from 2/ 5 to 5/ 5. Overall compliance 60% (30/ 50) was increased to 94% (47/ 50).
3. Once again, the concordance complied with the level of compliance before adoption of CAP standards as noted for items eight (6/ 12) and item # 10(1/ 14); MSDS and familiarity with the check-list, respectively. The MSDS are organized to contain health hazard information and to provide a safety resource for laboratory personnel working with these substances (Public health Agency of Canada, 2000) and (OSHA hazard Communication standard 29 CFR 1910.1200). It is anticipated that senior hospital management orientation on laboratory safety issues will increase compliance with safety regulations and standards.
4. Each organization should have a defined system for reporting laboratory injuries and accidents, as well as for investigating them. Events should be documented and reported to the employee health services (National Research Committee (U.S), 1989).

5. Lastly, it is suggested that the safety manual should be readily available and reviewed annually by the lab director and by the safety officer to ensure that it is accurate and current(Public Health Agency of Canada).
6. The concordance in items eight (MSDS sheets) and ten (Familiarity with manual's) was low, suggesting that these guidelines were not similar to those listed by CAP standards. Probabilities could be that these items are of tedious safety tasks and thus are significantly complicated to be monitored correctly. Additional awareness was needed in these areas. In the rest of the items, concordance was reasonably elevated and similar to the requirement implemented by CAP safety Standards.

Table 5.2.4 Comparison of Compliance with Standards for Hospital Emergency Procedure assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance* (2)
1	Fire response procedure	II	2/5	5/5	9/ 15
2	Chemical spill response	II	2/5	2/5	9/ 14
3	Bomb threat response	II	2/5	2/5	8/ 14
4	Infectious agent spill response	II	2/5	5/5	9/ 14
5	Elevator safety policy	II	2/5	3/5	11/ 12
Total			**10/25**	**17/ 25**	**46/ 69**
percent			**40%**	**68%**	

*(1) & *(2): See legend in Table 5.2.1

1. Regarding the 'Hospital Emergency Procedures' category, compliance was low before intervention; two hospitals out of five complied with all five items in this category. The position after intervention did not change for bomb threat (item three). Some improvements were seen in the elevator safety policy category. Full compliance of all hospitals (5/ 5) was reached in fire response procedure and infectious agents spill response procedures.

2. The overall compliance improved from 40 %(10/ 25) to 68 % (17/ 25).

3. It was remarkable to see that much improvement in compliance with fire standards; which reached 100% in all five hospitals. This implies that the hospitals have addressed and fulfilled the requirements, including having automated fire extinction systems, fire-resistant construction, self-closing doors, audible alarm systems, portable extinguishers

and safety cabinets for flammable liquids. This is in addition to staff training and annual fire drills.

4. The other area where 100% compliance was reached by all hospitals was the infectious agents spill responses (item four). Modest improvement was seen in the elevator safety policy. The U.S department of Labor on workplace emergencies and evacuations confirms the necessity to ensure preparedness for disasters that may involve chemical and infectious agents' spills, bomb threats, elevator safety and fire emergencies (OSHA, 2001). Telephoned threats of bombing should be included among the facility's emergency planning (McCltchey, 2001).

5. All spills and spatters of blood or body fluids must be cleaned with aqueous detergent, after which surface must be decontaminated (McClatchey, 2001).

6. The concordance in the items above that is, "Hospital Emergency Procedures" was reasonably average, meeting the essential standards for Emergency responses before and after CAP implementation.

Table 5.2.5 Comparison of Compliance with Standards for Fire Protection and Disaster Responses assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	All exit lights, doors, and signs are plainly visible	II	2/ 5	5/5	6/ 15
2	Fire extinguishers are properly located and charges	II	2/ 5	5/5	9/ 15
3	All fire equipment are routinely inspected and tagged	II	2/ 5	5/5	9/ 14
4	Artificial door-steps are not utilized	II	1/ 5	3/5	1/ 14
5	All fires and smoke are immediately reported	II	3/ 5	4/5	4/ 14
6	Staff understand well their roles in the event of a fire and disaster alert	II	1/ 5	4/5	1/ 14
7	Department has a disaster manual	II	1/ 5	4/5	1/ 14
8	Disaster manual is kept in a location easily accessible to the staff	II	1/ 5	4/5	1/ 14
9	Staff do know the location and content of the safety manual	II	1/ 5	5/5	1/ 14
10	Staff observe personal safe- guards such as body mechanics to present injuries on the job	II	3/ 5	5/5	11/ 14
11	Food and beverages are not consumed in laboratory areas wither specimens are handled	II	1/ 5	5/5	1/ 12
12	All work related injuries, illnesses or exposures are reported to supervisor	II	1/ 5	5/5	1/ 14
Total			**19/ 60**	**54/ 60**	**46/ 168**
Percent			**32%**	**90%**	

*(1) & *(2): See legend in Table 5.2.1

1. Table (5.2.5) shows improvement in compliance in all the 12 items.

2. Highest improvement was recorded in items 9, 11 & 12 from 1/ 5 to 5/ 5 compliance. On the other hand, all the five hospitals reached the full compliance in seven items (Items # 1, 2,3,9,10,11 & 12). Of the five items left, four reached 80% and one reached 60% compliance improvement.

3. The table showed that overall compliance improved from 32% (19/60) to 90% (54/ 60). It is noteworthy that the five hospitals gave more attention to the fire protection and disaster preparedness responses. This response is a clear indication that clear and systematic fire and safety guidelines are imperative for increasing efficient and successful management of emergency encounters (NFPA, 1983).

4. The result also concretized the rule that eating, studying and social activities should not take place in the lab (WHO, 2004) and (Stellman, 1998).

5. In items, four to nine, concordance is low, suggesting that previous strategies in these areas were poor, not similar to CAP Safety standards, thus more safety awareness had to be addressed in these items. While in items three and 10, concordance was much higher and measuring up to CAP safety Standards.

Table 5.2.6 Comparison of Compliance with Standards for Computer Safety Procedures assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Take stretch breaks every 2 hours	II	1/ 5	3/5	7/ 15
2	Vary their tasks	II	1/ 5	4/5	7/ 15
3	Use protective screens	II	3/ 5	4/5	8/ 15
4	Use arm/ head rest	II	2/ 5	3/5	1/ 15
5	Have correct chair adjustment	II	2/ 5	3/5	10/ 15
Total			**9/ 25**	**17/ 25**	**33/ 75**
percent			**36%**	**68%**	

*(1) & *(2): See legend in Table 5.2.1

1. In areas of Computer Safety Procedures of the hospitals, all the areas have shown improvements. Compliance improved 80% in one area (Item two, varying their tasks). 60% improvement was noticed in three items, namely; correct chair adjustment, using arm/head rest & stretch break every two hours. These are found in items one, four, & five.

2. Overall Compliance increased from 36 % (9/25) to 68% (17/25).

3. Noting the wide use of computer and long hours of screen time, it appears that more effort would be needed to improve the compliance in all areas of computer safety procedure.

The Canadian Standards Association (CSA) Guidelines on Office Ergonomics highlighted the physical drawbacks on the musculoskeletal system and visual acuity with prolonged use of computers. The implementation of CAP puts into consideration employees physical

well being by promoting practices that help reduce these possible negative effects (CSA, 2000).

4. The concordance in all items relating to computer safety procedures is low to average, thus indicating prior safety guidelines did not measure up and CAP ergonomic safety has to be reapplied, with much more stringent principles.

Table 5.2.7 Comparison of Compliance with Standards for Laboratory Equipment assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Electrical shock from lab equipment did not happen	II	1/ 5	4/5	1/ 13
2	All electrical equipment are grounded	II	1/ 5	4/5	2/ 15
3	The disconnects for all equipment are properly marked	II	1/ 5	4/5	2/ 15
4	Areas around breaker boxes are kept clear	II	1/ 5	3/5	3/ 15
5	Wiring and connections are checked regularly	II	2/ 5	3/5	1/ 15
6	Hoses, flittering and gauges are checked periodically for leaks	II	3/ 5	3/5	1/ 15
7	Contaminated equipment and work surfaces are cleaned with effective disinfectant	II	3/ 5	4/5	1/ 15
8	Gas cylinder kept upright	II	1/ 5	4/5	1/ 15
9	Gas cylinder secured/ chained to wall	II	1/ 5	4/5	2/ 15
10	Valve- protection caps are fastened when not in use	II	1/ 5	4/5	1/ 15
Total			**15/ 50**	**37/ 50**	**15/ 148**
percent			**30%**	**74%**	

(1) &(2): See legend in Table 5.2.1

1. Laboratory equipment must be maintained in proper working order. This means that laboratory needs to be checked periodically. And when it has excessive wear, it must be repaired or discarded (Day, 2001).
2. Table 5.2.7 showed compliance improvement of 80% in six items (Item #'s 1, 2, 3, 8, 9, and 10) which are electrical equipment grounded & disconnects properly marked, gas cylinders kept upright & secured and valve protection caps fastened when not in use. In item six, checking of hoses and gauges, there was no compliance recorded, which reflects deficient preventive maintenance approaches.
3. Improvement in compliance ranged from 0% to 80 %, 0% for item six, 20% for items five & seven, and 60% for item four.
4. Overall compliance is more than doubled from 30% (15/50) before to 74% (37/50) after CAP.
5. In items five to eight and ten in the table, the concordance amongst all three is little. This suggests that preceding or existing programs in these areas are not comparable to that of CAP and international Standards for Laboratory Equipment. Significant attention should be followed in equipment safety.
6. These findings deserve noting because of the increase in numbers and types of laboratory equipment employed in the medical lab. On the other hand, none of specific 12 areas reached full compliance.
7. It is worth noting that the three areas related to safety practices regarding gas cylinders showed 80% improvement in compliance.
8. The improvement in item one, which is the reduction of electrical shock incidents from laboratory equipment is a result of the improvement in compliance in the following items related to fire safety; namely: grounding of equipment, making of

disconnect, clearance of areas around breaker boxes and proper checking of electrical wirings and connections.

Where required, a gas supply piped into the laboratory with a gas cylinder should have outside storage, be weatherproof, be placed in a ventilated store, and/ or be chained to a secure feature (Cheesbrough, 2005) and (Stoner *et. al*., 1982).

Table 5.2.8 Comparison of Compliance with Standards for Laboratory-Acquired Infection assessed before and after CAP Implementation in Five UAE Hospitals

1. Aerosol- Generating Activities

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Opening containers	II	5/ 5	1/5	15/ 15
2	Blowing out	II	1/ 5	0/5	1/ 15
3	Mixing test tube contents	II	3/ 5	1/5	14/ 15
4	Opening lyophilized cultures	II	3/ 5	3/5	14/ 15
5	Centrifuging suspensions	II	2/ 5	3/5	12/ 15
6	Pouring liquids	II	4/ 5	4/5	14/ 15
7	Using automated pipettes	II	4/ 5	5/5	14/ 15
8	Mixing fluid cultures by pipette	II	1/ 5	2/5	3/ 15
9	Mixing with high speed blenders	II	2/ 5	1/5	6/ 15
10	Using poorly made, open or large wire loops	II	1/ 5	0/5	2/ 15
11	Spilling liquids	II	1/ 5	3/5	3/ 15
Total			**27/ 55**	**23/ 55**	**98/ 165**
Percent			**49%**	**42%**	

*(1) & *(2): See legend in Table 5.2.1

Laboratory instruments and the chemicals used in preparing samples can create conditions that range from relatively benign to highly hazardous. If not identified and controlled or

eliminated, these hazards can expose the laboratory worker to injuries and illnesses and cause damage to property and the environment (Wickman *et al*., 2006).

1. There has been a decrease in five aerosol generating activities. These are opening containers, blowing out, mixing test tube contents, using blenders, large wire loops) Items # 1, 2, 3, 9, 10.the operation of safe laboratory includes the use of equipment and reagents; these should be integrated in order to provide maximum safety for the personnel without impeding operation of the laboratory (Paul *et al*., 2000).
2. The practice of two aerosol generating activities i.e. opening lyophilized cultures and pouring liquids remained the same (items four & six).
3. On the other hand, there is an increase in centrifuging suspensions (item five); mixing fluids (item eight) practice.
4. In items three to seven concordance was high, measuring up to the requirements of CAP. Whilst in items one and 10 the concordance was extremely low. CAP Safety Awareness has to be used to educate staff about the guidelines on" Blowing out" and "Using poorly made, open or large wire loops".
5. There is an increase in liquid spilling (item #11) and the use of automated pipettes (item seven).
6. Overall, there is a decrease in practices leading to aerosol generation from 49% (27/55) to 42% (23/55).

Table 5.2.9 Comparison of Compliance with Standards for Laboratory- Acquired Infection assessed before and after CAP Implementation in Five UAE Hospitals

2. Aerosol- Reducing Practices Implementation

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	A glass/ plastic rod is used for spreading	II	2/ 5	4/5	2/ 15
2	Pipettes are drained instead of blowing them out	II	4/ 5	4/5	13/ 15
3	Cultures are mixed in a tube mixer	II	3/ 5	4/5	10/ 15
4	Disinfectant gauze used on work surfaces during transfer of bio-organic material	II	3/ 5	5/5	13/ 15
5	Equipment is properly maintained and cleaned	II	5/ 5	5/5	15/ 15
6	Centrifuge buckets in use are sealed	II	2/ 5	5/5	6/ 15
7	Specimens are carefully packaged during transport and storage	II	5/5	5/5	15/ 15
Total			**24/ 35**	**32/ 35**	**74**
percent			**69%**	**91.4%**	

*(1) & *(2): See legend in Table 5.2.1

1. It is noted that even prior to CAP implementation, compliance of the hospitals in the two items, five and seven has already reached 100% and this was maintained after the implementation. On the other hand, there was also a 100% compliance achieved in items four and six (use of disinfectant gauze and sealing of centrifuge buckets). However, the survey showed that there was no change in compliance for item two (pipettes drained instead of blowing).

2. Improvement in compliance ranged between 0% (items five & seven already in full compliance) and 60 %(Item six). According to the study of (Panov, 2004), by using sealed centrifuge cups workers are less likely to be exposed to dangerous materials.

3. It is recorded that the overall compliance before was 69% (24/35), and the remarkable increase has gone up to 91.4% (32/35).

4. In items five and seven the concordance is elevated. This suggests that the prior or existing policies in these areas corresponded and are comparable to that of CAP and international standards regarding Laboratory-Acquired Infection .Further reasons for this could be there was a higher awareness of infection through daily laboratory tasks.

Table 5.2.10 Comparison of Compliance with Standards for Needles and Sharp Instruments assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Is there an established &enforced policy to prevent recapping of needles?	II	1/ 5	5/5	3/ 14
2	Are there rules for the safe disposal & collection of sharp instruments and other hazardous materials?	II	4/ 5	5/5	12/ 14
3	Are such rules, if existent, reviewed regularly	II	1/ 5	5/5	3/ 14
Total			**6/ 15**	**15/15**	**18/ 42**
percent			**40%**	**100%**	

*(1) & *(2): See legend in Table 5. 2.1

1. A very remarkable full compliance has been shown by table 5.2.10 after the adoption of CAP standards.
2. It is noted that improvement in compliance ranged from 20% (item two, collection of sharp instruments and hazardous materials) to 80% for items one & three.
3. Overall compliance increased from 40% (6/15) to 100% (15/15) i.e. which is more than doubled from its previous record.

4. Concordance, which measures the perception of the interviewed hospital senior administrators, as measured before CAP implementation, parallels the compliance level at the same period. This is exemplified by the following:

a) Compliance before CAP in items one and three was 1/ 5 (20%) and was 3/ 15 (20%) respectively.

b) Compliance before CAP in item two was 4/ 5 (80%) and concordance was 12/ 15 (80%).

5. One corollary from these findings is that appropriate orientation of hospital leading administrators is important for quality improvement as judged by adoption of international standards. The overall concordance 18/ 45 (26.7%) mirrors the ranking in compliance before CAP, 6/ 15 (26.7%).

6. This concordance is in line with the concept of using needles and other sharp objects which should not be recapped (Rhinehart and Friedman, 1999) and (Crisp *et al*., 2005).

7. Cuts, lacerations, and punctures are also common among hospital workers (Health Alert, 1978). Needles and other sharp instruments (item two) should be discarded in designated puncture-resistant containers. Hospitals should establish and enforce policies (item one) to prevent the recapping of needles (NIOSH, 1988).

Items two that is “Safe disposal & collection of sharp instruments and other hazardous materials” has a high concordance, suggesting that hospitals had a professional standard of waste disposal techniques prior and later correlated to that of CAP standards. While in item one the concordance was low, recapping of needles policy was not at all of high significance in these hospitals.

Table 5.2.11 Comparison of Compliance with Standards for Obstacles and Broken Objects assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	The lab furniture & equipment are arranged as such to allow free movement in the lab	II	2/5	5/5	11/ 15
2	Doors, cabinet doors & drawers are closed when not in use	II	3/5	5/5	4/ 15
3	Only smooth & rounded corners on desks and benches are allowed in the lab areas	II	3/5	5/5	5/ 15
4	Broken glass is swept up and disposed off immediately and properly	II	3/5	5/5	2/ 15
5	Lab staff do not pick up broken glass with their fingers	II	3/5	5/5	2/ 14
6	Ampoules are grasped with protective gauze before sawing the tip with metal file and snapping the top open	II	3/5	5/5	6/ 14
Total			**17/ 30**	**30/ 30**	**30/ 88**
percent			**56.7%**	**100%**	

*(1) & *(2): See legend in Table 5.2.1

1. All six items showed increased compliance and achieved full compliance (5/5) after CAP implementation.
2. It is observable that before CAP implementation, none of the items showed full compliance. But after the implementation, compliance greatly improved in all areas from 40% (items # 2, 3, 4, 5, 6) to 60% improvement in item one.

3. Overall compliance increased from 56.7% (17/30) to 100% (30/30). This explains that furniture should be designed for convenient utilization and ample space should be provided for the safe conduct of laboratory works (Furr, 2000) and (WHO, 2004).

4. Broken glass is disposed of in heavy cardboard or Kraft board boxes labeled" broken glass" (Furr, 2000). And broken glassware must not be handled directly by hand, but must be removed by mechanical means, and to be decontaminated before disposing it (Furr, 2000) and (NIOSH, 1988).

5. Only in item one which is "movement in the lab" concordance was high, meaning it was comparable to that of CAP standards. But in the rest of the items a lower concordance was noted.

Table 5.2.12 Comparison of Compliance with Standards for Electrical Hazard assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Staff receive instructions on proper handling of electrical equipment	II	2/5	4/5	11/ 14
2	Incidents immediately reported	II	2/5	5/5	6/ 15
3	Defected Tagged	II	3/5	5/5	12/ 15
4	Defected removed from service	II	3/5	5/5	12/ 15
5	Staff, visitors & patients are prohibited from using ungrounded coffee pots, kettles, radios, fans, portable heaters etc.	II	3/5	5/5	12/ 15
6	A program is implemented to regularly check all electrical equipment & connections in labs tea-room to find damaged cords and ungrounded electrical equipment	II	2/5	4/5	5/ 14
7	Lab equipment are grounded and cords are placed behind the equipment	II	3/5	5/5	13/ 15
8	Microwave ovens are regularly cleaned and periodically checked for proper door closure and seal	II	3/5	3/5	11/ 15
Total			**21/ 40**	**36/ 40**	**82/ 118**
percent			**52%**	**90%**	

*(1) & *(2): See legend in Table 5.2.1

1. The table (5.2.12) shows that compliance has improved in seven of the eight items and has remained at the same level in item eight. Improvement in compliance ranged from 0% to 60% while 100% compliance was reached in five items # 2, 3, 4, 5 &7.
2. Overall compliance rose from 52% (21/40) to 90% (36/40) after CAP implementation.
3. According to Varnadoe (2008) the best designed equipment and emergency plans are of no use if worker's received deficiency training and that could even aggravate bad situations.
4. As discussed previously (under table 5.2.10, needles and sharp instruments) the compliance level before CAP mirrored the concordance in responses of the `hospital administrators.
5. It is essential though that all electrical installations and equipment are inspected and tested regularly, including earthling/ grounding system (McClatchey, 2001), and all laboratory electrical equipment should be earthed / grounded and conform to national electrical safety standards and codes (McClatchey, 2001).
6. Lastly, all equipment, including the coffee pots and microwaves, and the break room, should be checked for compliance with electrical safety standard upon receipt or before being placed into use (McClatchey, 2001) and (NIOSH, 1988).
7. The concordance in item one was high, suggesting that Staff received appropriate training on handling of electrical equipment, prior to CAP implementation. In item seven and eight concordance was higher, suggesting that guidelines in these areas correlated to that of CAP standards.

Table 5.2.13 Comparison of Compliance with Standards for Other Hazards assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Acids and all chemicals are properly labeled, stored and safely handled	II	1/5	5/5	4/ 15
2	Personal protective equipment are used. Protective measures are followed	II	3/5	5/5	12/ 15
3	Isolation techniques based on CDC recommendations are enforced when staff members handle patients with infectious diseases	II	1/5	5/5	1/ 15
4	Limit for exposure to ionizing radiation is enforced	II	1/5	3/5	1/ 15
5	Does your lab have limits set for exposure to radiation	II	1/5	2/5	2/ 15
Total			**7/ 25**	**20/ 25**	**20/ 75**
percent			**28%**	**80%**	

*(1) & *(2): See legend in Table 5.2.1

1. In this particular table, all the five areas showed great compliance from the five hospitals surveyed. Compliance improved to 60% for item four (limits for exposure to

ionizing), while item five improved to 40 % (limits set for exposure to radiation). Meanwhile the three items (items #'s 1, 2, 3) reached full compliance.

2. Overall compliance was 28% (7/25) before which increased to 80% (20/25) after CAP adoption.

3. Again, concordance levels demonstrated similar profile as reflected by the compliance before CAP. It is only proper then that chemicals in the laboratory should be stored in a flameproof cabinet and well-ventilated area, away from heat sources. Chemicals must be labeled with hazard information.

4. Also, all personnel should wear radiation safety badges at all times so that their exposure can be monitored (Calkins, 2008).

5. Lastly, according to National Research Council (1995), exposure should be minimized on shielding radiation sources and workers and visitors must be aware of emergency alarm and evacuation procedures.

6. The concordance in items three to five is low, signifying that the safety standards in these areas were not at all matching up to those of CAP standards and need to be addressed.

Table 5.2.14 Comparison of Compliance with Standards for Physical Exertion assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Aisles, passage ways and halls are not used as storage areas	II	1/5	5/ 5	1/ 15
2	Aisles and passage ways are adequate for the movement of personnel	II	3/5	5/ 5	3/ 15
3	Floors are treated with non- slip material	II	2/5	5/ 5	2/ 15
4	Spills are immediately cleaned up	II	2/5	5/ 5	3/ 15
5	Workers are taught to use proper lifting techniques to prevent injuries	II	2/5	5/ 5	4/ 15
6	Temporary electric cords for lights, television sets and projectors are place in a way that prevents tripping hazards, e.g. by taping to the floor	II	1/5	5/ 5	1/ 15
7	Only properly maintained safe ladders are used to reach high objects, not stools, chairs or boxes	II	0/5	5/ 5	13/ 15
Total			**15/ 35**	**35/ 35**	**27/ 105**
Percent			**42.8%**	**100%**	

*(1) & *(2): See legend in Table 5.2.1

1. This table shows that there was an improvement of compliance in all the seven items.

2. Improvement ranged from 40% for item two, to 100 % for item seven.

3. It is also noted that there is a 60% improvement in compliance for items three, four, & five and 80% improvement for items one & six. Noticeably, all the seven items showed an achieved full compliance.

4. Overall compliance was 43% (15/35) before and this time it increased to 100% (35/35) after CAP adoption.

5. Strains and sprains account for almost half of the compensable disorders among hospital workers (Health Alert, 1978). Incidents of falling, lifting patients and heavy materials, moving furniture, contribute to the frequent occurrence of these injuries (NIOSH, 1988).

6. As recorded in previous tables, concordance levels follow compliance status; where higher compliance is associated with higher concordance and vice versa. Concordances in items one to five were low, signifying previous safety measures in these areas were not adequate. But in the use of safe ladders, the concordance was higher.

Table 5.2.15 Comparison of Compliance with Standards for Emotional Stress assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Physician attitudes	II	3/ 5	4/ 5	11/ 15
2	Emergency response procedures	II	2/ 5	4/ 5	10/ 15
3	The need for accuracy	II	1/ 5	4/ 5	4 / 12
4	Lack of communication between shifts	II	2/ 5	4/ 5	6/ 15
5	Lack of communication between lab staff and doctors	II	2/ 5	4/ 5	4/ 15
6	Lack of communication among lab staff	II	1/ 5	4/ 5	3/ 12
7	Fear of making an error	II	2/ 5	5/ 5	5/ 15
8	Over work	II	5/ 5	5/ 5	15/ 15
9	Deadlines	II	5/ 5	5/ 5	15/ 15
10	Lack of support from pathologists	II	5/ 5	5/ 5	15/ 15
11	Lack of support from supervisors	II	4/ 5	5/ 5	14/ 15
12	Lack of appreciation by other hospital staff	II	3/ 5	5/ 5	12/ 15
13	Frequent interruption	II	3/ 5	5/ 5	13/ 15
14	Job insecurity	II	3/ 5	5/ 5	11/ 15
Total			**41/ 70**	**64/ 70**	**138/ 204**
Percent			**58.6%**	**91%**	

*(1) & *(2): See legend in Table 5.2.1

1. This question addressed the perception of department heads about the issue of emotional stress as a job hazard in laboratory practice. The recognition of administrator on the importance of stress in lab work has been enhanced after CAP implementation and this is revealed by the following results:

a) Perception improved in 11 of the 14 stress factors. The senior administrator considered three of the factors as important even before CAP implementation. These items were eight, nine and 10.

b) Improvement in perception ranged from 20% for item one to 60% for item six. On the other hand, there was a 40% perception improvement for items # 2, 4, 5, 12, 13 & 14. Lastly, there was a 60% perception improvement for items # three and six.

2. Overall perception increased more than three times from 58.6% (41/70) to 91% (64/70).

3. The results further prove that laboratory workers commonly report stress as a job hazard. A NIOSH study ranked clinical laboratory work seventh among stressful occupations based on frequency of admission to community mental health centers (Colligan *et al.,* 1977). Griffin and Klun (1980) listed the primary source of stress for hospital-employed medical technologists as physician attitudes, followed by emergency-response procedures, the need for accuracy, lack of communication (between shifts, between laboratory workers and doctors, and among laboratory staff), fear of making an error, especially if it might result in a patient's death, overwork, deadlines, lack of support from pathologists or supervisors, and lack of appreciation by other hospital staff members. Moreover, stress resulting from high work pressure can lead to more absenteeism due to illness (Leontaridi and Ward, 2002).

In items five and six concordance was lower, while in the rest of the items, we have a higher concordance for Standards for Emotional Stress.

Table 5.2.16 Comparison of Compliance with Standards for Work Practices assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Eating, drinking and smoking NOT done in laboratory at all times	II	3/5	5/ 5	8/ 15
2	Contact lenses NOT worn when working with chemicals	II	2/5	5/ 5	4/ 15
3	Lab coat/ apron worn while in the lab and removed when leaving	II	3/5	5/ 5	11/ 15
4	Face shield or goggles worn wherever accidental splashes to the face are possible	II	3/5	5/ 5	11/ 15
5	Food and beverages are not stored in refrigerators or elsewhere in the laboratory	II	2/5	5/ 5	9/ 15
Total			**13/ 25**	**25/ 25**	**43/ 75**
Percent			**52%**	**100%**	

*(1) & *(2): See legend in Table 5.2.1

Safe work practice is very important for protecting laboratory staff. Analysis of such practices in the five hospitals is revealed the following;

1. None of the items was fully compliant before CAP, but after the implementation compliance increased in all the five items and even reached 100%.

2. For instance, compliance improvement ranged from 40% for items one, three and four to 60% for items two and five.

3. Items two & four showed a compliance improvement of 60%. Eye protection is critical. A variety of safety glasses, goggles and face shields are available to protect against such hazards (Purschwitz, 2006). Overall compliance almost doubled from 52% (13/25) before to 100% (25/25) after CAP implementation. Preventing injuries may involve providing personal equipment to individual workers to protect them against hazards.

4. Lastly, it is advisable that individuals wearing contact lenses are required to wear them with the appropriate safety eyewear (OSHA, 1994).

5. In item two, the concordance was slight, implicating the proper guidelines for the use of contact lenses were not strictly followed. While in the rest of these items there were consistently average concordances noted.

Table 5.2.17 Comparison of Compliance with Standards for Labeling assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	All chemicals in the laboratory are clearly labeled	II	3/5	5/ 5	9/ 15
2	The laboratory safety officer maintains a list of all chemicals in the lab	II	4/5	5/ 5	13/ 15
3	Reviews the list with hospital health & safety committee	II	4/5	3/ 5	13/ 15
4	Personnel health service	II	3/5	4/ 5	10/ 15
5	Generic chemical name	II	4/ 5	4/ 5	13/ 15
6	Date of arrival	II	5/ 5	5/ 5	15/ 15
7	Probable shelf/ expiry data	II	5/ 5	5/ 5	15/ 15
8	Hazardous character	II	5/ 5	5/ 5	15/ 15
9	Special storage requirements	II	5/ 5	5/ 5	15/ 15
Total			**38/ 45**	**42/ 45**	**118/ 135**
Percent			**84%**	**93%**	

*(1) & *(2): See legend in Table 5.2.1

1. It is observed that this table presents some items having 100% compliance even before CAP implementation. There are four items on this regard, namely; six, seven, eight & nine. Meanwhile, on labeling of chemicals (item one) compliance improved 40% from 3/5 to 5/5

and 20% in items two & four, yet there was no change in compliance for the other five items (#'s 5, 6, 7, 8, 9).

2. Improvement in compliance ranged from 0% to 40% and overall compliance before was 84% (38/45) and increased to 93% (42/45).

3. It is suggested however that all chemicals used in a laboratory should be clearly labeled with the generic chemical name, date of arrival, probable shelf life, hazardous character and special storage requirements. The laboratory safety officer should maintain a complete list of all chemicals in the laboratory and review it with the hospital health and safety committee and the personnel health service according to OSHA 29 CFR 1910.1200 (NIOSH, 1998).

4. The majority of items in the table above have a reasonably elevated concordance for Standards for Labeling. Thus previous guidelines in these areas were equivalent to those of CAP standards.

Table 5.2.18 Comparison of Compliance with Standards for Chemical, Physical and Biologic Agents assessed before and after CAP Implementation in Five UAE Hospitals

A) Common Agents

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	A list is complied for organic compounds (e.g. acetone, formaldehyde, xylene and other solvents)	II	2/5	4/ 5	3/ 15
2	A list is complied for organic compounds	II	3/5	4/ 5	12/ 14
3	Physical hazards (e.g. ultraviolet radiation and ultrasonic devices)	II	2/5	4/ 5	9/ 13
4	Biologic agents such as viruses(hepatitis) and bacteria (TB)	II	3/5	5/ 5	13/ 14
5	Radioactive isotopes (e.g. iodine cesium)	II	2/5	4/ 5	11/ 14
Total			**12/ 25**	**21/ 25**	**48/ 70**
Percent			**48%**	**84%**	

*(1) & *(2): See legend in Table 5.2.1

1. Laboratory work requires the use of many chemical, physical and biological agents or use of kits containing such agents. Measures should be adopted to control their hazards. On this regard, the five hospitals showed improvement in compliance in all the five items after CAP implementation. However, only one item reached full compliance (item four). On the other hand, 40% compliance improvement in items one, three, four & five was shown on the table while item two reached 20% increase in compliance only.
2. Overall compliance before was 48% (12/25) which increased this time to 84% (21/25) after CAP adoption.
3. In order to minimize the presence of unrecognized cases and carriers, it is recommended that all new admissions and all new employees should have a

Mantoux test. If this is positive, further study with the roentgenogram and other laboratory methods should be made (Carp, 1937).

4. In Items two to five concordances were high, but in item one the concordance for the safety standards for lists of complied for organic compounds was lower, as the protocols in this area were somewhat dissimilar to that of CAP requirements.

Table 5.2.19 Comparison of Compliance with Standards for Chemical, Physical and Biologic Agents assessed before and after CAP Implementation in Five UAE Hospitals
B) Other agents

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Workers potentially exposed to hazardous substances are informed about the hazards symptoms of exposure and effects of over exposure	II	3/5	5/ 5	13/ 14
2	Workers exposures are monitored to ensure that airborne concentrations of specific contaminators are well below the allowable limits	II	3/5	4/ 5	12/ 15
Total			**6/ 10**	**9/ 10**	**25/ 29**
Percent			**60%**	**90%**	

*(1) & *(2): See legend in Table 5.2.1

1. Improvement in compliance after CAP noticed in both items.
2. 20% improvement in item one (workers are informed about the hazards of exposures) and 30% compliance increase in item two (monitoring the workers exposures).
3. Overall compliance before 60% (6/10) increased to 90% (9/10) following CAP implementation.

4. The concordances in all items above were elevated in safety standards for Chemical, Physical and Biologic Agents. Thus all prior safety guidelines for Chemical, Physical and Biologic Agents were very similar to that of CAP safety standards.

Table 5.2.20 Comparison of Compliance with Standards for Biological Samples assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Mercury in the blood lab	I	4/5	0/ 5	11/ 15
2	Hip uric acid in the urine (toluene exposure)	II	1/5	0/ 5	2/ 15
3	Enzyme activity levels(liver damage)	II	3/ 5	1/ 5	9/ 15
4	There is an established procedure for the proper storage handling and disposal of all chemicals	II	1/5	3/ 5	3/ 15
5	There is an established procedure to ensure decontamination and annual certification for bio- safety hoods	II	3/5	1/ 5	12/ 15
6	There is an established procedure for dealing with chemical spills	II	3/5	4/ 5	12/ 15
7	Names and telephone numbers of persons to be notified in emergency situations are posted	II	3/5	5/ 5	10/ 15
Total			**18/ 35**	**14/ 35**	**59/ 105**
Percent			**51.4%**	**56%**	

*(1) & *(2): See legend in Table 5.2.1

1. The table above shows an improved compliance for items one, two, three, four, six & seven after CAP implementation. With this improvement, items one, two and seven reached full compliance.

2. Improvement in compliance ranged from 20% (item six) to 80% (item one).

3. Overall compliance increased three times from 51.4% (18/35) to 56% (14/35).

4. It is worth noting that compliance for items one, two and three, is inverse to occurrence of the events listed in those items. Hence, compliance figures for those items are 1/ 5, 4/ 5 and 2/ 5, respectively. Similarly, the later figures for those were used in calculating the overall compliance.

5. The concordance in item four “proper storage handling and disposal of all chemicals” was low, and not comparable to those of CAP. While the concordance in item six, “the procedures for dealing with chemical spills” was higher and equivalent to those requirements of CAP.

Table 5.2.21 Comparison of Compliance with Standards for Office Area assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Desks, benches and countertops are free of sharps square corners	I	1/5	5/ 5	1/ 15
2	Materials on file cabinets are always evenly distributed so that upper drawers do not unbalance cabinet and cause it to fall over	I	2/5	4/ 5	2/ 15
3	Only one drawer is opened at time and **USUALLY** immediately closed after use	I	1/5	4/ 5	1/ 15
4	Papers and other office materials are **NOT** stacked on top of filing cabinets	I	1/5	4/ 5	1/ 15
5	Aisles and passageways are wide enough for easy movement	I	1/5	5/ 5	1/ 15
6	Aisles and passageways are kept clear at all time	I	1/5	3/ 5	1/ 15
7	Temporary electrical cords and telephone cables that cross aisles are taped to the floor or covered with material designed to anchor them	I	1/5	5/ 5	1/ 15
8	Office electrical equipment are properly grounded	I	2/5	5/ 5	2/ 15
9	The use of extension cords is discouraged	I	2/5	5/ 5	4/ 15
10	Carpets are well laid and stretched to prevent tripping hazards	I	1/5	5/ 5	3/ 15
11	Heavy materials are **NOT** stored on high shelves	I	1/5	3/ 5	2/ 15
12	The use of video display terminals (VDTs) follows NIOSH recommendations	I	1/5	3/ 5	2/ 15
Total			**15/ 60**	**51/ 60**	**21/ 180**
percent			**25%**	**85%**	

*(1) & *(2): See legend in Table 5.2.1

1. It is observed that after CAP implementation, compliance was improved in all the 12 items and improvement ranged from 40% (items # 2, 6, 11 & 12) to 80% (items # 1, 5, 7 & 10).

2. Four items (three, four, eight & nine) achieved 60% increase and four items achieved 40% improvement, namely items two, six, 11 and 12. On the other hand, full compliance was achieved for the six items (#'s 1, 5, 7, 8, 9, & 10).

3. Overall compliance before was 25% (15/60) which increased to 85% (51/60).

4. Although they are important for safety, these items are ranked as phase I, indicating that they are not mandatory. Additionally, a researched guideline on good clinical laboratory practice requires that the work environment be hygienic and designed with practically sufficient space and proper ventilation (Ezzelle *et al*., 2008).

5. Video display terminals (VDT's) (item # 12) have been implemented extensively in hospital office areas during the previous decade. Terminals should be selected to include modern ergonomic state- of- the- art design. They should then be properly fixed, and training in their use should be provided. Otherwise, they may be a source of musculoskeletal defects, shoulder, neck and arm, and eye problems. (NIOSH, 1981a)

6. The concordance for Standards for Office Area was low. Safety Standards for Office Area did not meet the criterion of CAP safety standards, nor were they similar.

Table 5.2.22 Comparison of Compliance with Standards for Responsibility of Department Head to Employees assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Head of department provides safety education at employees' department orientation	II	1/5	4/ 5	2/ 15
2	Head of department provides safety education when new hazard is introduced	II	3/5	4/ 5	9/ 15
3	Head of department performs periodic informal safety inspections to maintain a safe working environment	II	1/5	4/ 5	3/ 15
4	Head of department provides safety education information and training on what to do when there is a fire alarm	II	2/5	5/ 5	4/ 15
Total			**6/ 20**	**17/ 20**	**18/ 60**
percent			**30%**	**85%**	

*(1) & *(2): See legend in Table 5.2.1

1. Compliance improvement after CAP implementation in all four items.

2. Improvement of compliance by 20% was seen in item two and 60% in items one, three & four.
3. Only one item (item four) reached full compliance out of four items constituting the standards in area of Responsibility of Department Head to Employees.
4. Overall, more than double increase in compliance from 30% (6/20) to 85% (17/20) was seen.

The local laboratory management has the responsibility to:

- See that the physical facilities are adequate and in good working order.
- Conduct training program (WHO, 2004).
- Conduct in- house inspection of the facility and conduct inventories of the chemical holdings of the laboratory.

The concordance in item one "safety education at employees' department orientation" is low. Only two out of the fifteen responses were consistent with what CAP standards require.

Table 5.2.23 Comparison of Compliance with Standards for Responsibility of the Employees assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase*(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Employee is knowledgeable about applicable safety laws, ordinances and standards	II	1/5	5/5	2/ 15
2	Recognizes any physical and / or inherent hazard to their job	II	2/5	5/ 5	3/ 15
3	Takes precautions for assuring safety while performing duties.	II	1/5	5/ 5	2/ 15
4	Informs supervisor of equipment/ conditions that might be considered hazardous or potentially hazardous	II	1/5	5/ 5	1/ 15
5	Recommends to supervisor/safety officer on how to eliminate the hazard or improve safety performance	II	1/5	5/ 5	3/ 15
6	Makes recommendations to safety committee/director that may have a positive impact on accident and injury prevention	II	2/5	5/ 5	3/15
7	Utilizes universal blood and body fluids precautions when handling all specimens	II	2/5	5/ 5	5/ 15
Total			**10/ 35**	**35/ 35**	**19/ 105**
percent			**29%**	**100%**	

*(1) & *(2): See legend in Table 5.2.1

1. The results show that there was a remarkable compliance in all the seven items and all reached 100% increase.

2. There was a record of 80% improvement in compliance achieved in four items namely items one, three, four & five and 60% compliance in three items (two, six & seven).

3. The overall compliance before was 29% (10/35), and now it increased to 100% (35/35).

4. The fact that the overall compliance in this area (responsibility of the employees) reflects the full understanding of the employees for their role in daily laboratory operations, resulted in a maximum compliance. Each employee must be given and accept the primary responsibility for safety and the safety culture must flow from management to laboratory worker and must be embraced by each individual (Wickman *et al*., 2007). This is facilitated by their involvement in different laboratory accreditation activities.

5. The concordance in all items of Responsibility of the Employees in safety was extremely low. These were not of significant standards and not comparable to those of CAP's requirements. These have to be tackled to ensure staff safety involvement and awareness.

Table 5.2.24 Comparison of Compliance with Standards for General Areas assessed before and after CAP Implementation in Five UAE Hospitals

S. N	Items	Phase *(1)	Total Parameters		
			Before	After	Concordance*(2)
1	Floors are kept clean of debris and foreign objects	I	4/5	5/ 5	11/ 15
2	Entryways and exits have adequate clearance	I	4/5	5/ 5	11/ 15
3	Doors and cabinets are kept closed when not in use	II	3/5	5/ 5	9 /15
4	All telephones are properly secured and without exposed wires	I	1/5	5/ 5	3/ 15
5	All work areas have adequate ventilation and lighting	II	2/5	5/ 5	4/ 15
6	All lighting is operative an there is no defective or foreyard wiring	II	2/5	5/ 5	4/ 15
7	All electrical devices are inspected and approved for by biomedical engineering department prior to use	I	2/5	5/ 5	4/ 15
8	Adapts in use are approved by electrical engineering department	I	1/5	5/ 5	3/ 14
9	Liquids are placed away from electrical equipment	II	3/5	5/ 5	10/ 15
10	Cabinets and bookcases greater that 150 cm in height are secured to the wall	II	3/5	3/5	9/ 15
11	All electrical equipment are grounded with 3 wire ground or otherwise assessed and approved for use by electrical engineering department.	I	3/5	5/ 5	9/ 15
Total			**28/ 55**	**53/ 55**	**77/ 164**
percent			**50.9%**	**96.4%**	

*(1) & *(2): See legend in Table 5.2.1

The five hospitals have full compliance in the ten items after CAP implementation and improvement ranged from 20% (items one & two) to 80% (items four & eight). Moreover, there was a 40% increase of compliance recorded for items (three, nine & 11) and 60 % for items (five & seven).

Overall compliance almost doubled from 50.9% to 96.4%.

It is noted however that there was no improvement in item # 10 regarding securing large cabinets and bookcases to the wall. In many cases such fixation is not visible to the un-experienced observer. This is one of the guidelines for the laboratory work areas that there must be sufficient space to avoid hindrance to the work and protect employee's safety. (42CFR. Part493, subpart J (493. 1101), Standard; Facilities, 2005) and (CAP, 2006). Furthermore, the laboratory room's (ambient) temperature must be controlled so that equipment and testing are maintained (42 CFR, part 493, subpart K (493.1252), Standard, 2005).

Lastly, it is advised that all floors, walls, ceilings, and bench tops of the laboratory must be clean and well maintained (CAP, 2006) and (WHO, 2004).

In items one to three concordances were high, thus meeting the guidelines of and consequently similar to those set by CAP safety standards. Whilst, in items four to eight concordances were reasonably lower, indicating more awareness is needed in these Safety standards.

Table 5.2.25 Changes in Adherence to Laboratory Accreditation Standards before and after Implementation of CAP Requirements

S.N	ITEMS	Before	After
1	Laboratory Safety Programs	24/ 60(40%)	50/ 60(83%)
2	Safety Policies & Procedures	14/ 25(56%)	24/ 25(96%)
3	Hospital Safety Programs	30/ 50(60%)	47/ 50(98%)
4	Hospital Emergency Procedure	10/ 25(40%)	17/ 25(68%)
5	Fire Protection and Disaster Responses	19/ 60(32%)	54/ 60(90%)
6	Computer Safety Procedures	9/ 25(36%)	17/ 25(68%)
7	Laboratory Equipment	15/ 50(30%)	37/ 50(74%)
8	Laboratory Acquired Infection (activities)	27/ 55(49%)	23/ 55(42%)
9	Aerosol- Reducing Practices Implementation	24/ 35(69%)	32/ 35(91.4%)
10	Needles and Sharp Instruments	6/ 15(40%)	15/ 15(100%
11	Obstacles Broken Objects	17/ 30(57%)	30/ 30(100%)
12	Electrical Hazard	21/ 40(52%)	36/ 40(90%)
13	Other Hazards	7/ 25(28%)	20/ 25(80%)
14	Physical Exertion	15/ 35(42.8%)	35/ 35(100%)
15	Emotional Stress	41/ 70(59%)	64/ 70(91%)
16	Work Practices	13/ 25(52%)	25/ 25(100%)
17	Labeling	38/ 45(84%)	41/ 45(91%)
18	Chemical, Physical & Biologic (Comment Agents)	12/ 25(48%)	21/ 25(84%)
19	Chemical, Physical & Biologic (Other agents)	6/ 10(60%)	9/ 10(90%)
20	Biological Samples	18/ 35(51.4%)	14/ 35(56%)
21	Office Area	15/ 60(25%)	51/ 60(85%)
22	Responsibility of Depart. Head	6/ 20(30%)	17/ 20(85%)
23	Responsibility of the Employees	10/ 35(29%)	35/ 35(100%)
24	General Areas	28/ 55(51%)	53/ 55(96.4%)
Total		425/ 910	767/ 910
Percent		46.7%	84.3%

The responses of the laboratory directors in the five hospitals surveyed are summarized in the above table and in figure 5.2.25. Compliant responses are displayed as the number of responses and percent compliance before and after adoption of CAP standards. The overall compliance rate for the five hospitals changed from 47% to 84% before and after adoption of CAP standards.

Five areas achieved 100% compliance after intervention, namely, needles/ sharps, obstacles, physical exertion, work practices and responsibility of the employees. Maximum change was attained in the areas of employee's responsibility, needles/ sharps and fire protection and disaster responses.

The only area that showed a decline in compliance, from 49% to 42% before and after intervention, is that of laboratory acquired infection (activities). This decline is actually a positive sign of compliance indicating that there is a decrease in the incidence of laboratory acquired infections resulting from wrong laboratory procedures (see discussion under (Table 5.2.8) laboratory acquired infection.

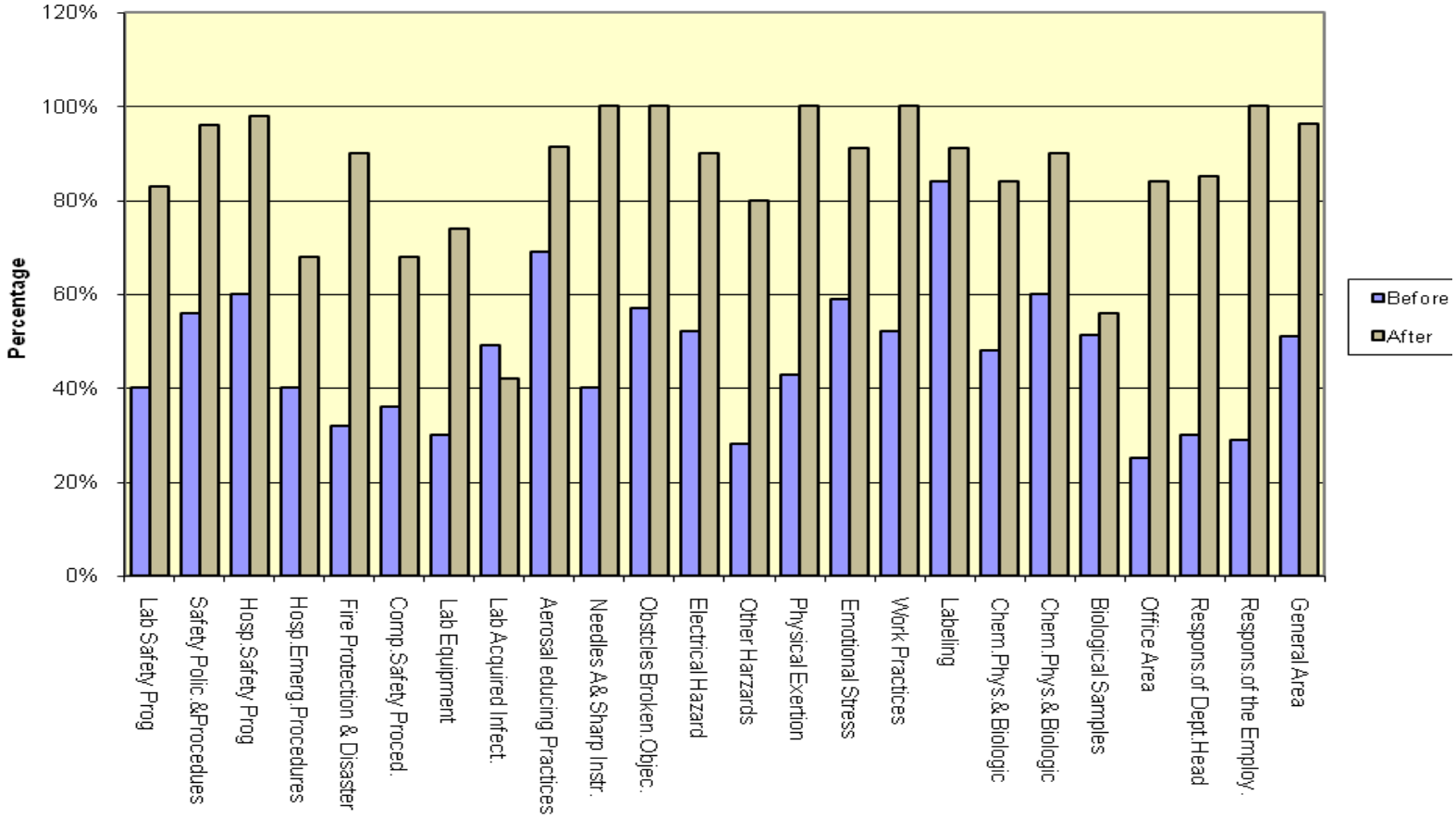

Chart.5.2.25 Changes in aldherence to Laboratory Standards before & after CAP Implementation

Table 5.2.26 Disagreements between Safety Officer & Infection Control Coordinator Responses in Responses to compliance Questionnaire

S.N	Area	Responses	
		In Agreement *	In Disagreement**
1	Laboratory Safety Programs	46	10
2	Safety Policies & Procedures	25	-
3	Hospital Safety Programs	27	6
4	Hospital Emergency Procedure	10	4
5	Fire Protection & Disaster Responses	12	24
6	Computer Safety Procedures	10	9
7	Laboratory Equipment	-	49
8	Laboratory Acquired Infection	37	13
9	Aerosol- Reducing Practices	25	7
10	Needles & Sharp Instruments	5	3
11	Obstacles Broken Objects	5	13
12	Electrical Hazards	18	7
13	Other Hazards	5	16
14	Physical Exertion	12	22
15	Emotional Stress	38	13
16	Work Practices	9	5
17	Labeling	37	1
18	Chemical, Physical & Biological Agents	12	4
19	Chemical, Physical & Biological (other Agents)	8	1
20	Biological Samples	18	10
21	Office Area	13	39
22	Responsibility of Head of Department	1	9
23	Responsibility of Employees	1	26
24	General Areas	15	20
Total		**389**	**361**
Percent		**36.2%**	**39.7%**

In agreement*: The safety officer and Infection control coordinators in each of the five hospitals agree with the head of laboratory department in 24 health and safety areas.

In disagreement**: The safety officer and Infection control coordinators in each of the five hospitals disagree with the head of laboratory department in 24 health and safety areas.

The analysis was geared to assess agreement between the two officers irrespective of the validity or otherwise of what they agreed upon. It has measured the instances when they disagreed in response to the 910 questions contained in the compliance questionnaire; the total number of responses by the five hospitals is 910.

It was found that the two officers disagreed on their responses more than 24% of the time [100-(36.2% + 39.7) = 24.1%].

This level of disagreement between the two officers reflects the lack of unified knowledge-base for what constitutes valid laboratory standard requirements. The introduction of CAP resolves such disagreement by providing common grounds for judgment.

Table 5.2.27 Measurement of Senior Hospital Administration of Health and Safety Requirement

S	# Items	ZMH		SKMC		TAWAM		MAFRAQ		AL AIN		Total 5 hospitals	
		C	NC	C	NC	C	NC	C	NC	C	NC	C	NC
1	Total lab safety programs	11	25	27	9	29	7	30	6	21	15	119	61
2	Total safety policies & procedures	5	10	15	-	15	-	15	-	15	-	65	10
3	Total hospital safety programs	14	16	25	5	24	6	26	4	20	10	109	41
4	Total hospital Emergency procedure	-	15	15	-	15	-	14	1	3	12	47	28
5	Total fire protection & disaster response	3	33	12	24	13	23	16	20	2	34	46	134
6	Total computer safety procedures	1	14	10	5	11	4	8	7	3	12	33	42
7	Total lab equipment	2	28	5	25	4	26	4	26	-	30	15	135
8	Total lab acquired infection	25	8	24	9	24	9	22	11	16	17	111	54
9	Total Aerosol reducing practices implementation	15	6	14	4	16	1	13	5	11	7	69	23
10	Total needles & sharp instruments	1	8	3	6	4	5	6	3	4	5	18	27
11	Total obstacles broken objects	9	9	6	12	7	11	4	14	4	14	30	60
12	Total electrical hazards	18	6	14	10	17	7	20	4	10	14	79	41
13	Total other hazards	5	10	4	11	4	11	7	8	-	15	20	55
14	Total physical exertion	3	15	5	13	7	11	5	13	6	12	26	64
15	Total emotional stress	22	20	30	12	33	9	33	9	33	19	151	69
16	Total work practices	8	7	11	4	11	5	10	5	4	11	44	32
17	Total labeling	5	7	9	3	11	1	11	1	8	4	44	16
18	Total chemical, physical & biological agents	4	11	12	3	12	3	12	3	8	7	48	27
19	Total hazardous substances	2	4	6	-	6	-	6	-	5	1	25	5
20	Total biological samples	2	16	12	6	13	5	15	3	9	9	51	38
21	Total office areas	1	35	5	31	3	33	13	23	-	36	22	158
22	Total responsibility HoD	-	12	5	7	4	8	8	4	1	11	18	42
23	Total responsibility of staff	1	20	4	17	4	17	7	14	3	18	19	86
24	Total general areas	9	24	18	15	22	11	18	15	3	30	70	95
	Grand total all Parameters	167	324	306	233	309	213	423	199	189	343	1279	1343
	Percent	34%		57%		59		32%		36%		49%	

As previously mentioned in chapter four (section 4.2.2) three senior administrators from each of the five hospitals were asked to answer questions about the health and safety (H&S) requirements covering 24 areas of health and safety practices in the medical laboratory. Their responses reflect their understanding of standard requirements in each area. The table above summarizes those responses where "C" denotes compliance i.e. the response is in line with the international requirements and "NC" denotes that response was not in accordance with the international standard requirement.

The corollary is that with the "C" s reflect the better understanding of the administrators of what is required; the "NC" s reflects their lack of such understanding.

The responses to question number two concerning total safety policies and procedures reveal that all 12 senior administrators in four hospitals have the right understanding of the requirements in this area. Administrators in ZMH were the only exception, where 10 out of the 15 responses given by them were contradictory to the standard requirement. The agreement between administrator's responses and actual requirement ranged between zero percent and 100% in various areas of health and safety, as illustrated by the following examples;

a) Zero percent agreement seen in responses to questions 4, 7 and 13 by ZMH and Al Ain hospital, respectively.

b) One hundred percent agreement was seen in responses to question four given by SKMC and Tawam hospital as well as question number 19 given by the same hospitals.

Overall, the percent compliance in all areas by each of the five hospitals ranged between 32% (Al Mafraq hospital) and 59% (Tawam hospital). The average agreement was 49%. These results reflect a low level of understanding of quality requirements in health and

safety in medical laboratories. The introduction of CAP and other accreditation programs will hopefully improve the situation.

5.3 Employee Survey

This part of the analysis tries to explore the effectiveness of the risk assessment practices in five hospitals in Abu Dhabi, UAE. This aim was achieved through identifying the strengths and weaknesses in the practices of the risk assessment. The instrument used in this analysis is a questionnaire with nine items that measures diversity of areas related to risk assessment practices such as assessors' knowledge and resources, assessment measure and control, measures updating, etc.

The questionnaire was administered to 525 staff members in five hospitals; Zayed Hospital (76 respondents), Tawam (81), Khalifa (189), Al Mafraq (95) and Al Ain Hospital (84). The frequency and percentage distribution were constructed for each item in the questionnaire and for each of the five hospitals.

The responses in the "completely agree" and the "somewhat agree" were merged under one category. Similarly, the responses in the "completely disagree" and the "somewhat disagree" were merged under one category. The reason behind this grouping was to facilitate the evaluation process of the risk assessment practices and to simplify data analysis (responses) to meet 60% agreement and disagreement.

An arbitrary threshold was set at 66% of the responses for both negative and positive statements to indicate a satisfactory level of implementing of the health and safety standards. Responses constituting 51% to 65% were taken to be indicating a weaker degree of agreement or disagreement.

Finally, three areas were identified based on the pre set threshold; 66% of the responses;

1. **Strengths:** High level of agreement or disagreement based responses equal to or exceeding 66% of the sample surveyed and

2. **Weaknesses:** Low level of agreement or disagreement based on responses representing 51% to 65% of the sample surveyed.
3. **Not applicable:** Responses representing less than 51% of the sample have been marked as not applicable (NA)

Zayed Military Hospital

Table below presents the responses for 76 staff member at Zayed Hospital for different risk assessment practices.

Table 5.3.1: Respondents' ratings for the risk assessment practices-Zayed Hospital

#	Item	Completely Agree	Somewhat Agree	Somewhat Disagree	Completely Disagree	Responses %
1	Assessors - Resources	34	10	31	1	76
		44.7%	13.2%	40.8%	1.3%	100%
2	Assessors – Knowledge	11	60	3	2	76
		14.5%	78.9%	3.9%	2.6%	100%
3	Practices - Hazards	29	7	36	4	76
		38.2%	9.2%	47.4%	5.3%	100%
4	Practices – Workers	26	13	8	29	76
		34.2%	17.1%	10.5%	38.2%	100%
5	Preventative measure - Misuse	2	34	33	6	75
		2.7%	45.3%	44.0%	8.0%	99%
6	Control Measures- Implementation	36	36	3	1	76
		47.4%	47.4%	3.9%	1.3%	100%
7	Control Measures- Identification	-	10	33	33	76
		0.0%	13.2%	43.4%	43.4%	100%
8	Control Measures- Monitoring	9	11	27	28	75
		11.8%	14.5%	35.5%	36.8%	99%
9	Risk assessments - Updating	1	9	36	30	76
		1.3%	11.8%	47.4%	39.5%	100%

The first two items in the questionnaire designed to examine the competence of the risk assessors. Around 58% of the respondents stated that the assessors have the necessary

resources, time, training and authority to carry out risk assessment. On the other hand, a significant percentage of the respondents (93.4%) agreed that the assessors have the required knowledge of the risk assessment principles, procedures and current health and safety applications. These two ratings highlighted a weak area in the risk assessment practices in terms of the risk assessors' resources, training, etc and a strong area it terms of the risk assessors' knowledge.

Third and fourth items in the questionnaire try to inspect the assessment practices that cover hazards and risks at work in addition to the workers who could be affected by the exposure to hazards and risks. The ratings in the above table show that 52.7% of the respondents disagreed that all hazards and risks at work were not assessed. On the other hand, 51.3% of the respondents agreed that the assessment practices covered the workers as well. These two ratings highlighted two weaknesses in the risk assessment practices at Zayed Military Hospital.

Another area was examined related to the preventative measures addressed in the fifth item in the questionnaire where 51.3% of the respondents disagreed that the preventative measures were misused. This percent highlighted a weak area in the risk assessment at Zayed Military Hospital.

The assessments of the control measures were inspected through three items in the questionnaire; items six, seven, and eight. These three items were addressing implementing, efficiency and monitoring of the control measures. The respondents' ratings revealed that; around 95% agreed that all control measures were being implemented, around 87% disagreed that the control measures lack the proper identification of risks to health and 72.3% disagreed that the control measures are monitored. These findings highlighted two efficient areas (strengths), namely; implementation and efficiency of the

control measures. However, the monitoring of the control measures was not fulfilled (weaknesses).

The last item in the questionnaire examines whether the risk assessment practices are kept up to date. The ratings for this item shows that around 87% of the respondents agreed that risk assessment practices are kept up to date. This rating reflects a strong area in the risk assessment practices at Zayed Military Hospital.

Tawam Hospital

The table below presents the responses for 81 staff members at Tawam Hospital for a variety of risk assessment practices.

Table5.3.2: Respondents' ratings for the risk assessment practices-Tawam Hospital

#	Item	Completely Agree	Somewhat Agree	Somewhat Disagree	Completely Disagree	Responses %
1	Assessors - Resources	73	0	8	0	81
		90.1%	0.0%	9.9%	0.0%	100%
2	Assessors – Knowledge	73	8	0	0	81
		90.1%	9.9%	0.0%	0.0%	100%
3	Practices - Hazards	73	0	8	0	81
		90.1%	0.0%	9.9%	0.0%	100%
4	Practices – Workers	0	8	73	0	81
		0.0%	9.9%	90.1%	0.0%	100%
5	Preventative measure – Misuse	0	0	8	73	81
		0.0%	0.0%	9.9%	90.1%	100%
6	Control Measures-Implementation	73	8	0	0	81
		90.1%	9.9%	0.0%	0.0%	100%
7	Control Measures-Identification	0	0	0	81	81
		0.0%	0.0%	0.0%	100.0%	100%
8	Control Measures-Monitoring	73	0	0	8	81
		90.1%	0.0%	0.0%	9.9%	100%
9	Risk assessments - Updating	0	0	73	8	81
		0.0%	0.0%	90.1%	9.9%	100%

Respondent rating for the first two items revealed the following: A significant percent of the respondents (90.1%) agreed that the risk assessors have the necessary resources, time, training and authority to carry out risk assessment. At the same percentage, respondents agreed that the assessors have the required knowledge of the risk assessment principles, procedures and current health and safety applications. These two ratings highlighted strong areas in the risk assessment practices in terms of the competences of the risk assessors.

Respondents' ratings for the third and fourth items in the questionnaire revealed that a significant percentage of the respondents (90.1%) agreed that risk assessment practices did

not cover all hazards and risks. Moreover, the same percentage of respondents disagreed that the risk assessment practices covered workers who could be affected by the exposure to hazards and risks. These two ratings highlighted weak areas in the risk assessment practices at Tawam Hospital.

Another area was examined related to the preventative measures in the fifth item in the questionnaire, where 100% of the respondents disagreed that the preventative measures were misused. This percent reflects a strong area in the risk assessment at Tawam Hospital.

The assessments of the control measures were inspected through three items in the questionnaire; items six, seven, and eight. The entire respondents (100%) agreed that all control measures were being implemented, disagreed that control measures lack the proper identification of risks to health and finally disagreed that risk assessment practices aren't kept up to date. Clearly the respondents' rating for the three items identified three strong areas in the risk assessment practices at Tawam Hospital.

The last item in the questionnaire examines whether the risk assessment practices are kept up to date. The ratings for this item show that the entire respondents (100%) agreed that risk assessment practices are kept up to date. Obviously, this complete rating distinguished a strong area in the risk assessment practices at Tawam Hospital.

Khalifa Hospital

The table below lists the responses for different risk assessment practices by 189 staff members at Khalifa Hospital.

Table 5.3.3: Respondents' ratings for the risk assessment practices-Khalifa Hospital

#	Item	completely Agree	Somewhat Agree	Somewhat Disagree	Completely Disagree	Responses %
1	Assessors -Resources	100	89	0	0	189
		52.9%	47.1%	0.0%	0.0%	100%
2	Assessors– Knowledge	50	139	0	0	189
		26.5%	73.5%	0.0%	0.0%	100%
3	Practices - Hazards	50	47	92	0	189
		26.5%	24.9%	48.7%	0.0%	100%
4	Practices –Workers	0	189	0	0	189
		0.0%	100.0%	0.0%	0.0%	100%
5	Preventative measure – Misuse	0	139	50	0	189
		0.0%	73.5%	26.5%	0.0%	100.0%
6	Control Measures- Implementation	100	89	0	0	189
		52.9%	47.1%	0.0%	0.0%	100%
7	Control Measures- Identification	0	89	100	0	189
		0.0%	47.1%	52.9%	0.0%	100%
8	Control Measures- Monitoring	0	139	50	0	189
		0.0%	73.5%	26.5%	0.0%	100%
9	Risk assessments - Updating	0	89	100	0	189
		0.0%	47.1%	52.9%	0.0%	100%

The respondent ratings presented in the above table show that the entire sample surveyed (100%) at Khalifa Hospital agreed that risk assessors have the necessary time, resources, training and authority to carry out risk assessment. Moreover, they agreed that the risk assessors have the knowledge and understanding of the work involved, of the principles of risk assessment, prevention and control, and the current health and safety applications. Accordingly, these two ratings distinguished strong areas in the risk assessment process at Khalifah Hospital.

The ratings for third and fourth items revealed that 51.4% of the respondents agreed that not all hazards and risks were covered through the assessment practices. However, the entire sample (100%) agreed that the assessment practices covered all workers who could be affected by the exposure to hazards and risks. These two ratings highlighted a weak area in the risk assessment practices that cover hazards and risks and a strong area in the practices that cover workers as well who could be affected by the exposure to hazards and risks.

The ratings for items six, seven, and eight that address the control measures show that all respondents (100%) agreed that the control measures were being implemented. Moreover, 73.5% of the respondents agreed that all control measures are monitored. These two ratings reflect two strong areas in the risk assessment for the control measures. However, a low level of agreement appeared among the respondents regarding the efficiency of the control measures in identifying the risk, where 47.1% agreed that the control measures lack the identification of risk to health and safety.

Finally, 52.9% of the respondents disagreed that the control measures were not up to date. This rating highlighted a weak area in the risk assessment practices at Khalifa Hospital.

Al Mafraq Hospital

The next table shows the respondents' ratings for different risk assessment practices for 95 staff members at Mafraq Hospital.

Table 5.3.4: Respondents' ratings for the risk assessment practices-Al Mafraq Hospital

#	Item	Completely Agree	Somewhat Agree	Somewhat Disagree	Completely Disagree	Responses %
1	Assessors - Resources	37	9	34	7	87
		38.9%	9.5%	35.8%	7.4%	92%
2	Assessors - Knowledge	37	43	4	6	90
		38.9%	45.3%	4.2%	6.3%	95%
3	Practices - Hazards	23	48	8	12	91
		24.2%	50.5%	8.4%	12.6%	96%
4	Practices – Workers	24	19	5	44	92
		25.3%	20.0%	5.3%	46.3%	97%
5	Preventative measure - Misuse	21	55	5	8	89
		22.1%	57.9%	5.3%	8.4%	94%
6	Control Measures - Implementation	22	42	12	17	93
		23.2%	44.2%	12.6%	17.9%	98%
7	Control Measures - Identification	61	15	12	5	93
		64.2%	15.8%	12.6%	5.3%	98%
8	Control Measures – Monitoring	19	15	10	48	92
		20.0%	15.8%	10.5%	50.5%	97%
9	Risk assessments – Updating	70	14	1	7	92
		73.7%	14.7%	1.1%	7.4%	97%

Respondents' ratings for the first two items revealed that around 48.4% of the respondents agreed that the risk assessors have the necessary resources, time, training and authority to carry out risk assessment. On the other hand, a significant percentage of the respondents (84.2%) agreed that the assessors have the required knowledge of the risk assessment principles, procedures and current health and safety applications. The former percent distinguished a weak area in the risk assessment practices in terms of the assessors'

recourses, time, training, etc., while the last rating reflects a strong area in the risk assessment practices in Al Mafraq Hospital in terms of assessors' required knowledge.

Respondents' ratings for the third and fourth items in the questionnaire which are related to the practices that cover the hazards and risks at work; 74.7% of the respondents agreed that all hazards and risks at work were assessed. On the other hand 51.6 percent were disagreed that the workers were not covered in the assessment practices. The first rating reflects a strong area in the risk assessment process while the second one highlighted a weak area in the process at Al Mafraq Hospital.

Another area was examined which is related to the preventative measures. This area was addressed through item No.five in the questionnaire. According to the rating presented in the above table, 80% of the respondents agreed that the preventative measures were misused. This percent reflects a weak area in the risk assessment practices at Al Mafraq Hospital.

The assessments of the control measures were inspected through three items in the questionnaire; items six, seven, and eight. The ratings in the above table show that around 67.4% of the respondents agreed that all control measures were implemented, around 35.8% agreed that all control measures were monitored and 80% of the respondents agreed that the control measures lack the proper identification of risks to health. Clearly, these percentages identified a strong area in terms of control measures implementation and two weak areas in terms of control measures monitoring and control measures efficiency in identifying risks to health.

The last item in the questionnaire examined whether the risk assessment practices are kept up to date. The ratings for this item show that around 88.4% of the respondents agreed that

risk assessment practices were not kept up to date. This percentage highlighted a weak area in the risk assessment practices at Al Mafraq Hospital.

Al Ain Hospital

The table below lists the responses for different risk assessment practices by 84 staff members at Al Ain Hospital.

Table 5.3.5: Respondents' ratings for the risk assessment practices-Al Ain Hospital

#	Item	completely Agree	Somewhat Agree	Somewhat Disagree	Completely Disagree	Responses %
1	Resources	33	8	31	5	77
		39.3%	9.5%	36.9%	6.0%	92%
2	Knowledge	35	38	2	4	79
		41.7%	45.2%	2.4%	4.8%	94%
3	Practices – Hazards	19	41	8	12	80
		22.6%	48.8%	9.5%	14.3%	95%
4	Practices – Workers	22	19	3	37	81
		26.2%	22.6%	3.6%	44.0%	96%
5	Misuse	18	48	4	9	79
		21.4%	57.1%	4.8%	10.7%	94%
6	Implementation	23	35	9	15	82
		27.4%	41.7%	10.7%	17.9%	98%
7	Identification	57	9	11	6	83
		67.9%	10.7%	13.1%	5.3%	99%
8	Monitoring	17	10	8	46	81
		20.0%	11.9%	9.5%	54.8%	96%
9	Updating	63	12	1	5	81
		75%	14.3%	1.2%	6.0%	96%

Respondents' rating for the first two items revealed that around 48.8% of the respondents agreed that the risk assessors have the necessary resources, time, training and authority to carry out risk assessment. On the other hand, a significant percentage of the respondents (86.9%) agreed that the assessors have the required knowledge of the risk assessment principles, procedures and current health and safety applications. The former percent

highlighted a weak area in the risk assessment practices while the last rating highlighted a strong area in the practices.

The ratings for third and fourth items revealed that 71.4% of the respondents agreed that not all hazards and risks were covered through the assessment practices. On the other hand, 48.8% of the respondents agreed that the assessment practices covered all workers who could be affected by the exposure to hazards and risks. These two ratings highlighted two weak areas in the risk assessment practices.

Another area was examined related to the preventative measures in the fifth item in the questionnaire where around 78.5% of the respondents agreed that the preventative measures were misused. This percent reflects strong area in the risk assessment at Al Ain Hospital.

The assessments of the control measures were inspected through three items in the questionnaire; items six, seven, and eight. The ratings in the above table show that around 69% of the respondents agreed that all control measures were implemented, 32% agreed that all control measures were monitored and 78.5% of the respondents agreed that the control measures lack the proper identification of risks to health. Clearly the respondents' rating for the three items identified three weak areas in the risk assessment practices at al Al Ain Hospital.

The last item in the questionnaire examined whether the risk assessment practices are kept up to date. The ratings for this item show that around 89.3% of the respondents agreed that risk assessment practices are not kept up to date. This percentage distinguished a weak area in the risk assessment practices at Al Ain Hospital.

All weaknesses and strengths per hospital are presented in the next table.

Table 5.3.6 Summary of Strengths and Weaknesses per Hospital

Category Hospital	Resources	Knowledge	Practices	Practices-2	Misuse	Implementation	Identification	Monitoring	Updating
Zayed	Strength (58%)	Strength (93%)	Strength (53%)	Strength (51%)	Strength (51%)	Strength (95%)	Strength (87%)	Weakness (72%)	Strength (87%)
Tawam	Strength (100%)	Strength (100%)	Weakness (90%)	Weakness (90%)	Strength (100%)	Strength (100%)	Strength (100%)	Strength (100%)	Strength (100%)
Khalifah	Strength (100%)	Strength (100%)	Weakness (51%)	Strength (100%)	Weakness (74%)	Strength (100%)	Strength (53%)	Strength (74%)	Strength (53%)
Mafraq	NA	Strength (84%)	Weakness (75%)	Weakness (52%)	Weakness (80%)	Strength (67%)	Weakness (80%)	Weakness (61%)	Weakness (88%)
Al-Ain	NA	Strength (87%)	Weakness (71%)	NA	Weakness (79%)	Strength (69%)	Weakness (77%)	Weakness (64%)	Weakness (89%)

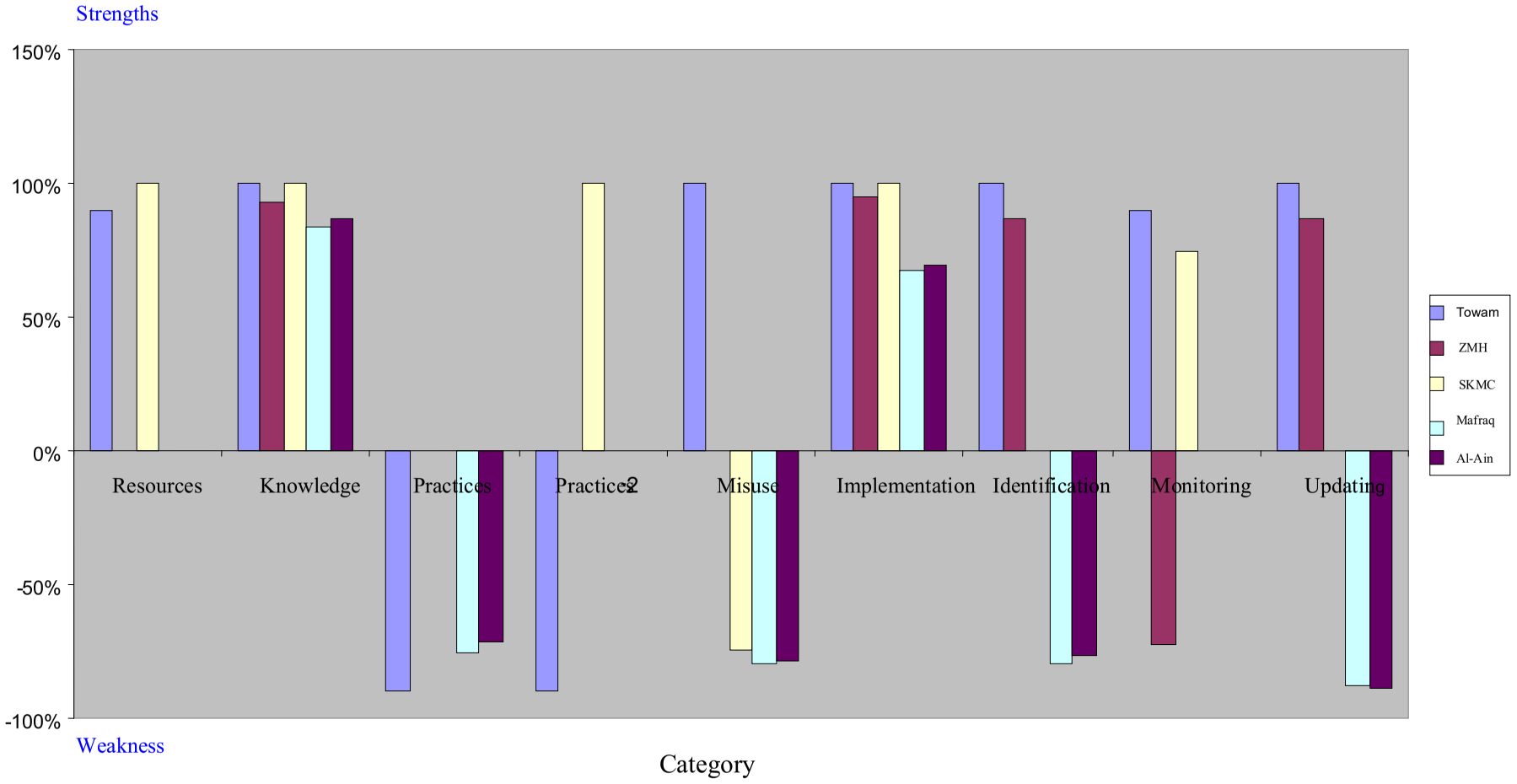

Figure 5.3.6.A: Summary of Strengths and Weaknesses. Results by category

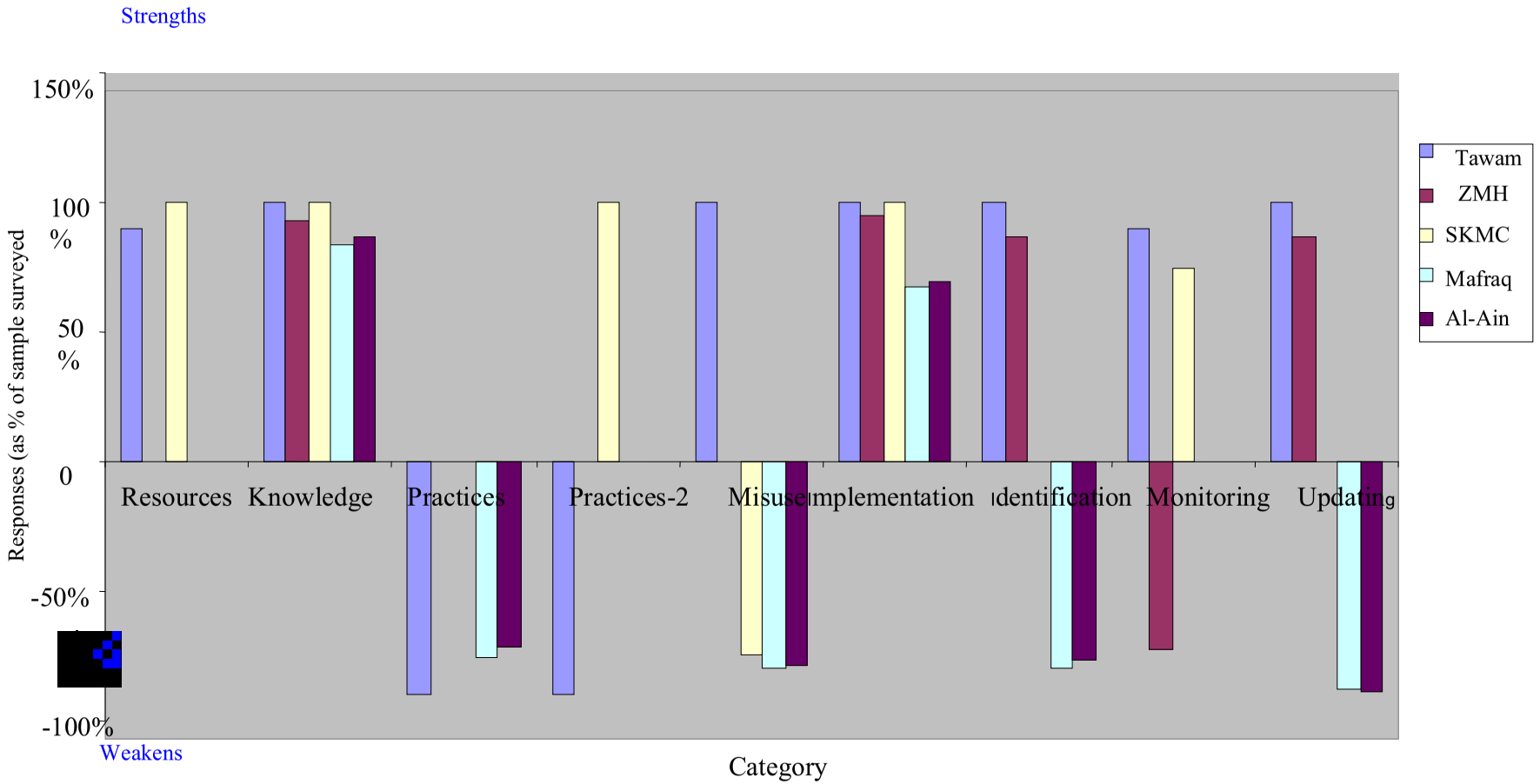

Figure 5.3.6.B: Summary of Strengths and Weaknesses (Results by hospital)

To conclude, the survey conducted at Tawam Hospital presented a more complete picture than the surveys conducted at the other four hospitals as each of the 9 survey questions had responses indicating levels of agreement or disagreement ranging from 90 to 100 percent of the sample surveyed. Thus, all of the responses exceeded the preset arbitrary threshold. The responses of the survey at Tawam indicate that the hospital possesses strengths in the areas of risk assessment resources, risk assessment knowledge, misuse of preventative measures, implementation of control measures, risk identification, controls monitoring and updating of risk assessment practices. On the other hand, the survey indicates that Tawam Hospital has weaknesses in both areas of coverage of the assessment practices.

The survey conducted at Zayed Hospital indicates that the hospital possesses strengths in the areas of risk assessment resources, risk assessment knowledge, assessment practices, misuse of preventative measures, and implementation of control measures, risk identification, and updating of risk assessment practices. On the other hand, the survey indicates that Zayed Hospital has a weakness in the area of controls monitoring.

The survey conducted at Khalifah Hospital indicates that the hospital possesses strengths in the areas of risk assessment resources, risk assessment knowledge, assessment practices' coverage of those affected, implementation of control measures, controls monitoring, risk identification, and updating of risk assessment practices. In contrast, the survey indicates that Khalifah Hospital has weaknesses in the area of assessment practices' coverage of hazards and misuse of preventative measures.

The surveys conducted at Al Mafraq Hospital and Al-Ain Hospital both indicate the same types of strengths and weaknesses in both hospitals, with the number of strengths less than, and the number of weaknesses greater than those found in the other three hospitals surveyed. Both hospitals possess strengths in the areas of risk assessment knowledge and implementation of control measures. In contrast, the survey indicates that both hospitals have weaknesses in the areas of assessment practices' coverage of hazards, misuse of preventative measures, risk identification, and updating of risk assessment practices, and controls monitoring. In Al Mafraq there is an additional weakness regarding assessment practices coverage of all those who could be affected. The survey responses are unable to give us conclusive information on the resources at Al Mafraq and Al-Ain Hospitals.

5.4 Discussion Group

Focus group discussions with the selected groups of individuals in the five laboratories were undertaken to gain information about their views and experiences in all aspects pertinent to their practice.

The benefits of focus groups discussed included gaining insights into shared understandings of the ways in which they were influenced by the laboratory activities, and practice.

Kitzinger (1994, 1995) argues that interaction is the crucial feature of the groups because the interaction between participants highlights their views of the issues, the language they use about an issue and their values and beliefs about a situation. Interaction also enables participants to ask each other questions, as well as to re-evaluate and reconsider their own understandings of their specific experiences. Moreover, the opportunity to be involved in decision making processes, to be valued as experts, and to be given the chance to work collaboratively with researchers can be empowering for many participants (Race *et, al*., 1994) and (Goss and Leinbach, 1996).

The focus group evaluated the changes in different laboratory parameters over the years 2004 and 2007; i.e. before and after implementation of health and safety standards. A scale of -10 to +10 was used to indicate direction and degree of change, where -10 represented maximum deterioration, zero represented no change and +10 indicated maximum improvements. A total of 35 parameters were evaluated. Table (4.5.A and 4.5.B) the 35 parameters grouped into six activity areas. All the changes noted were positive. Training area showed the highest score among the six areas (+5.8), whereas the work schedule exhibited the lowest level of change (+4.6) albeit being positive.

Within the training area, the largest change (+6.7) was scored by the acquisition, by the lab, of proficiency to do the tests. On the other hand, accessibility to training received the least score (+4.7).

The activity area of work schedule showed the maximum score of (+5.5) in the standards of working hours while the minimum of (+3.8) in the ability of using own time effectively.

In the area of policies & procedures, the scope covered by those policies and procedure received the highest score of (+6.2) and the guidelines clarity got the least score at (3.4).The parameter crowded & stressful within the area of space and infrastructure reached the score of (+5.5) while both space for self use and the availability of resources and testing were (+4.9).

The activity of psychosocial factors revealed the highest score of (+6.7) for encouragement and appreciation and (+4.9) for feeling competent to process PT with enough self confidence.

The proper & actual practice of guidelines & requirements in the last area titled (Others) has a score of (+6.7) and a score of (+4.5) for long and unstable shifts.

The overall improvement in staff satisfaction was modest, ranging from 4.6 to 5.8 with the highest improvements observed in the lab proficiency in doing the tests and also encouragement and appreciation, knowledge and practice of safety guidelines. Minimal improvement in satisfaction was seen in the area of guidelines clarity (3.4).

It seems that several areas will need to be addressed by the hospitals in order to achieve higher improvement in staff satisfaction.

Although topics were discussed openly by each of the groups, the individuals' responses were scored and used in the analysis that follows. There were no problems encountered in organizing the discussion or collecting the individuals' evaluations.

5. 4.A Discussion Group (Training, Work Schedule and Policies & Procedure)

S.N	Area	Questions		Total score	Relative change in score	Overall score
1	Training	1	Appropriate training & professional development opportunities	208	5.2	5.8
		2	Regular training offered	228	5.7	
		3	Training available and provided	229	5.7	
		4	When new test/ machine is introduced	263	6.6	
		5	Easily access	187	4.7	
		6	Lab has the proficiency in doing the test	269	6.7	
2	Work Schedule	1	Flexibility	173	4,3	4.6
		2	Standard working hours	219	5.5	
		3	Breaking timing	189	4.7	
		4	Able to use your time effectively	152	3.8	
		5	Enough work time for testing	193	4.8	
3	Policies & Procedure	1	Guidelines clarity	137	3.4	4.9
		2	Applicability	176	4.4	
		3	High standards	187	4.7	
		4	Conformity to international standards	192	4.8	
		5	Scope covered	249	6.2	
		6	Reporting results & accuracy	244	6.1	
		7	CAP evaluation & its influence on your satisfaction	193	4.8	

5. 4.B Discussion Group (Space & Infrastructure, Psychosocial Factors and Others)

S.N	Area	Questions		Total score	Relative change in score	Overall score
4	Space & Infrastructure	1	Crowded & stressful	221	5.5	5.1
		2	Space for lectures/ seminars	205	5.1	
		3	Space for self use	197	4.9	
		4	Lab has the availability of resources & facilities for testing	195	4.9	
5	Psychosocial Factors	1	Work atmosphere	223	5.6	5.5
		2	Management's relations with staff	192	4.8	
		3	Dedication to work	206	5.2	
		4	Encouragement & appreciation	267	6.7	
		5	Satisfied after implementation of CAP	229	5.7	
		6	Feel competent to process PT with enough self confidence	197	4.9	
		7	Level of co-ordination with co-workers	211	5.3	
		8	Environment influence (physician & patients)	217	5.4	
6	Others	1	Car parking	197	4.9	5.6
		2	Uniform NOT good quality	265	6.6	
		3	Long shifts & unstable shifts	178	4.5	
		4	Have proper knowledge about safety requirements	219	5.5	
		5	Get the proper & actual practice of safety guidelines & requirements	266	6.7	

5.5 Safety Reports and Charts

Table 5.5 Safety Reports and Charts

S.N	Parameter	Location/ Site				
		ZMH	SKMC	TAWAM	MAFRAQ	AL AIN
1	Periodicity	6-10/ YEAR	monthly	Monthly	Monthly	7-10 /per year
2	Coverage ;					
	a) incidents*		√	√	√	
	b) needle-sticks	√	√	√	√	√
	c) exercises/ drills		√	√	√	
	d) in-services		√	√	√	
	e) hospital acquired infections	√	√	√	√	√
3	Reports issued/ evaluated by	Icc*	Icc	Icc	Icc & HSC**(lab)	Icc
4	Guidelines followed during 2004-2007	In-house	JCI	JCI	JCI	In-house
5	Format/ Type (table, figure, chart, free text)	Tabular	Tabular chart figure free text	Tabular chart figure free text	Tabular chart figure free text	tabular
6	Period covered	2004/ 2007	2005/ 2007	2004/ 2007	2004/ 2007	2004/ 2007

***Incidents** include all injuries, falls, burns, or other harm but do not include needle-sticks

***Infection Control Coordinator (ICC):** The Infection control coordinator in the five hospitals typically included representatives for infectious diseases, laboratory, nursing, surgery, preventive medicine and quality assurance department. These ICCs held periodic meeting to evaluate the status of control of all infections resulting from hospitalization, contamination or otherwise.

****Health &Safety Committee (HSC):** The Health and Safety Committee draws its membership from all laboratory sections. Its chairman is a member of the hospital Health and Safety Committee. Its role is to setup guidelines and procedures to ensure safe operations in the lab.

Safety reports produced in the five hospitals were critically evaluated for their content, periodicity and format for the period 2004-2007 as exhibited in table (5.5) above. The reports varied with respect to the above parameters. Some reports were issued on 6-10 per/ year, others were monthly. The items covered in the reports also varied. Sheikh Khalifa Medical City, Tawam and Mafraq reports covered all the parameters under item two in table (5.5) while Zayed Military Hospital and Al Ain Hospital reports covered only needle-sticks and hospital acquired infections.

5.6 Impact of CAP Implementation on Health and Safety at Zayed Military Hospital

5.6.1 Proficiency Testing (PT): percentage (and number) of proficiency tests reaching satisfactory level as per CAP standards.

percent tests (and number) reaching satisfactory level						
Lab Sections						
Year	**Hematology**	**Special chemistry**	**Serology**	**Microbiology**	**Blood Bank**	**Biochemistry**
2005	60% (479)	77.8% (36)	91% (35)	84% (105)	75% (8)	84% (102)
2006	68% (330)	87% (218)	92% (148)	70% (39)	83% (18)	65% (364)
2007	87% (187)	97% (234)	97% (206)	95.6% (114)	87% (30)	85% (501)

Participation in proficiency testing (PT) program is one of CAP pre-requisites for their LAP (DHHS, 2003) and (Laessing RH, Ehrmeyer, 1999). The PT involves sending specimens by CAP to all labs participating in the program to be analyzed concurrently with their regular patient sample load. Results of participating labs are evaluated (about 23000 labs participate in the PT program). Our lab is performing very well in the PT. This helped to improve the competency of laboratory staff and management team alike. Additionally, retesting request has dropped and sent-out testing has decreased.

Over the years 2005 through 2007, a steady increase in satisfactory responses to proficiency challenge was observed in the hematology, special chemistry, serology, and blood bank sections. This was due to the continuous monitoring and staff education effort. Laboratories with more experience on PT have lower rates of unacceptable results (Tholend *et al*., 1995).

The slight drop in satisfactory responses to PT challenge observed in microbiology and serology sections in 2006 is attributed to the introduction of new equipment in those sections. The staff eventually got proficient in using the new equipment and maintained their > 95% proficiency level. The satisfaction level by the end of 2007 ranged from 85% for biochemistry to 97% for serology.

5.6.2 Productivity

Laboratory Tests	No. of tests performed		% increase in testing
	2004	2007	
Microbiology	81229	60591	- 25% (decrease)
Haematology	180174	323519	+ 80%
Serology	101772	91255	- 10% (decrease)
Biochemistry	556475	715293	+ 28%
Blood Bank	39287	47467	+ 21%
Histopathology	25482	35049	+ 38%
Special chemistry	37292	49072	+ 32%
PCR	140	1347	+862%

Most of the laboratory sections witnessed an increase in the number of tests performed. The increase ranged from 21% in the blood bank to over 800% in the PCR laboratory. The later was due to recent opening of the PCR service and the introduction of a number of new tests. On the other hand, there was a decrease in the number of tests in two of the laboratory sections, namely; Microbiology and Serology sections where there was a 25% and 10% drop in the number of the tests performed, respectively. The reasons for this drop were the following:

1. The overall number of test requests received in the microbiology and serology sections had dropped during the period 2004-2007.
2. Removal of some tests from certain laboratory sections; e.g. H. pylori test (around 960 tests per year) was removed from the microbiology section and it is currently done in the Endoscopy department.
3. Procedures for performing certain tests were changed, allowing less number of tests to be performed on a single specimen as illustrated by the following examples;

a) Throat culture: this was formerly done as two media plates; a blood Agar plate and chocolate Agar. As of 2006, only one plate is being used (the blood Agar plate). The result was a 50% decrease in the number of plates.

b) High numbers of vaginal swabs were done using the classical culture methodology. This was changed into stained slide grading system "N- score".

In this system, the gram stained specimen is graded using a score of 0+ to 4+ for lactobacilli, Gardenilla. Depending on the result total score, one of the following reports is issued:

(i) 0- 3 = gram stain NOT compatible with bacterial vaginitis.

(ii) 4- 6 = Altered vaginal flora

(iii) ≥ = gram stain compatible with bacterial vaginosis.

4. C - reactive protein (CRP) was removed from the serology testing menu. Now it is being performed in the special chemistry section. About 786 tests are done annually. The same applied to microsomal and thymoglobulin tests, which come to around 300 and 300 tests per year respectively.

5. As of 2005, some tests were removed from the serology test menu to be done separately in the recruitment clinic laboratory outside the hospital (unfortunately the number of tests done there could not be ascertained).

It is noted that the number of testing staff in all laboratory sections stayed the same during the period 2004-2007; this reflects an actual increase in the productivity per laboratory staff. Safe work is also a positive factor for productivity and economic growth (ILO, 2001). 13445.41 test per/ staff compared to 17415.70 after CAP. Labor productivity is one of the factors that impact efficiency of operations in health care institutions and as a component of CAP Laboratory Management Index Program (LMIP) (Valenstein, 2003).

5.6.3 Repeated Tests: total number of tests, repeated tests (between brackets) and percentage of repeated tests.

Year	Lab. Section					
	Hematology	**Special chemistry**	**Serology**	**Microbiology**	**Blood Bank**	**Biochemistry**
2005	40486 (2336) 5.8%	35977 (480) 1.3%	97666 (2100) 2.2%	69985 (110) 0.2%	37407 (792) 2.1%	546020 (7200) 1.31%
2006	105690 (1755) 1.7%	33506 (480) 1.4%	88650 (2015) 2.3%	70628 (110) 0.2%	46180 (602) 1.3%	670698 (7200) 1.07%
2007	323519 (1380) 0.4%	49072 (400) 0.8%	91255 (2014) 2.2%	60591 (156) 0.3%	47467 (588) 1.2%	715293 (7500) 1.04%

Table (5.6.3) displays the total number of tests and the number of repeated tests (shown between brackets) performed in the six sections of the medical laboratory at Zayed Military Hospital between the years 2005-2007. The percent number of repeated tests decreased steadily over the three years in four sections, namely; hematology, special chemistry, blood bank, and biochemistry. On the other hand, there was no change in the percent repeats in the serology and microbiology sections. The implications of the reduction in the repeated tests are two-fold:

(i) It indicates higher proficiency level of performance in the lab.

(ii) It results in financial saving.

5.6.4 Cost of Absenteeism at Work

Section	Parameter	Years		Change	Change %
		2004	2007		
Blood Bank	No of Staff	3	5		
	sick days	26	21	-5	
	Cost *	14,560	11,760	-2,800	- 19.2
Hematology	No of Staff	4	5		
	sick days	13	8	-5	
	Cost *	7,280	4,480	-2,800	-38.5
Microbiology	No of Staff	2	3		
	sick days	5	9	+ 4	
	Cost *	2,800	5,040	2,240	+ 80.0
Serology	No of Staff	3	4		
	sick days	38	3	- 35	
	Cost *	21,250	1,680	-19,570	- 92.1
Special Chemistry	No of Staff	2	3		
	sick days	3	3	-	
	Cost *	1,680	1,680	-	-
Blood Collection	No of Staff	2	1		
	sick days	8	2	- 6	
	Cost *	4,480	1,120	- 3,360	- 17
Histopathology	No of Staff	4	2		
	sick days	11	8	- 3	
	Cost *	6,160	4,480	-1680	- 61.7
Admin	No of Staff	3	4		
	sick days	24	14	- 10	
	Cost *	13,440	7,840	- 5,600	- 34.4
Total	No of Staff	23	27	+4	+17.4
	sick days	128	68	- 60	-47%
	Days/employee	5.6	2.5	-3.1	-55.4%
	Cost *	71650	38080	-33570	-47%

Table (5.6.4) above shows the number of Zayed Military Hospital's laboratory staff taking sick days off in 2004 and 2007, stratified according to the laboratory sections. The overall number of staff calling in sick increased from 23 in 2004 to 27 in 2007. None-the-less the total number of days taken off decreased from 128 days in 2004 to 68 days in 2007 (47% decrease). Similarly, the overall estimated cost of the sick days absenteeism fell from 19,470 US$ in 2004 to 10,347 US$ in 2007 reflecting a saving of about 47%. Employee absenteeism due to illness reflects costs for their employer due to decreased productivity (Coles and Treble, 1996).

It is noted that the average days-off per individual dropped from 5.6 days in 2004 to 2.5 days in 2007 (a drop of 55%). This indicates improved working conditions following CAP introduction affecting the work environment and employees satisfaction. In addition to other factors, staff satisfaction is determined by a safe work environment. Factors that contribute to absenteeism include personal demographics, health status, and attitude toward work, job satisfaction, job content, working conditions, workplace culture, potential lost earnings, and possible reprimand (Katherine Marshall, 2006). Consequently, increase in job satisfaction reduces the number of sick leaves and hence, decreases the cost of absenteeism.

5.6.5 Needle-Prick Injuries

Table 5.6.5 Number of needle- Prick injuries in five hospitals during the period 2004-2007

Hospital Name	Years			
	2004	2005	2006	2007
ZMH	39	30	15	12
TAWAM	-	-	46	8
KHALIFA	-	-	36	75
AL MAFRAQ	-	-	48	36
AL AIN	-	-	46	38

Table (5.6.5) shows the number of needle-prick injuries reported in each of the five hospitals during the period 2004-2007; before and after intervention, in Zayed Military Hospital. The number of needle-stick injuries dropped from 39 in 2004 to 12 in 2007. The number of needle-stick injuries in Tawam, Al Mafraq and Al Ain hospitals in 2006 and 2007 were 46 and 8, 48 and 36 and 46 and 38, respectively. This indicates a marked decrease in the number of injuries following the implementation of Health and Safety Standards.

SKMC hospital launched its incident reporting awareness program in 2006 in preparing for the JCI accreditation. This program resulted in an increase in the number of reported incidents including, needle stick, disposal, misplacement and handling of sharps, and punch by a colleague.

It is noted that the number of reports in 2007 was higher than 2006.This is due to increased awareness and encouragement about the importance of reporting rather than no increase in the number of incidents as revealed by our discussion with the hospital infection control coordinator and the laboratory head. It should be noted that there was an increase in the number of laboratory staff and laboratory testing volume in 2007. This might have contributed to the increase in number of incidents observed in 2007.

5.7 Impact of CAP Implementation on H & S at the American Hospital/ DUBAI

1. The leadership of the hospital has made a commitment to provide a safe environment for patients and staff. Special task force groups were formed to address ways of creating a safety culture. As the hospital prepared for JCIA Accreditation, it was the ideal time to look at the standards in a practical way before the accreditation visit in 2000. Top management recognized that reducing the number of incidents would have a positive effect on staff morale as well as improve productivity and also achieve some cost benefits.

2. The hospital policies encourage the reporting of all incidents without fear of retribution. Staff members accept this and are always willing to give input. Regular safety meetings with representations from all departments are an essential part of this reporting process. This is in addition to the individual department's safety meetings. Since the personnel are directly involved in the safety program. There are improvements in staff satisfaction level in areas like nursing, laboratory, staff retention as measured by the yearly survey conducted by Human Resources department.

3. Making patient safety as the top priority resulted in an overall improvement in safe practices for everyone, including staff and visitors.

4. The hospital has a full-time Performance Improvement/ Risk Assessment manager. This investment has been worthwhile and it contributes significantly to reduction of legal action and importantly patient safety.

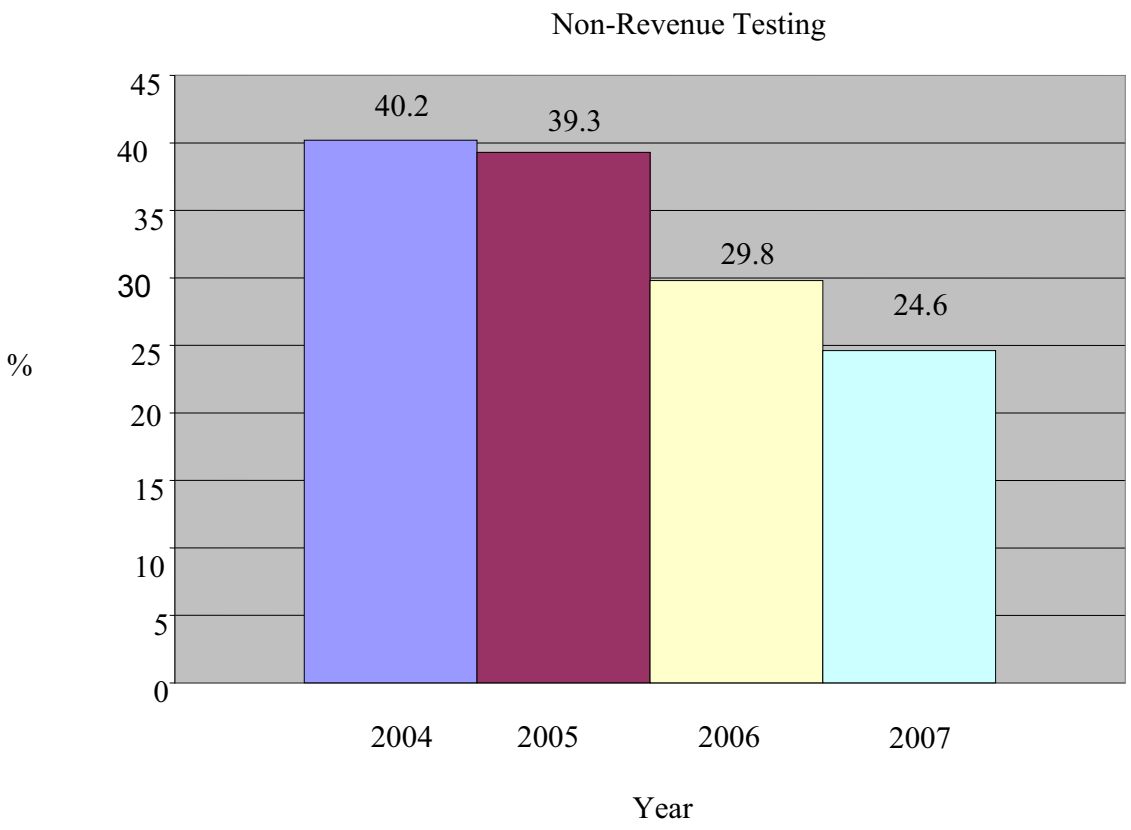

Figure 5.7.A: Non- Revenue testing in the years 2004 to 2007

1. Non-revenue testing in laboratories is a common challenge. If a laboratory consistently repeats tests unnecessarily, this adds to the cost. Because of the strategy described above, they have managed to reduce the percentage of non-revenue testing from 40.2% in 2004 to 24.8% in 2007(figure 5.7.A).

2. Unjustified repeated testing is costly to any laboratory. Retesting rate is one of the ongoing key quality indicators. Prior to CAP accreditation, technologists would repeat tests unnecessarily because of lack of confidence either in the method or due to inappropriate training. CAP mandates an external quality assurance program (proficiency testing) and also expects adequate training with documentation and evidence of competency. This strategy

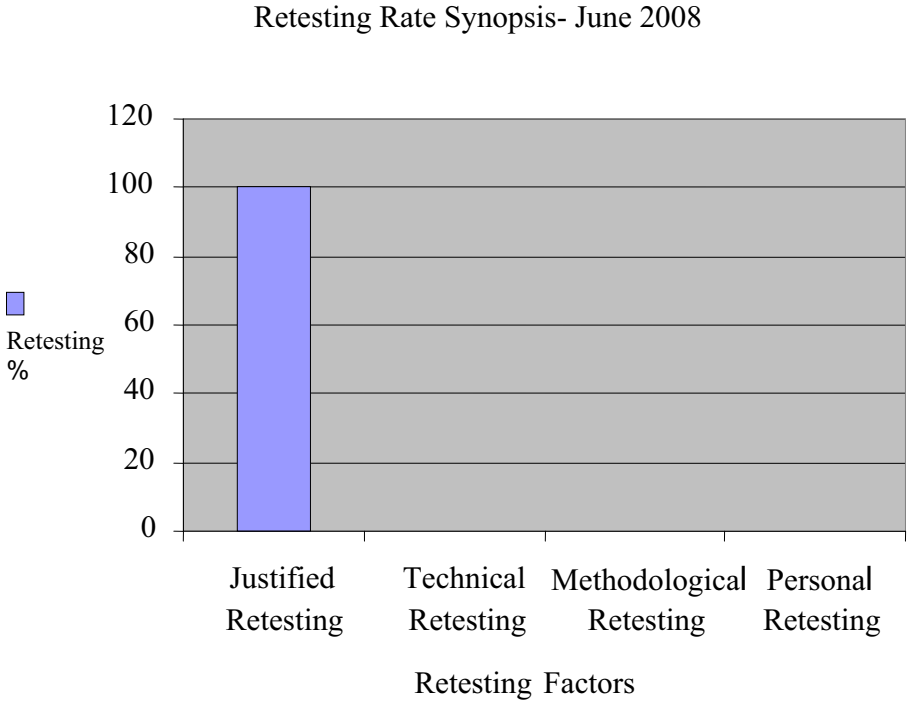

Figure 5.7.B: Retesting Rate Synopsis, June 2008

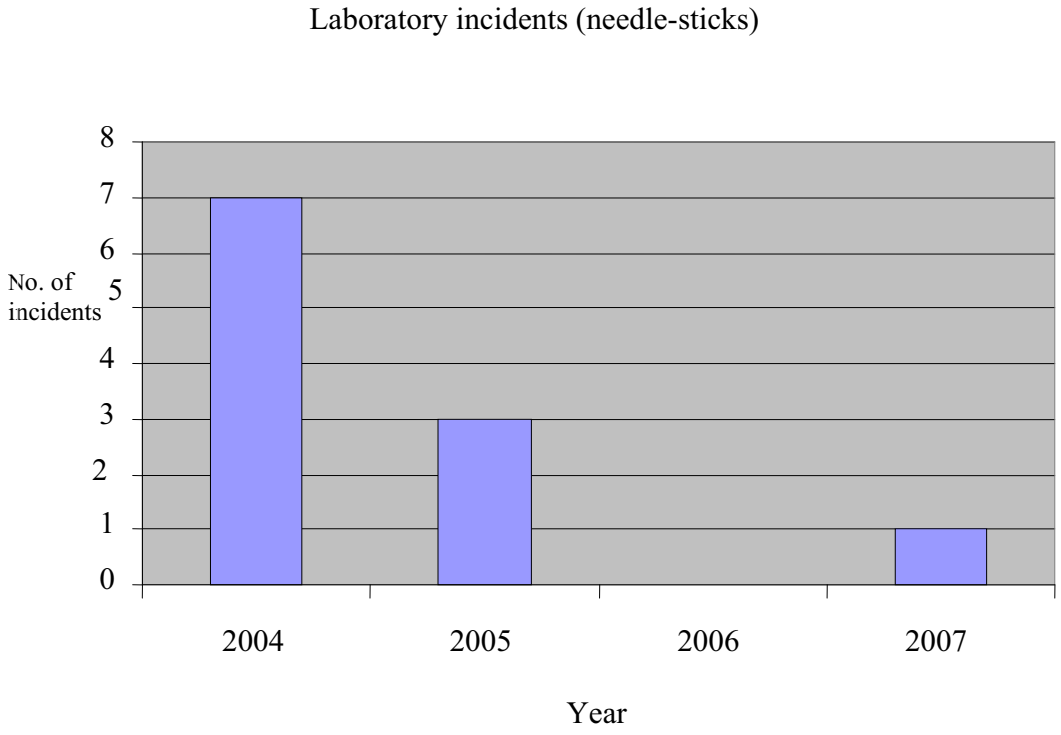

Figure 5.7.C: Number of needle sticks injuries in the lab for the year 2004 to 2007

3. A focus group in needle stick injuries has resulted in a significant reduction (now negligible) in the number of incidents compared to significant numbers prior to addressing this issue (figure 5.7.C).

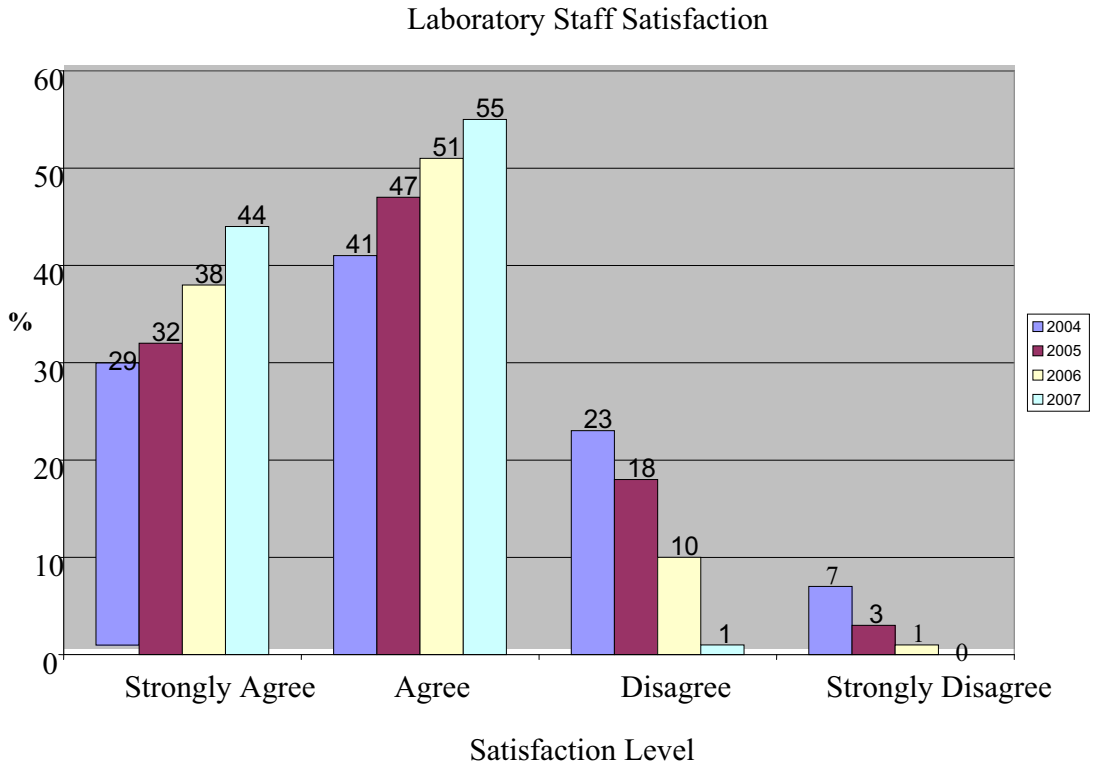

Figure 5.7.D: shows the laboratory staff satisfaction level in the years 2004-2007 (Performance Improvement Committee, PI/ 2007 report/American Hospital in Dubai).

The percentage of staff who strongly agreed that there was an improvement in satisfaction level rose from 29% in 2004 to 44% in 2007. Similarly, those who agreed rose from 41% in 2004 to 51% in 2006. The percentage of those who disagreed or strongly disagreed dropped from 23% to 10% and from 7 to 1%, respectively. The P-value was 0.051, indicating weak evidence to infer that the satisfaction level and the years are related.

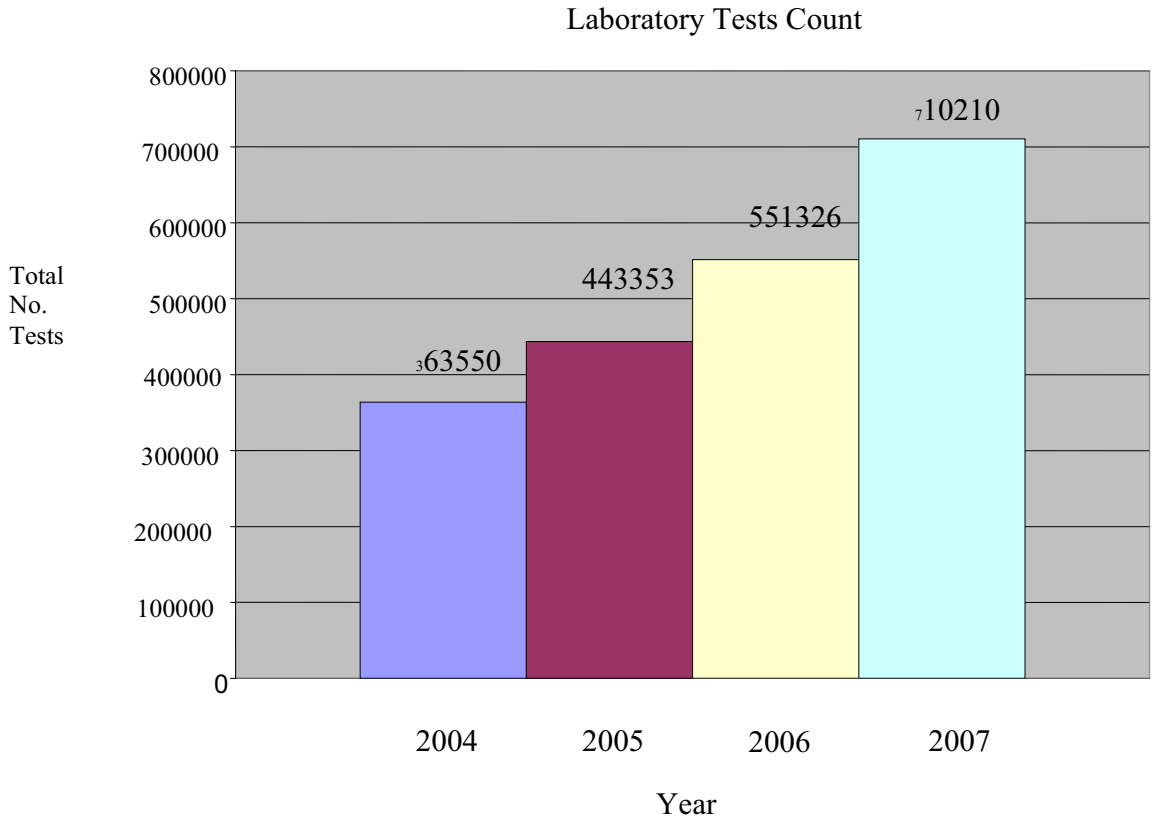

Figure 5.7.E: total laboratory tests count during the year 2004 to year 2007

In the laboratory, a focus on better outcomes by implementing safe practices and quality principles involving all staff from phlebotomists to pathologists, resulted in a marked improvement in staff satisfaction (figure 5.7.D), which in turn led to improved efficiencies as evidenced by the increase in the number of lab tests (figure 5.7.E). There were some cost savings mainly due to minimizing repeated testing.

5.8 Summary of Results

The basic objective of this chapter is to develop and validate a model that best describes the real delivery health, safety and hygiene system at the department of pathology and lab medicine at Zayed Military Hospital. This was an attempt to investigate problems and concerns from lab directors, safety officers, infection control coordinators and staff related to health, safety and hygiene system, inadequate resource planning and allocation practices in the current health safety system. To accomplish this objective, the first step was to prepare data for model input. In this step, reliable, relevant and accurate data that best represented the operational aspects of the current health safety system was prepared and used as input for the new approach.

The findings described in this thesis can be summarized as follows:

1. Senior level management within the UAE has the interest to achieve high levels of professional standards in all sectors.
2. Currently no effective legislation regarding Occupational Health & Safety is in effect in the UAE. The level of cultural awareness is quite limited.
3. In spite of its wide applicability, CAP has not been implemented in the gulf region.
4. When implemented by the author at ZMH, CAP proved useful in evaluating existing health and safety system.

The methodological approaches used in the study were quite useful in demonstrating the usefulness of implementing structured health and safety management system in improving performance and outcome. Since it has been established in 1979, Zayed Military Hospital has improved health and safety in several ways. Here are some of these achievements.

The hospital started with small fire safety team. By 1988, the hospital has added and modified already existing safety policies and procedures, thus regulating work practices in

some departments at ZMH such as medical laboratories safety, radiation safety, workshop safety, and others.

There was no official form of health and safety committee at ZMH except for a short period (2000-2001).Starting in 2001, the author, in collaboration with the medical management facilities department and CAP accreditation consultant, began an-evidence based initiative to implement international safety standards .The following are the achievements attained since then:

1. **Appointment of laboratory QA Consultant**

The work in improving laboratory performance and adherence to international standards began with the appointment of a laboratory QA consultant.

This paved the way to the development and implementation of QA systems, policies and procedures.

2. **Establishment of Health & Safety Committee**: In order to implement CAP lab health and safety standards, a health and safety committee was formed and one safety officer was named for each laboratory section (Appendix H).

3. **Compilation of Lab Health & Safety Manual**: Health and safety manual was written to provide guidelines, policies and procedures for the health and safety operation of the lab and to explain the basic emergency procedures (Appendix F).

4. **Employee Vaccination**: All laboratory staff has been vaccinated against hepatitis B virus. Their immunization status is monitored periodically.

The previously mentioned achievements could not have been attained without the support and commitment of the Medical Services Corps and the higher management of ZMH.

5. **Construction of emergency exits**: the laboratory doors have been changed to be the main exit doors in case of emergency and were fitted with push-out handles.

6. **Provision of first Aid kits in the lab**: the lab was divided into four areas and each area was supplied with one first aid kit which is used for the treatment in case of any minor injuries. Lab personnel were trained on how to use it and its need.

(a)

(b)

7. **Evacuation Plan**: An evacuation plan was formulated for activation and staff were oriented on its application. Evacuation drills are being planned (photo 5.8.c).

(c)

Photo 5.8.c; Evacuation plan was established in 2004, as no such plan existed before this one. According to the plan, the laboratory was divided into four areas (A, B, C and D). Each area had its own exits and the picture of each area was enlarged and displayed in the respective area.

8. Fire Extinguishers: Fire extinguishers were strategically distributed on four locations in the lab. They contained different media; water spray, alcohol foam, CO_2 and dry chemical powder, for fighting different types of fire or burns that might happen.

(d)

Photo 5.8.d; Two of the several types of fire extinguishers are shown above. Those were installed in four strategic locations in the lab.

9. **Dedicated TB Room**: one special room was designed to process TB specimens, thus meeting the requirements and recommendations from CDC and OSHA.

(e)

Photo 5.8.e; A specially equipped room, shown above, has been dedicated for processing TB specimens. A class III hood is shown in the background, containing sharp containers, automated pipettors and gas and electricity outlets.

10. Eye Wash and Shower stations: eye wash stations were provided in each department for use in case of exposure to any irritants or toxic chemicals. A shower station was also installed in the lab for entire body use in case of any contact with corrosive and toxic chemicals (Photo 5.8. f, g, & h).

(f)

(g)

Photo 5.8 f & g; Eye wash stations installed in all laboratory sections, Photo (f) shows an eye wash faucet on a wall stand in the blood bank area; Photo (g) is an eye wash

station situated on the bench top. Most of the benches in the laboratory are equipped with this type of eye wash stations. There are a total of nine eye wash stations in the laboratory.

(h)

Photo 5.8.h; one main shower station was installed in the middle corridor. None was available before 2003.

11. Fume Cupboards/ smoke detection: fire and smoke detectors were located in each room in the lab providing efficient alarming system in case of fire /smoke. Chemicals and corrosive reagents were placed in special cabinets to protect employees from fumes and contact with such chemicals.

(i)

Photo: 5.8. i; The above is one of the 48 smoke detectors installed throughout the lab.

(j)

Photo 5.8.j; Chemicals and corrosive reagents were placed in special cabinets and located in biochemistry section. No such existed in the past (before 2003).

12. Use of Sharps in Blood Bank & Phlebotomy: it has now become standard practice in ZMH lab for used needles or other sharp objects to be placed immediately into sharp containers. These sharp containers were available in phlebotomy area as well as blood bank and microbiology areas. Training and policy on proper handling of sharps has been implemented, in addition to avoiding the recapping of needles to prevent needle stick injuries.

(k)

Photo 5.8.k; Sharp containers similar to the one shown above are routinely used in specific areas in the lab (see text for details).

13. **Designated container for general & medical waste disposal**: laboratory waste, including serum, specimen cultures, stock of infectious agents, and waste from the analyzers or production of biological agents must be strictly handled in a safe manner to ensure that the bio-hazardous waste is properly discarded. This waste means as well any specimens sent to the lab should be considered highly hazardous.

(l)

(m)

14. Photo l; shows the old system of waste disposal where all the waste was dumped into one container, including medical waste, stationary, food wraps, etc. Photo (m) shows the introduction of separate container for each type of waste.

Special bio-hazardous yellow waste bags are now available and labeled as “biohazardous”. (Photo5.8.m). these bags must be securely tied to prevent leakage during handling, transportation or storage for proper disposal. While performing the removal of medical waste or when the infectious bags are emptied, the responsible personnel are required to wear protective equipment.

15. Reporting Mechanism for needle prick & other incidents: It is now mandatory that any incident that may occur in the lab, including needle prick, any sort of injury or exposure to hazardous materials must be reported immediately to the safety officer in the accident unit and incident report must be filed. It is the responsibility of the safety officer who must give clear directions regarding further medical management to ensure that the following measures are complied with and recorded: a) follow up steps taken, including lab testing, medical intervention and vaccination. b) Health status of the staff members over the period of two years. Appendix (I) Incidents Reports.

16. Fire Safety Drills: A special course about fire and drill was performed by specialists to all lab personnel, stressing what shall be done in the event of fire, including the critical time, the evacuating plan, how to be prepared and how to prevent panic in the event of emergency.

17. New bench tops & re-engineering: Great effort was put in the lab to improve the ergonomic conditions. Those included renovation of bench tops and placement of workers to ensure the safety, comfort and health of every employee in the lab (Photo 5.8.n).

(n)

(o)

18. The old benches (n) were replaced with new ones (o); these have antifungal, anti-fire and chemical resistance properties.

(p)

Photo 5.8.p; the hallway shown above separates the admin section of the lab from the technical side. No such separation existed in the past (before 2003).

(q)

Photo 5.8.q; the Figure above shows the newly installed lockers for male and female staff.

5.9 Final Summary Statement

The above figure graphs are visual illustrations of the H&S promoting areas introduced in large part by CAP implementation. These and many other examples were synergistically combined to help promote a cultural change in risk perception and hazard management throughout the laboratory work environment studied.

Chapter 6 Conclusions and Recommendations for Future Work

6.1 Summary and Conclusions

The work described in this thesis can be summarized with the following conclusions:

1. UAE has rapidly evolved as a highly advanced and economically developing base (section 1.6.1).

2. There is a general willingness at senior level within the UAE to achieve high levels of competence and standards in all industrial sectors.

3. Effective implementation of the proposed approach has shown improvements in productivity, operational cost, service quality, staff and management satisfaction (sections 5.6 and 5.8).

4. UAE has no effective legislation addressing Occupational Health & Safety and has limited cultural awareness of Health & Safety prevention.

5. CAP is a system-based management tool which has been developed and implemented initially in North America to help ensure a high standard of efficiency, accuracy and cost-effectiveness in medical laboratories. CAP has been implemented globally, but only to limited extent in the gulf region.

6. CAP has been implemented by the author and colleagues within Zayed Military Hospital between 2003-2007, and has been specifically used to introduce and establish an effective Occupational Health & Safety management system evidenced by:

   a) The general strategy of using CAP to improve H&S (section 3.1) has proved useful in evaluating existing health and safety systems in different hospitals in the Emirate of Abu Dhabi (section 4.2.1).

b) The management survey proved useful in defining inefficiencies and bottlenecks in the current health safety system (section 4.3.1).

c) The risk assessment responses and staff satisfaction levels proved instrumental in determining the status of the H & S policies & practices in the selected study area (section 4.3.2).

d) Results from staff questionnaire help in developing strategies to establish and maintain efficient H & S (section 5.3).

e) Discussion group interview is a useful tool for evaluating employees' understanding and expectations from health and safety programs (section 4.3.3).

f) Accident reports proved a useful tool to monitor effectiveness of health and safety practice implementations (section 4.3.4). Positive changes results in a sense of security and safety in the employees (section 5.8).

7. This thesis has demonstrated that a developing country such the UAE, with no previously existing H&S legislation and little risk prevention culture, can rapidly and effectively introduce effective industry specific H&S by adopting an integrated system-based approach

6.2 Recommendations for Future Work

1. This thesis included limited investigation and discussion of the true cost-effectiveness of working within the "CAP" system. Further investigation to confirm that CAP increases cost-effectiveness would be useful to help demonstrate justification of implementing CAP process.

This philosophy can be applied to many other industries and not just med labs. This CAP philosophy actually comes from general H&S legislation (e.g. UK Health and Safety at Work Act 1974, UK COSHH Regulations 1998) ‘’control of substances hazardous to health’’

2. CAP includes a system in which blinded samples are submitted and analyzed by participating laboratories and the author has found this also to be a useful staff training tool. It should equally be beneficial if CAP system includes a parallel tool to ensure adequate H&S processes are being implemented. It is not clear what this H&S tool may be (e.g. possibly a process related to risk assessment and control). Such monitoring and feedback tool should provide staff training, feedback and guidance. Though, what form it could take is beyond the scope of this thesis, but a useful recommendation for future work.

This thesis demonstrates that effective H&S management can be introduced through the system-based CAP process. However, risk assessment and H&S management would be enhanced with the existence of national H&S legislation. This would help support the healthcare setting. But moreover would provide a basis to implement and manage H&S in other industries in UAE. The author is currently negotiating establishment of a national UAE body (e.g. H&S committee) to focus attention on the need for development of H&S legislation in UAE and plans to share the positive experience with implementation of H&S through CAP in Zayed Military Hospital as an exemplary case study. How effective this committee could be remains to be seen.

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Appendix A

Relevant publications for some main Health and Safety Organizations

A: Health professional and workers Organizations:

A.1. American Federation of Government Employees (AFGE).

A.2. American Federation of State, country and Municipal Employees (AFSCME).

A.3. American Association of Occupational Health Nurses (AAOHN).

A.4. American Occupational Medical Association (AOMA).

A.5. Hospital workers Union 1199.

A.6. College of American Pathologist (CAP): Publishes Guidelines for clinical Laboratories.

A.7. Service Employees International Union (SEIU).

B: Manufacturer's Associations

E.1. American Association for the Advancement of Medical Instrumentation (AAMI): Publishes recommendations and Guidelines of worker safety and health in the handling of medical instruments.

C: Publications.

C.1. Newsletters:

Hospital infection control, Infection control Digest, Hospital Employee Health.

C.2. Checklists and manuals:

Health and safety manual for hospitals.

Hospital workers.

Safety and health hazards on the jobs.

OSHA and the hospital manager.

Hospital safety

Regulations for health care workers.

D: Journals:

American journals of public health

Hospitals

Infection Control

J of Hospital Occupational Health

J of Occupational Medicine

Occupational Health and Safety

Scandinavian J of work, Environment and health

Appendix B

JOB DESCRIPTION

Position Title: Senior Laboratory Technologist.
Departments: Department of Pathology & laboratory medicine.
Location: Zayed Military Hospital.

ZMH/Laboratory/Policy& Procedure/job description, 1999

JOB DESCRIPTION

Position Title: Senior Laboratory Technologist.
Reports to: Technical supervisor/ HoD
Departments: Department of Pathology & laboratory medicine.
Location: Zayed Military Hospital**.**
Grade:
Prepared/Revised: April-2008

JOB OBJECTIVE:

The laboratory must have one general supervisor who, under the direction of the laboratory director and supervision of the technical supervisor, provides day-to-day supervision of testing personnel and reporting of test results. In the absence of the director and technical supervisor, the general supervisor must be responsible for the proper performance of all laboratory procedures and reporting of test results.

JOB DIMENSION:

Directs reports to the Technical supervisor or Head of the Department..

QUALIFICATIONS, EXPERIENCE, & SKILS:

Have earned a bachelor's degree in a chemical, physical, or biological science or medical technology from an accredited institution; and

Have at least seven years of laboratory training or experience, or both, in high complexity testing within the specialty of the section or division that he supervised.

OR

Have earned a master's degree in a chemical, physical, biological or clinical laboratory science or medical technology from an accredited institution; and Have at least 5 years of laboratory

training or experience, or both, in high complexity testing within the specialty f the section or division that he supervised.

DISCRIBTION

The senior laboratory technologist is responsible for day-to-day supervision or oversight of the laboratory operation and personnel performing testing and reporting test results Must be accessible to testing personnel at all times testing is performed to provide on-site, telephone or electronic consultation to resolve technical problems in accordance with policies and procedures established either by the laboratory director or technical supervisor. Is responsible for providing day-to-day supervision of high complexity test performance by a testing personnel qualified, must be onsite to provide direct supervision when high complexity testing is performed by any individuals and Is responsible for monitoring test analyses and specimen examinations to ensure that acceptable levels of analytic performance are maintained. The technical supervisor may delegate to the senior laboratory technologist the responsibility for; (1) Assuring that all remedial actions are taken whenever test systems deviate from the laboratory's established performance specifications; (2) Ensuring that patient test results are not reported until all corrective actions have been taken and the test system is properly functioning; (3) Providing orientation to all testing personnel; and (4) Annually evaluating and documenting the performance of all testing personnel.

APPROVALS:

Division Head:

Department head:

Appendix C

Compliance Questionnaire

Dear Participant

This letter is to solicit your participation in a survey about the Health and Safety and provisions and practices in your hospital. This questionnaire is necessary for a study carried out in partial fulfillment of the requirements for PhD program at the University of Bradford/UK.

As a senior manager in your hospital, we realize that you are very busy with daily work and that you are carefully managing the continuous pressure on your valuable time. Nevertheless, we invite you to participate in this study and appreciate your effort to devote some minutes of your time to participate in this activity.

Please note that we will not analyze or publish individual responses. We will aggregate all responses for statistical analysis and only the summarized results will be reported and published.

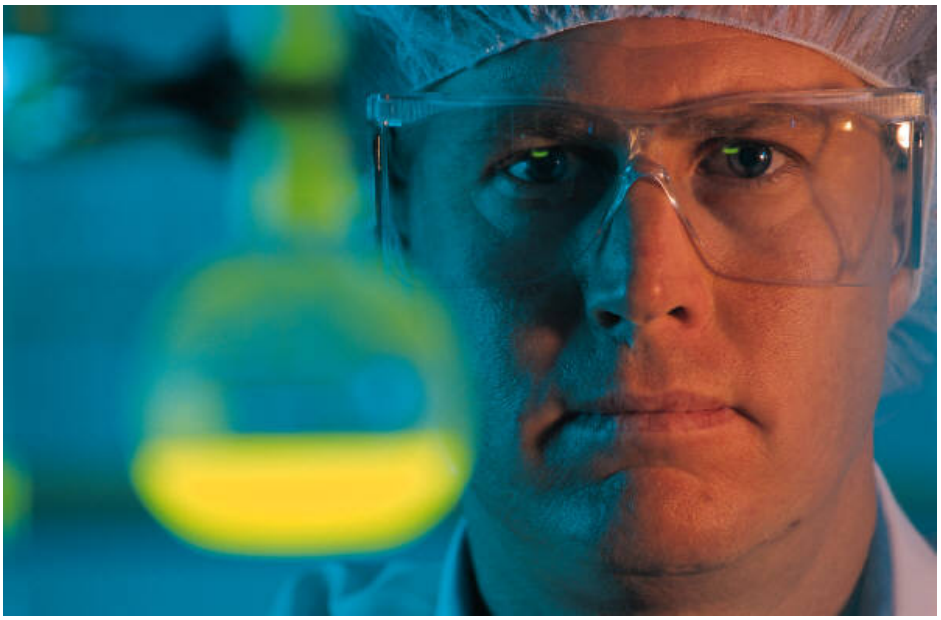
We hope that you will accept our invitation to participate in this study the results of which will benefit our sister institutes. We look forward to receiving your response.

Thank you in advance for your cooperation.

Sincerely
Matter S Al Hassani, 00971 50 4433954
PhD Program
School of Environmental Sciences
University of Bradford

Questioner on Laboratory Safety Polices, Procedures & Practices

(Lab Director, Health Safety Officer, and Infection Control Coordinator Survey)



Instructions:

Please choose the number that best reflects your response to each statement as follows:

1. **Completely disagree**
2. **Somewhat disagree**
3. **Somewhat agree**
4. **Completely agree**
5. **Not applicable**

The questioner based on CAP, CLSI [Clinical and Laboratory Standards Institution], and standards and abstracted from previous performance experience.

Laboratory Safety Programs' Survey:

Please indicate your agreement with each of the following statement:

- *laboratory has the following safety programs:*

Department:	

1- Completely disagree	2- Somewhat disagree	3- Somewhat agree
4- Completely agree	5- Not applicable	

1	Emergency eyewashes and showers	1	2	3	4	5
2	Chemical hygiene plan	1	2	3	4	5
3	Chemical fume hoods	1	2	3	4	5
4	Biological safety hoods	1	2	3	4	5
5	Formaldehyde programs	1	2	3	4	5
6	Vacating laboratory	1	2	3	4	5
7	Compressed gas cylinders	1	2	3	4	5
8	Blood borne pathogens exposure control program	1	2	3	4	5
9	Incident reporting and investigation program	1	2	3	4	5
10	Anthrax and other biological agents threat plan	1	2	3	4	5
11	Fire safety program	1	2	3	4	5
12	Personal protective equipment	1	2	3	4	5

Safety Polices & Procedures

- *The laboratory does have the following:*

13	Laboratory safety policy	1	2	3	4	5
14	Laboratory safety committee	1	2	3	4	5
15	Laboratory safety officer	1	2	3	4	5
16	Laboratory safety manual	1	2	3	4	5
17	Laboratory safety Accident Report Form	1	2	3	4	5

The organization/ institution (Hospital) has:

18	A safety or health & safety committee	1	2	3	4	5
19	An infection control committee	1	2	3	4	5
20	Accident Report Form	1	2	3	4	5
21	Needle stick form	1	2	3	4	5
22	Medical waste disposal policy	1	2	3	4	5
23	Nosocomical infection control policy	1	2	3	4	5
24	An infection control nurse\ coordinator	1	2	3	4	5

If yes; he /she is: part time full time

25	MSDS sheets for all commonly used lab reagents	1	2	3	4	5
26	The safety manual and update are reviewed annually by all lab staff	1	2	3	4	5
27	Familiarity with manual's contents is monitored by checklist	1	2	3	4	5

- The organization/ institution (hospital) has the following emergency procedures:

28	Fire response procedure	1	2	3	4	5
29	Chemical spill response	1	2	3	4	5
30	Bomb threat response	1	2	3	4	5
31	Infections agent spill response	1	2	3	4	5
32	Elevator safety policy	1	2	3	4	5

- *Fire Protection & Disaster Response:*

33	All Exit lights, doors and signs are plainly visible	1	2	3	4	5
34	Fire extinguishers are properly located an charges	1	2	3	4	5
35	All fire equipment are routinely inspected and tagged	1	2	3	4	5
36	Artificial door-steps are not utilized	1	2	3	4	5

37	All fires and smoke are immediately reported	1	2	3	4	5
38	Staff understand well their roles in the event of a fire and disaster alert	1	2	3	4	5
39	Department has a disaster manual	1	2	3	4	5
40	Disaster is kept in a location easily accessible to the staff	1	2	3	4	5
41	Staff do know the location and content of the safety manual					
U 42	Staff observes personal safe guards such as body mechanics to present injury on the job.	1	2	3	4	5
43	Food and beverages are not consumed in laboratory areas wither specimens are handled.	1	2	3	4	5
44	All work related injury, illness or exposure are reported to super	1	2	3	4	5

- *Staff using computers does the following:*

45	Take stretch breaks every 2 hours	1	2	3	4	5
46	Vary their tasks	1	2	3	4	5
47	Use protective screens	1	2	3	4	5
48	Use arm/ head rest	1	2	3	4	5
49	Have correct chair adjustment	1	2	3	4	5

- *The following activities are done **only** in an area of the laboratory that is separated from the technical work areas by a closed door:*

50	Eating and drinking	1	2	3	4	5
51	Manipulating contact lenses	1	2	3	4	5
52	Applying make up	1	2	3	4	5

Laboratory Equipment

Reference: chemical laboratory safety audit by Reich and Harris in 1997 provides a general protocol to help identify safety problems.

53	Electrical shock from lab equipment did happen	1	2	3	4	5
54	All electrical equipment are grounded	1	2	3	4	5
55	The disconnects for all equipments are properly marked	1	2	3	4	5
56	Areas around breaker boxes are kept clear	1	2	3	4	5
57	Writing and connections are checked regularly	1	2	3	4	5
58	Hoses and flittering and gauges are checked periodically for leaks	1	2	3	4	5
59	Contaminated equipment and work surfaces are cleaned with effective disinfectant	1	2	3	4	5

- *Cylinders of compressed gas are:*

58	Kept upright	1	2	3	4	5
59	Secured/ Chained to wall	1	2	3	4	5
60	Valve- protection caps are fastened when not in use	1	2	3	4	5

Laboratory- acquired Infection

Micro- organisms in the laboratory can be inhaled, ingested or inoculated through the skin. The main causes are bacteria and virsus.Many laboratory- acuired infections, especially common discreases, are not well reported. Sources include needle punctures, leaking syringes or tubes, spills breakage resulting in aerosols of infections material, injuries with broken glass or other sharps abd aspiration during mouth pipetting.

61. The following aerosal-generating acitivities are carried out in the laboratory:

Opening containers
Blowing out pipettes
Miuxing test tube contents
Opening lyophilized cultures
Centrifuging suspensions
Pouring liquids
Using automated pipetters
Mixing fluid cultures by pipette
Mixing fluid cultures by pipette
Mixing with high speed blenders
Using poorly made, open or large wire loops
Spilling liquids

62. The following aerosal-reducing paractice(s) are implemented in the laboratory:

A glass/ plastic rod is used for spreading
Pipettes are drained imnstead of blowing them out
Cultares are mixed in a tube mixer
Disinfectant guaze used on wok surfaces during transfer of bio-organic mterial
Equioment is properly maintained & cleaned
Centrifige buckets in use are sealed
Specimens are carefully package during transport and storage

Needles and Sharp Instruments

Cuts, laceractions and ounctures are also common among laboratory workers. Needles and other sharp instruments should be discarded in desinated puncture resistant conatiners and not in trash cans or plastic bags. Policies should be established and enforced to presevnt recapping of needles.

63	Is there an established and enforced policy to prevent recapping of needles?	1	2	3
64	Are there rules for the staff disposal and collection of sharp instruments and other hazardous materials?	1	2	3
63	Are such rules, if existent, reviewed regularly?	1	2	3

Obstacles & Broken Objects

Abrasions, contusions and laceractions are among occipational injuries reported in different hospital areas, including laboratory.

64	The lab furniture and equipment are arranged such they allow free movement in the lab	1	2	3	4	5
65	Doors, cabinet doors and drawers are closed when not in use	1	2	3	4	5
66	Only smooth and rounded corners on desks and benchers are allowed in the laboratory areas	1	2	3	4	5
67	Broken glass is swept up and disposal off immediately and properly	1	2	3	4	5
68	Lab staff do not pick up broken glass with their fingers	1	2	3	4	5
69	Ampoules are grasped with protective gauze before Suring the tip with metal file and snapping the top open.	1	2	3	4	5

Electrical Hazards

Staff should be instructed in the proper use of electrical eqiupment and should follow and take proper precausions.

70	Staff receive instruction on paper handling of electrical equipment	1	2	3	4	5

Defective equipment is immediately reported, tagged and removed from service (1,2,3)

1	Immediately reported	1	2	3	4	5
2	Tagged	1	2	3	4	5
3	Removed from service	1	2	3	4	5

74	Staff, visitors, patients are prohibited from using under-grounded coffee pits, kettles, ratios, fans, portable heaters, etc..	1	2	3	4	5
75	A program is implemented to regularly check all electrical equipment and connections in all labs, tea-rooms, to find damaged cords and under-grounded electrical equipment	1	2	3	4	5
76	Lab equipment is grounded and cords are placed behind the equipment	1	2	3	4	5

77	Microwave ovens are regularly cleaned and periodically checked for proper door closure and seal	1	2	3	4	5

Other Hazards

Miscellaneous other hazards are also found in lab areas.

78	Acids and all chemicals are properly labeled, stored and safety handled	1	2	3	4	5
79	Personal protective equipment are used and protective measures follower	1	2	3	4	5
80	Isolation techniques based on CDC recommendation are enforced when staff members are handling patients with infectious diseases	1	2	3	4	5
81	Limits for exposure to ionizing radiation are enforced	1	2	3	4	5
82	Dosed you lab have limits set for exposure to radiation	1	2	3	4	5

Physical Exertion

Strains and sprains are not uncommon among laboratory staff. Falling, lifting heavy materials, moving equipment and furniture, pushing heavy objects and wearing improper footwear all contribute to the frequency of injuries.

84	Aisles and passage ways are adequate for the movement of personnel	1	2	3	4	5
85	Aisles, passage ways and halls are not used as storage areas	1	2	3	4	5
86	Floors are treated with non-slip material	1	2	3	4	5
87	Spills are immediately cleaned up	1	2	3	4	5
88	Workers are taught to use proper lifting techniques to prevent injuries	1	2	3	4	5
89	Temp electric cords for lights, televisions, equipment, projection are placed in way that prevent tripping hazards e.g. by taping to the floor	1	2	3	4	5
90	Only properly maintained, safe ladders are used to reach high objects, not stools, chairs or boxes	1	2	3	4	5

Emotional Stress

Stress as a job hazard is commonly reported by laboratory workers. Clinical laboratory work ranked seventh among stressful occupations. The sources of stress are numerous.

91	Physician attitudes	1	2	3	4	5
92	Emergency response procedures	1	2	3	4	5
93	The need for accuracy	1	2	3	4	5
94	Lack of communication between shifts	1	2	3	4	5
95	Lack of communication between lab staff and doctors	1	2	3	4	5
96	Lack of communication among lab staff	1	2	3	4	5
97	Fear of making an error	1	2	3	4	5
98	Over work	1	2	3	4	5
99	Deadlines	1	2	3	4	5

100	Lack of support from pathologists	1	2	3	4	5
101	Lack of support from supervisors	1	2	3	4	5
102	Lack of appreciation by other hospital staff	1	2	3	4	5
103	Frequent interruption	1	2	3	4	5
104	Job insecurity	1	2	3	4	5

Work Practices

Safe work practices are very important in protecting laboratory staff.

105	Eating, drinking and smoking NOT done in laboratory, at all times	1	2	3	4	5

106	Contact lenses NOT worn when working with chemicals	1	2	3	4	5
107	Lab coat/ apron worn while in the lab and removed when leaving	1	2	3	4	5
108	Face shield or goggles worn wherever accidental splashes to the face are possible	1	2	3	4	5
109	Food and beverages are not stored in refrigerators or elsewhere in the laboratory	1	2	3	4	5

110	All chemicals in the laboratory are clearly labeled	1	2	3
111	The laboratory safety officer; maintains a list of all chemicals in the lab	1	2	3
112	Reviews the list with; Hospital health and safety committee	1	2	3
113	Personnel health service	1	2	3

114- The label contains:

Generic chemical name
Date of arrival
Probable shelf life/ expiry data
Hazardous character
Special storage requirements

Chemical, physical and biologic agents

Laboratory work requires the use of many chemical, physical and biologic agents or the use of kits containing such agents. Measures should be adopted to control their hazards.

115- Lists of common agents used in the lab are compiled for: (1-5)

1	Organic compounds (e.g. acetone, formaldehyde xylem, other solvents)	1	2	3
2	In organic compounds	1	2	3
3	Physical hazards (e.g. ultraviolet radiation and ultrasonic devices)	1	2	3
4	Biologic agents such as viruses (hepatitis and bacteria (TB))	1	2	3
5	Radioactive isotopes (e.g. iodine, cesium)	1	2	3
116	Workers potentially exposed to hazardous substances are informed about the hazards, symptoms of exposure an effects of over exposure	1	2	3
117	Workers exposures are monitored to ensure that airborne concentrations of specific contaminators are well bellow the allowable limits	1	2	3

118- Periodically, biologic samples are collected from workers to monitor their exposures to toxic substances. (1-3)

1	Mercury in the Blood Lab	1	2	3
2	Hippuric acid in the urine (toluene exposure)	1	2	3
3	Enzyme activity levels (liver damage)	1	2	3
119	There is an established procedure for the proper storage handling and disposal of all chemicals	1	2	3
120	There is an established procedure to ensure routine decontamination and annual certification for bio safety hoods	1	2	3
121	There is an established procedure for dealing with chemical spills	1	2	3
122	Names and telephone numbers of persons to be notified in emergency situations are posted	1	2	3

Officer Areas

Officer areas should not be overlooked during laboratory health and safety inspections.

123	Desks, benches and countertops are free of sharp, square crones	1	2	3	4	5
124	Materials in file cabinets are always evenly distributes such that upper drawers do not unbalance cabinet and cause it to fall over	1	2	3	4	5
125	Only ONE drawer is opened at a time and USUALLY IMMEDIATELT closed after use	1	2	3	4	5
126	Papers and other office materials are NOT stacked as top of filling cabinets	1	2	3	4	5
127	Aisles and passageways are wide enough for easy movement	1	2	3	4	5
128	Aisles and passageways are kept clear at all times	1	2	3	4	5
129	Temporary electrical cords and telephone cables that cross aisles are taped to the floor or covered with material designed to anchor them	1	2	3	4	5
130	Office electrical equipment are properly grounded	1	2	3	4	5
131	The use of extension cords is discouraged	1	2	3	4	5
132	Carpets are well laid and stretched to prevent tripping hazards	1	2	3	4	5
133	Heavy materials are NOT stored on high shelves	1	2	3	4	5

134	The use of video display terminals (VDTs) follows NOISH recommendations	1	2	3	4	5

Responsibility of Department Head to Employee

135- Provides safety education regarding identified hazards specific to the job at these time: (1-2)

1	Provide safety education at Employee's department orientation	1	2	3

2	Provides safety education when a new hazard is introduced	1	2	3

136	Performs periodic, informal safety inspections to maintain a safe working environment	1	2	3

137	Provides safety education information & training on what to do when there is a fire alarm	1	2	3

Responsibility of the Employee

1- Completely disagree 2- Somewhat disagree 3- Somewhat agree 4- Complete agree 5- Not applicable						
Please indicate your agreement with each of the following statement						
138	Employee is knowledgeable about applicable safety laws, ordinances and standard	1	2	3	4	5
139	Recognizes any physical and/ or inherent hazard to their job	1	2	3	4	5
140	Takes precautions for assuring safety while performing duties	1	2	3	4	5
141	Informs supervisor of equipment/ conditions that might be considered hazardous or potentially hazardous	1	2	3	4	5
142	Recommends to supervisor/safety officer on how to eliminate the hazard or improve safety performance	1	2	3	4	5
143	Makes recommendations to safety committee/director that may have a positive impact on accident and injury prevention	1	2	3	4	5
144	Utilizes universal blood and body fluids precautions when handling all specimens	1	2	3	4	5

General Areas

145	Floors are kept clean of debris and foreign objects	1	2	3	4	5
146	Entryways and exits have adequate clearance	1	2	3	4	5
147	Doors and cabinets are kept closed when not in use	1	2	3	4	5

148	All telephones are properly secured and without exposed wires	1	2	3	4	5
149	All work areas adequate ventilation and lighting	1	2	3	4	5
150	All lighting is operative an there is no defective or foreyard wiring	1	2	3	4	5
151	All electrical devices are inspected and approved for by biomedical engineering department prior to use	1	2	3	4	5
152	Adapts in use are approved by electrical engineering department	1	2	3	4	5
153	Liquids are placed away from electrical equipment	1	2	3	4	5

154	Cabinets and bookcases greater that 150 cm in height are secured to the wall	1	2	3	4	5
155	All electrical equipment are grounded with 3 wire ground or otherwise assessed and approved for user by electrical engineering department	1	2	3	4	5

End of the Questionnaire

Appendix D

Staff Questionnaire

Dear Participant

This letter is to solicit your participation in a survey about the Health and Safety and provisions and practices in your department. The questionnaire is necessary for a study carried out in partial fulfillment of the requirements for PhD program at University of Bradford/UK.

We realize that as a lab staff you are very busy with your daily work and that you are carefully managing the continuous pressure on your valuable time. Nevertheless, we invite you to your participate in this study and appreciate your effort to devote some minutes of your time to complete this questionnaire.

Please note that the questionnaire is anonymous and does not require a personal identification of the participant or his/her hospital. In addition, we will not analyze or publish individual responses. We will aggregate all responses for statistical analysis and only the summarized results will be reported and published.

We hope that you will accept our invitation to participate in this study and look forward to receiving your response.

Thank you in advance for your cooperation.

Sincerely
Matter S Al Hassani, 00971 50 4433954
PhD Program
School of Environmental Sciences
University of Bradford

Risk Assessment (Staff Survey)

Instructions:

Please choose the best area that best reflects your response to each of the statement.

A) Completely disagree
B) Somewhat disagree
C) Completely agree
D) Somewhat agree
E) Not applicable

The questioner has been adopted with some modifications, Development of a framework for resource planning and allocation in service organization by Dr. Rashed Alkaabi (Personal communication)

1. Risk Assessors have the necessary time, resources, training and authority to carryout Risk Assessment

☐ Completely disagree ☐ Somewhat disagree
☐ Completely agree ☐ Somewhat agree
☐ Not applicable

2. Risk Assessors have the knowledge and understanding of the work involved, of the principles of Risk Assessment, prevention and control, and the current health and safety applications

☐ Completely disagree ☐ Somewhat disagree
☐ Completely agree ☐ Somewhat agree
☐ Not applicable

3. Assessment practices don't cover all the hazards and risks at work

☐ Completely disagree ☐ Somewhat disagree
☐ Completely agree ☐ Somewhat agree
☐ Not applicable

4. Assessment practices cover all those who could be affected

☐ Completely disagree ☐ Somewhat disagree
☐ Completely agree ☐ Somewhat agree
☐ Not applicable

5. existing preventative measure are misused

☐ Completely disagree ☐ Somewhat disagree
☐ Completely agree ☐ Somewhat agree
☐ Not applicable

6. All control measures are being implemented

☐ Completely disagree ☐ Somewhat disagree
☐ Completely agree ☐ Somewhat agree
☐ Not applicable

7. Control measures lack the proper identification of Risks to health and Safety

☐ Completely disagree ☐ Somewhat disagree
☐ Completely agree ☐ Somewhat agree
☐ Not applicable

8. All control measures are monitored

☐ Completely disagree
☐ Somewhat disagree
☐ Completely agree
☐ Somewhat agree
☐ Not applicable

9. Risk assessments practices aren't kept up to date

☐ Completely disagree
☐ Somewhat disagree
☐ Completely agree
☐ Somewhat agree
☐ Not applicable

End of the Questionnaire

Appendix E

Discussion Group

Dear Participant

This letter is to solicit your participation in a discussion form about Health and Safety provisions and practices in your hospital specifically in the following areas: this open discussion form is necessary for a study carried out in partial fulfillment of the requirements for PhD program at university of Bradford/UK.

We realize that as a lab staff you are very busy with your daily work and that you are carefully managing the continuous pressure on your valuable time. Nevertheless, we invite you to your participate in this study and appreciate your effort to devote some minutes of your time to complete this questionnaire.

Please note that the questionnaire is anonymous and does not require a personal identification of the participant or his/her hospital. In addition, we will not analyze or publish individual responses. We will aggregate all responses for statistical analysis and only the summarized results will be reported and published.

We hope that you will accept our invitation to participate in this study and look forward to receiving your response.

Thank you in advance for your cooperation.

Sincerely

Matter S Al Hassani, 00971 50 4433954
PhD Program
School Environmental Sciences
University of Bradford

Interviews (Focus Group)

Group ( ) **Location**:

Key Points of Discussion:

- **Training**: ……

……..

……..

- **Work Schedule**: ……

……..

……..

- **Policy and Procedure**: ……

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- **Space and Infrastructure**: ……

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- **Psychosocial Factors**: ……

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……..

- **Others**: ……

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……..

……..

Appendix F

Laboratory Health and Safety Manual
Department of Pathology & Lab Medicine
Zayed Military Hospital

First Edition

Laboratory Health and Safety Manual
Department of Pathology & Lab Medicine
Zayed Military Hospital

Contents

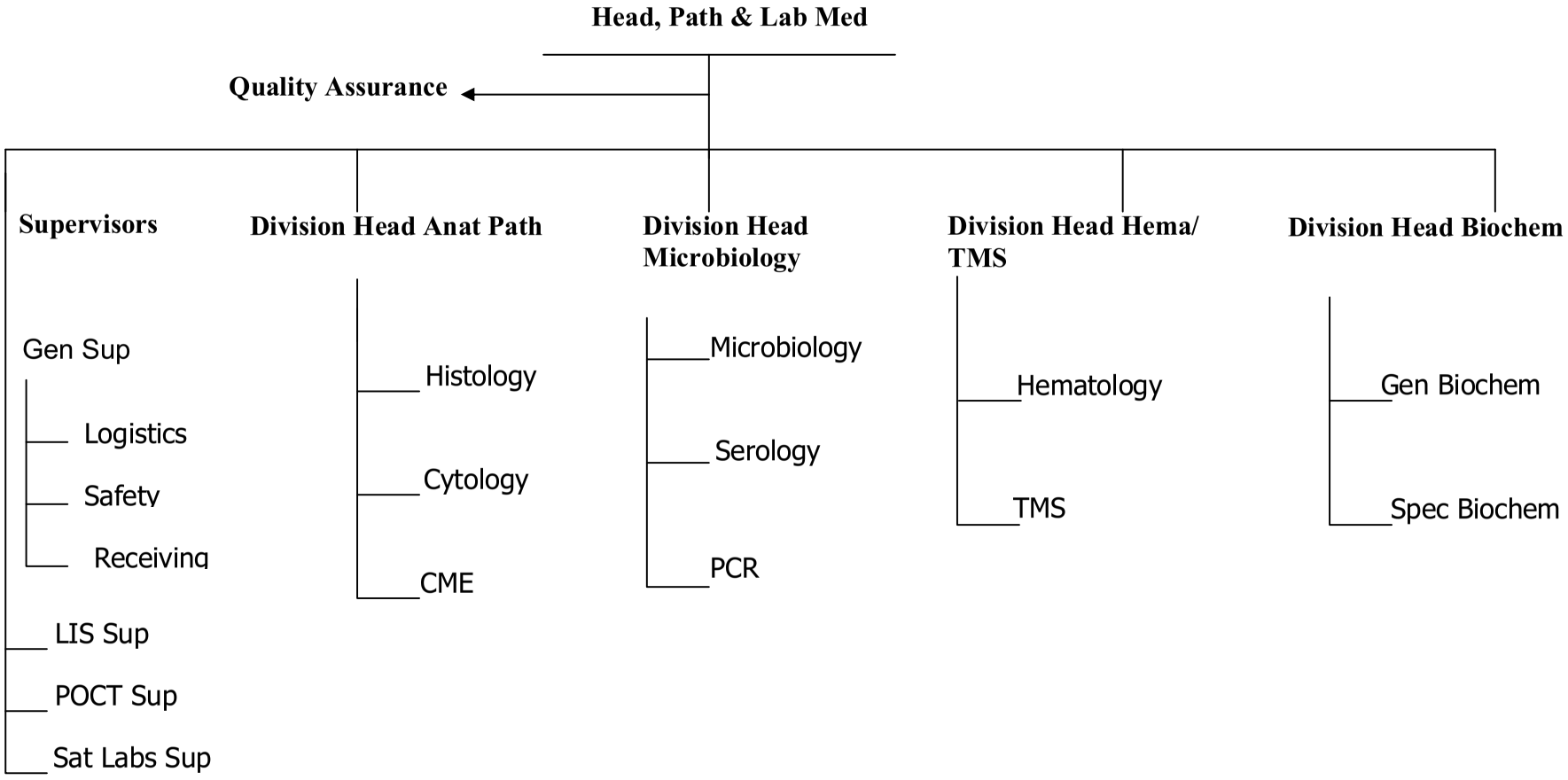
8	**Chapter 7**	Post Exposure Prophylaxis Plan a) First Aid b) Reporting of the Exposure c) Post exposure prophylaxis d) Testing & Counseling	
9	**Chapter 8**	Tackling Infectious Spills & Handling Infectious Spills a) General Guidelines b) Procedure for handling Biological spills	
10	**Chapter 9**	Management of Work Related Injuries a) Reporting of work Related Injuries b) Management Treatment of work related Injuries c) Documentation of work Related Injuries	
11	**Chapter 10**	Chemical, Hygiene & Hazard Plan a) General Safety Guidelines b) Chemical Post-Exposure procedure c) Chemical Inventory d) Material Safety Data Sheets	
12	**Chapter 11**	Employee Vaccination Programme a) Primary Vaccination Schedule b) Post-Exposure prophylaxis	
13	**Chapter 12**	Tuberculosis Exposure Control Plan a) Good Laboratory practice b) Procedural hazard & safety strategies c) Risk & Modalities of Transmission	
14	**Chapter 13**	Infectious Waste management & Disposal Plan a) Bio-hazardous waster and Sharp waste b) Rules	
15	**Chapter 14**	Waste Minimization & Pollution Control	
16	**Chapter 15**	Emergency Response & Contingency Plan a) General b) Types of Emergencies c) Reporting an Emergency d) Hazard Analysis	
17	**Chapter 16**	Formaldehyde Exposure Control Plan	
18	**Chapter 17**	Xylene Exposure Control Plan	
19	**Chapter 18**	Disabled Person Evacuation Plan	
20	**Chapter 19**	Cardio-Pulmonary Resuscitation	

21	**Chapter 20**	Bio terrorism Response Plan	
22	**Chapter 21**	Latex Allergy Policy	
23	**Chapter 22**	Tetanus Vaccination Program	
24	**Chapter 23**	Radioactive Waste Disposal	
25	**Chapter 24**	X-Ray Policy	
26	**Chapter 25**	Ultraviolet Radiation Safety Guidelines	
27	**Chapter 26**	Laboratory Disinfectant Policy	
28	**Chapter 27**	Formats of Safety Check	
29	**Chapter 28**	Electrical Safety	
20	**Chapter 29**	New Employees	
31	**Chapter 30**	Ergonomics	
32	**Chapter 31**	Fire Safety	-Types of fire Extinguishers -Fire & Life safety
33	**Chapter 32**	Personal Protective Equipment	a)- Protective clothing - Gloves - Eye - Skin - Respiratory - Hearing - Foot - Head b) – Shielding

Appendix G

Pathology & Lab Medicine Organization Chart according to CAP Requirements 2004

Path & Lab Med Org Chart



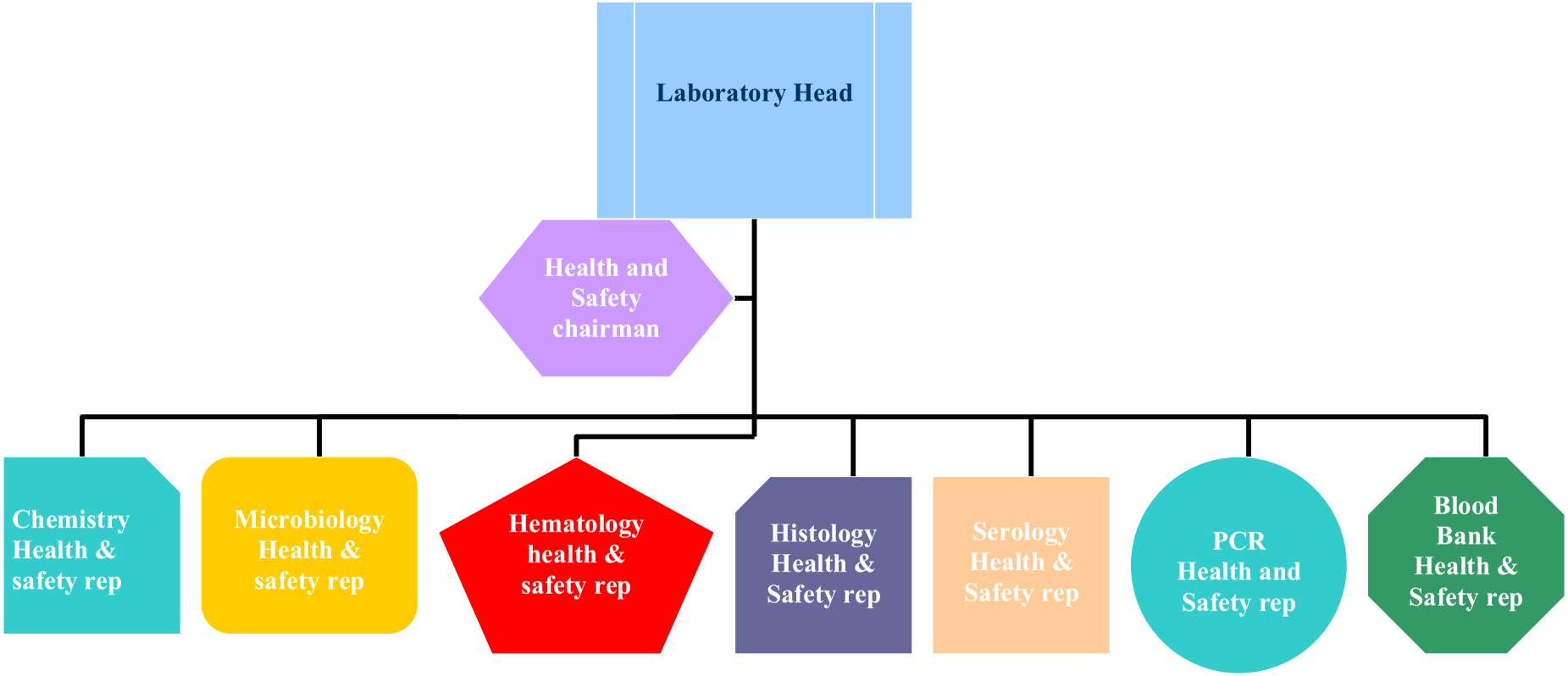
Prepared by: Mattar Saeed Al Hassani
Head of Path Dept. & Lab Med

Approved by: Col. Dr. Ali Obaid Al Ali
ZMH Commander

Appendix H

Laboratory Health and Safety Committee, Zayed Military Hospital

Laboratory Health and Safety Committee
Zayed Military Hospital



Appendix I

Incident Report
Department of Pathology & Lab Medicine
Zayed Military Hospital/Abu Dhabi/UAE

ZAYED MILITARY HOSPITAL
DEPT. OF PATHOLOGY & LAB MEDICINE

INCIDENT REPORT

Type of Accident:

Sharps	Needle Stick	Splash

Injured Person:

Surname: ---------- Mil. No: ----------

First Name: ---------- Date: ----------
Unit/ Dept: ----------

Part of Body Injured:

Description of Injury:

Infection Risk:

□ Uncontaminated with another person's blood, body fluid or tissue
□ Contaminated with another person's blood, body fluid or tissue
□ Unknown

Treatment of Injury:

a) Uncontaminated with another person's blood, body fluid or tissue

Rinsed with water	□ Yes	□ No
Rinsed with soap and water	□ Yes	□ No
Treated with antiseptic	□ Yes	□ No

Other: ----------

b) Contaminated with another person's blood, body fluid or tissue

Rinsed with water	□ Yes	□ No
Rinsed with soap and water	□ Yes	□ No
Seek medical treatment	□ Yes	□ No

Other: ----------
At time of injury what were you wearing?

Gloves	□ Yes	□ No
Mask	□ Yes	□ No
Protective Eye Wear	□ Yes	□ No
Protective Clothing	□ Yes	□ No

Immunization status of injured person:

Hepatitis B vaccination:
Post vaccination immunity result: □ Positive □ Negative □ Unknown

I have received immediate information and counseling from:

H & S Officer
Infection control Nurse
Medical Practitioner

Signature: ---------- Date: ____/____/___
Witness: ---------- Date: ____/____/___

Disclaimer

I _____ acknowledge that the injury I received was uncontaminated with another person's blood, body fluid or tissue. I acknowledge that no follow up is necessary.

Signed: ---------- Date: ____/____/___