Knowledge, Attitude and Practice as a Part of General Competency of Medical Laboratory Technologists in Khartoum State, Sudan (2011)

By

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B.Sc. in Medical Laboratory Sciences
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in Public and Environmental Health
Faculty of Health and Environmental Sciences
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Examination Committee

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Date of Examination: 27/5/2012.
قال تعالى:

(وَوَضَعْنَا الْإِنسَانَ بَوْلَادِهِ حَمَلْتُهُ أَمْهَهُ وَصَدَّاً عَلَى
وَمَن وَضَعْتُ فَيْ خَالِقُ نَعْمَانَ أَنْ أَهْضُرُ لِي وَلَوَالَّدَيْكَ إِلَيْهِ المَكِيرَ)

(الإسراء: 13)
DEDICATION

To

My mother

Soul of my father

Brother and sisters......Fiancée...

And to the people whom I love and re-
giving

All the glory and honor to them for me strength and support throughout life

Ah

med
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My deep thanks and gratitude to my supervisor Doctor Bakri Y. M. Nour for his keen supervision, valuable guidance and assistance provided to me during preparation of this thesis.

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To Ustaz Osama for his assistance in analysis of the data. To my cousin Hiba for her assistance.

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Knowledge, Attitude and Practice as a Part of General Competency of Medical Laboratory Technologists in Khartoum State, Sudan (2011)

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For M.Sc. in Public and Environmental Health (May, 2012)
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ABSTRACTS

The medical laboratory technologist is an allied health professional who is qualified by academic and practical training to provide service in clinical laboratory science. Competence is defined as the knowledge, skills, judgments and attitudes acquired through a combination of academic training and clinical experience that enable an individual to practice safely and ethically in a designated role. The general objectives of the study to verify the factors that affect general competency of medical laboratory technologist in Khartoum state in November 2011. A post retrospective study descriptive cross sectional study conducted in hospital laboratories in Khartoum state in November 2011. A well structured close ended questionnaires were distributed to those who graduated from medical laboratory sciences and permanently registered for MOH as MLTs in the Sudan and still work in medical laboratories. Data was analyzed by computerized SPSS program. The study population was 100 MLTS, 65% male and 35% female. The majority of age group was 20-29 years (50%). The main experience years group was 2-5 years (52%). 50% of the participants were not vaccinated against HBV. Almost 65% of respondents didn’t wash their hands using standard hand washing techniques. 82% didn’t know the technical errors in the laboratory and 81% didn’t know the indicators of analysis in terms of sensitivity and specificity. It is recommended that the curriculum of B.Sc MLT should be revised and updated to cope with the training needs of MLTs. Vaccination of staff against hepatitis B should also be done while guidelines for post prophylaxis should be widely disseminated. In conclusion, general competency, confidentiality and commitment, are vital characters for the MLTs and should be strengthened.
المعرفة، السلوك والأداء كجزء من الكفاءة لتقنيي المختبرات الطبية بولاية الخرطوم، السودان (2011م)

أحمد التجاني حسنين أحمد إبراهيم

ماجستير العلوم في الصحة العامة وصحة البيئة (مايو، 2012 م)
كلية العلوم الصحية والبيئية
جامعة الجزيرة

خلاصة البحث

تقنية المختبرات الطبية هي المهنية في مجال الرعاية الصحية الذي يكون مؤهلًا عن طريق التدريب الأكاديمي والعلمي لتقديم الخدمات في مجال العلوم المخبرية السريرية، وتعزز الكفاءة بالمعرفة والأحكام والمهارات والمواقف المكتسبة من خلال مزيج من التدريب الأكاديمي والخبرة السريرية التي تمكّن الفرد من الممارسة بأمان وأخلاقي في دور معين. الهدف العام من الدراسة من العوامل التي تؤثر على الكفاءة العامة لتقنيي المختبرات الطبية في ولاية الخرطوم في نوفمبر 2011. تم عمل دراسة استطاعية وصفية في مختبرات المستشفى في ولاية الخرطوم في نوفمبر 2011 عبر توزيع استبيانات على أولئك الذين تخرجوا من علوم المختبرات الطبية وتسليلهم في السودان ولا يزالون يعملون في المختبرات الطبية. تم تحليل البيانات بواسطة برنامج تحليل البيانات المجتمعية. يحتوي مجتمع الدراسة من 100 من تقنيي المختبرات الطبية 65% من الذكور و35% من الإناث، وكانت الغالبية من الفئة العمرية 20-29 سنة (50%). المجموعة الرئيسية للخبرة للمستضعفين في الدراسة كانت بين 2-5 سنوات (52%), مجموعة كبيرة من المشاركون لم ي留言板وا أيهم باستخدام معيار تقنيات عضل الأيدي (65%), لا يعرفون الأخطاء الفنية في المختبر و (81%) لا يعرفون مؤشرات التحليل من حيث الحساسية والخصوصية. فمن المستحسن أن ينغيون إعادة النظر في المناهج الدراسية لتكاليد تقنيي المختبرات الطبية وتحديثها لمواكبة الاتجاهات التدريبية التي يحتاجها التقني كما ينبغي تطعيم العاملين ضد التهاب الكويت الوبائي بـ
في الختام الكفاءة والثقة والالتزام من الصفات المهمة لتقنيي المختبرات الطبية ويجب أن تطور و تقوي.
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<td>American society for clinical pathology</td>
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<tr>
<td>BBP</td>
<td>Blood Borne Pathogens</td>
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<tr>
<td>B.Sc</td>
<td>Bachelor of Science</td>
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<td>CAP</td>
<td>College of American Pathologists.</td>
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<td>HBV</td>
<td>Hepatitis B virus.</td>
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<td>HIV</td>
<td>Human immunodeficiency virus</td>
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<td>IVF</td>
<td>In Vitro Fertilization</td>
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<td>MLTs</td>
<td>Medical Laboratory Technologist</td>
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<tr>
<td>MLS</td>
<td>Medical Laboratory Scientist.</td>
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<tr>
<td>MOH</td>
<td>Ministry Of Health</td>
</tr>
<tr>
<td>OSPH</td>
<td>Occupational Safety and Health Administration</td>
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<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
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<tr>
<td>QA</td>
<td>Quality Assurance</td>
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<td>QC</td>
<td>Quality Control</td>
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<tr>
<td>SBB</td>
<td>Specialty of Blood Banking</td>
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<td>SD</td>
<td>Standard Deviation</td>
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<td>SOP</td>
<td>Standard Operating Procedure</td>
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CHAPTER ONE
INTRODUCTION AND LITERATURE REVIEW

1.1 Background

1.1.1 Definition of competency

Competence is defined as the knowledge, skills, judgment and attitudes acquired through a combination of academic training and clinical experience that enable an individual to practice safely and ethically in a designated role (Saskatchewan Society of Medical Laboratory Technologists, 2010).

There are standards define the general body of knowledge, skills and attitudes of a competent medical laboratory technologist. They are based on an ideal, while remaining realistic, attainable and understandable. They cover all activities in the medical laboratory technologist's profession (Canadian Society for Medical Laboratory Science, 2000).

1.1.2 Definition of medical laboratory technologist

A medical laboratory scientist (MLS) (also referred to as a medical technologist or clinical laboratory technologist) is a healthcare professional who performs chemical, hematological, immunologic, microscopic, and bacteriological diagnostic analyses on body fluids and tissues biopsy (Wikipedia, 2012).

Medical Laboratory Scientists work in clinical laboratories at hospitals, doctor's offices, and reference labs. The clinical laboratory technologist /medical laboratory technologist is an allied health professional who is qualified by academic and practical training to provide service in clinical labora-
tory science. The clinical laboratory technologist /medical laboratory technologist must also be responsible for his/her own actions, as defined by the profession (College of health professions, 2008).

1.1.3 Job ethics

Code of Ethics for Medical Lab Technology.

1.1.3.1 Duty to the patient

Clinical laboratory professionals are accountable for the quality and integrity of the laboratory services they provide. This obligation includes maintaining individual competence in judgment and performance and striving to safeguard the patient from incompetent or illegal practice by others.

Clinical laboratory professionals maintain high standards of practice. They exercise sound judgment in establishing, performing and evaluating laboratory testing.

Clinical laboratory professionals maintain strict confidentiality of patient information and test results. They safeguard the dignity and privacy of patients and provide accurate information to other health care professionals about the services they provide.

1.1.3.2 Duty to colleagues and the profession

Clinical laboratory professionals uphold and maintain the dignity and respect of our profession and strive to maintain a reputation of honesty, integrity and reliability. They contribute to the advancement of the profession by improving the body of knowledge, adopting scientific advances that benefit the patient, maintaining high standards of practice and education, and seeking fair socioeconomic working conditions for members of the profession.
Clinical laboratory professionals actively strive to establish cooperative and respectful working relationships with other health care professionals with the primary objective of ensuring a high standard of care for the patients they serve.

1.1.3.3 Duty to Society

As practitioners of an autonomous profession, clinical laboratory professionals have the responsibility to contribute from their sphere of professional competence to the general well being of the community.

Clinical laboratory professionals comply with relevant laws and regulations pertaining to the practice of clinical laboratory science and actively seek, within the dictates of their consciences, to change those which do not meet the high standards of care and practice to which the profession is committed (Miami Dade College, 2011).

1.1.4 Specialty areas

Most Medical Laboratory Scientists are generalists, skilled in all areas of the clinical laboratory. However, some CLSs are specialists, qualified by unique undergraduate education or additional training to perform more complex analyses than usual within a specific field. Specialties include clinical biochemistry, hematology, coagulation, microbiology, bacteriology, toxicology, virology, parasitology, mycology, immunology, immunohistochemistry, immunohematology (blood bank), histopathology, histocompatibility, cytopathology, genetics, cytogenetics, electron microscopy and IVF labs. Medical technologists specialty may use additional credentials, such as "SBB" (Specialist in Blood Banking) from the American Association of Blood Banks, or "SH" (Specialist in Hematology) from the ASCP. These
additional notations may be appended to the base credential, for example, "MLS (ASCP) SBB" (Clinical and Laboratory Standards Institute; Wayne, 2004).

1.1.5 Role of medical laboratory technologist in the healthcare process

A Medical Laboratory Scientist's role is to provide accurate laboratory results in a timely manner. Safeguards, such as experimental controls, calibration of laboratory instruments, delta checks (monitoring of significant changes within a normal series of results, formerly known as the "previous patients check", and periodic surveys from the College of American Pathologists (CAP), ensure accuracy. Laboratory results aid clinical practitioners in confirming or ruling out diagnoses, monitoring chronic disease changes, and analyzing the effects of medical therapies (Arkansas State University, 2009).

Most medical technologists/clinical laboratory scientists are employed in hospital laboratories. The remaining are employed chiefly in clinics, physicians’ offices, the armed forces, research and testing laboratories, and government health agencies (A guide to health careers in Illinois, 2011).

1.1.6 Role of laboratory services

Laboratory services are an integral part of disease diagnosis, treatment, monitoring response to treatment, disease surveillance programmes and clinical research. The World Development Report 1993, regarded provision of Essential Health Technology as an important ingredient of Essential Clinical Services. Use of diagnostic techniques aid early diagnosis enabling appropriate and prompt intervention thereby reducing overall disease burden and promoting health (Indian council of medical research, 2008).
1.1.7 Personal and general laboratory safety measures

1. Never eat, drink, or smoke while working in the laboratory.
2. Read labels carefully.
3. Do not use any equipment unless you are trained and approved as a user by your supervisor.
4. Wear safety glasses or face shields when working with hazardous materials and/or equipment.
5. Wear gloves when using any hazardous or toxic agent.
6. Clothing: When handling dangerous substances, wear gloves, laboratory coats, and safety shield or glasses. Shorts and sandals should not be worn in the lab at any time. Shoes are required when working in the machine shops.
7. If you have long hair or loose clothes, make sure it is tied back or confined.
8. Keep the work area clear of all materials except those needed for your work. Coats should be hung in the hall or placed in a locker. Extra books, purses, etc. should be kept away from equipment, which requires air flow or ventilation to prevent overheating.
9. Disposal-technologist are responsible for the proper disposal of used material if any in appropriate containers.
10. Equipment failure if a piece of equipment fails while being used, report it immediately to your lab assistant or tutor. Never try to fix the problem yourself because you could harm yourself and others.
11. If leaving a lab unattended, turn off all ignition sources and lock the doors.
12. Never pipette anything by mouth.
13. Clean up your work area before leaving.
14. Wash hands before leaving the lab and before eating (Kostic's, 1997).

Any training program on exposure to biohazards must include:
a. The OSHA Standard for Blood Borne Pathogens (BBP).
b. Epidemiology and symptoms
c. Modes of transmission
d. Institution Control Plan
e. Procedures used in the facility which might lead to exposure to BBP (blood borne pathogens).
f. Methods for control.
g. Types of PPE available.
h. Personnel to be contacted in case of exposure.
i. Post exposure and follow up.
j. Signs and labels used in the facility.
k. Hep B vaccine program (Privette's, 2011).

1.1.8 Standard Operation Procedure (SOP)

A manual that establishes step by step procedures to be followed for a given operation in any situation (Toriimarie's, 2011).

A number of important SOP types are:
- Fundamental SOPs. These give instructions how to make SOPs of the other categories.
- Methodic SOPs. These describe a complete testing system or method of investigation.
- SOPs for safety precautions.
- Standard procedures for operating instruments, apparatus and other equipment.
- SOPs for analytical methods.
- SOPs for the preparation of reagents.
- SOPs for receiving and registration of samples.
- SOPs for Quality Assurance.
- SOPs for archiving and how to deal with complaints (Natural Resources Management and Environment Department, 1998).

1.1.9 Requirements of medical laboratory technologist

The usually average time to complete clinical laboratory science in the Sudan is four years involving three years of general academic training (THEORY, LAB) and one year specializing in one department of medical laboratory (hematology, microbiology, Parasitology, chemical pathology and histology. After the completion of university, the graduated person apply to ministry of health for temporal registration and start the national service for one year, then can get permanent registration through examination after two years from the date of temporal registration.

The ability to interact with people, a capacity for calm and reasoned judgment and a demonstration of commitment to the patient are qualities essential for a clinical laboratory technologist/medical laboratory technologist. They must demonstrate ethical and moral attitudes and principles which are essential for gaining and maintaining the trust of professional associates, the support of the community, and the confidence of the patient and family. An attitude of respect for the patient and confidentiality of the patient’s record and/or diagnoses must be maintained (College of health professions, 2008).
1.1.9.1 Academic requirement of medical laboratory technologist

Clinical laboratory technologists/medical laboratory technologists should be competent in collecting, processing, and analyzing biological specimens and other substances; performing analytical tests of body fluids, cells, and other substances; recognizing factors that affect procedures and results, and taking appropriate actions within predetermined limits when corrections are indicated; performing and monitoring quality control within predetermined limits; performing preventive and corrective maintenance of equipment and instruments or referring to appropriate sources for repairs; applying and exercising principles of management, safety, and supervision; demonstrating professional conduct and interpersonal communication skills with patients, laboratory personnel, other health care professionals, and with the public; recognizing the responsibilities of other laboratory and health care personnel and interacting with them with respect for their jobs and patient care; applying basic scientific principles in learning new techniques and procedures; relating laboratory findings to common disease processes, and establishing and maintaining continuing education as a function of growth and maintenance of professional competence (College of health professions, 2008).

Providing leadership in educating other health personnel and the community; applying principles of educational methodology, and applying principles of current information systems (Methodist hospital system, medical laboratory science program, 2012).

Upon graduation and initial employment, the clinical laboratory technologist/medical laboratory technologist should be able to demonstrate entry-level knowledge and skills in the above areas of professional practice (College of health professions, 2008).
1.1.9.2 Essential Functions for medical lab technologist (non academic requirements)

In addition to the academic requirements listed above, there are “essential functions” (non-academic requirements) that technologist must possess so they will not be endangered, not will they endanger others in the course of their regular work. A medical lab technologist must possess the following essential functions:

1) Manual dexterity

Must possess the ability to use hand(s) or prosthetic devices with coordination. Tasks that could be required are, but are not limited to:

1) Performing simple manipulative skills such as washing, writing, streaking plates, etc.

2) Performing moderately difficult manipulative skills such as positioning patients for phlebotomy procedures, using computer keyboards, etc.

3) Performing difficult manipulative skills such as invasive procedures, calibration of equipment, pulling, pushing and lifting objects greater than 20 lbs, etc.

2) Fine motor skills

Must possess the ability to safely and accurately perform all laboratory procedures, manipulate tools, instruments, small objects and other equipment in the laboratory with fingertips or adaptive devices.
3) Mobility
   Ability to maneuver around instruments and objects in the classroom and laboratory, as well as in the health care setting/clinical laboratory.

4) Visual Discrimination
   The technologist must be able to read charts and graphs, read instrument scales, discriminate colors, read microscopic materials, distinguish cloudy from clear and record results.

5) Hearing
   Must possess the ability to adapt with assistive devices.

6) Reading
   Should possess the ability to read, comprehend technical and professional materials (i.e., textbooks, magazines and journal articles, handbooks, and instructional manuals) and follow directions.

7) Speech
   Should possess the ability to verbally communicate effectively in English. (4)

8) Communication skills
   - Greet and verify the identities of patients. For example, medical laboratory technicians greet patients and verify contact and health care information to ensure they are collecting the specimen from the correct patient (daily).
- Discuss ongoing work with co-workers and managers. For example, they discuss work assignments and schedules with their managers. They discuss changes in policies and procedures, new and interesting medical developments and health concerns such as the potential for epidemics during staff meetings. Medical laboratory technicians in hospitals discuss ward assignments, floor coverage and backup plans for collecting missed attempt specimen samples with their co-workers. In clinics, they confirm pick-up and delivery times with couriers and ask information technology staff for assistance in resolving database malfunctions.

- Give instructions and provide reassurance to patients before, during and after specimen collection. They explain each step of collection procedures and comfort and reassure nervous patients. Technologists in hospitals may provide instructions for proper use of home test sampling kits and special collection procedures. Technologists in blood donor clinics give post-donation instructions to blood donors. (daily)

- Discuss sample collection and medical testing with co-workers, managers and colleagues. For example, they discuss the technical details of specimen collection, labelling, storage and analysis with their co-workers and managers. They receive directions for testing specimens from their managers. They speak with nurses and physicians to clarify and request additional information on patients' test requisition forms. They may give instructions to new trainees and answer their questions. For example, they explain and demonstrate specimen collection and test preparation procedures, answer trainees' questions and provide feedback and support.

- May discuss their performance reviews, annual learning goals and incident reports with managers. For example, they provide their managers
with details of incidents which may result in complaints that require their managers' intervention (Network, 2012).

9) Modes of Communication Used

i) In person.

ii) Using a teephone.

iii) Others e.g. video conferencing, public address system. For example, in hospitals they listen to public address systems and monitor their pagers.


10) Writing

Should possess the ability to communicate in written form in English.

11) Emotional stability

Must possess the ability to work accurately and safely under stress, adapt to changing environments and prioritize tasks.

12) Travel requirements

Must possess the ability to travel to required education/training destinations, such as the classroom, or clinical facility (College of health professions, 2008).

Also should be flexible, creative, and adapt to professional and technical change (Methodist hospital system, medical laboratory science program, 2012).

Error prevention depends on vigilance. Without this watchfulness, human factors can override systems designed to prevent mistakes. For example, people can make mistakes when they operate computerized analyzers.
Ignoring or overriding warning messages about abnormal operating conditions can lead to testing errors. Medical professionals should be vigilant and remain open to corrective input (Bonini et al., 2002).

Medical laboratory technologists need the following characteristics like integrity and a professional attitude, an aptitude for mathematics and science and a keen interest in scientific work, the ability to do detailed work and maintain a high level of accuracy, good color and form perception (to study blood cells, etc.), good communication and interpersonal skills and the ability to adapt easily and quickly to change (OCCinfo, 2010).

In general, medical technologists play a central role in clinical laboratory management. They carry out a wide range of administrative functions (e.g., scheduling laboratory personnel; reviewing/evaluating procedures and instituting remedial action for detected deficiencies/defects; reviewing and approving new test methodologies; selecting equipment to purchase; maintaining quality assurance, preventive maintenance and safety, and other laboratory programs; developing automatic data processing applications; preparing budget and staffing estimates and technical reports; designing technical manuals and forms; developing laboratory guidelines and/or regulations (British Columbia institute of technology, school of health science medical lab science, 2011).

Generally speaking, medical technologists at the full performance level and above perform laboratory tests which, because they have a high level of difficulty and/or are infrequently performed, require a special sensitivity to possible problems (Medical Technologist Series, 1984).
1.2 Literature review

A literature search was conducted for similar studies in the period 2004 to 2012 using hinari, trip database, pub med, cks. The searching included the parameters: 'competency, medical lab technologist, attitude, skills, practice, quality assurance, quality control, risk, laboratory, hospital'.

There was a cross-sectional study of health care workers in 2006 in laboratories in the two colleges of medicine and their teaching hospitals in Lagos State, Nigeria as regards universal precaution measures was conducted using a standardized self-administered questionnaire, which enquired about knowledge, attitude and practices of universal precautions. The hepatitis B vaccination statuses were also determined. All the participants wear gloves during laboratory work but 81.2% wear a single pair. Nylon gloves were commonly used (57%) followed by latex gloves (43%). 17.5% of the participants claimed to know what to do if exposed to infection. (i) 45.6% of the participants eat in the laboratory, (ii) 47.0% of them store foods and water in the refrigerators meant for storage of body fluids and chemicals, (iii) 31.5% of them put on cosmetics in the laboratory, (iv) 12.6% smoke and sniff in the laboratory, (v) 10.0% cut their finger nails with teeth and put their biros in their mouths in the laboratory. (vi) 36.5% do not know that tissues fixed in formalin can transmit infections. (vii) 91.5% are not immunized against hepatitis B virus (HBV). (viii) 99.0% of them do not take shower immediately after laboratory work. (ix) 82.0% of the participants do not feel that the use of masks is necessary in laboratory. It is concluded that the knowledge, attitude, perception, and compliance with universal precautions amongst these highly exposed laboratory workers are poor (Biomedical et al., 2006).

A research published at 2010 about Current Situation of Biosafety Practices in Selected Hospital Laboratories, Bangkok aimed to assess biosafety
practices among laboratory personnel of 4 selected governmental hospitals in Bangkok. Among 223 studied laboratory personnel, more than 50% of studied personnel were 41-60 years of age, except personnel in hospital B. The majority of the studied personnel had finished undergraduate degrees and higher (55% to 63.6%). The means of duration of working among 4 groups of hospital laboratory personnel ranged from 12.8 years to 20.7 years. Results of biosafety practice mean scores among studied personnel were moderate level. This study revealed the moderate level of biosafety practice scores among studied laboratory personnel. Use of appropriate protective barriers should be strengthened since the mean scores of this aspect were relatively lower than other aspects of biosafety. So reported that laboratory personnel's perception of health and safety also influenced compliance with safety guidelines and there is a need for education programmes to increase awareness on safe (Asia Journal of Public Health, 2010).

Another study done in July 2004 about competency assessment in the clinical microbiology laboratory concluded that opportunities for improvement in employee competency assessments were numerous. Toward these improvements, the CAP provided several suggestions which included the suggestion that direct observation can be used for assessing technical skills, judgment and analytical decision-making processes, and teaching and training of personnel. The CAP also noted that communication, judgment, and analytical decision making are essential skills that are rarely evaluated but that when they are evaluated, written testing should be used since interpretation of these skills using direct observation is highly subjective. In addition, the CAP recommended that laboratory employees who fail an assessment should not be allowed to perform these tasks if the competency assessment is a valid test of their skills, knowledge, and abilities. The CAP also con-
cluded that written testing was the one method of evaluation with the poorest compliance; thus, it did not recommend that written testing be used as an element of a competency assessment plan unless it can be performed consistently or is used as part of an assessment of communication and judgment skills (Susan and Laurel, 2004).

Another study done in 2012 about Knowledge, attitude and practice of quality assurance among medical laboratory technologists working in laboratories of Lahore which was to assess the knowledge and attitude of medical laboratory technologists working in laboratories of Lahore, regarding quality assurance and to identify the factors affecting the practices of quality assurance.

The study population consists of 58% female and 42% male participants. The mean age of participant MLTs was 24.2±3.4 (range 21-40) years. The participants were divided into group A & B according to the age. Group A had 82% MLTs of age range from 20-25 years. Group B consisted of 18% MLTs of >25 years old. The mean working experience of the MLTs was 2.4±2.9 (range 0.5 to 15) years. There was a significant gap among knowledge, attitude and practice scores. 78% of the majority of participants of the study claimed that they obtained knowledge about QA through job experience. It was also found that the main constraints to the application of QA program in laboratory were lack of training facilities in laboratories.

The study concluded that there is a deficiency in curriculum and training of B.Sc MLT about implementation of Quality Assurance and Quality Control in Laboratory (Azhar et al., 2012).
1.3 Rationale of the study

The important work performed by clinical laboratory professionals affects the health, safety and welfare of the public. Licensure is an effective tool to encourage laboratory professionals to possess the skills and expertise needed to perform quality testing. It is the foundation that will guarantee that licensed laboratory professionals possess adequate academic and clinical training, pass competency-based examinations, and participate in continuing education programs.

1.4 Objectives

1.4.1 General objectives

To verify Knowledge, attitude and practice as a part of general competency of medical laboratory technologists in Khartoum state in November 2011.

1.4.2 Specific objectives

1. To determine the capacity of knowledge, attitude and skills of medical laboratory technologist and so innovation for good performance improvements.
2. To establish a plan of action to strengthen the capacity of medical laboratory technologist for surveillance and awareness of competency.
3. To describe the tasks and knowledge of rights and duties in the laboratory through access to international laws.
4. The overview of risk management with a clinical laboratory point of view and to hopefully show how risk management can improve the quality of care we give patients.
CHAPTER TWO
METHODOLOGY

2.1 Study design
It was a post retrospective study descriptive cross sectional survey.

2.2 Study area
The study conducted in hospital laboratories in Khartoum State in November 2011.
2.3 Study population

The people worked in field of medical laboratory in Khartoum state.

2.4 Selection criteria

People who graduated from medical laboratory sciences and permanently registered for MOH in the Sudan and still work in medical laboratories.

2.5 Exclusion criteria

People who fulfill inclusion criteria but refuse to participate in the study.

2.6 Study instrument

Well structured close ended questionnaire.

2.7 Sample size

The questionnaires were distributed to 200 people but the respondents were 100 medical lab technologists. There were some limitations due to transportation and financial issues.

2.8 Data analysis

The data was analyzed by computer use statistical package for social science (SPSS) software and the results were expressed in frequency tables and figures.
2.9 Ethical consideration

This study was carried in a manner comply with the requirements of the code of ethics, also verbal consent has been obtained from each participant.
CHAPTER THREE
RESULTS

3.1 Demographic data

A total of 100 MLTs agreed to participate in this study. The majority of them were males 65(65%). A major practice experience was 2-5 yrs and those with postgraduate study 55(55%). The majority of age group were 20-29 yrs 50(50%). Most of the study participants worked in governmental laboratories 66 (66%).

Table (3.1): Demographic data (n=100).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency(percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>65(65)</td>
</tr>
<tr>
<td>Female</td>
<td>35(35)</td>
</tr>
<tr>
<td>Practice experience years</td>
<td></td>
</tr>
<tr>
<td>2-5 yrs</td>
<td>52(52)</td>
</tr>
<tr>
<td>6-9 yrs</td>
<td>35(35)</td>
</tr>
<tr>
<td>≥10 yrs</td>
<td>13(13)</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
</tr>
<tr>
<td>20-29 yrs</td>
<td>50(50)</td>
</tr>
<tr>
<td>30-39 yrs</td>
<td>43(43)</td>
</tr>
<tr>
<td>40-49 yrs</td>
<td>5(5)</td>
</tr>
<tr>
<td>≥50 yrs</td>
<td>2(2)</td>
</tr>
<tr>
<td>Working place</td>
<td></td>
</tr>
<tr>
<td>Governmental</td>
<td>66(66)</td>
</tr>
<tr>
<td>Private</td>
<td>17(17)</td>
</tr>
<tr>
<td>Academic</td>
<td>2(2)</td>
</tr>
</tbody>
</table>
3.2 Working times

3.2.1 Daily working hours

The majority of participants’ working hours per day were 8 hours 68(68%).

Fig. (3.1): Daily working hours.

3.2.2 Working days per week

The majority of participants’ working days per week were more than 5 days 51(51%).

Fig. (3.2): Working days per week.
3.3 Average income or salary per month

Most common salary among the participants was less than 400 $ 71(71%).

![Fig. (3.3): Average income or salary per month.](image)

3.4 Working in the same specialty in the laboratory

71(71%) of the MLTs participants worked in the same specialty in the laboratory while 29 (29%) were not.

![Fig. (3.4): Working in the same specialty in the laboratory.](image)
3.5 Post-graduation studies

About graduation after B.Sc. answered that 55 (55%) of participants had post graduation studies of training courses.

![Fig. (3.5): Having high graduate after B.Sc.](image)

3.6 Satisfaction about the working team

Almost 57(57%) responded that they were satisfied about working team and 43(43%) were not.

![Fig. (3.6): Satisfaction about working team.](image)
3.7 Immunization against HBV

When respondents were asked about the immunization against HBV 50 (50%) were vaccinated and 50 (50%) were not.

![Graph showing immunization against HBV](image)

**Fig. (3.7): Immunization against HBV.**

3.8 Attitude of MLTs in the laboratory

3.8.1 Wearing lab coat during working

In question regarding wearing lab coat during working, 82(82%) were found to wear it, while 18(18%) were not.

![Bar graph showing wearing lab coat during working](image)

**Fig. (3.8): Wearing lab coat during working.**
3.8.2 Eating and drinking inside the laboratory

82 (82%) of participants eat and drink inside the laboratory, while 18 (18%) did not.

Fig. (3.9): Eating and drinking inside laboratory.

3.9 Attitude regarding healthy practice inside the laboratory

3.9.1 Washing hands using standard washing techniques

Almost 65 (65%) of respondents didn’t use the standard hands washing technique, while 35 (35%) use it.

Fig. (3.10): Washing your hands in lab according to standard hands washing technique.
3.9.2 Wearing gloves in the laboratory

When MLTs were asked about wearing gloves in all test procedures in the laboratory, the majority 81(81%) do wear it.

Fig. (3.11): Wearing gloves in all test procedures in the laboratory.

3.10 Respond to verbal commands from doctors

When participant viewed about responding to verbal orders for tests, including tests added on to a specimen already in the lab, must be followed up by a request for a written order, 68(68%) answered yes, while 32(32%) answered no.

Fig.(3.12): Any verbal orders for tests, including tests added on to a specimen already in the lab, must be followed up by a request for a written order.
3.11 Knowledge about sensitivity of the test

The MLTs when asked about if the sensitivity of the test refers to its ability to measure low concentrations of analytes the majority 69(69%) didn’t know, while 19(19%) answered yes and 12(12%) answered no.

![Fig. (3.13): The sensitivity of a test refers to its ability to measure low concentrations of analytes.](image)

3.12 Knowledge about random error

Almost 76(76%) didn’t know the answer if random error affects the precision of the test, while 18(18%) answered yes and 6(%) answered no.

![Fig. (3.14): Random error affects the precision of the test.](image)
3.13 Knowledge about HBV and HIV in medical laboratory precaution

Almost 80(80%) of the respondents answered yes that HBV is more dangerous than HIV in medical laboratory precaution, while 8(8%) answered no and 12(12%) didn’t know.

Fig. (3.15): HBV is more dangerous than HIV in medical laboratory precaution.

3.14 Knowledge about standard deviation

When viewed the participants about as defined by a Gaussian distribution curve, the percentage of values would be expected to fall within two standard deviations of the mean 95%, 45(45%)didn’t know, while 43(43%) answered yes and 12(12%) answered no.
Fig.(3.16): As defined by a gaussian distribution curve, the percentage of values would be expected to fall within two standard deviations of the mean 95%.

3.15 Knowledge about control

When participants asked about a certain method, a control has a mean result of 12 with a standard deviation of 2 the acceptable 99.7 range for this control is (6-18), 54(54%) didn’t know the answer while 35(35%) answered yes.

Fig. (3.17): For a certain method, a control has a mean result of 12 with a standard deviation of 2. The acceptable 99.7 range for this control is (6-18).
3.16 Skills in using internet

Majority of participants 62(62%) did know how to search in the internet.

Fig. (3.18): Skills in using internet for searching.
CHAPTER FOUR
DISCUSSION

Knowledge, attitude and practice studies focus on a certain topic and are unique to a particular setting and designed for a specific issue. The Knowledge possessed by a community refers to their understanding of that topic. Attitude highlights their concept toward the subject, as well as any preconceived ideas they may have towards it. Practice refers to the ways in which they demonstrate their knowledge and attitudes through their actions.

Regarding experience years 52% MLTs had 2-5 years of working experience and 13% ≥10 years of working experience.

The level of awareness about universal precautions amongst laboratory workers was different, 82% wearing coat inside lab, 81% wearing gloves in all procedures in the laboratory, Although 65% do not used the best way to washing hands and this is due to the laws and sanctions from the Ministry of Health in case of not wearing a coat and glove.

Furthermore, 50% were not immunized against HBV, While 80% of them realize the seriousness of HBV in the laboratory, While 80% of them realize the seriousness of HBV in the laboratory. It may be for economic condition.

The attitude and practice of the laboratory health workers towards universal Precaution call for a lot of concern as 82% of them ate and drink in the laboratory.

The findings of our study regarding the satisfaction about the working team that 57 % satisfied and 43% not satisfied. Bonini et al. (2002) reported that low job satisfaction can compromise a person’s intention to stay at a
job. Considerations other than job satisfaction may play a part in worker turnover; however a lack of satisfaction with one’s job lessens the chances of further development of a career and, ultimately, reduces one’s willingness to continue in the same employment. Irrespective of the reasons, high staff turnover can adversely affect the quality of laboratory service and, thereby, the healthcare patients receive.

By quality control we generally mean the use of a system for insuring reliable results of clinical laboratory analyses.

Faulty performances that cause an error in test results fall into two large categories: random error and systematic error (This category includes all the “wrong” laboratory measures due to non-human action). Both types of errors must be investigated and resolved for accurate and precise testing, we must focus on these errors in terms of knowledge and practices.

Four indicators are most commonly used to determine the reliability of a clinical laboratory test. Two of these, accuracy and precision, reflect how well the test method performs day to day in a laboratory. The other two, sensitivity and specificity, deal with how well the test is able to distinguish disease from absence of disease. These basic concepts are the cornerstones of reliability of your test results and provide the confidence your health care provider has in using the clinical laboratory.

The importance of using an SD that is appropriate to the control material being used is due to the fact that the probability of error detection is based on the statistical probability that a control value will fall within the mean and SD limits that have been determined for the particular control. Thus, based on statistical probability, the likelihood that a measured QC value will fall outside the [+or-]2 SD limits is calculated to be approximately one out of every 20 results, and the likelihood that it falls outside the [+or-]3 SD limits
is approximately one in every 300 QC results. These probabilities are only true, however, if the SD used in establishing the QC ranges are those that have been established following repeated measurement of the QC material. Uses of artificial limits, such as the evaluation criteria established by CLIA, for use with the multirule procedure are inappropriate.

Acceptable Standard Deviation;a smaller SD represents data where the results are very close in value to the mean. The larger the SD the more variance in the results. Data points in a normal distribution are more likely to fall closer to the mean. In fact, 68% of all data points will be within ±1SD from the mean. 99% of all data points will be within ±3SD. To state it briefly, statisticians have determined that values no greater than plus or minus 2 SD represent measurements that are more closely near the true value than those that fall in the area greater than ± 2SD. Thus, most QC programs call for action should data routinely fall outside of the ±2SD range.

Proficiency testing is a quality control procedure for evaluating performance of a laboratory as a whole, not of individual workers, including knowledge about standard deviations and quality assurance programs.

Medical laboratory technologist who worked in government a hospitals and private earned on average 34,000$ annually in USA and Gulf state, compared with medical laboratory technologist worked in Sudan hospitals average earn less than 5000$ annually, that affects the job performance that help increase working hours or immigration to improve the living condition.
CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The attitude of medical laboratory technologists toward the biosafety measures was poor.

The knowledge of basic concepts and skills of medical laboratory technologists was poor during while working.

There were poor computer skills (internet) among medical laboratory technologist.

The continuous professional development training is insufficient

5.2 Recommendations

- Short courses, training lectures, scenario based study, journal clubs, laboratory research and updated sessions should be offered to MLTs during B.Sc training period.
- Therefore recommend that the curriculum of B.Sc MLT should be revised and updated to cope with the training needs of MLTs.
- Institutes should provide effective training program to maximize retention of knowledge of MLTs.
- Training programs while starting working in the field immediately after graduation so that the technologist can have more professional skills and attitude but it should be under close supervision using logbook check list after finishing each department
- Vaccination of staff against hepatitis B and C should also be done which should be for free by ministry of health or the hospitals where MLTs
worked while guidelines for post prophylaxis should be widely disseminated.

- Put up signs, pictures, and alerts for the ideal example of the way in washing hands.

- License should be renewed after fulfillment of certain criteria; such as attending certain number of learning hours each years and every couple of years doing a research and so on. Using score logbook; when MLT collect certain points can have license renewal.

- In order to achieve advanced knowledge they should read journals, articles and research papers and attend refresher courses to develop dedication and commitment in their attitudes.

- Comprehensive course in QC terminology, practices, statistics, and troubleshooting for the clinical laboratory. Designed for those who have little or no experience with quality control but need a firm grounding, this course will help all Medical laboratory technologists quickly and easily identify and correct errors in quality control procedures

- Professionalism, job ethics and description, good clinical laboratory practice and communication should be introduced in the curricula of medical laboratory sciences
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Wikipedia, M. (2012). Medical Laboratory Scientist. Available online at:
APPENDICES

Appendix (1): Questionnaire about knowledge, attitude and practice as part of general competency of medical laboratory technologists in Khartoum state, Sudan (2011).
<table>
<thead>
<tr>
<th>Age group</th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>≥ 50</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td>Male</td>
<td>Female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience years</td>
<td>2-5 years</td>
<td>6-9 years</td>
<td>≥10 years</td>
<td></td>
</tr>
<tr>
<td>Working place(s)</td>
<td>Governmental</td>
<td>Private</td>
<td>Academic</td>
<td></td>
</tr>
<tr>
<td>Working hours per day</td>
<td>8 hours</td>
<td>9-12 hours</td>
<td>&gt;12 hours</td>
<td></td>
</tr>
<tr>
<td>Working days per week</td>
<td>≤2</td>
<td>3-5</td>
<td>&gt;5</td>
<td></td>
</tr>
<tr>
<td>Average income or salary per month</td>
<td>≤400$</td>
<td>401-700$</td>
<td>&gt;700$</td>
<td></td>
</tr>
<tr>
<td>Did you work in the same specialty in the Laboratory now?</td>
<td>Yes</td>
<td></td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Did you have a high Graduate (after B.Sc)</td>
<td>Yes</td>
<td></td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Yes</td>
<td>No</td>
<td>I don’t know</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>Are you satisfied about working team regarding number of staff and responsibility</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you take immunization against HBV</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you put on your Laboratory coat during working</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you wash your hand in Laboratory according to standard hand washing technique</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you eat and drink inside the laboratory</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wearing gloves in all procedure of laboratory test</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any verbal orders for tests, including tests added on to a specimen already in the lab, must be followed up by a request for a written order</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The sensitivity of a test refers to its ability to measure low concentrations of analytes</td>
<td>Yes</td>
<td>No</td>
<td>I don’t know</td>
<td></td>
</tr>
<tr>
<td>Random error affects the precision of a test</td>
<td>Yes</td>
<td>No</td>
<td>I don’t know</td>
<td></td>
</tr>
<tr>
<td>HBV is more dangerous than HIV in medical laboratory precaution</td>
<td>Yes</td>
<td>No</td>
<td>I don’t know</td>
<td></td>
</tr>
<tr>
<td>As defined by a Gaussian distribution curve, the percentage of values would be expected to fall within two standard deviations of the mean 95%</td>
<td>Yes</td>
<td>No</td>
<td>I don’t know</td>
<td></td>
</tr>
<tr>
<td>For a certain method, a control has a mean result of 12 with a standard deviation of 2. The acceptable 99.7 range for this control is (6-18)</td>
<td>Yes</td>
<td>No</td>
<td>I don’t know</td>
<td></td>
</tr>
<tr>
<td>Did you know how to search using internet</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>