A

TECHNICAL REPORTS

ON

STUDENTS INDUSTRIAL WORK EXPERIENCE SCHEME

AT

GENERAL HOSPITAL LAGOS ODAN

BY

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CERTIFICATION

I hereby certify that this SIWES report was collected and collated by Ajayi-Obe Kehinde Catherine with matriculation number 21/15 BSB002 under my supervision. The report has been read and approved as meeting part of the requirements for the award of a B.Sc. degree in Biochemistry, Faculty of computing and Applied Science of the Thomas Adewumi University.

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DEDICATION

This work is dedicated to the Almighty God for all his blessings and guidance throughout the period of the SIWES training.

ACKNOWLEDGEMENT

I am using this opportunity to express my gratitude to my industry based supervisor; Dr Uduak ikpegbu and all esteemed staff for their disciplined and gracious attitude throughout my stay with them. I am also indebted to all the staffs of the laboratory for their help and encouragement. Special appreciation to my parents Mr and Mrs Ajayi-Obe for their support and encouragement as well as my friends and siblings;, Ogere and Tolani among others. God bless you all.

ABSTRACT

The Student Industrial Work Experience Scheme (SIWES) program is an essential look aspect of undergraduate training, designed to provide practical experience and bridge the gap between academic knowledge and real-world applications. This report summarizes a three-month SIWES placement at General hospital Lagos, during which comprehensive exposure to healthcare operations, patient care, and clinical administration was gained. The primary objective of the placement was to develop practical skills in various hospital departments, including the outpatient department, laboratory, pharmacy, and records. Throughout the program, activities focused on assisting healthcare professionals in patient documentation, laboratory testing, and medication management. Additionally, I was involved in observational learning under the supervision of laboratory technicians, enhancing my understanding of medical procedures, patient interaction, and administrative processes within a hospital setting. Hands-on experience in patient data handling also provided insights into healthcare information systems, and a solid grasp of confidentiality and ethical practices in a clinical environment. This experience was invaluable in developing practical skills, a professional work ethic, and interpersonal abilities necessary for future roles in healthcare. It also emphasized the importance of teamwork, accuracy, and empathy in delivering quality healthcare services. The SIWES program has thus played a pivotal role in bridging theoretical knowledge and practical skills, preparing me for further studies and a career in the healthcare sector.

TABLE OF CONTENTS

CHAPTER ONE

1.0 INTRODUCTION

Student industrial work experience (SIWES) is a concept aimed at setting out involve the local, business world and employers of labour in the development and training of technical operative skills. SIWES is a program designed by the ITF (Industrial training fund) to prepare student for challenges they will face in their respective fields when they become part of the nation's workforce. The duration of the program is in months which is included in curriculum of Thomas adewumi university after 200L and 300L second semester. The programme also carries a number of three credits units each in the university curriculum. Over the years, SIWES has contributed immensely to building the common pool of technical and allied skills available to the Nigerian Economy which is needed for the nation's industrial development. These contribution and achievements have been possible because of regular innovations and improvement in the modalities employed for the management of the scheme

The S.I.W.E.S was launched in 1973 by the Industrial Training Fund (I.T.F) as a programme designed to impart the undergraduate of the nation's tertiary institutions studying various professional courses with the practical methods of performing functions to real life situations on site, in the office or even the factory

and how they apply themselves mentally, intellectually and physically in relation to what they have been taught in the classrooms theoretically

1.1 BACKGROUND HISTORY OF ITF

ITF was established in 1971, the Industrial Training Fund has operated consistently and painstakingly within the context of its enabling laws, i.e. Decree 47 of 1971. The objective for which the Fund was established has been pursued vigorously and efficaciously. In the three decades of its existence, the ITF has not only raised training consciousness in the economy, but has also helped in generating a corps of skilled indigenous manpower which has been manning and managing various sectors of the national economy.

Over the years, pursuant to its statutory responsibility, the ITF has expanded its structures, developed training programmes, reviewed its strategies, operations and services in order to meet the expanding, and changing demands for skilled manpower in the economy. Beginning as a Parastatal "B" in 1971, headed by a Director, the ITF became a Parastatal "A" in 1981, with a Director-General as the Chief Executive under the aegis of the Ministry of Industry. The Fund has a 13 member Governing Council and operates with 6 Departments and 3 Units at the Headquarters, 27 Area Offices, 2 Skills Training Centres, and a Centre for Industrial Training Excellence.

As part of its responsibilities, the ITF provides Direct Training, Vocational and Apprentice Training, Research and Consultancy Service, Reimbursement of up to 60% Levy paid by employers of labour registered with it, and administers the Students Industrial Work Experience Scheme (SIWES). It also provides human resource development information and training technology service to industry and commerce to enhance their manpower capacity and in-house training delivery effort.

The main thrust of ITF programmes and services is to stimulate human performance, improve productivity, and induce value-added production in industry and commerce. Through its SIWES and Vocational and Apprentice Training Programmes, the Fund also builds capacity for graduates and youth self-employment, in the context of Small Scale Industrialization, in the economy.

1.3 HISTORICAL BACKGROUND OF SIWES

The students Industrial Work Experience Scheme (SIWES) is a Skills Training Programme designed to expose and prepare students of Universities, Polytechnics/Colleges of Technology/Colleges of Agriculture and Colleges of Education for the Industrial Work situation they are likely to meet after graduation. The scheme also affords students the opportunity of familiarizing and exposing themselves to the needed experience in handling equipment and machinery that are usually not available in their Institutions.

Before the establishment of the scheme, there was a growing concern among our Industrialists that graduates of our Institutions of Higher learning lacked adequate practical background studies preparatory for employment in Industries. Thus, the employers were of the opinion that the theoretical education going on in higher institutions was not responsive to the needs of the employers of labour. It is against this background that the rationale for initiating and designing the scheme by the Fund during its formative years – 1973/74 was introduced to acquaint students with the skills of handling employers' equipment and machinery. The ITF solely funded the scheme during its formative years. But as the financial involvement became unbearable to the Fund, it withdrew from the Scheme in 1978. The Federal Government handed over the scheme in 1979 to both the National Universities Commission (NUC) and the National Board for Technical Education (NBTE). Later the Federal Government in November 1984 reverted the management

and implementation of the SIWES Programme to ITF and it was effectively taken over by the Industrial Training Fund in July 1985 with the funding being solely borne by the Federal Government.

1.4 AIM AND OBJECTIVE OF SIWES

The aim of S.I.W.E.S is to bridge the gap between the level of knowledge acquired in tertiary institution and the practical application of such knowledge in the field of work

The objectives are:

i. To provide an avenue for students in industries of higher learning to acquire industrial skills and experience in the courses of study
ii. To prepare student for the work situations they are to meet after graduation
iii. To expose students to work methods and techniques in handling equipment and machineries that may not available in the educational institutions
iv. To make transition from school to the world of work easier and enhance students contact for later job placements
v. To improved student's interpersonal relationship with others in their field
vi. To prove students an opportunity to apply his/her knowledge in real work situation, thereby bridging the gap between college work and actual practice

1.5 IMPORTANCE OF SIWES

1. It exposes students to working system wherever they found themselves after they eventually graduate.

2. It widen the scope of students to vast in the profession.

3. It allows the students to gain work methods, and also teach student how to handle tools and machinery practical.

4. It enables the students to have the opportunity of securing jobs after graduation.

1.6 ROLES OF BODIES INVOLVED IN THE MANAGEMENT OF SIWES PROGRAMME

1.6.1 THE ROLE OF FEDERAL GOVERNMENT

The federal government has these roles to play;

a) To provide adequate funds to the Industrial Training Fund through the Federal Ministry of Industries for the Scheme.

b) To make it mandatory for all Ministries, companies and Parastatals to offer places for the attachment of students in accordance with the provisions of Decree No. 47 of 1971 as amended in 1990.

1.6.2 THE ROLE OF THE INDUSTRIAL TRAINING FUND (ITF)

i) Formulate policies and guidelines on SIWES for distribution to all the SIWES participating bodies, institutions and companies involved in the scheme.

ii) Regularly organize orientation programmes for students prior to their attachment,

iii) Receive and process Master and Placement Lists from the Institution and Supervising Agencies, i.e. (NUC, NBTE, NCCE);

iv) Supervise students on Industrial Attachment

v) Disburse Supervisory and Students allowances

vi) Organize biennial SIWES National Conference and Annual SIWES Review Meeting;

vii) Provide insurance cover for students on attachment;

viii) Ensure the visitation (tours) of ITF officers to the Supervising Agencies, Institutions, Employers and students on attachment.

ix) Provide information on companies for attachment and assist in the industrial placement of students.

x) Continuously review and carry out research into the operation of the SIWES.

xi) Vet and process students' logbooks and ITF form 8.

1.6.3 THE ROLE OF THE INSTITUTION

i. Appoint SIWES Co-ordinators, and supporting staff.

ii. Prepare and submit six copies of Master Lists not later than 31st March and six copies of Placement lists not later than 31st May of each SIWES year to the ITF. All submissions must be made through the Supervising Agencies. However two advanced copies should be sent to the ITF.

iii. Apply job-specifications as prepared for all the accredited courses and award appropriate credit units in accordance with Federal Government minimum academic standard guidelines;

iv. Identify placement opportunities for students' attachment with Employers;

v. Supervise students at their places of attachment and sign their log-books;

vi. Organise orientation courses in collaboration with the ITF for their students;

vii. Submit comprehensive reports on the scheme to ITF through their Supervising Agencies on ITF Form 8A at the end of every year's programme.

viii. Ensure payment of outstanding allowances and render all returns to the ITF during the SIWES year.

ix. Submit all completed ITF form 8 to the nearest ITF Area Office.

1.6.4 THE ROLE OF THE EMPLOYERS

i) To collaborate with the institutions in the preparation of job specifications for the approved courses for SIWES;

ii) To accept students for Industrial Attachment as stipulated in ITF Decree No. 47 as amended (1990).

iii) To provide welfare services – e.g. medication and pay for hospitalization of students while on attachment whenever the need arises;

iv) To participate fully in the assessment of programmes/students by completing the necessary instruments – e.g. ITF form 8, logbook etc.

v) To allow students have access to their facilities;

vi) To appoint an Industry-based Supervisor for students on attachment.

1.6.5 THE ROLE OF STUDENTS

i) To attend institution's SIWES orientation programme before going on attachment.

ii) To be obedient to constituted authorities and adhere strictly to all rules and regulations of the Organization where the student is attached.

iii) To be regular and punctual at respective places of attachment.

iv) To avoid change of place of attachment, except in special circumstances this must be determined and approved by their institution's supervisor, the employer and the ITF;

v) To complete SPE – 1 form and get it endorsed by their employers who will forward same to the ITF;

vi) To record all training activities and other assignments in the log-book and complete ITF Form-8 to ensure proper assessments.

vii) To be diligent, honest, conscientious, take pride in the protection of employer's property throughout the attachment period.

1.7 DURATION OF THE INDUSTRIAL TRAINING PROGRAM

The industrial training program is a compulsory course for all students as part of the fulfillment in their degree. SIWES is four months in polytechnics at the end of ND1, four months in college of education at the end of NCE11, and six months in th1e universities at the end of 300 or 400 or 500 levels depending on the discipline. My three months Students' Industrial Work Experience Scheme was carried out in two aspects one at the end of 200L second semester and the second part of the SIWES was carried out immediately after 300L second semester break at Lagos State General Hospital.

1.8 BENEFITS OF INDUSTRAL TRAINING TO STUDENTS

The purpose of industrial training is to expose students to real work environment, practical experience and at the same time, to acquire knowledge through practical job execution. Through this process, students would develop skills in work ethics, communication, management, and others. More so, this practical training program

allows students to relate theoretical knowledge with its application in the work environment.

The benefits of industrial training are:

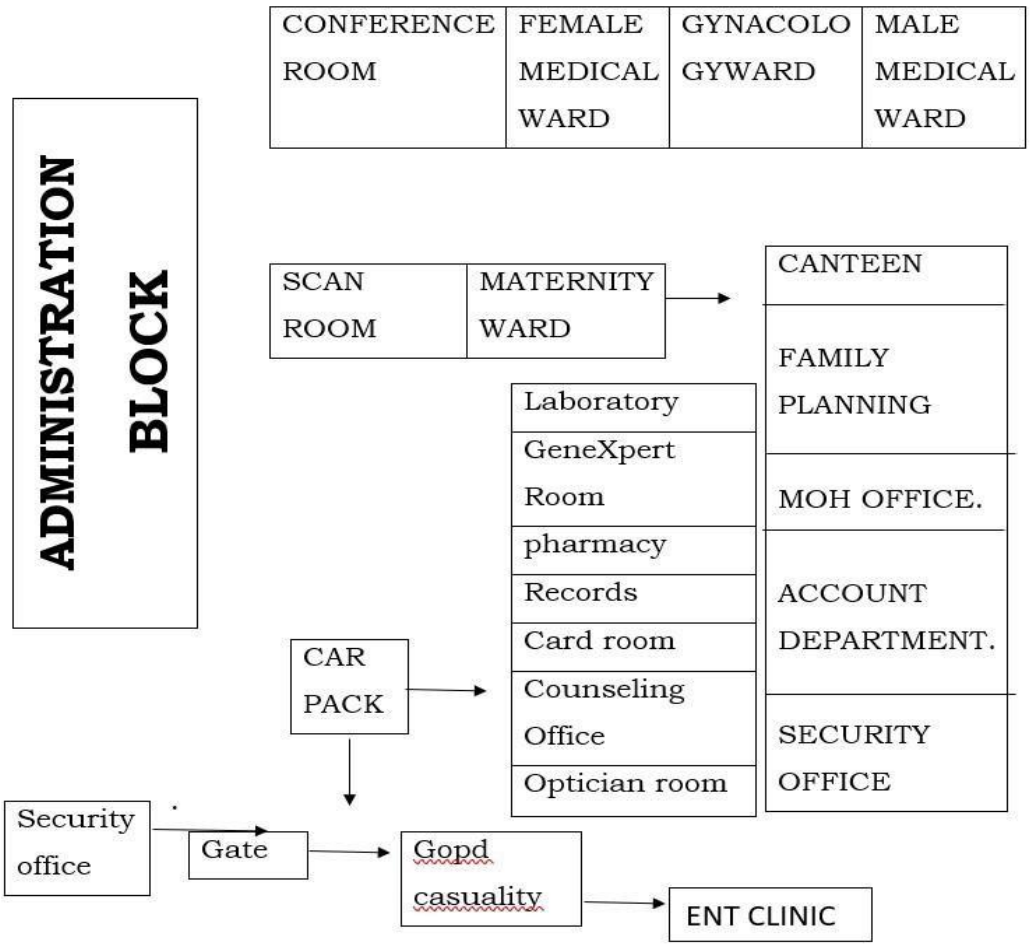
- To provide students the opportunity to test their interest in a particular career before permanent commitments are made;
- To develop skills in the application of theory to practical work situations;
- To develop skills and techniques directly applicable to their careers;
- Internships will increase student's sense of responsibility and good work habits;
- To expose students to real work environment - experience gained and knowledge in writing report in technical works /projects;
- Internship students will have higher levels of academic performance;
- Internship programs will increase student earning potential upon graduation;
- To build the strength, teamwork spirit and self-confidence in students' life;
- To enhance the ability to improve students' creativity skills and sharing ideas;
- To build a good communication skill with group of workers and learn proper behavior of corporate life in industrial sector.

CHAPTER TWO

2.1 COMPANY AND ORGANIZATIONAL BACKGROUND

ORGANOGRAM

The Lagos State General Hospital was established with the aim of providing quality and very affordable health services to the community bearing in mind that lots of people around the community find it difficult financially to access quality health care services. It started operation with only a staff and a few items in the test menu. The establishment was government sponsored. The hospital is fully registered with the Medical Laboratory Science Council of Nigeria and it is gradually growing its staff strength and work load. The main objective is to provide quality and a very affordable diagnostic services to the community.



Organogram of Lagos State General Hospital

2.1.1 Vision

A healthy and productive population in Ilesha, Osun state

2.1.2 Mission statement

To provide accessible, quality and sustainable proper health services to all people living in Lagos State through:

- Delivery of appropriate, acceptable and affordable health services in both private and public health facilities.

- Increasing community participation and ownership.
- Strengthening the promotion, preventive, curative and rehabilitative health services.
- Resource mobilization and allocation.
- Promoting private and public partnership in health service delivery.

2.2 VARIOUS DEPARTMENTS IN LAGOS GENERAL HOSPITAL, ODEN

Lagos State General Hospital has up to eight departments, each headed by a director as follows;

- Research and statistics
- Public health services/Disease control
- Finance and Accounts
- Nursing services
- Pharmaceutical services
- Administration and supply
- Medical services
- Medical Emergency Response Team (ESMERT)

The director with board members supervises the activities of the management of diagnostic center in terms of health administration and also leads the management team.

2.3 INTRODUCTION TO LABORATORY

Laboratories are facilities provides controlled conditions in which scientific or technological research experiments, and measurement may be performed.

2.3.1 GENERAL LABORATORY SAFETY RULES AND PRECAUTIONS

Laboratory precautions are safety measures taken to minimize or eliminate accidents in the laboratory for laboratory accidents to be avoided in order to prevent injury, disablement or ill health of staff or patients, the need for a laboratory health and safety programme is essential.

Basic Precautions

The following are precautions that are adhered to on a daily basis:

1) All lab scientists/technicians within the laboratory must wear protective clothing
2) Specimens and reagents should be labeled properly
3) Talking during a routine work must be avoided
4) The work benches must be clean daily before and after work
5) Reagents and glassware should be returned to their appropriate positions after use
6) Hands should be washed after handling sample or specimen, cultures and before leaving the laboratory

7) Chemicals should be stored in stopped containers and under appropriate temperature

8) Hand gloves should always be worn when working or cleaning in the laboratory

9) Nose masks should be worn when dealing with chemicals which emit gas

10) Strong solution or chemicals should not be pipette by mouth

2.3.2 LABORATORY EQUIPMENT, APPARATUS AND USES

There are so many equipment and apparatus used in the laboratory but below are some of them;

CLOVER A1C SELF ANALYSER

Clover A1c Self Analyser is an in vitro diagnostics instrument for measuring A1c hemoglobin by a well-established boronate affinity method. It can analyse samples of whole capillary blood or EDTA, venous blood treated with heparin. CLOVER A1c Self analyser is designed to support diabetes control. They are intended for use by patients, laboratory staff, clinics and hospitals.

USES

- It is used for measuring A1c hemoglobin

REFRIGERATOR: This is used to preserve samples, reagents etc, which are used for daily analysis and cannot be exhausted at once. The refrigerator helps provide optimum environment for materials to be preserved.

SELEXONTM D-DIMER TEST STRIP

SelexOnTM D-dimer test strip is an in-vitro diagnostic device that measures the concentration of D-dimer within venous whole blood. The test is used for diagnosis of Deep Vein Thrombosis, Pulmonary Embolism or Disseminated Intravascular Coagulation. This SelexOnTM D-dimer test strip uses an EDTA-treated venous

whole blood sample and should be operated by experts in the laboratory or hospital.

USES

The SelexOnTM D-dimer test strip is used with the SelexOnTM meter for quantitative determination of D-dimer concentration in venous whole blood specimen.

MICROPIPETTE: It is special laboratory equipment which is mainly used for measuring liquids of smaller volume so that it can be transferred easily. The

measurements are specified in the pipette. By this, it is possible to transfer a smaller quantity of liquid from one container to another.

CENTRIFUGES: This type of lab equipment comes in various shapes and sizes. The equipment is capable of separating the non-soluble material from the available sample.

TIMER: This type of medical lab equipment is used in the general practice or laboratory for determining the speed of blood sedimentation or for monitoring the run time of certain analyses or devices.

FIRE EXTINGUISHER: Fire extinguishers apply an agent that will cool burning heat, smother fuel or remove oxygen so the fire cannot continue to burn.
extinguishers will put out fires in ordinary combustibles including wood, cloth, rubber, paper, as well as many plastic materials.

GLASSWARE: This is the most essential lab equipment. Some of the types of glassware used in laboratories are beakers, flasks etc. They are used for transferring, storing and measuring liquids. Florence flask is a special type of glassware used for heating liquids.

DIGITAL THERMOMETER : This type of medical lab equipment is used to read a wide range of temperatures based on their type and purpose. It's used to measure the temperature accurately.

Other laboratory equipment includes:

ethanol, sterilized bottle, cotton wool, EDTA, hand gloves, bio safety cabinet.

2.4 LABORATORY RULES AND REGULATIONS

Laboratories, whether in academic, industrial, or clinical settings, operate under specific rules and regulations to ensure the safety of personnel, protect the environment, and maintain the integrity of scientific research. The specific rules may vary depending on the type of laboratory and the nature of the work conducted, but here are some common laboratory rules and regulations:

1. **Personal Protective Equipment (PPE):**

   Wear appropriate PPE, including lab coats, gloves, safety glasses or goggles, and closed-toe shoes, to protect against chemical splashes, spills, and other hazards.

2. **Training and Education:**

   All laboratory personnel should receive proper training and education on the specific hazards, protocols, and emergency procedures relevant to their work.

3. **Chemical Handling and Storage:**

   Follow proper procedures for handling, storing, and disposing of chemicals. This includes using chemical fume hoods, labeling containers, and understanding the properties of the chemicals being used.

4. **Emergency Procedures:**

Know the location and proper use of emergency equipment, including eyewash stations, safety showers, fire extinguishers, and emergency exits. Understand evacuation procedures.

5. **Equipment Operation:**

   Operate laboratory equipment according to manufacturer instructions and ensure that equipment is properly maintained. Report any malfunctions promptly.

6. **Waste Management:**

   Dispose of laboratory waste, including chemical waste and biological materials, according to local regulations and institutional policies. Separate waste streams appropriately.

7. **Personal Conduct:**

   Maintain good personal hygiene, and do not eat, drink, or apply cosmetics in the laboratory.

   Avoid engaging in horseplay or any behavior that could compromise safety.

8. **Restricted Access:**

   Control access to laboratories to ensure that only authorized personnel enter. Visitors should be accompanied by trained laboratory personnel.

9. **Glassware Handling:**

Use and handle glassware with care to avoid breakage. Dispose of broken glass in designated containers.

10. **Biological Safety:**

Follow proper procedures for working with biological materials. Use appropriate containment measures, including biosafety cabinets, when working with potentially infectious agents.

2.5 GENERAL CLEANING OF THE LAB

To efficiently clean the lab, start by organizing equipment and materials. Then, wipe down surfaces with appropriate cleaning agents and dispose of waste properly. Remember to follow safety protocols and use protective gear.

CHAPTER THREE

3.0 EXPERIENCED ACQUIRED

3.1 HEMOGLOBIN A1C (HBA1C)

The Hemoglobin A1c (HbA1c) test is a critical diagnostic and monitoring tool in the management of diabetes mellitus. It provides a comprehensive measure of a patient's average blood glucose levels over two to three months, reflecting long-term glycemic control. This test has gained significant clinical acceptance due to its reliability, ease of use, and its predictive value for diabetes-related complications. In this report, the focus will be on the procedural steps involved in HbA1c testing, its clinical significance, and the challenges associated with its application.

3.1.1 Procedure for HbA1c Testing

HbA1c testing is based on the principle of hemoglobin glycation, where glucose molecules bind to hemoglobin in red blood cells in a non-enzymatic reaction. This glycation is irreversible and depends on the average blood glucose concentration over the lifespan of the red blood cells, approximately 120 days (Sherwani *et al.*, 2016). The proportion of glycated hemoglobin is expressed as a percentage of total hemoglobin.

- ❖ Specimen Collection

Blood for HbA1c testing is typically collected in ethylenediaminetetraacetic acid (EDTA) tubes, which act as anticoagulants. Approximately 2–3 mL of venous blood is sufficient for analysis. Proper labeling and storage of samples are essential to ensure the integrity of the results.

❖ Analytical Methods

Several analytical techniques are employed to measure HbA1c levels, including high-performance liquid chromatography (HPLC), immunoassays, enzymatic assays, and point-of-care testing devices.

i. High-Performance Liquid Chromatography (HPLC): This is the gold standard for HbA1c measurement due to its high accuracy and specificity. The method separates glycated hemoglobin based on charge differences, and the results are quantified spectrophotometrically (Nguyen *et al.*, 2018).

ii. Immunoassays: These utilize antibodies specific to glycated hemoglobin to detect and quantify HbA1c levels. They are widely used in clinical laboratories due to their ease of use and reliability.

iii. Point-of-Care Devices: These portable devices allow rapid HbA1c testing in outpatient settings or at the bedside, providing results in minutes. While convenient, their accuracy may be slightly lower than laboratory-based methods.

❖ Quality Assurance

To ensure accuracy, laboratories use calibration standards and quality control samples. Results are interpreted according to established reference ranges, with HbA1c levels <5.7% considered normal, 5.7–6.4% indicating prediabetes, and ≥6.5% confirming diabetes (American Diabetes Association [ADA], 2023).

3.1.2 Clinical Importance of HbA1c

The HbA1c test has revolutionized the diagnosis and management of diabetes. Its clinical utility extends beyond glycemic monitoring to risk stratification and prognostication.

- ❖ Diagnosis of Diabetes

HbA1c testing is a recommended diagnostic criterion by the ADA and the World Health Organization (WHO). Unlike fasting plasma glucose or oral glucose tolerance tests, HbA1c does not require fasting and reflects long-term glycemic trends. An HbA1c value of ≥6.5% on two separate occasions is diagnostic for diabetes (ADA, 2023).

- ❖ Monitoring Glycemic Control

Regular HbA1c testing allows healthcare providers to evaluate the effectiveness of therapeutic interventions, including lifestyle modifications, oral hypoglycemic agents, and insulin therapy. Lowering HbA1c levels has been shown to reduce the risk of diabetes-related complications significantly (Sherwani *et al.*, 2016).

- ❖ Risk Assessment for Complications

The HbA1c test serves as a robust predictor of complications. Higher HbA1c levels are associated with an increased risk of microvascular complications such as retinopathy, nephropathy, and neuropathy. Additionally, HbA1c correlates with the risk of macrovascular complications, including cardiovascular diseases and stroke (Nguyen *et al.*, 2018).

- ❖ Prognostic Value

Studies have demonstrated that reducing HbA1c levels by even 1% can decrease the risk of microvascular complications by 37% and macrovascular complications by 14% (UK Prospective Diabetes Study Group, 1998). For most patients, maintaining HbA1c levels below 7% is recommended to minimize the risk of complications.

Test procedures for HBA1c

1. Switch on the Hba1c and calibrate the machine using a daily calibrator

clover A1c self strip

2. **Take out the clover A1c self strip and turn it up and down for 5 times before dipping it inside the blood sample**

3. **After dipping it into the blood sample, you insert it into the clover A1c analyzer and close the cover**

4. Set on the timer for 5 mins, after 5 mins you will get your results in percentage

3.1.3 Advantages and Limitations

i. HbA1c reflects average glucose levels over several months, providing a more stable indicator of glycemic control than fasting glucose or random glucose tests.

ii. The test does not require fasting, making it easier for patients to comply.

iii. It predicts the risk of diabetes complications more reliably than short-term glucose measurements.

Limitations

i. Conditions like sickle cell anemia and thalassemia can interfere with HbA1c measurements, leading to inaccurate results.

ii. Anemia, recent blood loss, or hemolytic diseases can affect HbA1c levels, as these conditions shorten the lifespan of red blood cells.

iii. Since HbA1c reflects long-term glycemia, it is not useful for detecting acute changes in blood glucose levels.

3.2 RHEUMATOID FACTOR (RF) TEST

The **Rheumatoid Factor (RF) test** is a key diagnostic and prognostic tool in the evaluation of autoimmune diseases, particularly **rheumatoid arthritis (RA).** RF is an autoantibody targeting the Fc region of IgG antibodies, which are part of the body's immune system. While RF is most commonly associated with RA, it can

also be elevated in other autoimmune disorders, chronic infections, and certain malignancies.

3.2.1 Test Procedure for Rheumatoid Factor

The RF test measures the presence and concentration of rheumatoid factor in the blood. It can be performed using various methods, including agglutination, nephelometry, and enzyme-linked immunosorbent assay (ELISA).

- **Specimen Collection**

Sample Type: Venous blood is typically collected.

Anticoagulant: Serum samples are preferred, although plasma may also be used.

Volume Required: Approximately 5 mL of blood is collected into a plain red-top or serum separator tube (SST).

- **Methods of Analysis**

Several laboratory methods are employed to detect RF:

Agglutination Tests: Involve mixing patient serum with particles (e.g., latex beads or red blood cells) coated with human or animal IgG.

Agglutination, or clumping, indicates the presence of RF.

These tests are qualitative but less sensitive compared to other methods.

Nephelometry and Turbidimetry: These automated techniques measure the turbidity or light scattering caused by immune complexes formed between RF and IgG-coated particles.

Results are quantitative, offering more precise RF concentrations.

Enzyme-Linked Immunosorbent Assay (ELISA): Involves immobilizing IgG on a solid surface to capture RF from the patient serum.

A secondary antibody labeled with an enzyme detects bound RF, producing a color change that is measured spectrophotometrically.

ELISA is highly sensitive and specific.

- **Reference Values**

Normal Range: RF levels below 20 IU/mL are generally considered negative.

Positive Test: RF levels above 20 IU/mL may indicate the presence of an autoimmune disorder, though the specific threshold can vary by laboratory.

- **Quality Control**

Positive and negative control samples are analyzed alongside patient specimens to ensure the reliability and accuracy of results.

Regular calibration of equipment and adherence to standard operating procedures are critical.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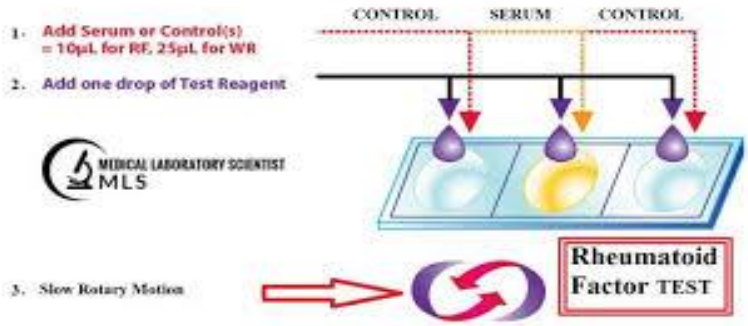
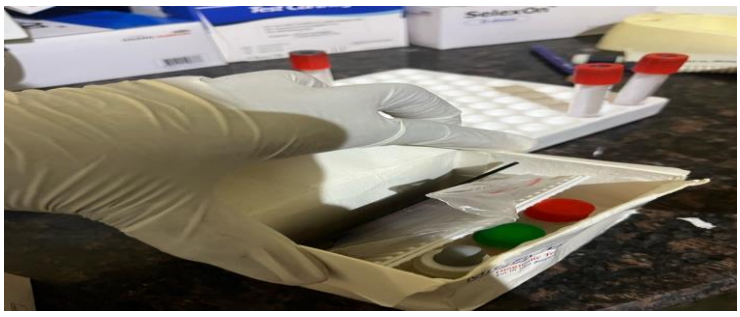
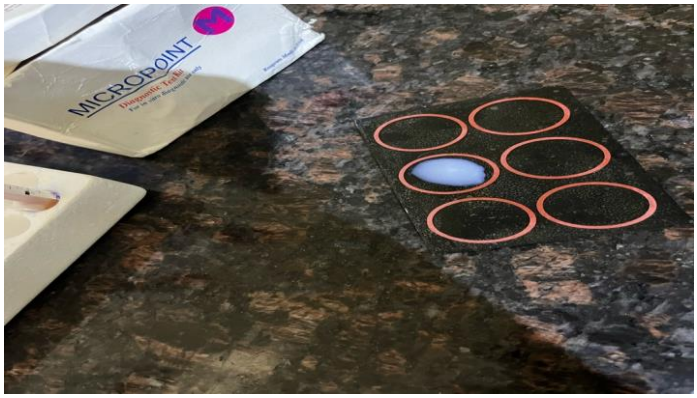

CONTROL
SERUM
CONTROL
1. Add Serum or Control(s) = 10µL for RF, 25µL for WR
2. Add one drop of Test Reagent
MEDICAL LABORATORY SCIENTIST
MLS
3. Slow Rotary Motion
Rheumatoid Factor TEST





3.2.2 Clinical Significance of the Rheumatoid Factor Test

The RF test holds diagnostic, prognostic, and differential value in the clinical evaluation of autoimmune diseases. However, it must be interpreted within the context of a patient's clinical history, symptoms, and other diagnostic findings.

1. Diagnostic Role in Rheumatoid Arthritis

Rheumatoid arthritis is a chronic inflammatory autoimmune disorder characterized by joint pain, swelling, and stiffness. RF is present in approximately **70-80% of RA patients,** making it an important marker for the disease (Baka *et al.*, 2014). However, its absence does not rule out RA, as some patients may have seronegative RA.

2. Prognostic Implications

Higher RF levels are associated with more severe disease and a higher likelihood of extra-articular manifestations such as vasculitis and interstitial lung disease (Klareskog *et al.,* 2008). Persistent high RF levels may indicate a poorer prognosis.

3. Differential Diagnosis

RF can be elevated in conditions beyond RA, which is important for differential diagnosis:

Other Autoimmune Diseases: RF may be positive in **Sjogren's syndrome, systemic lupus erythematosus (SLE),** and **mixed connective tissue disease.**

Chronic Infections: Conditions like hepatitis B and C, tuberculosis, and endocarditis can cause RF elevation.

Malignancies: Certain lymphoproliferative disorders may also show elevated RF levels.

Normal Aging: A small percentage of healthy elderly individuals may have detectable RF without clinical disease.

3.2.3 Limitations of the RF Test

While the RF test is a valuable diagnostic tool, it has certain limitations:

Lack of Specificity: RF is not exclusive to RA and can be elevated in numerous other conditions. Thus, it must be used in conjunction with other diagnostic criteria.

False Positives: RF can be detected in healthy individuals, especially the elderly, and in patients with chronic infections.

Variable Sensitivity: Although RF is present in most RA patients, **20-30% of patients with RA** may test negative (seronegative RA), necessitating additional tests such as anti-cyclic citrullinated peptide (anti-CCP) antibodies.

3.2.4 Complementary Tests

To enhance diagnostic accuracy, the RF test is often combined with other laboratory and imaging studies:

Anti-Cyclic Citrullinated Peptide (Anti-CCP) Test:

Highly specific for RA and can detect early-stage disease.

Erythrocyte Sedimentation Rate (ESR) and C-Reactive Protein (CRP):

These inflammatory markers help assess disease activity.

Imaging Studies:

X-rays, MRI, or ultrasound can identify joint erosions or inflammation characteristic of RA.

3.3 C-REACTIVE PROTEIN (CRP) TEST

The **C-Reactive Protein (CRP) test** is a widely used laboratory assay for measuring levels of CRP, a marker of systemic inflammation. CRP is an acute-phase protein produced by the liver in response to inflammation, infection, or tissue damage. Elevated CRP levels provide crucial information about the presence

and severity of an inflammatory condition, making it an invaluable tool in diagnostic medicine.

3.3.1 Test Procedure for C-Reactive Protein

The CRP test involves quantifying the concentration of CRP in blood plasma or serum. Several methods are available, ranging from simple qualitative assays to high-sensitivity quantitative techniques.

- **Specimen Collection**

Sample Type: Venous blood is required for the test.

Collection Tube: Serum separator tubes (SST) or EDTA tubes are typically used.

Volume Required: A minimum of 2–3 mL of blood is needed.

Pre-Test Requirements: Fasting is generally not required unless specifically indicated.

- **Methods of Analysis**

CRP levels can be measured using various techniques:

Turbidimetric Assay: Measures changes in turbidity caused by CRP-antibody complexes in the sample. Widely used due to its simplicity and reliability.

Immunoassay: Enzyme-linked immunosorbent assay (ELISA) or chemiluminescent immunoassays (CLIA) use specific antibodies to detect CRP. These methods are highly sensitive and precise.

High-Sensitivity CRP (hs-CRP): Designed to detect very low levels of CRP, hs-CRP is used primarily in cardiovascular risk assessment. It requires specialized equipment and reagents.

Point-of-Care Testing: Portable devices provide rapid CRP results, often used in outpatient or emergency settings.

- ❖ **Reference Ranges**

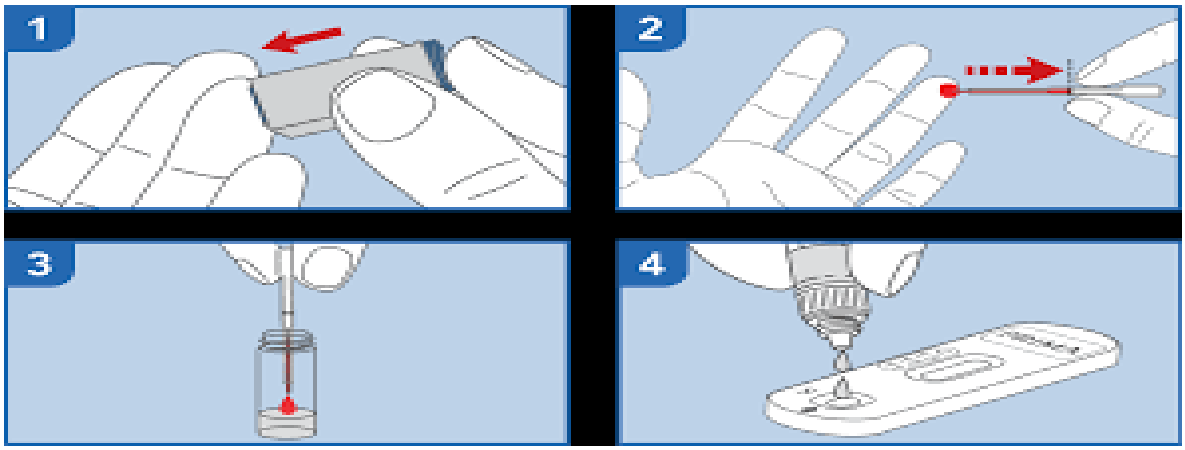
Normal CRP Levels: <1 mg/L (low risk of inflammation).

Moderate Elevation: 1–3 mg/L (may indicate low-grade inflammation or cardiovascular risk).

High Levels: 3 mg/L (suggestive of acute inflammation, severe infection, or chronic inflammatory disease).

- ❖ **Quality Assurance**

Laboratories run controls with known CRP concentrations alongside patient samples to ensure the accuracy of the test. Regular calibration and maintenance of analyzers are essential.



3.3.2 Clinical Significance of the CRP Test

CRP levels correlate with the intensity of systemic inflammation, providing valuable diagnostic and prognostic information.

1. Role in Diagnosing Infections and Inflammatory Diseases

Acute Infections: Elevated CRP levels are a hallmark of bacterial infections. The levels can rise within hours of infection and peak within 48 hours. CRP levels above 10 mg/L are commonly seen in bacterial infections, whereas lower levels may occur in viral infections (Sproston and Ashworth, 2018).

Chronic Inflammatory Diseases: High CRP is observed in autoimmune disorders such as **rheumatoid arthritis (RA), systemic lupus erythematosus (SLE),** and **inflammatory bowel disease (IBD).**

2. Monitoring Disease Progression

CRP levels are valuable for tracking the progression of inflammatory diseases or the efficacy of treatment. A decreasing CRP trend often indicates a response to therapy, while persistently elevated levels suggest ongoing inflammation.

3. Cardiovascular Risk Assessment

High-sensitivity CRP (hs-CRP) is a critical marker for cardiovascular diseases. CRP levels between 1–3 mg/L indicate moderate cardiovascular risk, while levels >3 mg/L suggest a high risk of conditions like myocardial infarction and stroke (Ridker, 2016).

4. Differentiating Between Conditions

CRP can help distinguish between inflammatory and non-inflammatory causes of symptoms:

Elevated CRP in febrile conditions supports an inflammatory or infectious cause.

Normal CRP levels often point to non-inflammatory disorders.

3.3.3 Advantages and Limitations

Rapid and Sensitive: CRP levels rise quickly in response to inflammation, offering early diagnostic clues.

Non-Specificity: While this can be a limitation, it also allows CRP to serve as a marker for a broad spectrum of conditions.

Ease of Measurement: The test is simple, inexpensive, and widely available.

Prognostic Value: It predicts outcomes in various conditions, such as sepsis, chronic inflammation, and cardiovascular events.

Limitations

While CRP is sensitive to inflammation, it does not pinpoint the underlying cause, necessitating further diagnostic workup.

Factors like age, sex, and ethnicity can influence baseline CRP levels.

Elevated CRP is seen in both inflammatory and non-inflammatory conditions, such as malignancies or trauma.

3.3.4 Applications of the CRP Test

1. Autoimmune and Inflammatory Diseases: CRP levels aid in the diagnosis and monitoring of conditions like RA and SLE. A correlation exists between disease activity and CRP levels in these conditions.

2. Infection Management: CRP guides the differentiation between bacterial and viral infections. Serial measurements help assess the effectiveness of antimicrobial therapy.

3. Cardiovascular Medicine: hs-CRP provides insights into the risk of atherosclerosis, coronary artery disease, and other cardiovascular conditions. It is incorporated into risk prediction models for personalized cardiovascular care (Ridker, 2016).

3.4 D-DIMER TEST

The **D-dimer test** is a blood assay used to detect the presence of D-dimer, a protein fragment produced during the degradation of a blood clot. It is an essential diagnostic tool for evaluating conditions associated with abnormal clot formation and breakdown, such as venous thromboembolism (VTE), disseminated intravascular coagulation (DIC), and pulmonary embolism (PE). Its clinical significance lies in its utility for ruling out thrombotic disorders, as elevated levels suggest active clot formation and fibrinolysis.

3.4.1 Test Procedure for D-Dimer

1. Turn on the D-Dimer selexon analyzer and scan with the SelexOnTM D-

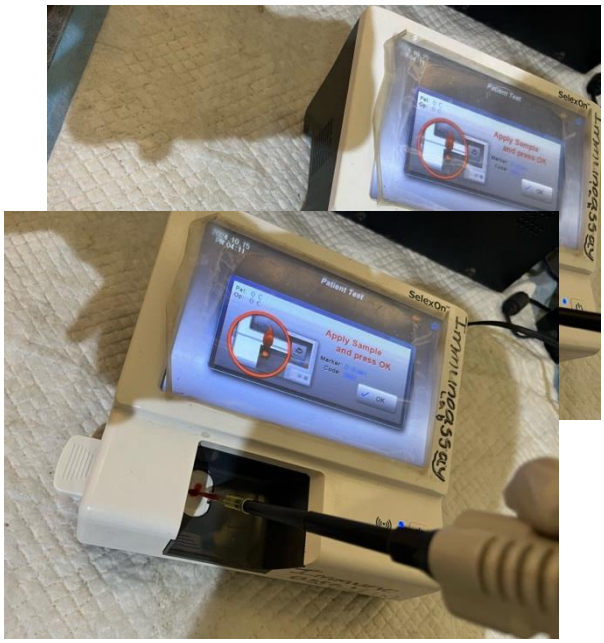
dimer test strip

2. Input the patient first letter name .e.g.Ajayi-Obe Catherine will be input as A C

XL

3. Put in the SelexOnTM D-dimer test strip

4. Pipette the blood sample into the SelexOnTM D-dimer test strip



5. **After 10 mins , you will get your results in ng/mL**

The D-dimer test is typically performed in clinical laboratories using immunoassays or point-of-care devices. The results are often reported quantitatively in fibrinogen equivalent units (FEU).

- **Specimen Collection**

Sample Type: Venous blood.

Collection Tubes: Citrated plasma (blue-top tube) is preferred, as citrate prevents clotting while maintaining coagulation factors.

Volume Required: Approximately 2–3 mL of blood.

Pre-Test Instructions: No specific patient preparation is required; fasting is not necessary.

- **Methods of Analysis**

Several techniques are used to detect D-dimer levels:

Enzyme-Linked Immunosorbent Assay (ELISA): The gold standard for D-dimer testing due to its high sensitivity and specificity. Involves the binding of antibodies to D-dimer fragments and detection through enzymatic reactions.

Latex Agglutination Assays: A rapid and cost-effective method where latex particles coated with anti-D-dimer antibodies aggregate in the presence of D-dimer. Used for qualitative or semi-quantitative results.

Turbidimetric Immunoassay: Measures light scattering caused by immune complexes of D-dimer and specific antibodies in the sample. Provides quantitative results and is widely used in automated laboratory systems.

Point-of-Care Testing: Handheld devices allow bedside D-dimer measurement, providing rapid results for urgent clinical decision-making.

- **Reference Ranges**

Normal Levels: <500 ng/mL FEU. Elevated levels above this threshold are indicative of fibrinolysis and possible thrombotic conditions.

- **Quality Assurance**

Calibration with known D-dimer standards ensures the accuracy of quantitative tests.

Positive and negative controls are analyzed with patient samples to verify the reliability of results.

3.4.2 Clinical Significance of D-Dimer

The D-dimer test is crucial in diagnosing and managing disorders involving coagulation and fibrinolysis. However, it is primarily valued for its **negative predictive value** (NPV), effectively ruling out thrombosis when levels are normal.

1. Diagnosis of Venous Thromboembolism

Elevated D-dimer levels are seen in **deep vein thrombosis (DVT)** and **pulmonary embolism (PE)** due to excessive clot formation and breakdown.

The test is most effective in low-to-moderate risk patients, where a negative result rules out these conditions with high certainty (Kline *et al.*, 2014).

2. Monitoring Disseminated Intravascular Coagulation (DIC)

In DIC, widespread clot formation is accompanied by fibrinolysis, leading to elevated D-dimer levels. The test is used to monitor disease progression and response to treatment.

3. Pregnancy and Postpartum Complications

D-dimer levels are physiologically elevated in pregnancy but can indicate complications such as placental abruption or preeclampsia when excessively high (Waner *et al.*, 2016).

4. Risk Assessment in Cardiovascular Diseases

Elevated D-dimer levels are associated with an increased risk of arterial thromboembolism, stroke, and myocardial infarction, particularly in older adults or patients with atrial fibrillation.

5. COVID-19-Related Coagulopathy

In severe COVID-19 cases, elevated D-dimer levels indicate hypercoagulability and increased risk of thrombotic complications, serving as a prognostic marker for disease severity and mortality (Tang *et al.*, 2020).

3.4.3 Advantages and Limitations

High Sensitivity: The test reliably detects fibrinolysis, making it a powerful tool for ruling out thrombotic conditions.

Rapid and Non-Invasive: It provides quick results using a simple blood sample.

Wide Applicability: Useful in various clinical scenarios, including thrombotic disorders, pregnancy, and critical care settings.

Low Specificity: Elevated D-dimer levels occur in numerous conditions unrelated to thrombosis, such as inflammation, infection, trauma, or malignancy. This limits its ability to confirm a thrombotic diagnosis.

Limited Utility in High-Risk Patients: In high clinical suspicion of VTE, imaging studies like venous ultrasound or CT pulmonary angiography are required regardless of D-dimer results.

Physiological Variations: Levels are naturally elevated in pregnancy, aging, and postoperative states, complicating interpretation.

3.4.4 Applications of the D-Dimer Test

1. Thrombosis Rule-Out Test

In patients with suspected DVT or PE and low to intermediate pre-test probability, a negative D-dimer test effectively excludes thrombosis, reducing the need for costly and invasive imaging studies.

2. Monitoring Anticoagulant Therapy

In patients receiving anticoagulants for thrombotic conditions, D-dimer levels can help assess treatment efficacy and determine the risk of recurrence.

3. Risk Stratification in Acute Conditions

High D-dimer levels are predictive of poor outcomes in conditions like DIC, severe infections, and COVID-19, guiding therapeutic decisions.

4. Clinical Research

D-dimer is a biomarker in studies investigating the pathophysiology of coagulation and its role in systemic diseases.

D-dimer test is an essential tool in modern diagnostic medicine, particularly for ruling out venous thromboembolism and monitoring coagulation disorders like DIC. Its high sensitivity and rapid turnaround time make it invaluable in emergency and critical care settings. However, due to its low specificity, D-dimer results must always be interpreted in conjunction with clinical findings and imaging studies. As research continues, its role in disease prognostication and management, especially in complex conditions like COVID-19, is likely to expand.

CHAPTER FOUR

4.0 EXPERIENCE ACQUIRED, CHALLENGED ENCOUNTERED, RECOMMENDATION AND CONCLUSION

4.1 EXPERIENCE ACQUIRED

Working at the Lagos State General Hospital has given me the opportunity of getting a firsthand appreciation of learning its fundamentals, learning to work with various equipment's. I also learnt about different medical tests and procedures.

4.2 CHALLENGES ENCOUNTERED

A lot of challenges occur which includes;

- The issue of non-acceptance of student by employers making it difficult to secure places of training.
- Accommodation problem
- Transportation problem
- Finance
- Early resumption at the places of training just as the permanent staff

4.3 RECOMMENDATIONS

In view of the relevance of the SIWES program, it is important that it is sustained by the government through the Industrial Training Fund (ITF) as it exposes the student to work tools, facilities, and equipment that may not be available in their respective institutions in relation to their course of study. To this end, I recommend that the following under-listed points should be implemented:

- Students should be well prepared for this kind of employment environment (SIWES).
- They should as a matter of necessity choose functional companies and related
- organizations for their training to acquire the necessary skills for their professional development.
- Organized private sectors, government establishments and other related organizations should be encouraged to accept student for training in their establishments. This could 26 done by establishing functional companies where students would be trained and organizations would enjoy and maximize to the full the services of the students free of charge.
- Employers should also be encouraged to make provision for temporary accommodation for students' trainee during their training to eliminate the issue of accommodation problem.
- It is also recommended that institutions should release funds for the payment of stipend to trainees to ease off the problem of inadequate fund on students.
- Funds should also be released to institutions for effective supervision of students during

SIWES training.

- The company should provide more safety equipment's to prevent further environmental and health hazards.

4.4 CONCLUSIONS

My industrial attachment with Lagos State General Hospital has been one of the most interesting, productive and instructive experience in my life. Through this training, I have gained new insight and more comprehensive about the real industrial working condition and practice, it has also improved my soft and functional skills. All these valuable experiences and knowledge's that I have gained were not only acquired through the direct involvement in task but also through other aspects of the training such as: work observation, interaction with colleagues, superior, and other people related to the field. And from what I have undergone, I am sure that industrial training program has achieved its primary objective.

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