Republic of Yemen

Ministry of Higher Education and Scientific Research

Council for Accreditation and Quality Assurance

National Academic Reference Standards

Undergraduate Laboratory Medicine Program

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First Draft

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PREFACE

The Council for Accreditation and Quality Assurance in Higher Education (CAQAY) is pleased to introduce this document that contains the National Academic Reference Standards for Laboratory Medical education. In the light of its mission and general policy for developing National Academic Reference Standards (NARS) for higher education, the Council intends to present this document with a view to provide higher education institutions with reference points in the design, delivery and review of their academic programs. It also aims at providing these institutions with a general guidance for articulating the key attributes of tomorrow's Laboratory Medical education graduates, and learning outcomes associated with the programs. By these National Academic Reference Standards stated in this document, the Council hopes to solve the problems that higher education institutions face during the process of programs' review or development by bridging the gap that usually arises as a result of the general absence of national academic reference standards. Hence, there is a genuine need for National Academic Reference Standards for Laboratory Medicine program.

In this changing world of globalization and digitalization, Faculties of Medicine and Health Sciences have to produce graduates who are relevant in the 21st Century that is marked by rapid development in technology, knowledge explosion, borderless economic and business operations and many other complex problems of the new millennium. Therefore, the graduate attributes presented in this document and the learning outcomes derived from them as well as teaching and assessment methods provide Faculties of Medicine's deans, department chairs and faculty members with a frame of reference for reviewing their curriculum. If the design, content, and implementation of Faculties of Medicine and Health Sciences curricula are guided by the set of graduate attributes and learning outcomes presented in this document, these faculties will certainly produce well-prepared, self-motivated and responsible Laboratory Medicine specialists who can assume their expected professional duties in solving the community problems and facing diagnostic healthcare challenges of the 21st century.

The Council recognizes that Faculties of Medicine have to respond to the unprecedented changes in the methods of Laboratory Medical education. We hope that faculties of medicine will respond to the intent of this document with some sense of urgency. Faculties of Medicine should consider establishing formal processes for using those attributes and learning outcomes to guide reviews of their curricula and program specifications. This should also be accompanied by gradual but significant changes in the way faculties of medicine teach and assess their students. This aspect of Laboratory Medical education entails a special focus from the deans and department chairs in order to make sound improvements in Laboratory Medical education in our country.

Prof. Abdullateef Haidar,
Sana'a, Jan. 29, 2019

National Academic Reference Standards (NARS)

National Academic Reference Standards (NARS) are the expected minimum requirements of knowledge and skills necessary to fulfill the requirements of an academic degree.

NARS aim at providing a minimum level of reference that guides the academic community to prepare academic program specification documents in a particular field or specialization. It also represents the overall expectation of academic qualifications, abilities and qualities that graduates should acquire when completing a program of study.

NARS represent a threshold of standards that encourage higher levels of achievement and therefore require educational institutions to distinguish themselves in their educational performance by developing their own Academic Reference Standards (ARS). On the other hand, ARS for educational institutions are higher level of requirements that educational institutions must achieve through their academic programs to ensure that their graduates are able to carry out professional or career practices successfully.

It must be pointed out here that NARS do not intend to provide a unified national curriculum for academic programs, nor do they seek to provide a list of contents for academic programs. Hence, the authors of NARS documents avoided that, because it is the core task of higher education institutions. In turn, higher education institutions should refer to NARS documents to prepare their program specification documents that typically include programs goals, graduate attributes, learning outcomes, study plans, contents, strategies for teaching and learning, assessment methods, etc.

HISTORY OF LABORATORY MEDICINE IN YEMEN

During the 1970s, Yemen was undergoing rapid demographic and epidemiologic transition and the health was burdened with the life-style associated diseases as well as new and existing infectious diseases. There was also a great need for efficient diagnostic services. To respond to these challenges, the degree of Laboratory Medicine was first introduced in 1978 as Medical Laboratory Sciences and was allocated to a newly established division in the Faculty of Science, Sana'a University, prior to the establishment of the Faculty of Medicine and Health Sciences. This program was established to educate and train health care professionals to deal with these health challenges and carry out proper diagnostic services. The degree aimed to produce specialists who are competent in their profession, aware of and able to respond to the societies health needs and able to pursue graduate education both locally and internationally. This program was initially supported by the World Health Organization (WHO). It was also the first of its type in the Middle East region. It was based on a similar program in Canadian Universities.

The degree was initially a four-year program whereby students from the third year specialize in either Biochemistry and Hematology or Microbiology and Parasitology, followed by 6 months of internship at Yemen Central Laboratory which was supported by the WHO. This program went on for the subsequent 9 years till 1987. Then, in response to the demands of the labour market, these fields of specialization in the program were replaced by a more general and multi-specialization program which included various tracks such as Biochemistry, Haematology, and Microbiology and Parasitology .)

In 1988, the Medical Laboratory Sciences Unit was moved to the Faculty of Medicine and Health Sciences. Following the steps of Sana'a and Aden Universities, other public and private universities started during the 1990s to establish and include Medical Laboratory Sciences in their academic programs. The number of the program's graduates in Sana'a University has exceeded 3000 graduates at present. Postgraduate studies (MSc and PhD) were also established initially in two departments (Biochemistry and Microbiology) in 1998

and MSc in Parasitology was started later. Very recently, some universities have established a separate Faculty of Laboratory Medicine.

The current challenges facing Laboratory Medicine graduates include the advent of the new sophisticated technologies in the field of laboratory diagnosis and the need to review the current curriculum to align it with the recent advancements in this dynamic field. With the ever-increasing number of Medical Schools in Yemen, other challenges that face the Medical education in general are related to the urgent need for appropriate accreditation and standardization in all aspects of Medicine and Allied Health Sciences.

NATIONAL ACADEMIC REFERENCE STANDARDS FOR LABORATORY MEDICINE PROGRAM

I. GRADUATE ATTRIBUTES

Upon successful completion of an undergraduate Laboratory Medicine program, the graduates should be able to:

1. **Demonstrate understanding of basic Biomedical Sciences in Laboratory Medicine.**
2. **Apply knowledge of Biochemical, Hematological, Immunological, Microbiological, Parasitological and Blood Banking in laboratory investigation.**
3. **Demonstrate an in-depth knowledge of the relationship between laboratory data and pathologic processes, and how laboratory data are related to health and disease.**
4. **Use critical thinking and problems solving skills in laboratory diagnosis to make evidence-based decisions.**
5. **Communicate effectively and demonstrate professionalism in dealing with patients, their families and other health care workers.**
6. **Maintain confidentiality, adhere to moral and ethical standards of investigations and comply with the government regulations applied to Medical Laboratory.**
7. **Perform investigations and implement updated laboratory technology in the interpretation of results efficiently and professionally.**
8. **Apply measures of Bio-risk and quality management.**
9. **Use their knowledge, laboratory training and research skills to explore and respond to medical science issues on various scales.**
10. **Engage in continuous education, self-study and lifelong learning.**

II. LEARNING OUTCOMES

A. KNOWLEDGE AND UNDERSTANDING

Upon successful completion of an undergraduate Laboratory Medicine program, the graduates will be able to:

A1 Demonstrate an understanding of fundamental knowledge of Biomedical sciences (Biology, Chemistry, Biophysics, Anatomy, Histology, Physiology, Human Genetics and Molecular biology).

A2 Demonstrate understanding of the principles and procedures of Biochemical, Hematological, Immunological, Microbiological and Parasitological Sciences as well as Blood Banking in laboratory investigation.

A.3 Define and describe the mechanisms of various metabolic processes in the physiological and pathological conditions.

A.4 Identify different biological sample collections, processing, storage and transportation.

A.5 Show an awareness of research design, Epidemiology and the appropriate use of statistical analyses to enable a valid interpretation of experimental results.

A.6 Integrate knowledge of various key disciplines and current Laboratory methods available to further their understanding of the study, investigation, diagnosis and monitoring of human health and disease in clinical and research environments.

A.7 Recognize analytical variables that affect test accuracy and take action.

A.8 Demonstrate an awareness of the applicability of the Laboratory Medicine to the careers/specialization which graduates may wish to pursue.

B. COGNITIVE/INTELLECTUAL SKILLS

Upon successful completion of an undergraduate Laboratory Medicine programs, the graduates will be able to:

B.1 Integrate the concepts and principles of the basic and applied Medical Sciences to formulate and test hypothesis.

B.2 Troubleshoot technical errors and interpret results efficiently and professionally.

B.3 Use critical thinking and problem solving skills to make evidence-based decisions.

B.4 Analyze and evaluate evidence-based information needed in Laboratory Medicine practice.

C. PRACTICAL AND PROFESSIONAL SKILLS:

Upon successful completion of an undergraduate Laboratory Medicine program, the graduates will be able to:

C.1 Execute quality management system and biosafety procedures in laboratory practice.

C.2 Apply technical skills in using laboratory equipment, tools, and materials in laboratory practice.

C.3 Collect, transport, preserve and store samples according to Standard Operating Procedures (SOPs).

C.4 Employ different methods in the diagnosis of various Biochemical, Hematological, Immunological, Microbiological, Parasitological and pathological diseases.

C.5 Apply standard procedures in blood banking and transfusion services

C.6 Utilize appropriate manual and automated techniques in Laboratory investigations.

C.7 Prepare, process, interpret and present data using appropriate qualitative and quantitative techniques, statistical programs, and spreadsheets for presenting data.

D. GENERAL / TRANSFERABLE SKILLS

Upon successful completion of an undergraduate Laboratory Medicine program, the graduates will be able to:

D. 1 Participate in teamwork harmoniously and exhibit collaboration with colleagues and other health care professionals.

D. 2 Communicate effectively using appropriate scientific language orally and in writing.

D. 3 Effectively use computer skills as well as information and communication technologies.

D. 4 Engage in continuous education and long life learning.

D. 5 Demonstrate ethical conduct with patients, colleagues and health care workers.

D. 6 Conduct research projects in the field of Laboratory medicine with sense of social responsibility.

D. 7 Understand their own responsibilities and professional limitations and follow the rules of medical organizations and the authority regulations.

TEACHING AND LEARNING STRATEGIES AND ASSESSMENT TOOLS

NARS approach emphasizes the importance of aligning teaching, learning and assessment with NARS to help students acquire graduate attributes and the intended learning outcomes.

Although teaching and learning strategies and assessment methods vary from one discipline to another and from an academic program to another, whatever teaching and learning strategies and assessment tools are used, they should provide students with opportunities to acquire graduate attributes and the intended learning outcomes. This requires that curricula design and delivery methods should be updated periodically to respond to developments in the subject matter, the results of research about teaching and learning in higher education, changes in national policy, professional practices and the needs of employers.

A. Teaching and Learning Strategies

The introduction of NARS in higher education curriculum development is a new approach that requires higher education institutions to adopt appropriate teaching and learning strategies to help students achieve academic standards and to demonstrate that all their graduates are able to achieve those standards.

Regardless of the teaching approach adopted by a faculty, institutions of higher education should provide a great deal of active learning in which the students are actively involved in the learning process, and allocate enough time for directed self-learning and reflections as to encourage students to develop life-long learning habits.

Curricula should also be designed to provide students with sufficient opportunities to acquire adequate knowledge and to develop practical and professional skills to a level that qualifies them to obtain professional licensing. This requires sufficient practical applications and field training during long periods of their academic study.

In general, teaching and learning in undergraduate Laboratory Medicine programs should use a variety of teaching methods, such as:

- Active Lectures (supported with discussions),
- Case studies and Problem-based learning,
- Seminars, tutorials and Journal clubs,

- Laboratory training,
- Laboratory classes and Fieldwork
- Computer and web-based learning,
- Use of communication and information technology,
- Self-directed study and research.

B. Assessment Tools

Assessment is the means by which students' ability to meet academic standards is measured and should be a key part of the learning process. To ensure this, faculties should design consistent and credible assessment tools at course level and at program level as well.

On the other hand, NARS require an emphasis on rigorous assessment of practical and professional skills to identify those who are not yet qualified for the profession or occupation. The ways to achieve this may vary, but should always include direct and frequent observations of students during practical applications and field training.

It should also be noted that while it may be difficult to assess professional attitudes directly, the impact of attitudes on students' behavior should be assessed by observing this behavior over a period of time.

Finally, assessments must be accurate but should not be exhausting or repetitive, as this may affect the learning process.

In general, assessment in undergraduate Laboratory Medicine programs should use a variety of teaching methods, such as:

- Short essays and Quizzes,
- Written assessments, such as multiple choice questions (MCQs),
- Multi-competency comprehensive assessments, such as viva-voce and objective structured Laboratory exams,
- Logbooks and portfolios,
- Projects or dissertation report and work field report.

TERMINOLOGY

1. **Higher education institutions:**

   These are universities, faculties, higher institutes and academies which offer academic programs that extend for a period of more than three years of study under the supervision of the Ministry of Higher Education and Scientific Research.

2. **NARS:**
   The national academic reference standards prepared by the Council for Accreditation and Quality Assurance with the assistance of specialized experts and representatives of various beneficiary sectors to represent the minimum standards required for accreditation of academic programs.

3. **ARS:**
   Academic reference standards prepared by higher education institutions, provided that they include NARS as well as a number of standards (attributes and learning outcomes) that distinguish an institution from other institutions (allowing for creativity and diversity).

4. **Academic program:**
   A distinct and well-structured group of courses that, after successfully completed, enable students to get an academic degree associated with an academic program (BA / BSc, MSc, PhD).

5. **Graduate attributes:**

   A set of attributes (competencies) that result from the acquisition of knowledge and skills during the study of a particular academic program, and which identify what the graduate is expected to exhibit at the end of an academic program .

6. **ILOs:**
   Intended Learning Outcomes (ILOs) refer to the knowledge, understanding and skills that specify what a student should know, be able to do and the values to be acquired after the completion of a study unit, a course or an academic program.

7. **Knowledge and understanding:**
   Key facts, concepts, laws, theories and techniques that the students are reasonably expected to acquire in a particular field of specialization. It also includes mental skills such as memorizing and comprehension.

8. **Intellectual skills:**

These are skills that the academic program seeks to help students develop, such as analysis, the ability to choose from different alternatives, discussion and reasoning skills, innovation, creative thinking and problem solving.

9. **Practical and professional skills:**
   These are skills that enable a student to convert acquired academic knowledge into practical applications such as: ability to diagnose diseases, write medical prescription, manage water resources, or accomplish an engineering design.

10. **Transferable skills:**
    These are general skills that involve several disciplines, such as communication skills, computer skills, IT skills, management skills, discussion and negotiation skills, self-marketing skills, time management skills, teamwork skills, presentation and delivery skills, and research skills.

11. **Health care professionals**
    These are individuals who provide diagnostic, preventive, curative, promotional or rehabilitative health care services in a systematic way to people, families or communities.

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