
Original Article

Curricular transformation of health professions education in Tanzania: The process at Muhimbili University of Health and Allied Sciences (2008–2011)

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Abstract Tanzania requires more health professionals equipped to tackle its serious health challenges. When it became an independent university in 2007, Muhimbili University of Health and Allied Sciences (MUHAS) decided to transform its educational offerings to ensure its students practice competently and contribute to improving population health. In 2008, in collaboration with the University of California San Francisco (UCSF), all MUHAS's schools (dentistry, medicine, nursing, pharmacy, and public health and social sciences) and institutes (traditional medicine and allied health sciences) began a university-wide process to



revise curricula. Adopting university-wide committee structures, procedures, and a common schedule, MUHAS faculty set out to: (i) identify specific competencies for students to achieve by graduation (in eight domains, six that are inter-professional, hence consistent across schools); (ii) engage stakeholders to understand adequacies and inadequacies of current curricula; and (iii) restructure and revise curricula introducing competencies. The Tanzania Commission for Universities accredited the curricula in September 2011, and faculty started implementation with first-year students in October 2011. We learned that curricular revision of this magnitude requires: a compelling directive for change, designated leadership, resource mobilization inclusion of all stakeholders, clear guiding principles, an iterative plan linking flexible timetables to phases for curriculum development, engagement in skills training for the cultivation of future leaders, and extensive communication.

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Introduction

Tanzania's high disease burden results in part from limited availability of professional health care and public health programs guided by well-educated leaders.^{1,2} Doctors, nurses, and other health professionals frequently work in settings for which they are not prepared by their education, and without sufficient supervision.^{3,4} Immediately upon qualification, public health and clinical graduates take up assignments in district hospitals with heavy responsibilities. Although governmental and non-governmental organizations (NGOs) provide considerable in-service training, it is crucial for academic institutions to graduate young professionals with foundational competencies for life-long professional development.

On obtaining its charter in 2007, faculty and leadership at Muhimbili University of Health and Allied Sciences (MUHAS) decided to revise curricula across all educational programs.⁵ In November 2008, the Bill & Melinda Gates Foundation awarded MUHAS, in partnership with the University of California San Francisco (UCSF) in the United States (US), a grant for the Academic Learning Project (ALP). One key objective of the ALP was to facilitate the proposed curricular revision at MUHAS.⁶ The timing of the award coincided with a directive from the Tanzanian Commission for Universities (TCU), the government's regulatory arm

for higher education, for all universities in Tanzania to base their curricula on the development of competencies in their graduates. Although competency-based education was a novel construct to most MUHAS faculty, by October 2011 faculty had together revised all curricula and were delivering competency-based courses to first-year students across all health professions programs.

We describe the change process at MUHAS, including the challenges, strategies, and lessons learned. We anticipate this article will interest other academic institutions and governments attempting to close the gap between educational outcomes and effective practice. A recent Lancet Commission report proposes reforming health professions education to strengthen health systems worldwide.⁷ The MUHAS experience provides an important case study of educational and logistical issues involved in shaping curricula relevant to meeting health challenges in under-resourced settings. Defining outcome goals for graduates and curricula to reach them is a defining feature of a transition to competency-based education. Other papers in this special issue introduce complementary strategies for teaching and student assessment,⁸ and for leadership to foster continuing educational innovation and scholarship about it.⁹

Background and Significance

The development of the MUHAS schools of dentistry, medicine, nursing, pharmacy, and public health and social sciences, along with its institutes of traditional medicine and allied health sciences, is detailed elsewhere in this special issue.⁵ MUHAS now offers a total of 78 programs. These include 10 diploma (vocational for auxiliary personnel rather than professionals), 13 undergraduate (Bachelor's), and 55 postgraduate programs (Master's and PhD).¹⁰

Table 1 summarizes the MUHAS professional degrees.¹⁰ Health faculty last revised these programs in 2003, when the schools were still part of the University of Dar es Salaam (UDSM). At this time, the UDSM reorganized the academic year from a four-term quarter system to a two-term semester system. Apart from this restructuring and some enhancing and streamlining of content, the programs retained the knowledge-based teaching approach (emphasizing acquisition of content versus how students are able to apply knowledge) developed by the school of medicine in the early 1970s and adopted later by the other professional programs as they were established.

**Table 1:** Structure of MUHAS professional programs^a

<i>Program</i>	<i>Duration and student intake capacity</i>	<i>Summary of program content</i>
Dentistry (DDS)	Five years followed by an internship year; annual intake capacity of 35	Two and a half years of preclinical coursework in the basic and social sciences. During clinical training, students have rotations in oral surgery, operative dentistry, periodontics, pediatric dentistry, orthodontics and prosthodontics, and field work through community dentistry
Environmental Health Sciences (BScEHS)	Three years followed by a 6-month internship; annual intake capacity of 40	One and a half years of basic science courses and 1.5 years of basic and advanced environmental and occupational health courses, and field and practical training.
Medicine (MD)	Five years followed by an internship year; annual intake capacity of 200	Three years of basic and social science courses, followed by 2 years of clinical clerkship during which students rotate through internal medicine, pediatrics and child health, general surgery and surgical specialties, obstetrics and gynecology, psychiatry and mental health, and community medicine
Medical Laboratory Sciences (BMLS) (five programs)	Three years followed by an internship; annual intake capacity of 25	One and a half years of basic and general laboratory sciences common to all five programs. The remaining 1.5 years is devoted to laboratory studies specific to a given program
Nursing (BScN)	Four years followed by an internship year; annual intake capacity of 90	Two years of basic and social science courses followed by 2 years of clinical and research training
Pharmacy (BPharm)	Four years followed by an internship year; annual intake capacity of 50	Integrated study of basic sciences, social sciences, and professional courses. The final 2 years are devoted to professional studies, research training, community pharmacy and clinical/hospital training, and industrial pharmacy attachments

^aThese program characteristics did not change during curricular revision.

Most students entering the professional degree programs are graduates of national advanced-level (A-level) secondary school education programs with strong science backgrounds. Up to 10 per cent of each incoming class enters from diploma-level programs with extensive

clinical and practical experience but not necessarily an adequate science foundation. The average age of students entering from A-level programs is around 21 years; about 30 per cent are female. Increasingly, university entrants have grown up in urban areas, unlike many of their predecessors who, like 70 per cent of Tanzanians, lived in rural villages.

Depending on the program, these students graduate after 3, 4, or 5 years and join a small pool of Tanzanian health professionals who lead efforts to address national health priorities through clinical care and community public health programs. The majority of these graduates begin work in underserved rural settings where severe health issues are common. The graduates endure having few professional colleagues, little supervision, and poor access to information (including the Internet). Some remain in rural districts despite the challenges, and others return to university for postgraduate education. Some leave their profession or relocate their practice to another country because the challenges they face in practicing their profession in Tanzania seem insurmountable.¹¹

Until MUHAS began to quadruple its student intake in the mid-1990s, the traditional knowledge-based teaching model worked well for small student cohorts. Professors mentored students individually or in small groups, and demonstrated first-class care at the national hospital. Students had role models to follow and graduated with pride in their professions. However, by 2010, a similar number of faculty who had taught cohorts of fewer than 100 students in 1997 were teaching the same basic science curriculum to a group of more than 300 dental, medical, nursing, and pharmacy students. No longer was the traditional knowledge-based teaching model meeting the needs of students; it had become difficult for faculty to use the same teaching strategies with the growing numbers of students.

Envisioning New Curricula to Address Health Needs of Tanzanians

In March 2009, the vice chancellor hosted a workshop for all MUHAS directors, deans, and department heads. He challenged faculty to envision and develop new curricula to equip MUHAS graduates to address the significant health needs of the country. Education experts from MUHAS, the TCU, UDSM, and UCSF laid out the steps (described in Box 1) they believed would be necessary to transform knowledge-based



Box 1: Principles underlying the development of the new curricula at MUHAS (2008–2011)

- Curricula are crafted to ensure that graduates are equipped to provide the best quality and most appropriate health care to the people of Tanzania.
- Curricular review and revision are coordinated across schools, and every opportunity is sought for synergies and efficiencies in teaching and assessment of students across professions.
- Curricular review and revision involve an inclusive process engaging as many stakeholders as possible, inside and outside MUHAS.
- Curricula are competency-based with measurable milestones for achievement of learning outcomes by students.
- Curricula are efficient in reducing content overlaps and redundancies, making best use of faculty and student time.
- Traditional methods of teaching and assessment are complemented by innovative and appropriate methods as resources allow.
- MUHAS provides faculty with developmental and technical support throughout the curricular review, revision process, and implementation.

curricula into competency-based curricula. Throughout the process of review and revision, MUHAS operated by these principles.

The Approach to Introducing the Competency-Based Curricula

In 2009, MUHAS developed university-wide committee structures, procedures, and a common schedule, which allowed faculty across all schools and institutes to work together. These committees oversaw the identification of competencies, steered a national survey to trace and interview graduates, developed university-wide guidelines for curricular revision, and provided technical support to faculty throughout the process. A joint MUHAS–UCSF ALP team facilitated the curricular revision, drawing on expertise across each institution’s respective schools. UCSF educational experts worked closely with MUHAS colleagues and committees in specific schools and university-wide.

The MUHAS–UCSF team based its approach on the structure and guidelines UCSF had previously described for leading change in an academic institution.¹² These included lessons and recommendations framed primarily in relation to Kotter’s change management model¹³ and refined secondarily by the work of Bolman and Deal,¹⁴ Kanter,¹⁵ and Kouzes and Posner.¹⁶

Table 2 summarizes the steps for developing the new competency-based curricula that we describe below. They are logically ordered here, but the activities often overlapped and were not necessarily sequential.

Step 1: Identify competencies for students to acquire by graduation

MUHAS interpreted ‘competency’ as an integrated application of knowledge, skills, attitudes, values, experiences, and tools to solve a problem or to perform an activity.¹⁷ The MUHAS–UCSF ALP team reviewed published competency frameworks, mostly developed for medical and nursing education in the US, the United Kingdom, and Australia.^{18–23} The ALP team shared these frameworks with MUHAS deans at the first campus-wide meeting to organize the MUHAS response to the TCU’s directive for competency-based education. In March and April 2009, school deans met with their faculty to determine how existing program objectives could be translated into competencies. For example, the DDS program had already grouped its objectives as knowledge, skills, and attitudes, although the drafters had not formulated objectives to lead to performance, learning outcomes, or competencies.

The deans and faculty decided to tailor the published competency frameworks into domains that fit the Tanzanian context, agreeing in April 2009 on the eight MUHAS competency domains described in the Appendix and in Tables 3 and 4. These domains have similarities to the six adopted by the Accreditation Council for Graduate Medical Education^{24,25} and the seven described by the Institute for International Medical Education.²⁶ MUHAS created a domain for relationship with colleagues to encourage respectful teamwork, and another for relationships with patients and communities, to emphasize how the graduates should recognize and relate to their differing needs. MUHAS introduced a specific domain for teaching skills.

Importantly, MUHAS adopted the eight competency domains across all its programs with identical competencies for six of these domains. The ALP team drafted a set of competencies for the six common domains (Table 3), which each school reviewed and jointly finalized. Schools defined their discipline-specific competencies for the two other domains (professional knowledge and practical/clinical skills) (Table 4). MUHAS faculty confirmed domains and competencies by July 2009. The Appendix provides the full list of competencies in each domain.

Table 2: Schedule of activities for curricular revision at MUHAS December 2008–October 2011

<i>Dates</i>	<i>Activities</i>	<i>Responsibility</i>
<i>Preparation</i>		
December 2008–June 2009	Definition of institutional and school visions and establishment of committees, roles, and responsibilities	Academic Learning Project (ALP), university
March 2009	Call by MUHAS vice chancellor to start curricular revision	University
<i>Development of competencies</i>		
January 2009–June 2009	Cross-school agreement of the required competencies	ALP, university, schools, faculty
<i>Analysis of the old curricula</i>		
March 2009–July 2009	Internal review of course content resulting in reports on gaps, overlaps, and redundancies	Departments, faculty, students
July 2009–September 2009	Consultation with external stakeholders about adequacies of the current programs (tracer study)	ALP, university, schools, faculty, students, stakeholders
<i>Development of the new curricula</i>		
September 2009–March 2010	Development of the university's curricular revision guidelines	ALP, university
March 2009–present	Preparation of faculty to revise and implement the curriculum	ALP, faculty from MUHAS, UDSM, and UCSF
March 2010–June 2010	Drafting of individual course content	Departments, faculty
March 2010–June 2010	Drafting of program curricula	Schools, faculty
August 2010–October 2010	Sharing of the revised program curricula with stakeholders and incorporation of their comments	Schools, faculty, external specialists and stakeholders, students
October 2010–May 2011	Completion, compilation, and quality checking of revised curricula across the university	University, faculty
May 2011–August 2011	Processing for MUHAS senate approval	Schools, Senate
September 2011	Approval by the TCU	University, Tanzanian Commission for Universities
<i>Delivery of the new curricula for all incoming students started in October 2011</i>		



Table 3: Examples of competencies within MUHAS's six competency domains that are common to all its health professional programs

<i>Competency domain</i>	<i>Examples of importance to people's health</i>
<p>Relationships with patients, clients, and communities: Be able to establish constructive relationships and communicate effectively with people from diverse socioeconomic and cultural backgrounds; able to communicate health information to the public</p>	<ul style="list-style-type: none"> ● Explain to an elderly man from a rural area what happened when he had a stroke, what is expected for recovery, and how to prevent a subsequent stroke ● Explain the importance of hand and face washing to the residents of a village with a high incidence of trachoma, and understand what barriers may have impeded these preventive measures
<p>Relationships with colleagues: Communicate with other health providers and work effectively as members of a health-care team Communicate with health agencies</p>	<ul style="list-style-type: none"> ● Coordinate needed nursing and pharmacy care for a pediatric HIV patient ● Work with other health providers to determine what medications and route of administration are appropriate for a stroke patient who is unable to eat
<p>Teaching skills: Be able to teach to health professions students and communities</p>	<ul style="list-style-type: none"> ● Teach an intern visiting your clinic by providing effective feedback and instruction ● Teach a session on prevention of cardiovascular disease at a community health fair by applying principles of adult learning
<p>Maintaining good practice: Identify strengths and limits of one's own practice; take appropriate actions to address them, regularly seeking and critically evaluating new information. Use systematic evidence to improve health-care delivery</p>	<ul style="list-style-type: none"> ● Monitor incidence of hospital-based infection, assess the data to determine the likely cause, and develop an intervention ● Keep up-to-date on new advances in the treatment of HIV ● Recognize when to seek assistance from a colleague
<p>Working within the system and context of health care: Understand how the national health-care system functions, deliver health care by coordinating between agencies, and consider cost-effectiveness and cost burdens to patients</p>	<ul style="list-style-type: none"> ● Understand how a rural patient with advanced cancer may have moved through local, district, and national hospital systems ● Consider that a woman may not be able to present for delivery due to transportation costs
<p>Professionalism: Maintain ethical standards and patient confidentiality</p>	<ul style="list-style-type: none"> ● Show responsiveness and respect to patient needs above self-interest ● Be accountable to patients, society, and the profession

Step 2: Analyze the old curricula

MUHAS engaged as many internal and external stakeholders in curricular review as possible in order to better understand the adequacies and inadequacies of current curricula.



Table 4: Examples for each health professional program within MUHAS's competency domains of professional knowledge and clinical/technical skills

<i>Profession</i>	<i>Professional knowledge</i>	<i>Practical/clinical skills</i>
Dentistry (DDS)	Employ knowledge of oral microorganisms	Perform surgery to remove a tumor from the oral cavity of an elderly patient to avoid progression of cancer
Environmental Health Sciences (BScEHS)	Employ knowledge of the transmission of cholera through fecal contamination of water sources to plan a safe sanitation system in an emergency camp for displaced people	Perform an environmental impact assessment for a factory opening to determine the potential health impacts on the surrounding community
Medicine (MD)	Employ knowledge of pathophysiology of non-communicable diseases prevalent in Tanzania to diagnose and manage patients with, for example, diabetes, heart diseases, and cancer	Develop and prioritize correct and appropriate plans for patient management
Medical Laboratory Sciences (BMLS)	Employ knowledge on morphology and characteristics of microorganisms to enable proper diagnosis of an infection	Perform various laboratory tests and interpret results for proper diagnosis of a given disease condition
Nursing (BScN)	Diagnose high blood pressure and explain to a patient the potential risks and lifestyle factors that they can modify to reduce their risk	Develop a management plan for a patient infected with HIV, TB, and with nutritional deficiencies
Pharmacy (BPharm)	Employ knowledge of drug interactions, drug incompatibility, side effects, toxicity profiles, and antimicrobial susceptibility patterns for the appropriate treatment regimen selection	Formulate, compound, and dispense medications as prescribed

In March 2009, MUHAS directed all course leaders to work with faculty and students, reviewing their courses in terms of content, instructional approach, and means of assessment, in order to suggest improvements. Because MUHAS competency domains had already been drafted, the request for review included consideration of the extent to which existing courses matched these domains. During July and August of 2009, teams of faculty and students undertook a tracer or alumni study locating and interviewing 237 recent MUHAS graduates and 87 supervisors, working in Dar es Salaam and in distant regions. The survey sought graduates' perceptions of how well their MUHAS

Table 5: Involvement of stakeholders in reviewing and revising the curriculum

<i>Stakeholders</i>	<i>Stakeholders' observations</i>
Students	Students gave feedback about their educational needs through focus groups and informally to faculty. Students wanted more clinical and practical training, opportunities for active learning, training to use computers, and educational technology. Students felt that their course loads were overwhelming, particularly in the preclinical years
Faculty	Faculty gave input through focus groups, surveys, and during meetings and workshops. Faculty wanted to be able to use instructional strategies to increase active learning, use more technology in their teaching, develop and communicate expected student outcomes, teach and assess professionalism, and work interprofessionally
Recent graduates	Recent graduates gave opinions during the national tracer study about how well prepared they felt when they entered the workplace. These graduates felt they needed more clinical and practical training and wanted better relationships with faculty
Employers, supervisors, coworkers, and clients of recent graduates	Supervisors and coworkers of recent MUHAS graduates, also surveyed during the tracer study, felt that graduates needed more clinical skills training and a stronger ability to apply their theoretical knowledge to real-world problems
Professional bodies	Professional bodies assisted in revising curricula. They were enthusiastic about developing the competency-based curriculum and provided expertise. The Tanganyika Medical Association identified professionalism as a major area for MUHAS to address in its curricula
Ministry of Education and Vocational Training (MOEVT)	MOEVT mandated that all universities adopt competency-based curricula and provided guidelines for how the new curricula at MUHAS should be structured. The Tanzanian Commission for Universities approved the new curricula
Educational advisors	UDSM faculty advisors introduced faculty to the requirements of curriculum revision, UCSF provided educational advisors as part of the ALP

training prepared them for their first employment, and the extent to which the knowledge-based curricula had equipped them with the new MUHAS competencies. The survey also sought supervisors' perceptions about the relevance of the proposed new competencies and the recent MUHAS graduates' competence in these areas. Table 5 summarizes the results of these consultations.

Step 3: Revise and restructure courses to introduce competencies

The university curriculum committee published university-wide guidelines for curricular revision detailing how to: package the contents of a



course into distinct modules that can be taught and examined within a given time frame; fit courses into teaching hours available in a semester while allowing for program's requirements for clinical rotations; assign credits to courses based on the number of hours allocated to varied instructional activities (classroom, clinical, and fieldwork among them); define competencies and learning objectives and align teaching strategies and assessment to those competencies; and introduce appropriate instructional design. Each school organized a retreat to discuss the principles and requirements for revising courses as outlined in the guidelines.

To introduce faculty to competency-based education and to prepare them to implement revised curricula, UCSF ALP team members worked with MUHAS faculty to develop a 3-day training. Delivered subsequently by MUHAS faculty in workshop format, it covered competency-based education, curricular revision, and teaching skills and strategies.⁸ Seventy faculty members from across all MUHAS schools and institutes participated in four such training courses during the fall of 2009. UCSF then provided intensive training for an interprofessional group of promising young teachers identified by MUHAS. In March 2010, this group formed the MUHAS Health Professions Educators Group (HPEG). The HPEG began, in October 2010, to offer faculty development workshops to further support colleagues introducing competency-based approaches and innovations in their teaching and assessment.⁹

Faculty responsible for courses worked independently to revise them. In a second series of school retreats in June 2010, faculty, students, representatives from professional bodies, and other stakeholders reviewed revised courses to consolidate them into the new program curricula. Participants resolved issues, simplifying required formats for course descriptions, reducing redundancies between courses, determining the length of semesters, examining the sequencing of courses in each curriculum, and requiring programs to identify key milestones; that is, the set of competencies students must achieve before being allowed to move to the next year or step in a program of study.

MUHAS hosted three university-wide retreats between October 2010 and January 2011. Key faculty from each school finalized crosscutting curriculum issues: examination regulations, program milestones, and a plan for evaluating the new curricula once implemented. The final retreat focused on refining and organizing courses in each program into

final form for TCU approval; faculty reviewed each course to ensure all faculty had matched all objectives to specific competencies, and had aligned contents, instruction, and assessments accordingly. In September 2011, the TCU accredited all undergraduate curricula. In October 2011, faculty opened the new academic year teaching new curricula to all new entrants – the pioneers.

Outcome of Curricular Revision

Table 6 summarizes the major changes to program content and structure. All schools reduced overlapping material to increase teaching efficiency and to free time for students to study (encouraging preparation and collaboration in pursuit of research or clinical projects). Course directors added new materials to update curricula in response to changing health priorities in Tanzania, for example, increasing attention to non-communicable diseases. New courses in information technology, ethics, communication, and professionalism now form part of preclinical training in all disciplines. All schools enhanced clinical training. The school of medicine increased its clinical clerkship (rotations) from 2 to 3 years and created junior and senior clerkships. The school of pharmacy increased the time allotted to clinical pharmacy and extended clinical training on the wards, as explained elsewhere in this issue.²⁷ The school of nursing recruited and trained a new cohort of clinical preceptors to help supervise its students in clinical practice.

Box 2 describes salient features of the new curricula. Each course now includes learning outcomes addressing at least three competency domains. These outcomes are specific, measurable, and linked to specific instructional and assessment strategies outlined for that course. Most courses are divided into modules, each with its own learning outcomes, unit load or credits, instructional design, and student assessment strategies. Many course leaders have adopted new instructional strategies to promote the development of competence. Examples include: a low-tech surgical skills laboratory to help students learn and practice basic skills; live interviews with patients that introduce clinical aspects to preclinical courses including biochemistry and physiology; an interdisciplinary journal club; and more interaction in large classes based on team-based learning. Student assessment will focus more on students' ability to apply and not simply recall information, thus demonstrating skills through objective clinical examinations and problem-solving. Faculty

Table 6: Educational changes made to MUHAS programs during curricular revision by competency domain

<i>Competency domains</i>	<i>Educational strategies</i>	<i>DDS</i>	<i>BScEHS</i>	<i>MD</i>	<i>BMLS</i>	<i>BScN</i>	<i>BPharm</i>
Relationships with patients, clients, and communities	Introduce a communication course in the first year	X	X	X	X	X	X
	Assess communication during clinical teaching	X	—	X	—	—	—
Relationships with colleagues	Introduce a communications course in the first year	X	—	X	X	—	X
	Increase group work and give feedback on communication and teamwork during student group work	X	X	X	X	X	X
Teaching skills	Introduce a teaching course for postgraduate students	X	X	X	X	X	X
Maintaining good practice	Introduction of an information technology course to first-year students	X	X	X	X	X	X
Working within the system and context of health care	Introduce or improve courses, for example, in community health, health management, and forensic medicine in field attachments, visits and projects, and practical/clinical rotations	X	X	X	X	X	X
Professionalism	Introduce a course on professionalism and ethics for all students	X	X	X	X	X	X
	Assess professionalism during teaching	X	X	X	—	X	X
Professional knowledge	Use information and communications technology to optimize learning	X	X	X	X	X	X
	Re-sequence courses	X	X	X	—	X	X
	Increase active learning	X	X	X	—	X	X
	Increase problem-solving	—	—	X	—	—	X
Practical/clinical skills	Increase length of time devoted to clinical teaching	X	—	X	X	X	X
	Increase exposure to clinical teaching, practical learning, and ward rounds	—	X	X	—	X	X
	Improve teaching methods in practical activities	X	X	X	—	X	X
	Improve clinical teaching by introducing clinical correlates	X	—	X	—	X	X
	Improve clinical exams	X	—	X	—	X	X
	Introduce clinical logbooks	—	—	—	—	X	—



Box 2: Salient features of the MUHAS curricula adopted in October 2011

- Student progression is determined by achievement of competence in all domains, and this is captured at the course level by competency assessment forms and at the program level by program milestones.
- The curricula provide flexibility, allowing time for students to engage in experiences that address special skills or interests, including research.
- There is a systematic approach to progressive development of clinical and practical skills, clinical reasoning, and the practice of culturally competent patient, family, and community-centered care by the health professions students from the beginning of their training through graduation.
- Students learn about various systems, models, and settings of health care through experiences including care of patients in different settings, for example in rural communities.
- The curricula employ multiple teaching methods and assessment strategies, thus encouraging faculty and students to be partners in active, experiential learning.
- The learning environment throughout the curricula is characterized by professionalism, honesty, integrity, collegiality, respectful interactions, inquisitiveness, and humility.
- Effectiveness and outcomes of the programs are monitored systematically, with timely feedback to key stakeholders (including faculty and students) to ensure ongoing quality improvement.
- Faculty development, resources to assist in developing and implementing the programs, and faculty recognition are aligned with program goals.

will also assess students on their demonstrated communication skills and professionalism in clinical care – the first time that these competencies are explicitly part of student assessment at MUHAS.

Lessons Learned

We undertook this ambitious institutional change over a 3-year period. During that short time, we moved from introducing faculty and students to competency-based education, through curricular revision, to approval and implementation of new curricula for all undergraduate programs in all MUHAS schools. The path to approval and implementation of the new curricula was not without challenges for faculty and administration. Our reflections on the process reveal several key, interlocking pieces that should be in place when implementing such fundamental change.

- *A compelling directive for change:* Because Tanzanian public universities review their curricula periodically, MUHAS faculty anticipated revisions to their programs and courses. In addition, the



accrediting body directed universities to introduce competencies into their curricula, and tracer study data indicated ineffectual preparation of health professionals. At the same time, the government and private donors worked to increase the quantity and quality of health professionals throughout the country. With absolute numbers of health workers on the decline,²⁸ collaboration to increase enrollments across Tanzania created a compelling environment for innovation at MUHAS.

- *Designated leadership*: The MUHAS deputy vice chancellor for academic affairs was responsible for the entire curricular change process and he organized a university-wide steering committee.
- *Mobilized resources*: MUHAS designated a project office and the Directorate of Continuing Education and Professional Development to facilitate the process. Bill & Melinda Gates Foundation project funding covered costs of the tracer study, retreats, faculty development activities, some curricular leadership time, full-time project staff to coordinate the process, and technical advice from UCSF. Although the funding did not reimburse MUHAS faculty for the time they spent revising courses and programs, the availability of funds was important for other aspects of the process and made the revision possible.
- *Inclusion of all stakeholders*: MUHAS consulted faculty, students, graduates, and employers, as well as relevant administrative and governmental units and educational experts nationally and internationally. Although curricular revision incorporated the collective suggestions, to remain relevant to the needs of the students and to the health needs of the people it will be essential to maintain such dialogue.
- *Clear guiding principles for change*: The university curriculum committee formulated and circulated curricular revision guidelines before actual revision began. As faculty and administration were learning as they prepared the guidelines, revisions were needed during the process – which led to frustration. Going forward, edited guidelines will be available to assist other universities embarking on a similar process.
- *An iterative plan linking flexible timetables to phases for development*: It was difficult for most faculty and project staff to anticipate the time it would take for each phase. Despite the initial goal of introducing the curriculum within 2 years from the start of the revision process, the work was so intense for faculty that the schedule had to be extended a year.

- *Engagement in skills training for the successful development of new leadership:* The iterative and inclusive process of skill-building facilitated more extensive buy-in to educational innovations and curricular reform. The work of debating and developing new curricula, although difficult, added value and relevance to population health and resulted in engaging faculty constructively. It also permitted the identification and subsequent formation of new academic leadership. Collaborations across schools and programs leveraged areas of strength, created efficiencies, and ultimately enriched the sense of a community of educators.
- *Communication, communication, communication:* Team members establishing and prioritizing individual relationships among themselves was key to sustaining a successful process. Notable challenges they experienced included: high-intensity work undertaken by multiple teams across schools, institutions, and continents; inadequacies in the virtual networking infrastructure; cultural differences between professional programs; competing professional demands on team members' availability; and unpredictability of external factors such as academic calendars and funding cycles for students. Frequent, direct, in-person communications were often the most successful means of overcoming these obstacles, and thus we believe of crucial importance to such a process.

Conclusion

The education of MUHAS's graduating health professionals influences the quality of interventions to protect populations from threats to health as well as to provide clinical care. With this in mind, the MUHAS vice chancellor provided the leadership to create and implement curricular revision. Having introduced a competency framework, MUHAS will assess student achievement accordingly throughout their education and upon graduation; and will further build its graduates' competence through postgraduate education and continuing education. As the first university to offer competency-based education in Tanzania, MUHAS faced substantial challenges, including lack of local reference frameworks and expertise. However, opportunities also emerged, and the change process most notably: enriched and renewed the learning environment; revised and streamlined curricula in each school; spawned



a community of educators including new leaders such as members of the HPEG; and enhanced collaborations across the health professions.

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Appendix

MUHAS common competencies

Upon graduation, all our graduates, in each of their specific fields of endeavor, will be able to demonstrate the following competencies:

Relationships with patients, clients, and communities

- Establish constructive relationships and communicate effectively with patients, clients, and/or communities in order to address needs and preferences.
- Provide service appropriate to the varying backgrounds of different individuals and groups.
- Communicate health concerns and policies effectively to the public.

Relationships with colleagues

- Receive and incorporate advice from colleagues.
- Motivate colleagues.
- Contribute effectively to team goals.
- Work effectively with other health professionals.

Teaching skills

- Prepare and deliver effective health promotion messages to communities.
- Teach a course for health professionals or students.

Maintaining good practice

- Systematically evaluate one's own performance and practice.
- Regularly seek information necessary to improve professional practice (lifelong learning).
- Apply evidence-based decision making.
- Participate in applied research activities.
- Use information technology to optimize learning.
- Show leadership and managerial skills.

Working within the system and context of health care

- Show knowledge of how the health-care system functions (structures, policies, regulations, standards, and guidelines).

- Work effectively in various health-care delivery settings and systems (hospitals, government, ministries, NGOs, communities, and industry).
- Coordinate and implement health service delivery and health interventions within the health-care system.
- Incorporate considerations of cost-effectiveness into health service delivery.
- Incorporate considerations of patient cost burden into health service delivery.
- Promote quality care in health systems through audits, accreditations, and/or evaluations.
- Identify system challenges and implement potential solutions.

Professionalism

- Maintain ethical standards (confidentiality, informed consent, and avoiding practice errors and conflicts of interest).
- Apply entrepreneurial skills for advancement of practice and the profession.
- Show sensitivity and responsiveness to diversity (culture, age, socioeconomic status, gender, religion, disability etc).
- Show respect, compassion, and integrity while interacting with patients, clients, communities, and health professionals.
- Advocate and implement fair distribution of health-care resources in Tanzania.

MUHAS professional competencies

Upon graduation all our graduates in *dentistry*, in addition to achieving the MUHAS common competencies, will be able to:

Professional knowledge

- Employ knowledge of the structure and functions of the human body in the management of oral-facial diseases.
- Employ knowledge of the causes and mechanisms of diseases to manage congenital and acquired conditions of the oral-facial region.
- Employ knowledge of physical, psychological, and sociocultural factors in the causation and progression of diseases in order to plan an approach to prevent and manage common oral health challenges.
- Employ knowledge of clinical reasoning to solve oral-facial clinical problems.
- Employ knowledge of pathophysiology of communicable diseases prevalent in Tanzania in order to diagnose and manage patients with, for example, HIV, AIDS, and oral-facial infections.
- Employ knowledge of pathophysiology of non-communicable diseases prevalent in Tanzania in order to diagnose and manage patients with oral-facial problems.
- Employ knowledge of conditions and emergencies common to Tanzania that require oral surgery in order to manage patients with oral-facial trauma and other hard- and soft-tissue conditions.



- Employ knowledge of common childhood oral-facial conditions in Tanzania in order to appropriately manage childhood oral-facial diseases.

Practical/clinical skills

- Gather complete and focused histories in an organized manner appropriate to the clinical situation and patient or relative's ability to understand.
- Conduct complete oral-facial and relevant physical examination in a systematic manner.
- Document the findings in an organized and comprehensive manner.
- Formulate and prioritize correct and appropriate plans for patient management.
- Use and maintain dental instruments and equipment.
- Perform common oral-facial procedures in a manner that minimizes patients' pain associated with procedures.
- Follow universal precautions and sterile technique.
- Anticipate patients' needs, provide appropriate patient care, participate in discharge planning, and create individualized disease management and/or prevention plans including patient self-management and behavior change.
- Demonstrate confidence and comfort with the primary provider role and the provision of longitudinal care.

Upon graduation, all our graduates in *environmental health sciences*, in addition to achieving the MUHAS common competencies, will be able to:

Professional knowledge

- Employ knowledge of environmental and occupational health to promote public health and prevent diseases and ill conditions.
- Employ knowledge of the causes and pathophysiology of animal-food-related illness to manage epizoonotic diseases.
- Employ knowledge of physical, psychological, and sociocultural factors in the causation and progression of diseases in order to plan an approach to prevent and manage common health challenges.
- Employ knowledge of environmental health reasoning to solve public problems.
- Employ knowledge of pathophysiology of communicable diseases prevalent in Tanzania to manage community health programs for the prevention and treatment of, for example, HIV and AIDS, malaria, TB, cholera, and water- and sanitation-related diseases.
- Employ knowledge of pathophysiology of non-communicable diseases prevalent in Tanzania in order to manage public health programs for the prevention and treatment of, for example, diabetes, heart diseases, and cancer.
- Employ knowledge of common food hygiene and safety for port-of-entry and other food stores for the safety of the population.
- Employ knowledge of research and epidemiological methods so as to be able to conduct research on public health issues.

- Employ knowledge on urban settlement patterns to solve problems of people in the slums and growing towns so as to safeguard the public health.

Practical/clinical skills

- Gather complete and focused histories in an organized manner appropriate to particular workplace situations, for example, for the safeguarding of public safety.
- Conduct complete and relevant physical examination and inspection of environmental stressors in a systematic manner.
- Document findings in an organized and comprehensive manner.
- Formulate and prioritize correct and appropriate plans for public health management.
- Perform common environmental impact assessment procedures and create proper environmental impact statements.
- Follow universal precautions and aseptic conditions during food- and water-quality management.
- Anticipate a community's needs, provide appropriate public care, participate in hazards mapping for the prevention of diseases and adverse conditions among the population.
- Demonstrate confidence and comfort with the prevention of health and safety dangers for workers at different workplaces for sustainable public health.

Upon graduation, all our graduates in *medical laboratory sciences*, in addition to achieving the MUHAS common competencies, will be able to:

Professional knowledge

- Apply the principles and clinical significances of advanced tests.
- Improve the laboratory-working environment by applying knowledge and skills acquired during the training.
- Improve the quality of laboratory services rendered to the society.
- Apply established safety laboratory rules.
- Assess factors that affect procedures and results and take appropriate action within predetermined limits.
- Correlate laboratory findings with clinical conditions.
- Apply problem-solving strategies to administrative, technical, and research duties at various levels.
- Design laboratory-based and community-oriented research in collaboration with others.

Practical/clinical skills

- Perform routine clinical laboratory tests.
- Interpret laboratory results of the tests.
- Manage laboratory equipment and instruments.



- Adhere to good laboratory practice.
- Demonstrate leadership and management ability.
- Implement laboratory quality management system.

Upon graduation, all our graduates in *medicine*, in addition to achieving the MUHAS common competencies, will be able to:

Professional knowledge

- Employ knowledge of the structure and functions of the human body in the management of diseases.
- Employ knowledge of the causes and pathophysiology of diseases to manage diseases.
- Employ knowledge of physical, psychological, and sociocultural factors in the causation and progression of diseases in order to plan an approach to prevent and manage common health challenges.
- Employ knowledge of clinical reasoning to solve clinical problems.
- Employ knowledge of pathophysiology of communicable diseases prevalent in Tanzania in order to diagnose and manage patients with, for example, HIV and AIDS, malaria, TB, and cholera.
- Employ knowledge of pathophysiology of non-communicable diseases prevalent in Tanzania in order to diagnose and manage patients with, for example, diabetes, heart diseases, or cancer.
- Employ knowledge of common surgical conditions prevalent in Tanzania for management of patients with, for example, tropical ulcer, hernia, or hydrocele.
- Employ knowledge of common obstetrics and gynecology conditions in Tanzania for management of patients with, for example, prolonged labor, abruptio placenta, or postpartum hemorrhage.

Practical/clinical skills

- Gather complete and focused histories in an organized manner, appropriate to the clinical situation and patient or relative's ability to understand.
- Conduct complete and relevant physical examination in a systematic manner.
- Document findings in an organized and comprehensive manner.
- Formulate and prioritize correct and appropriate plans for patient management.
- Perform common procedures and employ practices to minimize patients' pain associated with procedures.
- Follow universal precautions and sterile technique.
- Anticipate patients' needs, provide appropriate patient care, participate in discharge planning, and create individualized disease management and/or prevention plans including patient self-management and behavior change.
- Show confidence and comfort with the primary provider role and the provision of longitudinal care.

Upon graduation, all our graduates in *nursing*, in addition to achieving the MUHAS common competencies, will be able to:

Professional knowledge

- Employ knowledge of the structure and functions of the human body, nursing principles, and the scientific concepts necessary to provide competent nursing care.
- Employ knowledge of the causes and mechanisms of disease, as well as the application of evidence-based knowledge, in order to provide nursing care.
- Employ knowledge of physical, psychological, and sociocultural factors in the causation and progression of diseases to plan an approach in order to prevent and manage common health challenges.
- Employ knowledge of clinical practice, critical reasoning, and reflection in order to solve nursing problems in Tanzania.
- Employ knowledge of mechanisms of communicable diseases prevalent in Tanzania and provide appropriate nursing care.
- Employ knowledge of mechanisms of non-communicable diseases prevalent in Tanzania to provide relevant nursing care.
- Employ knowledge of appropriate nursing care for conditions common to Tanzania requiring surgery.
- Employ knowledge of obstetrics and gynecology conditions prevalent in Tanzania in order to provide care of patients with, for example, prolonged labor, abruptio placenta, postpartum hemorrhage, and eclampsia.

Practical/clinical skills

- Gather complete and focused patient information in an organized manner appropriate to the clinical situation and patient or relative's ability to understand.
- Conduct complete and relevant nursing assessment in a systematic manner.
- Document nursing findings in an organized and comprehensive manner.
- Formulate and prioritize correct and appropriate plans for patients' nursing care.
- Perform common procedures and act to minimize patients' pain associated with procedures.
- Employ universal precautions in infection-control procedures during the provision of care.
- Anticipate patients' needs, provide appropriate patient care, participate in discharge planning, and create individualized nursing and/or prevention plans including patient self-management and behavior change.
- Show confidence and comfort with the primary provider role and the provision of longitudinal nursing care.

Upon graduation, all our graduates in *pharmacy*, in addition to achieving the MUHAS common competencies, will be able to:

Professional knowledge

- Employ knowledge of the structure and functions of the human body in pharmacotherapy.
- Employ knowledge of chemical composition, structure, and properties of therapeutic substances in the treatment of diseases.



- Employ knowledge of drug interactions, drug incompatibility, side effects, toxicity profiles, and antimicrobial susceptibility patterns in the appropriate selection of treatment regimens.
- Employ knowledge of clinical reasoning to solve clinical problems.
- Employ knowledge of mechanisms of communicable diseases prevalent in Tanzania in order to advise on treatment, control, and prevention.
- Employ knowledge of mechanisms of non-communicable diseases prevalent in Tanzania in order to advise on treatment, control, and prevention.
- Employ knowledge of drug and food interactions and drug incompatibility to counsel patients on adverse drug reactions and food-drug interactions.

Practical/clinical skills

- Formulate, compound, and dispense medications as prescribed.
- Review prescriptions to assure accuracy, to evaluate their suitability, and to ascertain the needed ingredients.
- Maintain records, such as pharmacy files, patient profiles, charge system files, inventories, control records for radioactive nuclei, and registries of poisons, narcotics, and controlled drugs.
- Assess the identity, strength, and purity of medications.
- Monitor and evaluate quality assurance system and implement WHO/GMP in drug industry.
- Follow universal precautions and sterile technique.
- Competently handle procurement, drug distribution and storage.
- Plan, manage, and evaluate retail and wholesale pharmacies and small- and large-scale pharmaceuticals production.