

Revising a 60-Year-Old Medical and Dental Curriculum in a Medical School in Sub-Saharan Africa

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Abstract

Background: Regular review and revision of curricula ensure that teaching and assessment of students are contemporary. The College of Medicine, University of Ibadan (CMUI) is Nigeria's oldest medical school. It was established in 1948 and has had several medical curricular reviews. However, the philosophy and methods of teaching and assessment were largely unchanged. In 2001, the institution initiated a revision of its medical and dental curricula which was completed in 2010.

Objectives: To describe the experience with the revision of the CMUI Bachelor of Medicine and Bachelor of Surgery (MBBS) and the Bachelor of Dental Surgery (BDS) curricula and to identify challenges encountered during the process and the methods used to overcome them.

Materials and Methods: Relevant data from the project records, administered questionnaires, interviews and focus group discussions with the stakeholders, were collated and analyzed.

Results: The CMUI MBBS/BDS Curriculum was revised to produce an integrated, system-based, person-centred, community-oriented and competency-driven method of instructions. This home-grown instrument is directed at the local health needs and manpower requirements now and in the future as identified by the stakeholders, is in keeping with the vision and mission statements of the CMUI and meets current standards in medical education. This was achieved by building bridges between all stakeholders to overcome inevitable challenges.

Conclusion: Revision of medical curricula in resource-poor countries of sub-Saharan Africa is challenging but can be accomplished by involving all stakeholders to produce home-grown instruments that also meet contemporary global standards in medical education.

Keywords: Sub-Sahara Africa, Curriculum revision, Competency-based medical education (CBME), Teaching and assessment, Integrated learning

Abstrait

Contexte: L'examen et la révision réguliers des programmes d'études garantissent que l'enseignement et l'évaluation des étudiants sont contemporains. Le Collège de médecine de l'Université d'Ibadan (CMUI) est la plus ancienne école de médecine du Nigéria. Il a été créé en 1948 et a fait l'objet de plusieurs révisions de programmes médicaux. Cependant, la philosophie et les méthodes d'enseignement et d'évaluation sont restées largement inchangées. En 2001, l'institution a initié une révision de ses curricula médicaux et dentaires qui s'est achevée en 2010.

Objectifs: Décrire l'expérience de la révision des cursus CMUI Bachelor of Medicine et Bachelor of Surgery (MBBS) et Bachelor of Dental Surgery (BDS) et identifier les défis rencontrés au cours du processus et les méthodes utilisées pour les surmonter.

Matériels et méthodes: Les données pertinentes provenant des dossiers du projet, des questionnaires administrés, des entretiens et des discussions de groupe avec les parties prenantes ont été rassemblées et analysées.

Résultats: Le programme CMUI MBBS/BDS a été révisé pour produire une méthode d'instruction intégrée, basée sur le système, centrée sur la personne, axée sur la communauté et axée sur les compétences. Cet instrument local est axé sur les besoins locaux en matière de santé et de main-d'œuvre, actuels et futurs, tels qu'identifiés par les parties prenantes, est conforme à la vision et aux énoncés de mission du CMUI et répond aux normes actuelles en matière d'enseignement médical. Ceci a été réalisé en construisant des ponts entre toutes les parties prenantes pour surmonter les défis inévitables.

Conclusion: La révision des programmes d'études médicales dans les pays pauvres en ressources de l'Afrique subsaharienne est difficile, mais peut être accomplie en impliquant toutes les parties prenantes pour produire des instruments locaux qui répondent également aux normes mondiales contemporaines en matière d'éducation médicale.

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Introduction

Curriculum revision has been described as ‘a total reconstruction of a curriculum’ and refers to the process of completely overhauling an existing curriculum to make it conform to modern realities, national needs and global expectations [1]. Regular review and revision of medical curricula ensures that teaching and assessment of medical students are contemporary, as about half of all medical knowledge is said to become obsolete every 5 years [2]. It has been reported that well-executed efforts to improve quality of learning through curriculum review and revision raises the students’ perceptions of their overall wellbeing [3].

Most Sub-Saharan African (SSA) countries review their medical curricula infrequently due to financial constraints and other peculiarities of the sub-region [4]. The College of Medicine, University of Ibadan (CMUI), established in 1948, is Nigeria’s oldest medical school and its curricula, similar to those of other SSA universities, were modeled after those in its colonizing country, the United Kingdom [5,6]. The CMUI had reviewed its medical curriculum several times but the philosophy of methods of teaching and assessment were largely unchanged as these reviews were content-based while the subject-centred structure of the curriculum was preserved.

Given the long interval since the last review, the CMUI initiated a revision of its instruments of medical/dental institution, by its College Curriculum Committee in 2001. The aim of the project was to produce an instrument for medical and dental instruction that met current and future national health needs and global standards. The Institution also took advantage of Institutional Strengthening Grant obtained from the John T. and Catherine D. MacArthur Foundation. by the University of Ibadan in 2004. Part of these funds were used to complete the College’s wholesome revision of its MBBS and BDS Curricula as a pilot for the university-wide curriculum revision/review. The project was completed in 2010 and the revised curriculum approved and adapted. This article describes the experience during the revision process, identifying challenges encountered and the methods used to overcome them.

Materials, Methods and Results:

The revision of the CMUI MBBS/BDS Curriculum was a 10-year project that was done through a series of overlapping processes which can be divided broadly into six (6) parts as described below:

Preparatory Processes

Part I – Capacity building in medical education (2001-2004)

The first step in the curriculum revision process was the need to build up human resource capacity in medical education in the College. The College Executive therefore encouraged members of staff to undertake formal training in this field. Under this initiative, seven CMUI faculty who acquired medical education skills locally and internationally through the IFME®, FAIMER® and National Open University of Nigeria programs played key roles in the revision process.

Part 2- Needs assessment (2001 – 2006)

In an overlap with the first part, the College Executive also initiated processes to raise awareness for the need for curriculum revision amongst all stakeholders. To this end, a ‘needs assessment’ of the CMUI host community was undertaken through questionnaires, interviews and discourses among the relevant stakeholders (teaching and non-teaching staff, medical students, private health sector employers, patient representatives, secondary school teachers, State’s Education Board members as well as members of the general public). Subsequently, a sensitization workshop titled ‘*Which Doctors Do We Want?*’ was held at which changes in the societal health needs as well as desired changes in medical education were identified and discussed by these stakeholders. In addition, lectures were given on curriculum development and reform which enlightened members of the CMUI community on new trends in medical education [7].

These events revealed that the knowledge and skills being acquired by CMUI’s medical and dental graduates were not guided by, or directed at the health needs of their host community or the demands of their prospective employers. Particular deficiencies were noted in communication, practical laboratory, entrepreneurial and self-directed learning competences. As such, the stakeholders concluded that there was a mismatch between the type of medical graduates being produced by CMUI and the ideal doctors desired for the country. Hence, a revision of the medical curriculum was considered necessary.

Reforming the MBBS and BDS Curricula

The curriculum reform was done in two steps. The first was a critical review process of the ‘old’ curriculum. The second part utilised the information from this guide the development of the ‘revised’ curriculum. This latter process necessitated the restructuring of the methods of instructions and assessment schedules as well as the addition of new

courses to ensure acquisition of the newly identified desired competences.

Part 3 – Curriculum Review (2005 – 2007):

The curriculum review was done at all academic levels in the university using its well-established committee system.

First, the Central College Curriculum Committee and the Curriculum Sub-Committees of the four faculties in the College undertook an initial review of the ‘old’ curriculum. Subsequently, an MBBS/BDS Curriculum Review Committee (CRC) was formed to direct further review of the old curriculum. The membership of the CRC ensured representation of all four faculties in the CMUI i.e. Faculties of Basic Medical Sciences, Clinical Sciences, Public Health and Dentistry. Undergraduate sub-deans of the four faculties, representatives of the major departments and student representatives were all members of the CRC.

The ‘Terms of Reference’ of the CRC were:

- i. Identification of strengths and weaknesses of the old curriculum,
- ii. Identification of the mode of instruction best suited to address the short-comings of the old curriculum and development of a template for a revised curriculum.
- iii. To achieve these objectives, the CRC undertook the activities below. The 200 Level to 400 Level curriculum of the Bachelor of Dental Surgery (BDS) curriculum was included in these activities ensuring a concurrent review of the undergraduate dental (BDS) curriculum. This is because at these levels of study, the curricular activities are similar for the MBBS and BDS undergraduate students.

- a. **Review of relevant medical education documents** including the Pre-2010 CMUI MBBS /BDS Curricula [8], FAIMER [9], and National Open University web-based Education Resources [10], WFME Basic Minimum Global Standards [11], Benchmark Academic Standards of the Nigerian National Universities Commission (NUC) [12], Guidelines on Minimum Standards of Medical and Dental Education in Nigeria by the Medical and Dental Council of Nigeria [13], and Tomorrow’s Doctors by the General Medical Council of the United Kingdom (UK) [14]. In addition MBBS/BDS Curricula universities in the United Kingdom (Cambridge [15] and London [16] and the United States of America (Michigan [17], Michigan State University [18] which have contributed to old CMUI MBBS / BDS curricula were also reviewed.

- b. **Administration of questionnaires** to medical students in all classes of study from 200Level to 600Level (Pre-Clinical and Clinical). The questionnaires evaluated the following: i) the student learning mode ii) student study process iii) students’ clerkship/postings and iv) assessment methods in the old curriculum. Part of these results of these evaluation processes have been published [19].
- c. **Identification of current and future medical education and national health/medical practice needs**, through the following instruments: Administration of pre-tested questionnaires on the topic to 758 students representing 68% of the student population sampled; Evaluation of two cycles of the selection interviews for admission into the medical and dental schools. Lastly focus group discussions with samples of other stakeholders namely Executives of the College, the Faculties and the Teaching Hospital, representatives of Teaching and Non-Teaching staff, other students, the alumni, private and public employers (doctors and dentists), and members of the public and patient groups. There were a total of five stakeholder discourses and sessions which gave the various stakeholders the opportunity to evaluate specific aspects of the CMUI curriculum in small groups and proffer suggestions for improvement.

This wholesome review process acknowledged the strengths and identified weaknesses of the old MBBS and BDS curriculum. The identified deficiencies are itemized in Table 1.

Philosophy of the Revised Curriculum

A series of brainstorming sessions by the CRC level on the information gathered during this phase led to a consensus that an integrated, system-based, person-centred, community-oriented and competency-driven method of instruction would best leverage on the strengths and attend to the short-comings of the existing curriculum to produce doctors that will meet the present and future healthcare needs in Nigeria. Consequently, a draft template for an integrated, system-based, community-oriented and competency-driven curriculum was developed and sent to faculties, departments, students and selected CMUI alumni worldwide for their input. The revised version of the Draft Template which incorporated the feedback from the various stakeholders was presented to the College Curriculum Committee (CCC) and was finally approved for development into a full curriculum by the CMUI Academic Board on November 30, 2007.

Table 1: Deficiencies of the Old MBBS and BDS Curricula

1. Abstract teaching of core basic medical science subjects and lack of early clinical orientation of students.
2. Disjointed methods of teaching and assessment.
3. Inadequate community outreach and the understanding of the national health manpower needs by the students.
4. Poor funding of the teaching hospital and College of Medicine with increasing inability to meet the requirements of medical instruction.
5. Inadequate practical or clinical skills resulting in limited preparation of students for practice in the 'real world'.
6. Poor remediation and lack of exit points for chronically repeating students.
7. Lack of opportunity for suitable students to undertake combined/intercalated (research) degrees.
8. Poor self-directed learning skills on the part of the students.

Part 4 – Curriculum Revision (2007-2010):

Following approval of the draft template, the CRC was expanded into the Expanded Curriculum Review Committee (ECRC) with inclusion of departmental and sub-specialty representatives involved in the MBBS and BDS programs of the CMUI.

The Draft Curricular Template was utilised by ECRC to develop templates for revision of departmental curricula into integrated, system-based,

person-centred, community-oriented and competency-driven instruments with problem-based learning (PBL) components. Using these templates, fully revised departmental curricula were produced by all departmental curriculum sub-committees. The ECRC then collated all departmental submissions to produce the complete and fully revised CMUI MBBS curriculum [20,21].

Graphical Representation of the 2010 CMUI MBBS Curriculum.

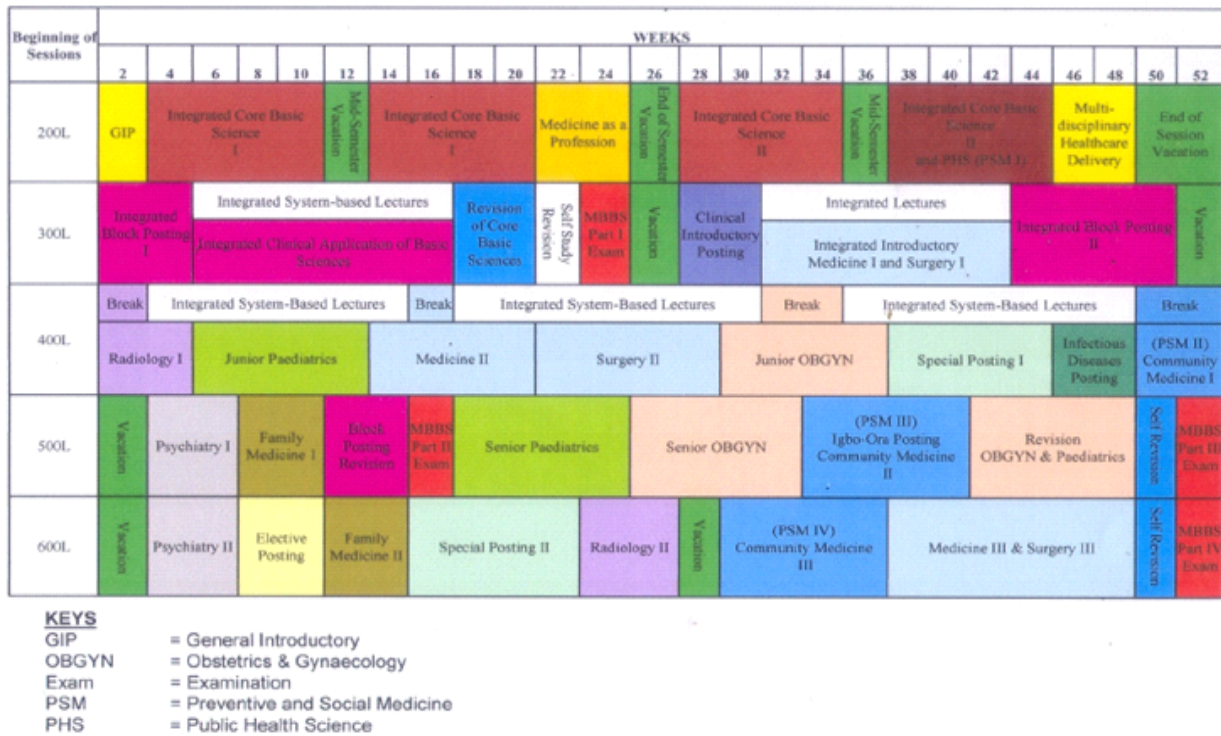


Figure 1: The 200L and 300L (1st semester) are preclinical students, who need to pass the MBBS Part I exam before advancing to the clinical years. The 300L (2nd semester), 400L, 500L and 600L students are clinical students.

The Revised MBBS/BDS Curriculum (Figure 1)

In keeping with the vision and mission of the University of Ibadan and its College of Medicine, the 2010 CMUI Revised MBBS/BDS curriculum meets current global standards in medical education, and is socially responsive to the present and future health needs and manpower requirements of its host community. The novel features of this revised curriculum include: i) arrangement of postings into block formats that can be awarded aggregate credit units to make transfers to Bachelor of Science (B.Sc) courses easier, ii) introduction of relevant new

courses, iii) early introduction of students to clinical training, iv) emphasis on small group teaching and student research projects to encourage self-directed learning and encourage critical/analytical thinking. The modifications made to achieve these features are summarized below.

1. Content modifications

The modification of contents in the new curriculum was achieved through the introduction of new courses and increasing emphasis, and reorganizing the others.

Table 2 New Postings in the CMUI 2010 Review MBBS/BDS Curriculum

No	Title	Description	Level
i.	The General Introductory Posting (GIP)	This posting introduces the student to the vision and mission of the University and to the ethics and etiquette of the profession.	200
ii.	The Applied Medical Sciences (AMS)	This posting aims to stimulate the students' interest in all branches of medical science.	200
iii.	Medicine as a Profession (MAP)	The history and humanities aspects of medicine including, the Sociology of Medicine, Communication Skills, Literature and Medicine, as well as Medical jurisprudence.	200
iv.	Multidisciplinary Healthcare Delivery (MHC)	Joint sessions with Nursing, Physiotherapy, Human nutrition, Environmental Health Science, Medical Laboratory Science and Pharmacy students. The goal of this course is to inculcate the Philosophy of multidisciplinary approach to health care delivery, by giving an early orientation to working collaboratively as a team.	200
v.	Critical Care Medicine	During this posting, students are taught theoretical and practical aspects of basic life support/first aid; and introduction management of mass casualty.	200
vi.	Family Medicine (FAM) and Elderly Care Medicine -ECM (Geriatrics & Gerontology)	These postings are recognise the family unit as an important factor in health and disease states and the increasingly ageing population in many countries including Nigeria	200
vii.	The Human Nutrition for Medicine (HNM)	To teach the significance of nutrition in the pathogenesis and treatment of many diseases.	200
viii.	The Complementary and Alternative Medicine (CAM)	This posting is in cognizance of the prevalent usage of medicine supplements and herbal preparations in our society.	200
ix.	Clinical Application of Basic Medical Sciences Posting	This ensures early exposure of this students to clinical and laboratory medicine scenarios to give them a better understanding of the relevance of the basic medical sciences to subsequent clinical science learning. Didactic lectures, tutorial and practical sessions during these postings will be delivered by clinicians and laboratory medicine specialists along with the core basic scientists in the Pre-Clinical School.	300
x.	Infectious Diseases Posting (IDP)	To meet the increasing prevalence of communicable diseases globally.	400-600

- A. Newly introduced courses/postings:** The newly introduced courses are listed in Table 2
- B. Postings/Disciplines with Increased Emphasis:** The duration of the following postings was increased Radio-diagnosis and Therapy, Psychiatry, Human Nutrition, Specialty Surgery, Health Economics and Health Administration/Management, Preventive and Social Medicine and Reproductive and Sexual Health (RSH).
- C. Reorganized Postings:** Most of the postings were reorganized due to the introduction of integrated learning at various levels. This change was to synchronize learning of contents and reduce repetitive teaching of subjects by the departments.
- 2. Modifications to Teaching, and Assessment**
Teaching activities including didactic lectures, practical sessions and tutorials; as well as assessment of the students were also integrated at the affected levels. Horizontal integration was done at either the preclinical or clinical school while vertical integration involved an interplay of disciplines in both schools.
- A. Horizontal/Integration/Concurrent Teaching:** This was achieved at the pre-clinical level (200 Level and 300 Level 1st semesters) with the integration of the three core basic medical science subjects namely Anatomy, Biochemistry and Physiology. Also, at the junior (300Level 2nd semester) clinical level, the postings in Medicine and Surgery were integrated using a system-based approach. The two block postings of the Basic Medical Sciences which include pathology, pharmacology and the laboratory medicine specialties were also integrated at the 300L and 500Levels.
- B. Vertical/Integration/Sequential Teaching:** This was achieved with the newly introduced *Clinical Application of Basic Medical Sciences Posting* at the 300 Level 1st semester described in Table 2.
- C. Combined Integration:** Some postings achieved both horizontal and vertical integration. These include the *Integrated System-based Core Lectures* through the entire 400 Level period where core basic medical scientists and clinicians deliver a series of system-based lectures. This will ensure a holistic understanding of disease entities rather than the disjointed learning identified as a major deficiency of the old curriculum. The newly introduced *Infectious Diseases Posting* will also be taught across disciplines by Basic Medical Scientists (laboratory scientists) and clinicians.
- D. Student Assessment:** In keeping with the philosophy of the new curriculum, assessment of students will also be competency-based and integrated in all examinations. This implies demonstration of possession of the desired competencies. Formative and summative assessments will be done and all the newly introduced courses shall be included in the examinations. Theoretical assessment methods include Essays (short and long essay types) and multiple-choice questions (MCQs), while practical/clinical examinations include long case, short case, objective structured clinical examination (OSCE), objective structured practical examination (OSPE), portfolio and viva voce.
- 3. Modification to Learning**
- A. Competency-based Learning:** To achieve a competency-based curriculum, the new curriculum focuses on the competencies/skills that the students need to acquire. This was achieved by modifying the teaching and assessment methods. Each department identified well-defined and specific learning objectives which will direct teaching, learning and assessment of subjects/courses. These included measurable knowledge, skills and attitudes the students were expected to have acquired at the end of training. The new curriculum also allots 60% of teacher-student contact time to practical or clinical sessions while 40% is allocated for didactic lectures. The integration of subjects described above was able to reduce the time needed for didactic lectures which are basically teacher-centered. More small-group tutorial sessions are included to ensure deeper learning, better mentoring and improved formative assessment of students. The use of Problem-based learning, especially during small group sessions, was also emphasized.
- B. Prioritization of learning:** Prioritization of desired competencies was also undertaken to further guide the teachers and students on what competencies to concentrate on during teaching and assessment, and thus learning. Subject contents were allotted 50%, 30% and 10% of the instruction time for 'must-know', 'should-know' and 'may-know' topics respectively. Assessment of these

subject contents is also to be based on this prioritization.

- C. Self –directed Learning:** To address the noted deficiency of poor self-directed learning in the students, the new curriculum incorporated twelve term papers/projects in different disciplines and e-learning platforms at all levels of training. These learning methods will also expose the students early to the culture of research.

4. Other modifications

Other novel modifications in the revised MBBS/BDS curricula are:

- A. Community Orientation:** As a community-oriented curriculum, provisions have been made for increased students' contact with the community through visits to accredited community health centers as early as from the 200 Level. All clinical departments were mandated to include community-oriented components in their departmental curriculum.
- B. Allotment of Credits Units:** Unlike in the old curriculum, each course has been allotted credits units based on the existing NUC criteria. Hence, it will be easier for medical and dental students to exit at stipulated exit points for a variety of reasons which may include a change to a Bachelor of Science course or temporary exit to undertake an intercalated degree program (see below). However, unlike other undergraduate courses, all the courses offered in the MBBS/BDS programs are compulsory.
- C. Intercalation:** In line modern trends in medical education, this revised curriculum allows students to take a break from the MBBS/BDS course at the 500 Level and undertake Masters or Doctorate degree program utilizing the course credits acquired at the 200 – 400 Levels. Upon completion of the postgraduate degree, he/she then returns to complete the MBBS course.
- D. Remediation:** In these revised curricula, students are allowed a maximum of three (3) attempts only at each part of the MBBS/BDS Final Examinations. This is because the vertical integration of courses precludes continuous repetition of classes undertaken at the different levels of instruction.

Part 5 – Institutional Approval of the Revised Curriculum

After synchronization of submissions from all departments to ensure a uniform layout in the

document, the final 2010 CMUI MBBS Curriculum was then presented to and approved by the CMUI Academic Board on March 22, 2010 for medical instruction. The approval was ratified by the University Senate on August 30, 2010 and whence it became the legally accepted MBBS/BDS curriculum of the University of Ibadan

Part 6 – Implementation of 2010 CMUI MBBS Curriculum

The implementation commenced with the first set of students admitted for the 2011-2012 academic session. To facilitate implementation of the approved curriculum, the following steps were taken: The Curriculum Implementation Sub-Committee was formed to execute and monitor the implementation process; all departments produced a list of requirements which will be required to ensure successful implementation and faculty development programs were organized to re-orientate and educate the teaching staff on pedagogical skills essential for effective implementation of the newly revised curriculum. Despite the continuous awareness regarding the new curriculum at many fora, challenges were faced in the process of implementation right from onset. These challenges were at all levels i.e. institution staff and students.

At the institutional level, funding the implementation was a major challenge. Funds were required for training staff, providing new infrastructure or modifying old ones to suit new requirements, providing the numerous teaching aids (including a well-developed clinical skills laboratory) essential for successful implementation of a competency-based curriculum and establishing a Medical Education Unit.

The staff, both teaching and non-teaching also had the challenge of participating in pedagogical sessions on various aspects of the curriculum alongside running activities of the old curriculum. They also had to change their orientation regarding prioritization of knowledge. The specialist teachers are especially affected as some teachers expect students to know the entire subject being taught. Many teachers also complained about increased time commitment since more teacher-student contact time is required in a CBME curriculum.

The first sets of students faced the challenge of 'wading through uncharted waters' as their seniors were unable to guide them as the latter were being concurrently trained with the old curriculum. The senior-junior mentorship through the medical school is a well-known component of the 'hidden curriculum' in most schools. Hence, the pioneer students felt vulnerable and were sometimes anxious about the outcome of the implementation. However, succeeding

sets of students appear more comfortable with the new curriculum as they now have the guidance of seniors who have passed through the initial years of implementation. This information was garnered from a study of a cohort of preclinical and clinical students using the Dundee Ready Educational Environment Survey (DREEM) instrument, a validated questionnaire that measures the quality of educational environments.

Discussion

The goal of medical education is to produce medical graduates who have the knowledge and understanding of health and diseases, and who have acquired basic clinical skills and attitudes required for high standards of medical practice [14]. The current healthcare challenges facing Sub-Saharan Africa (SSA) are particularly severe and demand that the continent's medical/dental schools produce graduates that are able to respond to the peculiar needs of their community [22]. This is especially important as SSA has only 1.7% of the world's physicians despite having 24% of the world's total burden of disease [4]. In addition, the brain drain syndrome continues to attract a significant proportion of the physicians in SSA to the developed world [23], whilst those left behind work in an environment with severely limited resources.

The philosophy of medical education is constantly modified to address the changing needs of the society to be served as well as methods being utilized in teaching, assessment and patient management should ideally be regularly reviewed in order to remain relevant for the health needs of a country [7,24]. However, majority of MBBS curricula in SSA medical schools are largely inherited from colonial parent schools and are thus largely unsuitable for the culture of their countries [6,7]. Furthermore, most are out-dated as the societies they serve have healthcare needs which are constantly changing due in part to the changing demography of populations, migration and the consequences of economic inequalities [25]. Unfortunately, curriculum reviews are infrequently done due to the numerous challenges of the sub-continent especially financial.

There is a global shift to produce physicians with easily identifiable and measurable competences who are fit-for-practice through the use of multi-modal instructions in medical schools. Consequently, preferred curricula are outcome/competency-based and focus on education models that respond to workforce needs and meet societal expectations [26]. Competency-based medical education (CBME) is an outcome-based training model that concentrates on equipping the graduate with knowledge, skills and attitudes that are relevant to the host community [27].

This educational model is adjudged to be most-suited for rapidly changing health needs of individual communities and is increasingly being adopted worldwide [23]. CBME curricula are increasingly popular with SSA medical schools revising their curricula as these are considered best able to produce competent graduates with the skills required for contemporary medical and dental practice on the continent [28].

Competency-based medical education (CBME) makes it easy for all the medical sub-specialties and disciplines to direct teaching and assessment towards achieving a common goal of acquiring specific competencies [6,26,27]. In line with this philosophy, methods of instruction and assessment in this new curriculum are directed at clearly identified desired knowledge, attitudes and skills required for the medical/dental graduate to be responsive to the needs of the community. These desired competences are derived based on the identified health needs of the host community and determination of these competencies ensures that each curriculum is unique to its institution/community. In the 2010 CMUI revised curriculum, these competencies have further been prioritized to 'must know', 'should know' and 'may know' to guide the students and focus learning on the health needs of the community. In addition, teacher-student contact time has been increased to at least 60% in order to ensure acquisition of practical skills. It is hoped that other innovations such as tele-health/tele-medicine and distance learning may solve some of the problems of staff shortages in SSA.

One of the shortcomings of the old curriculum was the students' perception of abstract learning of the basic medical science subjects due to delayed exposure to clinical clerkship [7]. Modern trends in medical education encourage introduction of the biomedical science component of the medical/dental curricula to the students within the clinical context of patients' problems [17,22]. Hence, in this revised curriculum, integration of pre-clinical and clinical curricula was achieved through vertical and horizontal integration, with more emphasis placed on the clinical relevance of basic science subjects. Vertical integration at the 3rd year of study was introduced to expose students early to clinical aspects of medicine thereby improving their knowledge of applied basic medical sciences (figure 1). Previous studies have also shown that when learning, contents are presented in context to the learner, knowledge is better valued, retained and consolidated [30]. Horizontal integration was achieved at both pre-clinical and clinical levels. The basic medical science subjects are now taught in coordinated system-based modules. Similarly, at the junior and senior clinical levels, integrated clinical

postings are further consolidated through the introduction of integrated system-based core lecture series, while students still undertake specialty clerkship rotations in groups. These innovations aim to avoid repetition of overlapping contents and time wastage, so that more time can be spent acquiring relevant competencies and clinical skills. This model has also been affirmed by educational bodies like the General Medical Council (GMC), UK, who strongly recommended the integration of the basic sciences and clinical training within a core system based medical curriculum instead of the traditional practice of teaching these subjects as separate entities [14].

Many medical schools in SSA have developed impressive curricular innovations designed to meet their local and regional health care needs while following global trends in medical education [29-33]. In this regard public health and family medicine are also being increasingly emphasized in undergraduate medical curriculum, in view of the persistent high prevalence of communicable diseases in SSA. This trend is reflected in the revised 2010 CMUI curriculum with the inclusion of new postings such as Infectious Diseases, Family Medicine and Complimentary / Alternative Medicine.

It is well known that sustainable higher education reforms can only be achieved by involving all stakeholders as failure to carry them along may result in negative public reactions and student protests [29,31,33]. This desirable inclusive process may however prolong the curriculum reform as noted in our institution where the curriculum review/revision spanned a period of 10 years. However, this challenge is not limited to developing countries only as the 2012 curricular revision of the University of Kentucky, College of Medicine also spanned six years [34].

Faculty development and re-orientation sessions are important components of a curriculum review) as the teachers are major carriers of the vision and implementers of the mission of an institution [35]. These sessions should be done concomitantly with the curricula reform process to ensure that these staff are familiar with the changes being proposed. It also encourages their buy-in into the revision process and will significantly reduce their opposition to the 'revised curriculum' upon its completion and roll-out. In addition, these training sessions will minimize the challenges associated with implementation of the revised curriculum especially the new skills required for teaching and assessing CBME curricula. It is equally important to carry the non-teaching staff along, and to arrange training sessions for them as well as they also play important roles in all the teaching and assessment processes. Involvement of students at all stages of curricular reform is mandatory because they are best able to

give an insight into the challenges of the new learning process being adopted.

Similar to other institutions globally [36], CMUI had to overcome significant constraints when implementing this innovative curriculum. In CMUI, some of the constraints to the curriculum revision process were insufficient funds, lack of cooperation on the part of some members of staff, insufficient staff for the project, non-availability of needed equipment such as desk top computers, printer and office space as well as low remuneration of project staff. These factors may also have contributed to the long duration of the review/revision process. However, the challenges associated with the curriculum review and revision processes were overcome by combining judicious use of internal and external resources with the understanding of prevailing local and international milieu, and by building bridges between all stakeholders. In addition, running two different curricular concurrently posed some challenges to the students, faculty and management. These were overcome by continuous re-training and reorientation sessions of staff, and mentoring and counselling sessions of students the outcomes of which were fed back to the College Executive for action as was necessary.

Just like the review and revision processes were carefully planned, there is a need for careful implementation, monitoring and evaluation of the impact of the revised curricula [36]. Quality assurance principles must also be developed to maintain quality in the delivery of this curriculum. The Curriculum Implementation Committee subsequently transformed into the College of Medicine Education Unit (CMEU) to ensure successful implementation of the revised curriculum.

Subsequent to the completion of the MBBS/BDS curriculum revision, the undergraduate dental, nursing and physiotherapy curricula have all been successfully revised. The 2010 CMUI revised curriculum has also served as template for the newly developed Nigeria Medical Undergraduate Curriculum adopted by the country's Ministries of Education and Health, the National Universities Commission (NUC) the Medical and Dental Council of Nigeria (MDCN) and other national and international institutions involved in the training of health professionals [37].

Conclusion

The College of Medicine, University of Ibadan revised its medical and dental curricula in line with the dictates of contemporary and mandatory high quality health care needs for local consumption and global applications. The resultant CMUI document meets current global standards in medical education, and

focuses on local health and manpower needs for now and in the future. It is also in keeping with the vision and mission of the University, its Medical School and Teaching hospital. Also, by involving all stakeholders in the revision process, we have produced a truly home-grown instrument that is widely accepted and thus should be easier to implement. The first set of students to be trained using the instrument was admitted into the preclinical year of the 2011/2012 academic session and graduated in 2017/2018 session. The curriculum continues to attract national and international interest and it served as the pilot for a university-wide and college-wide curricular revisions. The authors hope other medical schools in SSA will learn from the CMUI experience and build on it.

1. Footnote ^a: Anyanwu JC, Olopade FE, Mullan P, Kolars JC and Olapade-Olaopa EO. *Perception of students on the learning environment during early stages of curriculum reform at the College of Medicine, University of Ibadan. (AJMMS Accepted for publication)*

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