Curriculum Development Strategy

Supported By
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2 INTRODUCTION

Recent advances in high-throughput sequencing and genotyping technologies are driving the boundaries of medicine and healthcare into the “genomic medicine” era. Genomic medicine is defined as "an emerging medical discipline that involves using genomic information about an individual as part of their clinical care (e.g., for diagnostic or therapeutic decision-making) and the health outcomes and policy implications of that clinical use.” (NHGRI). To facilitate a rapid and informed adoption of the Genomics Medicine into routine clinical care, healthcare professionals’ training and education will need to be transformed radically. Lack of or inadequate training could delay the translation of the emerging information into quality healthcare. While there is a growing number of initiatives developing and implementing Genomic Medicine curricula there are numerous shortcomings in the current trends, which include:

- Developing curricula for healthcare professions and researchers in isolation such as nurses or undergraduate degrees and disregarding the collaborative nature of the healthcare.
- Lack of tractable evaluation processes to assess i) the rate of the adoption of the curriculum and ii) the impact of the curriculum on students’ knowledge, attitudes and skills.
- Lack of guidelines and standards for curricula development in Genomics in Africa
- Lack of curricula developed based on a framework

H3ABioNet (Pan African Bioinformatics Network - www.h3abionet.org) in collaboration with the University of Cape Town’s Division of Human Genetics, initiated the development of an African Genomic Medicine Curriculum for personnel involved in genetics/genomics research and healthcare workers. The initiative is African led and supported by the Southern African Human Genome Project and the University of Pretoria.
2 Kern’s 6-Step Approach to Curriculum Development

Figure 1: An illustration of Kern’s 6-step model approach in curriculum development. Not indicated in the diagram is the curriculum maintenance process.

Educational programs have aims and goals which in most instances are not clearly articulated. Using a model/framework to develop the curriculum helps clarify aims and objectives of the curriculum. This helps the Medical educators meet the needs of their students, patients and other key stakeholders. The Kern’s 6-step model advocates linking of curriculum to health care needs.

2.1 Step 1: Needs & Problem Identification

This step involves clarifying health care needs and problems to be addressed. The current and ideal approaches for addressing the problem are assessed to help focus the education intervention.

What are the problems and needs?

- Limited knowledge on how genetics and genomics contribute to disease in Africa.
- Limited learning opportunities which make use of existing actionable African-specific case studies and diagnostics in the clinics.
- Limited training in Africa which sufficiently address genetics, genomics and emerging technologies (see Report: Survey of Training in Genetics and Genomics in Africa).
- Limited knowledge in Genetic and Genomics of healthcare works involved in research
- Slow translation of discoveries into the Healthcare system
2.1.1 Who, what is affected and IMPACT of these needs and problems?

- Patients and families in genetics and genomics are likely to be misinformed about their health and receive poor care from unskilled healthcare professionals.
- Research participants involved in genetics and genomics are likely to be misinformed about the research studies, their impact from poorly skilled healthcare workforce.
- Healthcare workforce not confident in their skills and knowledge in genetic and genomics. The healthcare workers likely to benefit from the curriculum are highlighted below. The curriculum will aim to change knowledge, attitudes and skills of healthcare professionals.

**Figure 2:** The healthcare professionals likely to impact on Genomic Medicine.
2.1.2 Current Versus Ideal

The current situation is that most healthcare professionals in Africa are not trained in Genetics and Genomics. As illustrated in Figure 2, the ideal situation would be to have modules for undergraduate students, Masters programmes and professional development courses.

2.2 Step 2: Target Students & Needs

To identify target students and their needs the following activities were undertaken:

**Workshop in Dakar:** The target students and needs were assessed through several ways and key findings are reported below. The workshop attendees included researchers in the medical field especially in genetics and genomics and healthcare workers.

**Training in Genetics and Genomic across Africa:** A survey was conducted to assess Genetics and Genomics Training across Africa.

**Monthly Working Group Meetings:** Target students and their needs are continually discussed during monthly working group meetings.

**Table 3: Target students & Needs.**

<table>
<thead>
<tr>
<th>Area</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived deficiencies and needs</td>
<td>One report published from Cameroon highlighted the lack of knowledge and skills in nurses and doctors. In addition</td>
</tr>
<tr>
<td>Previous and already planned training</td>
<td>See the training survey report for details. There is a lack of expertise on the continent.</td>
</tr>
<tr>
<td>Learning styles, preferences regarding different learning strategies</td>
<td>All types of learning styles and strategies are likely to be acceptable including online and distance learning</td>
</tr>
<tr>
<td>Existing proficiencies, current performance</td>
<td>The g2g2 website was accessed which houses competency lists for nurses, pharmacists, physician assistant and genetic counselors</td>
</tr>
<tr>
<td>Barriers, enabling and reinforcing factors</td>
<td>H3ABioNet has resources and experience in training across Africa. - Working group members who are spread across Africa with expertise in training</td>
</tr>
<tr>
<td>Resources available</td>
<td>-H3ABioNet has resources.</td>
</tr>
</tbody>
</table>
2.3 **STEP 3: GOALS & OBJECTIVES**

The overall goals and objectives of the curriculum are clarified. These direct the content of the curriculum, evaluations and. The goals and objectives can be categorized by individual students, students in aggregate and the educational programme in general.

Individual students’ goals and objectives will be developed for each type of health professional separately using a competency mapping procedure we adapted from several sources. Thus far the individual students’ goals and objectives have only been completed for nurses (see the competency mapping process). Once all competency mapping for all healthcare providers have been completed we plan on suggesting a set of core competencies for Genomic Medicine for all healthcare professionals in Africa.

**Overall objectives of the curriculum include:**

- Establish a genomic medicine curricula for healthcare professionals and researchers which is comprehensive and adaptable based on community-suggested competencies and outcomes.
- Equipping educators of healthcare professionals in Africa with a ready to use curriculum that is tailored for the healthcare needs of the continent, is competency driven and adaptable to the specific students’ needs.
- Develop pilot and flagship professional development courses based on the curriculum
- Critical mass of healthcare workers to take up the flagship Genomic Medicine online training
- Finally, the chief national provider of health services (Ministry of Health and Child Care) will adopt the curriculum so that the schools and the population at large can be taught BLS
- Establish genomic medicine critical quality indicators for assessments of the competency levels of healthcare professionals and researchers
- Establish a monitoring system to capture the rate of adoption of the curriculum once developed
- Develop model/flagship modules/courses based on the developed curricula.

2.4 **STEP 4: EDUCATIONAL STRATEGIES**

Educational strategies include outlining content and educational strategies to be used based on the goals and objectives in Step 3.

**Methods:** A range of methods will be recommended for the implementation of the training.

- Case-based approach/Problem based approach
- Blended learning
- Online/Distance learning
- Flipped classrooms

**Content:** The group assessed modules from existing curriculum and identified topics which could be included in a similar curriculum for Africa. Topics include:

1: An Introduction to Human Genetics and Genomics
2: Omics Techniques and their Application to Genomic Medicine  
3: Genomics Rare Inherited Diseases  
4: Molecular Pathology of Cancer and Application in Cancer Diagnosis, Screening, and Treatment  
5: Pharmacogenomics and Pharmacogenetics  
6: Application of Genomics in Infectious Disease  
7: Bioinformatics, Interpretation, and Data Quality Assurance in Genome Analysis  
8: Laboratory Experience & Biobanking  
9: Ethical, Legal and Social Issues in Applied Genomics  
10: Genetics and Genomics Counselling  
11: Economic Models and Human Genomics  
12: Research Skills and Community Engagement for Genomics  
13: Nutrigenomics and genetics  
14: Microbiomes  
15: Public Health Genomics & Genetic Epidemiology  
16: Application of Genetics & Genomics to Non-communicable diseases  
17: Genomic Medicine in the Workplace (Project based)

2.5 Step 5: Implementation

H3ABioNet and the University of Cape Town Human Genetics Division is leading and responsible for the implementation under the guidance of the African Genomic Medicine Curriculum Committee. We have a small planning committee and external reviewers. Potential sources of funding are still being sought.

Figure 4: Suggested timeline for the development and implementation of the curriculum
### 2.6 Step 6: Proposed Evaluations

<table>
<thead>
<tr>
<th>Factors to be evaluated</th>
<th>Evaluation questions</th>
</tr>
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<tbody>
<tr>
<td>African Genomic Medicine Curriculum Committee (Content developers, Facilitators and Trainers)</td>
<td>Change in knowledge, attitudes, skills in curriculum development</td>
</tr>
<tr>
<td>Students</td>
<td>Change in Knowledge, Attitudes and Skills in Genomic Medicine Amongst Healthcare Professionals.</td>
</tr>
<tr>
<td>African Genomic Medicine Curriculum Committee &amp; Tertiary institutes</td>
<td>An inventory of Genetics &amp; Genomics Training and Curricula in Institutes of Higher Learning in Africa.</td>
</tr>
<tr>
<td>Healthcare Facilities &amp; Laboratories</td>
<td>An Inventory of Genetics &amp; Genomics resources and current practices in healthcare facilities &amp; laboratories</td>
</tr>
<tr>
<td>Genetic/Genomics Diagnostic tests</td>
<td>Utility of Existing Diagnostic Platforms and Tests to African populations</td>
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### 2.7 Ongoing Step: Curriculum Maintenance

Once complete, the curriculum will be continually reviewed and adjusted. In addition, adoption of the curriculum will also be monitored.