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Biomedical Research at Namibia's First School of Medicine and Pharmacy

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Abstract
Research is an integral part of the curricula of both the pharmacy and medical degree programs at the University of Namibia (UNAM) School of Medicine (SOM). Early in their career students identify research projects and pursue them within the context of their degree program. At a fundamental level these projects expose students to the scientific method and encourage the development of analytical and interpretative tools that will be important in their professional lives. The inclusion of research as a subject significantly aligns the institutions' research agenda with the health needs of the country. Research at UNAM SOM, within both the medicine and pharmacist degree programs, aims to nurture self-directed learning within an inter-professional milieu.

Introduction
The University of Namibia (UNAM) School of Medicine (SOM) was established in Windhoek in June 2009 using a classical curriculum that was influenced by those presented at contributing sister institutions in South Africa. Courses commenced on the 8th of February 2010 with five lecturers and the 59 students that had been admitted to the Bachelor of Medicine and Bachelor of Surgery program (M.B.Ch.B.). At that time the University of Namibia (UNAM) had allocated one classroom and practical considerations had the students remaining in class while the medical faculty rotated in throughout the day. This system would remain in place, with space increased to two classrooms, until a separate medical campus was inaugurated in April of 2011. In the initial two years, advanced program planning and efficient deployment of pedagogical infrastructure not only permitted the school to present its pre-clinical curriculum but also allowed for the school of medicine to expand. The second intake, in February of 2011, admitted 65 students into medicine with 25 more admitted into the new four year Bachelor of Pharmacy degree (B.Pharm.). The UNAM SOM is currently one of the youngest in Africa and forms part of the Consortium of New Southern African Medical Schools (CONSAMS).[1]

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Sub-Saharan Africa (SSA) medical schools are increasingly streamlining their medical education towards becoming more relevant, community oriented and nationally focused.[2,3] Results from a survey by Mullan et al. demonstrate these curricular trends within SSA.[2] Their findings indicate that three predominant educational methods are frequently implemented together, community-based education, problem-based learning (PBL) and multidisciplinary team-based learning (TBL). The authors also emphasize the importance of research as a focus within these medical schools.[2] The scope of health research within SSA as extrapolated from MEDLINE-indexed publications is limited predominately to HIV/AIDS, chronic and non-communicable diseases and malaria research.[4,5] Parasitic research due to the high incidence of associated diseases also ranked high in the topics of study.[6] Changing social conditions and fast paced urbanisation has begun to shift research in South Africa to address the increased rates of cancer, cardiovascular disease and other non-communicable diseases.[5,6]

Medical education at the UNAM SOM embraces a community-based education curriculum aimed at the training of generalists. As part of this the medicine and pharmacy curricula incorporate a unique subject known as Independent Research Studies (IRS) and Research Methods and Project for

the M.B.Ch.B and B.Pharm. degrees respectively. The research focus of this program is student and society centered and aims to foster the development of self-directed learning skills. Self-directed lifelong learning has become a fundamental element of medical competence.[7,8]

The independent research develops from student interactions with the communities in which they serve or within the faculty based on current research efforts. Outreach of this nature significantly aligns the intuition with the health needs of the country. Here the authors describe the structure of IRS and its value to attaining the national health needs. Furthermore, insights to the institution's research focus are also provided.

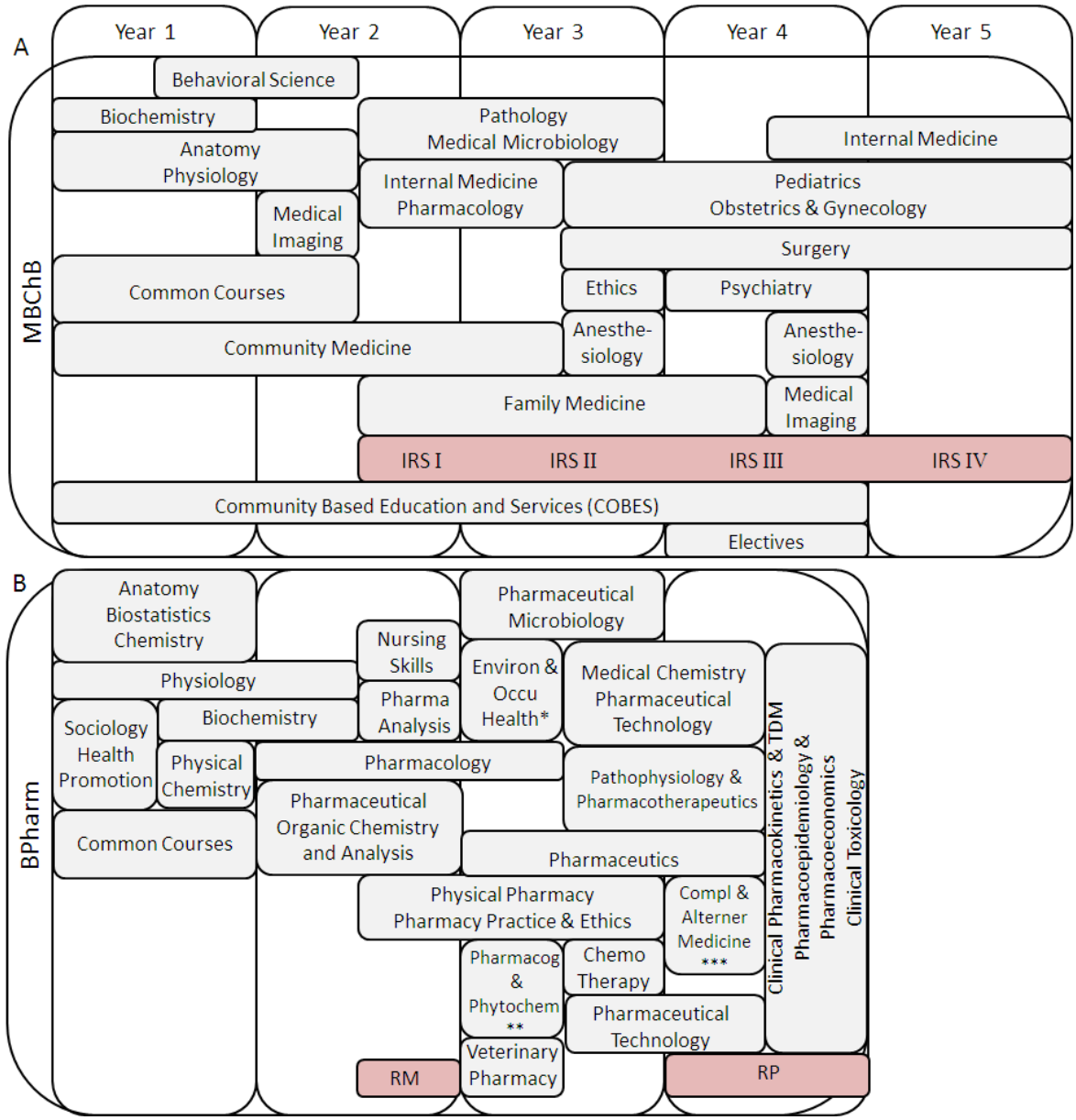

Figure 1: *Independent Research is a critical component of both the M.B.Ch.B. (A) and B.Pharm. (B) curricula. Independent Research Studies (IRS) progresses over seven semesters from: introduction to knowledge management (IRS I), proposal writing (IRS II), data collection and analysis (IRS III), and writing and presentation of thesis (IRS IV). The pharmacist degree program initially addresses basic research skills in a subject known as Research Methods (RM) (Figure 1B). Data collection, analysis and writing a scientific report follow later under the heading of Research Project which stretches over two semesters. (*Environmental & Occupational Health; ** Pharmacognosy & Phytochemistry; *** Complementary and Alternative Medicine)*

Research and Independent Research Studies

The Curricula

Students admitted to the UNAM SOM and School of Pharmacy (SOP) typically have just matriculated from secondary school with many coming from previously disadvantaged social groups and environments. As such, there is often the need to establish a strong foundation in the scientific method. It is within this context that the school has implemented an IRS program in which a strong understanding of research methodology is as important as the research topic itself. The underlying skills critical to research, the ability to conduct a literature review, the critical appraisal of results, and an escalated cognizance of research techniques all improve student independence and critical thinking.[9] Beyond this, students acquire an in-depth knowledge of a specific research topic and become skilled in presenting their findings.10 Globally, research develops critical assessment and thinking, promotes information literacy, and directs students to possible postgraduate training.[11]

At the SOM the primary objective of IRS projects is to develop the students' ability to evaluate scientific literature and participate in self-directed study. Both require the student to critically reflect. The research projects are also aimed, through their links to the community, at having a high impact value on health resource utilization and management of diseases relevant to Namibia. An important goal is to introduce students to both the theory and practice of research.

IRS for the medicine degree program is required and starts in the second semester of the second year (IRS I) and progresses until the tenth and final semester as IRS II to IRS IV (Fig. 1A). IRS is presented concurrently with subjects such as pathology, medical microbiology, internal medicine and pharmacology. Initial didactic lectures convey key aspects relating to biomedical research. Over seven semesters students learn the fundamental skills in research methodology, statistics, how to critically review literature, identify a research question, formulate hypotheses and, develop a problem statement and justification of the study. From here they progress to formulate objectives, select study design and strategy, critically appraise experimental design, and apply principles of medical ethics. An important feature of the program is that each student is assigned a faculty mentor who has research expertise in the students developing area of interest. Throughout this period of independent study the student has the opportunity to develop their research proposal, collect data, and communicate findings through written reports and an oral presentation. The faculty mentor provides continual feedback and tutoring throughout this period paying particular attention to the development of the student's scientific writing skills. The subject is concluded in their final year as IRS IV with the writing and presentation of a thesis (Fig. 1A).

The pharmacist degree program addresses many of the same basic principles, such as conducting a literature search and research tool development that is presented in Research Methods (RM) (Fig. 1B). Data collection, analysis and write-up follow later, covering two semesters under the heading of Research Project (RP) (Fig. 1B). Again, these research concerned subjects are offered in parallel with subjects such as medical chemistry, pharmaceutics, pharmaceutical technology and pharmacotherapeutics (Fig. 1B). The final requirement, however, is not a thesis but a formal written research report and oral presentation.

Research Projects

Ideally student work can receive recognition through publication but the ultimate goal is to provide them with the tools necessary to evaluate research and its potential merit as a component of their practice as a general practitioner or pharmacist. These skills are developed within an inter-professional educational (IPE) framework and instill the principle of life-long learning. Each selected project is supervised by a member of the faculty and relates to existing research within each department. Students have the option to either liaise with a specific department, for instance the Department of Anatomy, and develop a research project within that context or develop a project de novo. The research supervisor thus serves as a mentor that continuously provides feedback on the progress. An excerpt of the current projects supervised by the Departments of Anatomy and Physiology is shown in Table 1. As an example one student is focusing on a project titled "An anatomical study of the accessory internal thoracic artery". This project aims to document the incidence and anatomical origin of the accessory internal thoracic artery among the cadaver population of the institution through dissection. In addition the student will have to extrapolate the embryological origin of this variation and assess the clinical relevance and possible application in cardiac bypass surgery.

Regardless of its origins, there is often considerable interaction and consultation with faculty over the course of a project. The research supervisor thus serves as a mentor that continuously provides feedback on the progress and also advises on possible ethical considerations associated with the project. Ethical clearance for each project is obtained through a review process by a departmental review committee that reports to the ethics committee of the SOM.

Research Title
Etiology of burn wounds and the subsequent infection thereof in Windhoek, Namibia
An anatomical study of the accessory internal thoracic artery
Use of and attitudes regarding influenza vaccine among Windhoek Central Hospital nursing staff
The posterior intercostal vein and its relation to the internal vertebral venous plexus (IVVP): A Histological Study
Student approaches towards studying anatomy and their perceived responsibility
Epidemiology of rheumatic heart disease in Namibian children
Development of a quality control evaluation in the cardiac catheterization laboratory in Windhoek Central Hospital
Phonocardiographic evaluation of non valvular heart disease in Namibia
Impact of obesity on the development of hypertension in Namibian school children

Table 1: *Samples of undergraduate research projects*

Assessment

Student assessment is both formative and summative. The formative aspect allows for student feedback through the research supervisor or mentor and serves to guide the development of the project and the streamlining of methodologies. This is to ensure constructive alignment between the learning outcomes of the subjects (IRS, RM and RP), the learning experience and the environment in which research is conducted.[12] This follows after the students have consulted their faculty supervisor and gained experience on the sample size, research justification, data collection tools and methods, the consideration of independent and dependent variables, ethical considerations and the calculation of a budget. Assessment of these criteria is summative and is conducted towards the end of each semester based on a marking scheme as depicted in Figure 2. A panel of judges from the faculty assesses the project's progress and grades the candidate. The assessment ultimately aims to positively reinforce the teaching and learning activities associated with the project through feedback by the supervisor and panel of judges. This feedback will update students on their progress or the lack thereof, they will gain advice on available resources and project routing, and be motivated to engage and progress further.[13,14]

Marking Scheme

Description		Mark	Total
Background Information			2
Literature review			10
Problem Statement and Study Justification			4
Hypotheses Formulation			2
Research Question			3
Objectives			
Main Objective (Broad Objective)			3
Specifics Objectives			8
Methodology			
Study design			2
Study area			2
Study Population			5
Data collecting tools			2
Data collecting Methods			10
Sampling Methods			3
Sample size estimation			5
Data Analysis Methods and its Justification			5
Study variables			
Independent variables			2
Dependent variables			2
Ethical Consideration			5
Budget and Budget justification			4
Research Plan or Work Plan			3
References			5
Appendix			
Consent form			3
Questionnaire			10
TOTAL MARK			100

SIGNATURE OF THE EXAMINER

Figure 2: *The research projects are assessed based on the above marking scheme.*

Discussion and Future Directions

The significance of research extends beyond the creation of new knowledge and promotes the overall growth of the medical school, the recruitment and retention of staff, the strengthening of infrastructure, and the attraction of external collaborators.[2] The latter has the danger of veering the research interests towards that of the collaborator and ethical collaboration is therefore encouraged by various organizations.[15,16] Current literature refers to research initiatives in medical curricula either as an elective subject or as a

postgraduate program. The work by Willis and Deardorff in 2011, for instance, describes the evolution of a series of meetings, lectures, workshops and symposia towards the establishment of a Research Learning Community (RLC).[17] The RLC continues to serve as a consolidating entity for student focused elective courses with a research focus. The University of Vermont College of Medicine makes provision of a fourth year research requirement as part of their undergraduate program. Their initiative was aimed at promoting communication skills, analytical reasoning and revisiting basic science knowledge.[18]

UNAM SOM's approach is formal and incorporates research as a subject and imparts an obligatory research culture within the curricula. An obvious disadvantage here is the lack in data on the outcome and evaluation of our IRS initiative as our first students have only finished IRS2 (Figure 1A). Regardless, research is a keystone of medical pedagogy within UNAM's SOM which is aimed at self-directed lifelong learning in the same way as problem-based learning activities employed by other medical schools.[19] Furthermore, it is important to note that this course is not intended to produce fully mature independent physician-scientists. Rather, we feel it is essential that all medical and pharmacy student training be grounded, at least in part, in research methodology. Through this we hope that students are encouraged to develop an appreciation for the application of scientific method to clinical quandaries and perhaps a desire to apply these to the unique clinical challenges that they will meet in our country.

Assessing the strengths and weakness of the program is difficult at this stage. The first group of students has yet to progress into the later stages of the program and as such there is little quantifiable product. That said, the quality of research is, and will continue to be dependent on faculty interest and participation. For instance, at this juncture there are a limited number of faculties engaged in research. This places a substantial supervisory role on individual faculty members and often finds them working outside of their subject areas. Continued recruitment of physician-scientists and research faculty will ameliorate this problem in some part but a long-term plan will be needed to accommodate the numbers of students entering the program. Perhaps some supervision may come from community physicians. Already many of the students have community based research projects. There may be an opportunity to directly strengthen healthcare outcomes simply by codifying these student-supervisor relationships. Lastly, student engagement in research has the potential to stimulate revision of basic scientific content but this needs further investigation.

Conclusion

The descriptive report presented here provides some insight in to the inclusion of research as a subject within the medical and pharmacy curricula. The primary purpose of these projects is to expose students to the scientific method and encourage the development of analytical and interpretative tools that will be important in their professional lives. The research projects result from student relations within the communities they serve or the current research efforts of faculty members. Through this we hope to nurture self-directed learning.

Key Words

Independent research, self-directed learning, inter-professional, Namibia

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