



# Conception of Pharmacological Knowledge and Needs Amongst Nigerian Medical Students at Lagos State University College of Medicine: Implication for Future Biomedical Science in Africa

Luther Agbonyegbeni Agaga and Theresa Adebola John\*

Department of Pharmacology, Lagos State University College of Medicine, 1-5, Oba Akinjobi Way, Ikeja, PMB 21266, Ikeja, GRA Lagos Nigeria.

**Summary:** In Nigeria, medical students are trained in more didactic environments than their counterparts in research-intensive academic medical centers. Their conception of pharmacology was thus sought. Students who are taking/have taken the medical pharmacology course completed an 18-question survey within 10min by marking one/more choices from alternatives. Instructions were: "Dear Participant, Please treat as confidential, give your true view, avoid influences, avoid crosstalk, return survey promptly." Out of 301 students, 188 (62.46%) participated. Simple statistics showed: 61.3% respondents associated pharmacology with medicine, 24.9% with science, 16.8% with industry, and 11.1% with government; 32.8% want to know clinical pharmacology, 7.1% basic pharmacology, 6.7% pharmacotherapy, and 34.2% want a blend of all three; 57.8% want to know clinical uses of drugs, 44.8% mechanisms of action, 44.4% side effects, and 31.1% different drugs in a group; 45.8% prefer to study lecturers' notes, 26.7% textbooks, 9.8% the Internet, and 2.7% journals; 46.7% use standard textbooks, 11.5% revision texts, 2.66% advanced texts, and 8.4% no textbook; 40.4% study pharmacology to be able to treat patients, 39.1% to complete the requirements for MBBS degree, 8.9% to know this interesting subject, and 3.1% to make money. Respondents preferring aspects of pharmacology were: 42.7, 16, 16, and 10 (%) respectively for mechanisms of action, pharmacokinetics, side effects, and drug lists. Medical students' conception and need for pharmacology were based on MBBS degree requirements; they lacked knowledge/interest in pharmacology as a science and may not be the potential trusts for Africa's future pharmacology.

**Keywords:** pharmacology, medical students, biomedical science, education, Nigeria

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\*Address for correspondence: [theresaadebola@yahoo.com](mailto:theresaadebola@yahoo.com) Tel: +2347056736586, +2348160944635

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## INTRODUCTION

Medical students in research-intensive institutions in developed countries are generally trained in academic medical centers that have a strong bent towards scientific research. In Nigeria, university education is focused on didactic teaching and learning. As a developing country, Nigeria is in need of research and development in all fields. In the field of medicine, medical graduates of Nigeria are not commonly prepared for research and development in medical sciences. Primary focus and often the only focus is on clinical service to patients. The concept of physician scientist and doctors doing scientific bench work may not be an identified interest or need in Nigeria.

Pharmacology is a science and is one of the subjects studied by medical students. Like other medical sciences, pharmacology as a science grows and becomes relevant for human life through research. Much of research advancement in the sciences in developed countries comes from universities as a product of research carried out by professors, postdoctoral associates, and science students,

especially those on PhD programs. In Nigeria, pharmacology departments in medical or pharmacy schools cater for the medical and the pharmacy degree curricula. It is possible for medical curricular interests to limit basic science interests (John, 2011, 2012a). It is well noted that biomedical science research output and publications from Africa, including Nigeria, is very low compared to output from developed countries (Parez-Iratxeta and Andrade, 2002; Tijssen, 2007; Ezema, 2010; Adams *et al.*, 2010). Langer *et al.*, (2004) indicated five reasons why research from developing countries were underrepresented in international health literature: poor research production, poor preparation of manuscripts, poor access to global scientific literature, poor participation in publication-related decision making processes, and bias of international journals. Other noted factors include: inadequate infrastructure (John, 2009, 2010), lack of funding, and lack of state-of-the-arts research skills (John, 2012b, 2013). These are varied and often complex issues for any change agent. While all these reasons are generally recognized, their roots are little investigated. It is necessary to pinpoint the most

fundamental factors for the simplest change. The major question being asked by the investigator is: “Is there interest in science?” The present investigation sought to know what medical students, the principal beneficiaries of pharmacology education in Nigeria, think of pharmacology and do with pharmacology.

The biomedical sciences such as pharmacology are generally taught in medical schools in Nigeria for the Bachelor of Medicine, Bachelor of Surgery (MBBS) degree. The students receive mainly didactic theory when they pass through pharmacology departments. Thus their brush with sciences such as pharmacology may not present science beyond a requirement for the MBBS degree. Pharmacology together with other basic sciences such as anatomy, physiology, biochemistry, microbiology, and pathology form the pedestal of therapeutics. In many Nigerian medical schools the role of pharmacology departments and academic pharmacologists may be solely didactic teaching, i.e., to serve the needs of the MBBS Degree Program but this is not documented. Pharmacology is a science. It is proper of scientists to do research and add to scientific knowledge, especially needed and useful knowledge. It is also proper of scientists to train and raise new scientists. The source of new scientists is generally from amongst the students taught. In pharmacology (or other basic science) departments that lack any BSc, MSc, or PhD training programs, is there any possibility of new basic or clinical pharmacologists (or other basic scientists) emerging from amongst the medical students; is there any possibility of significant scholarly contribution to global science and medical solutions; and is there any

possibility of translational research with entrepreneurial results and nation building?

The Pharmacology Department at Lagos State University College of Medicine (LASUCOM) is one of such departments-of-interest. We sought to find out the perspectives of medical students that have been taught pharmacology at the department. The two goals of this investigation were: 1) to determine their conception of pharmacological knowledge and 2) to determine their conception of their pharmacological needs. By detecting the perception of the value of science amongst medical students, we could decide to restructure medical schools’ pharmacology departments to include basic science degree programs along with the MBBS Program.

### MATERIALS AND METHODS

A simple questionnaire survey was used to mine judgments of students at various levels of study at the 6-year medical school. They all study pharmacology at the 400 level (4<sup>th</sup> year) and some have closer experience with clinical pharmacology at the 500 (63 students) and 600 (77 students) levels. Presently there are two sets (63 and 98 students) of 400 level students due to an altered calendar.

Participants were instructed as follows: Dear Participant, Please treat as confidential, give your true view, avoid influences, avoid crosstalk, return survey promptly. The questionnaire asked for the following details of the participants: Name: (initials) optional; Phone number: optional; Course of study; Academic level; Sex; Age. The participants were given 10 ± 5 minutes to answer the questionnaire in Table 1.

Table 1. Questionnaire used to mine conceptions of pharmacological knowledge and needs amongst Nigerian medical students at Lagos State University College of Medicine.

1	When did you study pharmacology?	I am presently attending pharmacology lectures	I had pharmacology lectures in the past	I am presently receiving training in clinical pharmacology	I will always be learning pharmacology
2	Why do you study pharmacology?	to know this interesting science	to be able to treat patients	to complete requirements for MBBS	to be able to make money
3	Do you prefer to study:	minimal pharmacology	broad pharmacology	actions and uses without drug lists	everything necessary to get MBBS
4	Do you want to know:	mechanisms of action	clinical uses	side effects	different drugs in a group
5	Which one do you like best?	mechanisms of action	pharmacokinetics	drug lists	side effects
6	Which one do you like the least?	mechanisms of action	pharmacokinetics	drug lists	side effects
7	Do you want to know:	basic pharmacology	clinical pharmacology	pharmacotherapy	a blend of all three
8	Which one do you prefer to study?	lecturer’s notes	text books	Internet information	journals
9	What do you prefer within a 9-4 pharmacology lecture day?	1h lectures with short breaks (15 min) plus 1h lunch break	straight 9-12 am and 1-4 pm lectures	2h lectures and 1h lunch break	I have no preference amongst these

10	What helps you cope with medical school load	adequate night rest and regular diet	time management	positive thinking	support of peers
11	Will you be a pharmacologist?	never	not interested	possibly	definitely
12	Which text books do you use?	revision text	standard text	advanced text	no text
13	How much reading material should be in lecturers' notes	same as standard text book	half of standard text book	quarter of standard text books	no opinion
14	Drugs are:	necessary evils	good and beneficial	lifelong needs	not for everyone
15	What should concern your lecturer?	that you pass your assessments and exams	that you become good professionals	that you in turn produce good professionals	that you become wealthy
16	What should your lecturer use to prepare lectures?	personal experience	text books	Internet	research
17	Who is responsible for any medical error you may make in future?	yourself	your employer	your educators	your mentors
18	What field is pharmacology important for?	medicine	science	industry	government

## RESULTS

There are a total of 301 students in the school who are taking or have taken the medical pharmacology course and 188 (62.46%) of them agreed to participate in the survey. Amongst other observations of respondents, pooled data revealed that: 85 students were presently taking the medical pharmacology course and the rest took it in the past; 61.3% respondents associated pharmacology with medicine, 24.9% with science, 16.8 % with industry, and 11.1% with government; 32.8% want to know clinical pharmacology, 7.1% basic pharmacology, 6.7% pharmacotherapy, and 34.2% want a blend of all three; 57.8% want to know clinical uses of drugs, 44.8% mechanisms of action, 44.4% side effects, and 31.1% different drugs in a group; 45.8% prefer to study lecturers' notes, 26.7% textbooks, 9.8% the Internet, and 2.7% journals; 46.7% use standard textbooks, 11.5% revision texts, 2.66% advanced texts, and 8.4% no textbook; 40.4% study pharmacology to be able to treat patients, 39.1% to complete the requirements for MBBS degree, 8.9% to know this interesting subject, and 3.1% to make money. Respondents preferring aspects of pharmacology were: 42.7, 16, 16, and 10 (%) respectively for mechanisms of action, pharmacokinetics, side effects, and drug lists. More students (30.67%) liked drug lists least, followed by pharmacokinetics (13.3%), mechanisms (12.9%) and side effects (6.2%).

About any medical error they could make, 60.8% would blame themselves while 18.7%, 6.7% and 2.2% would attribute some responsibility to their educators, employers, and mentors respectively. For lecturers, 52.4% of the students expect lectures to be prepared from text books, 36.9 % from research, 34.2% from personal experience, and 30.2% from the Internet; 57.8% believed their lecturers should be concerned about their becoming good professionals, 19.6% about their passing exams, 15.6% about they, themselves, in turn producing good professionals, and 5.3% about the students becoming wealthy. Finally, 0.4% would definitely and 33.8% would probably become pharmacologists, while 27.1% are not interested in becoming pharmacologists and 8.4% would never be pharmacologists. Figure 1 pools data depicting the students' conception of pharmacological knowledge needs, Figure 2 pools data on the students' interests in pharmacology, and Figure 3 pools data on the students' learning of pharmacological.

## DISCUSSION

Three major facts underline the present discussion. 1) Pharmacology departments (and other basic medical science or biomedical science departments) are typically within medical schools and occasionally in pharmacy schools and faculties of life or biological

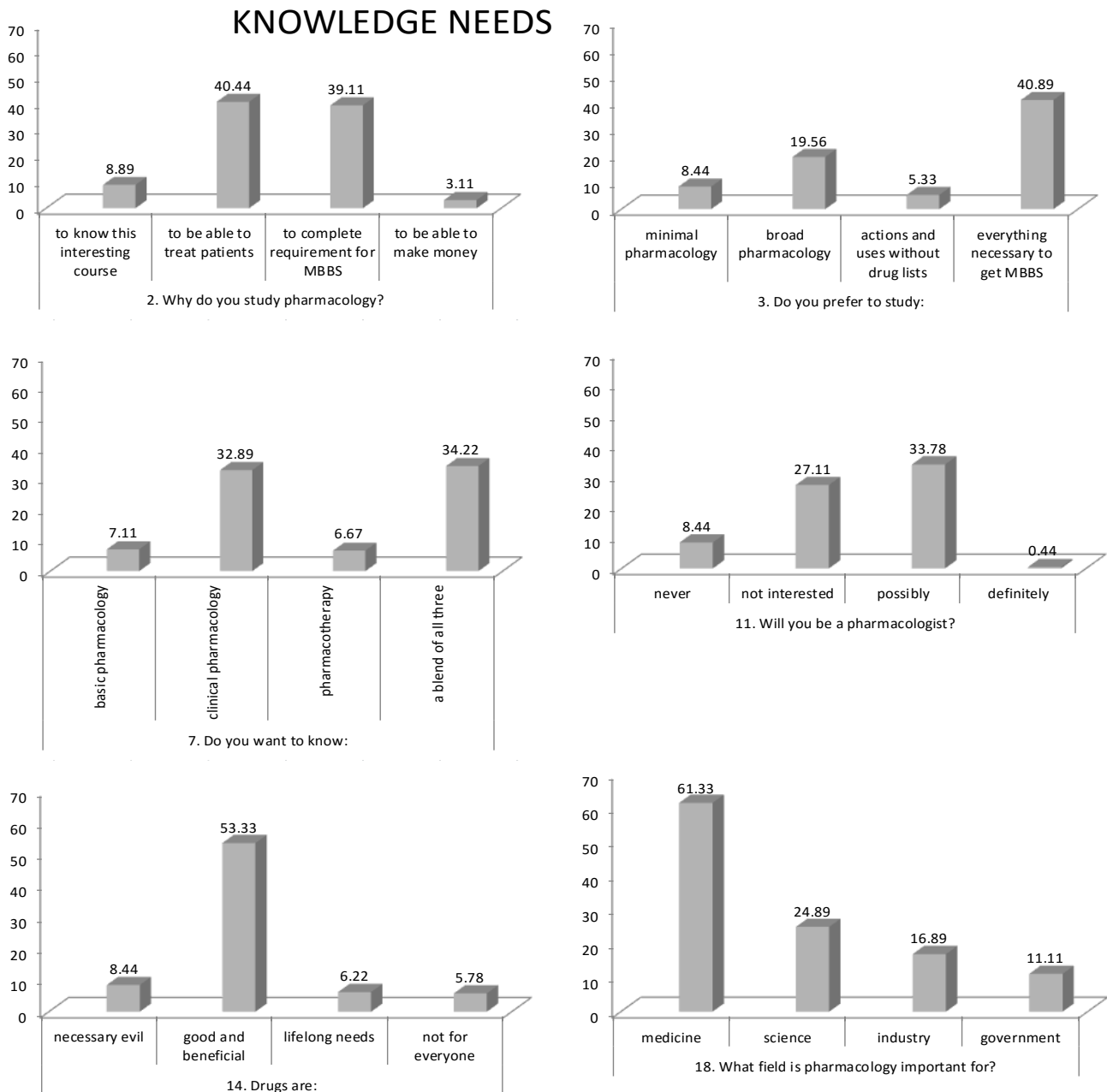


Figure 1. Questions and responses showing medical students' conception of pharmacology knowledge needs.

Sciences. Medical school curricula apply as needed in problem-based learning, pharmacotherapy teaching, and therapeutics and may consider basic pharmacologists (scientists) as dispensable. 2) Pharmacology departments, as centers of knowledge of pharmacology, do have roles in acquiring, preserving, imparting, and utilizing scientific knowledge (in pharmacology). They provide pharmacology education, training, and application to people that may end up with varied professional functions and interests in specific aspects of pharmacology. The same could be said for other basic science departments. 3) Nigeria (like many parts of

Africa) has its challenges when it comes to knowledge and utilization or application of science and technology as needed. Africa's chronic health problems such as HIV-AIDS and sickle cell disease or acute epidemics such as ebola fever and lassa fever need more and better solutions by local scientists as well as global partners. It is thus important to raise and support up-to-date scientists in the fields of medicine and health care. The status-quo of Nigerian medical schools may not adequately reflect a proper vision of the role of scientists in nation building and the power of scientists to effect betterment of people's lives. Medical schools in Nigeria may need

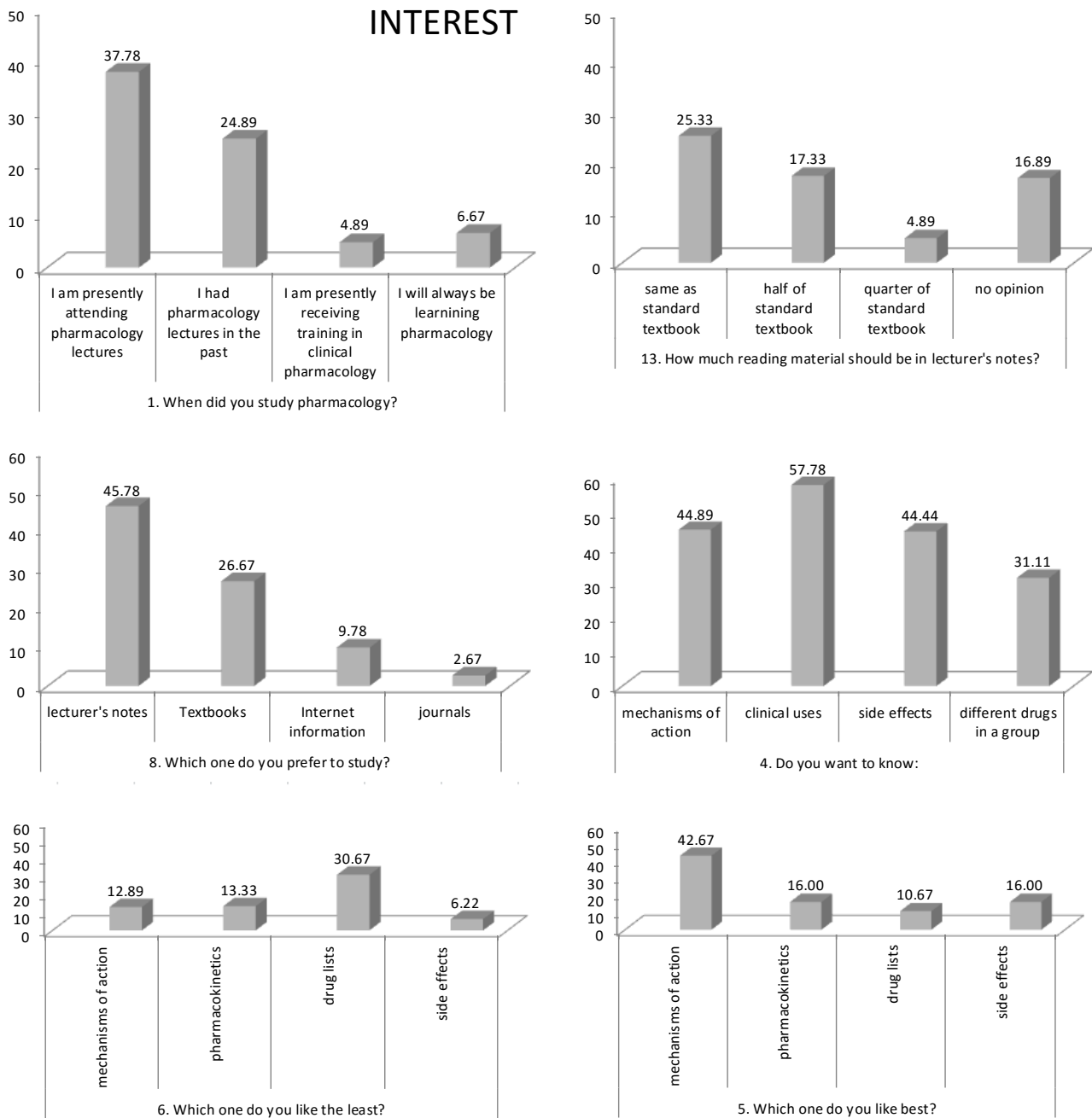


Figure 2. Questions and responses showing medical students' interest in pharmacology

to rebrand as centers of excellence for medical sciences such as physiology, pharmacology, biochemistry, molecular biology, etc., that are disciplines that belong to both science and medicine. Change agents are needed to promote these disciplinary turfs and to develop science degree curricula at BSc, MSc, and PhD levels, where they can be established. The present survey indicates that such change agents may not come from the typical students of Nigerian medical schools, medical students.

The Department of Pharmacology at LASUCOM is within the Faculty of Basic Medical Sciences, and along with some other departments, it teaches medical students that pass through during their fourth year of the MBBS Program. This pharmacology department

has no students of its own and does not run any program leading to the graduation of pharmacologists or scientists. It serves only the MBBS and BDS Programs, and a new BSc Nursing Program and new BSc Physiology Program. For reasons gathered from this simple survey, the medical students that pass through the department are not likely to become future pharmacologists or scientists.

**Conception of pharmacology knowledge needs.**

The medical students' conception of pharmacology knowledge needs is rightly based on their professional goals, the majority declaring the reason for their studying pharmacology are "to complete

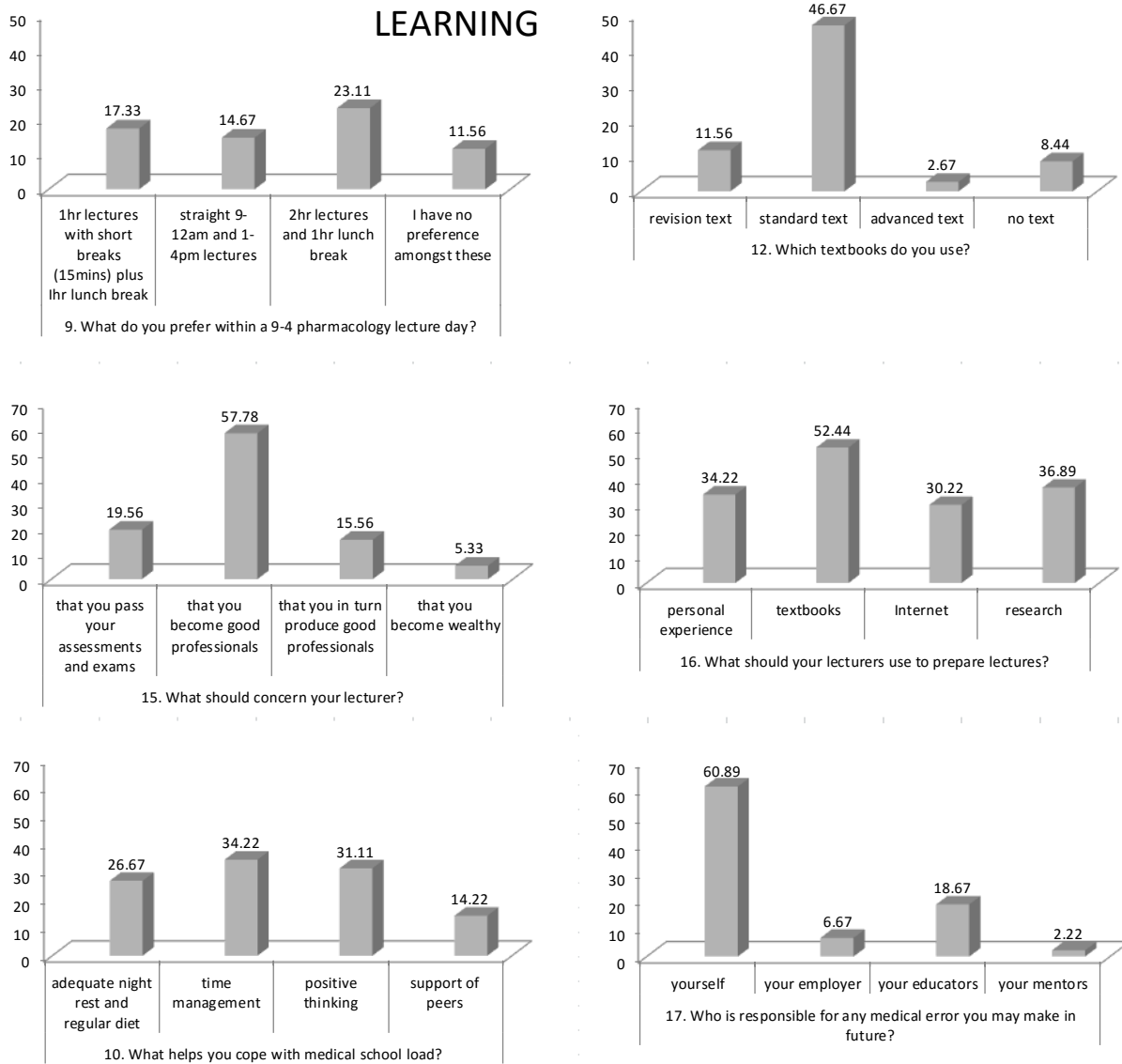


Figure 3. Questions and responses showing some aspects of medical students' learning of pharmacology

requirements for MBBS" (39.11%) and "to be able to treat patients" (40.44%). Very few actually study pharmacology to know the subject (8.89%) or to make money (3.11%). They mainly prefer to study "everything necessary to get MBBS" (40.89%) and prominently "clinical pharmacology" (32.89%). Importantly, the students associate pharmacology more with medicine (61.33%) than with science (24.89%) ( $p < 0.001$  with student's t-test) and fewer associate it with industry (16.89%) or government (11.11%). While the majority of the students view drugs as good and beneficial (53.33%) and consider pharmacology as a subject that is important mainly for the field of medicine (61.33%), notably only a minute percentage would definitely become pharmacologists (0.44%) (Figure 1).

**Interest in pharmacology.** The medical students' interest in pharmacology is rightly focused on their desire to satisfy their lecturers and pass their MBBS exams. Accordingly, they prefer to study pharmacology using the lecturer's notes (45.78%) over

textbooks (26.67%), Internet (9.78%), or journals (2.67%). A small percentage (6.67%) consider that they would continue to learn pharmacology in the future. Their interests in pharmacology reflects in their conception of its necessity for clinical practice. They mainly want to know: clinical uses of drugs (57.78%), mechanisms of action of drugs (44.89%), and side effects of drugs (44.44%), most of the respondents (42.67%) admitting they liked "mechanisms of action" best (Figure 2).

**Learning of pharmacology.** The students learn pharmacology through standard lectures; vary in their preferences for various lecture schedules without a dominant preference (all preferences  $< 24\%$ ), and rely on their lecturers to help them become good professionals (57.78%) but hold themselves responsible for the knowledge they acquire and utilize (60.89%). They expect their lecturers to gather their knowledge from various sources: experience, textbooks, Internet and research, research being the second biggest expectation. While students mainly

use both lecturer's notes and text books for studying pharmacology, discussed for Figure 2, most students (45.67%) actually prefer studying lecturer's notes and 26.67% actually prefer to study text books. Very few of the students use advanced texts (2.66%) compared to standard texts (46.67%) (Figure 3). Personal skills such as time management (34.22%) and positive thinking (31.11%) help these students through the large work load and intense program within the environment provided by the medical school (Figure 3).

The interests and focus of the medical students surveyed is in pharmacology as a requirement for getting their MBBS degree and becoming doctors. The present investigation shows that it is important for basic science departments such as pharmacology departments that are situated in medical schools and not in other faculties within an institution to consider if they are missing anything by not having BSc, MSc, and PhD programs in their subject. Scientists are trained through an apprentice-expert relationship when PhD candidates and postdoctoral associates are attached to specific mentors. For such training, some scientific standards are needed. Some scientific societies have published standards for the PhD Degree. For example, The International Union of Biochemistry and Molecular Biology in 2000 published the "Standards for the PhD Degree in the Molecular Biosciences" which included issues related to knowledge, research, skills, responsibilities of the supervisor and of the candidate, and funding (IUBMB, 2000). Recently, in 2012, the Organization of PhD Education in Biomedicine and Health Sciences in the European System (ORPHEUS) in conjunction with the Association of Medical Schools in Europe and the World Federation for Medical Education published a proposal titled "Standards for PhD Education in Biomedicine and Health Sciences in Europe" aimed at "quality assurance", "safeguarding the reputation of the PhD as a research degree" and "strengthening career opportunities for PhD graduates" (ORPHEUS, 2012). Some of these standards involved: "research environment" and the "outcomes" of the training. The world has become a global village and what scientists do in Nigeria, for example, should match what scientists do globally. The pharmacology department at LASUCOM may represent many Nigerian (and African) pharmacology departments or basic medical science departments. The students passing through it do not want to become pharmacologists or scientists, therefore the Department is not capable of its full capacity and functionality as a pharmacology department. There are several implications of such situations in African institutions.

African poverty in the past cannot be dissociated from low scientific productivity. Nigerian and other African universities are well known for their lack of funding which in part is due to their lack of intellectual property, royalties, and profits – products of research and development. Research and the money brought into the university through research activities are paid keen attention by the world's top universities. In the year 2013/2014 the University of Oxford (UO) gained £478,300,000 in research income; while University College London (UCL) gained £374,503,000, University of Cambridge (UC) gained £371,200,000, Imperial College London (ICL) gained £350,900,000, University of Edinburgh (UE) gained £215,934,000, and the University of Manchester (UM) gained £213,726,000. In the same year, the total grant income for UE, UCL, UO, UC, UM, and ICL from UK research councils were £204,116,000; £182,437,000; £182,200,000; £178,600,000; £162,579,000; and £161,400,000 (Wikipedia, 2015). Some of these incomes are from the field of biomedicine. Not only in the USA and Europe is biomedicine contributing to the economies. In China and Asian countries, biomedicine is playing a significant role in both healthcare and the economies. For example, Shandong Sinobioway Biomedicine Co., Ltd estimated their net profit for 2015 to be 180,007,400 yuan - 258,760,700 yuan (Reuters, 2015). In 2014 income-related rankings, Chinese universities beat US universities (Times Higher Education, 2014).

Continued low scientific productivity may have serious implications for **Africa's future economies**. Governments in many developed countries have invested massively in PhD education, believing that trained researchers will contribute to the 'knowledge society' (beyond academia) and thus increase the competitiveness of their countries in the future economies of the world (Mulvany, 2013).

African health **challenges** are not unsurmountable. "Biomedical research is a powerful tool for solving health challenges in developing regions" (Zofou *et al.*, 2011) and Africans need more home-grown solutions to their own problems. They otherwise remain markets for foreign "Big Pharma" and unregulated global money-driven medicine (Wilberg, 2014). New generation African scientists need to rise to solve African problems. Institutional support and government funding are two of the factors identified by African biomedical scientists-in-training that need to increase in order to facilitate biomedical science research in Africa (Zofou *et al.*, 2011).

Another implication is that through scientific training, innovative and resourceful university graduates and researchers become successful entrepreneurs and can become significant contributors to **endowment** of

their Alma Mater. Endowments help universities to keep good standards, including research standards. "With a current endowment of over \$32.7 billion, Ivy League Harvard University is the wealthiest university in the world." It has an annual research budget of \$799.4 million and is ranked #1 University in the World (The Best Schools 2016). The University of Texas System's endowment is \$25.4 billion. It has an annual research budget of \$1.12 billion (system-wide) and is ranked #39 University in the World. Amongst the younger universities, University of Maryland, founded in 1963, has an endowment of \$867 million and an annual research budget of \$442 million (The Best Schools, 2016).

This survey identifies why biomedical science may be denigrated in Nigeria in particular and perhaps in Africa in general: medical schools tend to be entirely focused on medical education and pay little or no attention to **biomedical science training and research**. The recently initiated and continuing efforts of the Nigerian Government through the Tertiary Education and Training Fund has made financing available for improvement of scientific research but medical schools lacking BSc, MSc, PhD and postdoctoral programs that generate dedicated researchers, are limited in their capacity to transform biomedical science in Nigeria. Neither could they effectively take advantage of global initiatives that can build their capacity for improved biomedical science research and productivity (Wagner *et al.*, 2008; POST, 2004; Whitworth *et al.*, 2008; Nwaka *et al.*, 2010; Mc Grail *et al.*, 2006) and successful careers of home-grown scientists (Frantz, 2011; TDR, 2005; Kirigia *et al.*, 2006; Kupfer *et al.*, 2010; NASA, 2009; Pololi *et al.*, 2004).

The pharmacology and other basic medical science departments in Nigeria that teach only medical students may be limited in their mission as scientists, certainly raising new and possibly excellent doctors but not necessarily new scientists. Pharmacology and other science departments that would also partake in the mentoring of basic/biomedical science students and post-doctoral researchers through expert-apprenticeship relationships is a robust way to communicate, transmit, and enhance the much needed biomedical science power in Africa. Apart from the need to enhance scientific activity, is there also a need to replenish basic and clinical pharmacology staff or other biomedical science staff in academia for the future training of medical students and scientists?

**Recommendation.** The basic science departments that teach only medical students should be encouraged by professional associations and governments to start Bachelor's, Master's, PhD and postdoctoral programs alongside the MBBS curriculum in order to raise

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basic/biomedical scientists with diverse primary interests in science, research, development, entrepreneurship, corporate business, and government. Enhanced interest in science should be explored as a necessary impetus for structural and functional development of scientific activity, research productivity, national development, and global contribution. **Interest in science and its usefulness** is a key factor for economic and developmental change needed in Africa.

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