

Full length Research Article

Academic Staff Strengths of Postgraduate Training Programs in Pharmacology in the USA Pre- and during Covid-19 Pandemic - A Cue for Capacity Building in Pharmacological and other Programs in Nigerian Universities

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Summary: Structure and function go hand in hand for any administration, including running a program. For the training of pharmacologists, this is also true. A component of the structure of academic programs is academic staff strength. We wanted to know the academic staff strength of programs and departments in American universities that run training programs in pharmacology at post graduate level to inform development in Nigerian and other African academia. Through departmental and program webpages accessed from the listing on the website of the American Society for Pharmacology and Experimental Therapeutics (ASPET), we mined data on academic staff of departments running graduate programs leading to PhD Pharmacology in the United States of America (USA). All the data were mined within 96 hours of starting the investigation in 2016 and again in 2021 during the COVID-19 pandemic and were studied using Microsoft Excel® spreadsheets and descriptive statistics. From the descriptive statistics of a total of 25 such programs, the programs were not identical and varied in their staff compositions by numbers. A total of 1,993 academic staff members in 2016 and 2,042 academic staff members in 2021 were serving the 25 graduate pharmacology programs. Notably more than 25% and less than 50% of the three categories of professorial cadre were non-pharmacology PhD holders. From the composite data of 2016 and 2021, mean staff per program were: 23 professors, 13 associate professors, and 15 assistant professors with 2 each of adjunct staff in the categories of professor, associate professors, and assistant professor. Also, composite average per program were 5 joint staff, 3 postdoctoral fellows, 4 emeritus professors, and 11 various researchers. A pattern of top heavy majority of professors was observed from both the 2016 and 2021 investigations. Post docs, miscellaneous researchers, joint staff, and emeritus professors formed a dynamic pool. In totality, academic staff of the 25 graduate pharmacology programs in the USA in 2016 and in 2021 was top-heavy, experience and expert laden with the professorial cadre, diversified, and steady from 2016 to 2021. Non-professorial cadre depicted dynamism in 2021 during COVID-19 pandemic.

Keywords: *academic staff strength, COVID-19 pandemic, USA universities, Nigerian universities, pharmacology, PhD program*

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INTRODUCTION

Structure and function go hand in hand for both organizational and program success. For the training of pharmacologists, this is also true. A component of structure is academic staff strength. We wanted to know the academic staff strength of programs and departments in universities in the United States of America (USA or US) that run training in pharmacology at post graduate levels. This could give us a cue for capacity building of Nigerian pharmacology programs and Nigerian academia in general.

American institutions are well supported by government and non-government partners. They have consistently dominated top positions in international rankings because they take care of quality. For example, the Times Higher Education World University Rankings has been released

continuously since 2010 showing consistency in American dominance. This particular ranking evaluates teaching, research, faculty citations, international outlook (i.e., the number of international students and collaborations), and industry income - which reflects knowledge transfer partnerships with businesses. In the 2022 rankings, eight of the top 10 universities are US institutions and 12 of the top 20 are US institutions (Times Higher Education World University Rankings, 2022). American universities attract students from across the globe because they have high academic standards and follow thorough training processes. Thus, they help to form future leaders of the world.

In 2021, seeing the overt impact of the COVID-19 pandemic on the whole world and on all spheres of human endeavors, we carried out an opportunistic investigation, repeating an original study done in 2016. Thus, we sought to observe any difference in academic staff strength that

might have been due to COVID-19 pandemic, an active, intervening, uncontrolled, qualitative variable.

Tertiary education systems in Nigeria have suffered structural and skills gaps (John, 2009; 2010; and 2012a) and this is being addressed particularly with the Tertiary Education Trust Fund (TETFund), established in 2011 through the Tertiary Education Trust Fund Act 2011 (TETFund, 2020; Onyeike and Eseyin, 2014). In the past few decades, science and technology are fields that have grown tremendously, sometimes breaking through physical, cultural, philosophical and psychological barriers to release new knowledge, processes, and products of innovation and creativity. Such change has also been in the field of biomedical science, the bedrock of medicine (John, 2003; 2011, 2012b) while Nigerian universities remained lacking in the newer techniques of biomedical science research and collaborative multidisciplinary research culture (John, 2013, 2014, 2015; Akudolu et al., 2018) commonly utilized globally in universities. From 1967 until recent, biomedical science research in Nigeria had low global visibility (Nwagwu, 2005). Better funding has enhanced research output (Odeyemi et al., 2019). However, as observed with pharmacology as a science in Nigeria (Agaga and John, 2016), for example, interest in biomedical science research may be lacking in students in the field of medicine and health professions in Africa. Kumwenda et al., (2017) note lack of such interest in science in Africans. This is an aspect of education that can be improved through expert mentoring, technical exposure, and recognition of scientific contributions because Nigerians (and possibly other Africans) become impactful scientists (Akinpelu, 2018) when given the right support.

The general trend in the past few decades is that young African graduates in the medical sciences that are naturally keen on pursuing science migrate to developed countries where opportunity and stability await them (Blacklock et al., 2014; Nwagwu Emeka, 2015). Such brain drain affects Africa's development negatively (NASAC, 2019). Lack of interest in science may be at the root of Africa's sometimes unwarranted poverty and dependency. Economic, civic, and social differences between developed and developing countries may not be divorced from educational differences. A continued evolution in academic science is necessary for the socio-economic development of Nigeria and other Sub-Saharan African countries. Every young biomedical scientist is presented with various challenges besides the pressure to obtain funding and to generate publications (Chen et al., 2020; Kumwenda et al., 2017) and without effective mentoring, many Africans cannot sustain their interests in a research career.

Academic staff strength of pharmacology departments is important for the needed mentoring and research resources that early career pharmacologists require to establish themselves in the Nigerian context and to be able to imprint their own vocational signatures in the socio-economic development of the country and on the global stage. We looked at the academic staff strength of North American Universities to appreciate the task ahead for Nigerian academic leadership. Our objective was to know the total staff strength of programs and departments in American universities that run training programs in pharmacology at post graduate levels, leading to Ph.D Pharmacology.

MATERIALS AND METHODS

Through departmental and program webpages, we mined data on academic staff of departments running graduate programs in pharmacology in the USA, leading to PhD Pharmacology. All the data were mined within 96 h of starting the investigation in 2016 and again opportunistically in 2021 when COVID 19 pandemic was an intervening variable. COVID-19 was unplanned, not direct experimental intervention and opportunistic harvesting of data was deemed informing. The same investigator mined the data in 2016 and in 2021 using the same method. The list of such departments was obtained from The American Society for Pharmacology and Experimental Therapeutics (ASPET) webpage. ASPET is a national society for pharmacology and an authoritative presenter of related information in the US. There was a total of 25 such programs in 2016 and a total of 28 in 2021. We retained the use of the same 25 programs for comparison of data of 2016 and 2021. The data we generated was analysed using Microsoft® Excel spreadsheets and descriptive statistics. Differences between means were analysed by one tailed paired Student's T-tests and significance determined at $p < 0.05$.

Our study was based on American universities, but we also obtained data from 8 top Nigerian Universities according to overall staffing. These top universities were obtained from the Nigerian University System Statistical Digest, 2017 that gives overall data on staff but lacked departmental details (National Universities Commission, 2018). The eight universities' pharmacology departments' websites were sought between December 11th and 12th 2022. We also obtained oral information for these pharmacology departments from individual members of academic staff who were linked to us by The Nigerian Society for Pharmacology and Experimental Therapeutics (NISPET). Because the University of Ibadan is the first to be established Nigerian university (existing since 1948 and nicknamed "The Premier University"), we also sought information about its pharmacology staff.

RESULTS

Table 1 presents the various domiciles of 25 PhD Pharmacology programmes from where data was mined for this investigation. (Currently in April 2022, there are 28 programs listed). In the following data of 2016 and 2021, 2016 represents pre-COVID-19 time and 2021 represents the COVID-19 time during which COVID-19 was a passive intervening variable that is uncontrolled, unmeasured but was universal in impact.

Table 2 shows the general distribution of academic staff by professorial and other categories presented as sums of numbers from the 25 programs. The staff are program faculty of pharmacology departments; adjunct faculty of pharmacology departments; joint staff shared by pharmacology departments/programs and cognate departments/programs; emeritus professors of pharmacology departments; postdoctoral fellows of pharmacology departments and various other researchers of pharmacology departments with less distinct categorization (Table 2).

Table 1.

Domiciles of 25 PhD Pharmacology programmes from where academic staff data was mined in 2016 and in 2021.

	PhD Pharmacology Domicile	Date accessed in 2016	Date accessed in 2021
1	Boston University SOM, Boston, MA	27.5.2016	14.9.2021
2	Brown University, Providence, RI	27.5.2016	14.9.2021
3	Case Western Reserve University SOM, Cleveland, OH	27.5.2016	14.9.2021
4	Georgia Regents University Medical College of Georgia, Atlanta, GA	27.5.2016	14.9.2021
5	The Ohio State University, College of Pharmacy, Columbus, OH	28.5.2016	14.9.2021
6	The University of Texas, Austin, Austin, TX	28.5.2016	15.9.2021
7	The University at Buffalo, Buffalo, NY	28.5.2016	15.9.2021
8	University of Arkansas for Medical Sciences, Little Rock, AR	28.5.2016	15.9.2021
9	University of California, Davis, Davis, CA	28.5.2016	15.9.2021
10	University of California, San Diego, La Jolla, CA	28.5.2016	15.9.2021
11	University of California, San Francisco, San Francisco, CA	28.5.2016	15.9.2021
12	University of Cincinnati COM, Cincinnati, OH	28.5.2016	15.9.2021
13	University of Florida, COM, Gainesville, FL	29.5.2016	15.9.2021
14	University of Illinois at Chicago, College of Pharmacy, Rockford, IL	29.5.2016	15.9.2021
15	University of Illinois at Chicago COM, Chicago, IL	29.5.2016	16.9.2021
16	University of Kentucky College of Pharmacy, Lexington, KY	29.5.2016	16.9.2021
17	University of Michigan, Ann Arbor, MI	28.5.2016	16.9.2021
18	University of Mississippi Medical School, Jackson, MS	28.5.2016	16.9.2021
19	University of Oklahoma, College of Pharmacy, Oklahoma City, OK	29.5.2016	16.9.2021
20	University of Texas HSC, San Antonio, TX	29.5.2016	16.9.2021
21	University of Wisconsin SOM, Madison, WI	28.5.2016	16.9.2021
22	Vanderbilt University SOM, Nashville, TN	29.5.2016	17.9.2021
23	Washington State University, Seattle, WA	30.5.2016	17.9.2021
24	Wayne State University, Detroit, MI	30.5.2016	17.9.2021
25	Weill Cornell Medical College, New York City, NY	30.5.2016	17.9.2021

Table 2.

General distribution of academic staff by professorial and other categories presented as sums of numbers from 25 programs.

	PROGRAM FACULTY			ADJUNCT FACULTY			OTHER FACULTY INVOLVED			
	professor	associate professor	assistant professor	professor	associate professor	assistant professor	joint staff	postdocs	emeritus	various researchers
2016	564	368	350	65	82	68	106	137	82	171
2021	585	297	397	40	34	37	154	25	97	376

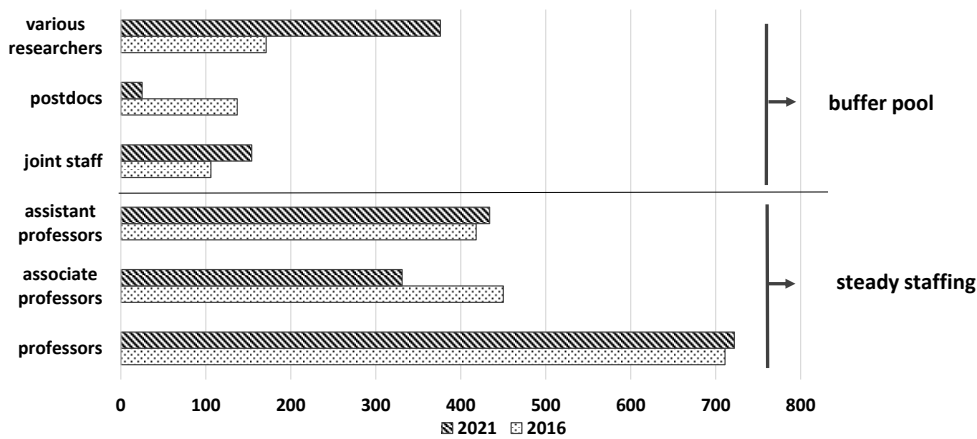


Figure 1.

Steady and dynamic buffer pools of academic staff members in 2016 and in 2021 serving 25 PhD Pharmacology Programs of North American Universities.

Joint faculty include professors, associate professors, and assistant professors. “Various researchers” are persons who equally do research at all levels but are not faculty members. They work in different labs. Some of these are designated as senior research scientists.

Within the 25 departments and programs studied, there were in total for 2016/2021 respectively, 711/722 professors (including 82/97 emeritus professors.), 450/331 associate professors, and 418/434 assistant professors listed in the departments plus 106/154 joint staff, 137/25 post-doctoral fellows, and 171/376 various researchers (Figure 1). These numbers summed up make a total of 1,993 academic staff members in 2016 and 2,042 academic staff members in 2021 serving the 25 PhD Pharmacology programs collectively.

From the descriptive statistics in Table 3, the programs were not identical and varied in their staff compositions as

can be seen by the lowest and highest numbers and the medians for each category of staff and the sample variance within each group. Where a category was not included in one or more departments and N<25, an average using actual N was also calculated (average #s) (Table 3). The total numbers of staff members across the 25 programs in 2016 and in 2021 showed steady staffing for professorial cadre (Figure 1) and using one-tailed paired Student’s T-tests there generally was no significant difference between the 2016 and 2021 data for the professorial cadre (p= 0.2; 0.05; 0.26; 0.18; 0.21; 0.50) (Figure 2). There was a general increase in sample variance in 2021 during the pandemic in all categories (15 out of 16 categories, post docs decreasing) (Table 3).

Table 3.

Descriptive statistics of academic staff of 25 PhD Pharmacology Programmes of North American Universities showing a general increase in sample variance in 15/16 categories in 2021 during the COVID-19 pandemic.

		PROGRAM STAFF			ADJUNCT STAFF			PHD PHARMACOLOGY STAFF			NON PHARMACOLOGY PHD STAFF				VARIOUS OTHERS		
		Prof	AssPr	AsstPr	Prof	AssPr	AsstPr	Prof	AssPr	AsstPr	Prof	AssPr	AsstPr	other	joint	post doc	emeritus
2016	Lowest	7.0	3.0	5.0	1.0	1.0	1.0	2.0	1.0	1.0	4.0	3.0	1.0	1.0	1.0	10.0	1.0
	Highest	46.0	24.0	29.0	5.0	8.0	9.0	27.0	18.0	25.0	8.0	5.0	12.0	27.0	13.0		22.0
	Mode	15.0	18.0	11.0	3.0	4.0	2.0	7.0	8.0	7.0	4.0	5.0	1.0	6.0	1.0	N/A	2.0
	Median	23.0	16.0	13.0	3.0	4.0	3.0	11.5	8.0	7.0	8.0	5.0	4.0	7.0	4.0	21.5	3.0
	Average #S	23.5	14.7	14.0	3.3	3.9	3.6	12.1	7.5	8.2	10.0	6.1	4.9	8.1	4.6	34.3	4.3
	Mean of 25	22.6	14.7	14.0	2.6	3.3	2.7	11.6	7.5	8.2	8.4	5.1	3.9	6.8	4.2	5.5	3.3
	Variance	92	31.5	35	1.4	3.7	4.8	36.7	16.3	32.2	36.7	16.3	32.2	34.4	8.5	1190	22.8
2021	Lowest	9.0	1.0	4.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Highest	62.0	28.0	83.0	7.0	8.0	10.0	33.0	28.0	83.0	42.0	19.0	25.0	140.0	26.0	9.0	31.0
	Mode	13.0	9.0	9.0	1.0	2.0	1.0	8.0	7.0	7.0	1.0	4.0	1.0	3.0	1.0	N/A	4.0
	Median	17.0	10.0	10.5	4.0	4.0	2.0	13.0	7.0	7.0	9.0	4.0	4.5	7.0	7.0	5.0	4.5
	Average #S	23.4	11.9	16.5	4.0	4.3	3.7	13.2	7.8	11.7	14.3	6.3	7.9	17.9	8.6	5.0	6.9
	Mean of 25	23.4	11.9	15.9	1.6	1.4	1.5	13.2	7.5	11.2	8.6	3.0	3.2	15.0	6.2	1.0	3.9
	Variance	213.6	46.8	272.1	6	7.4	12.5	44.4	35.8	264.1	227.5	32.0	71.7	1032	56.5	10	56.2

Keys: Prof. = Professor; AssPr = Associate professor; AsstPr = Assistant professor

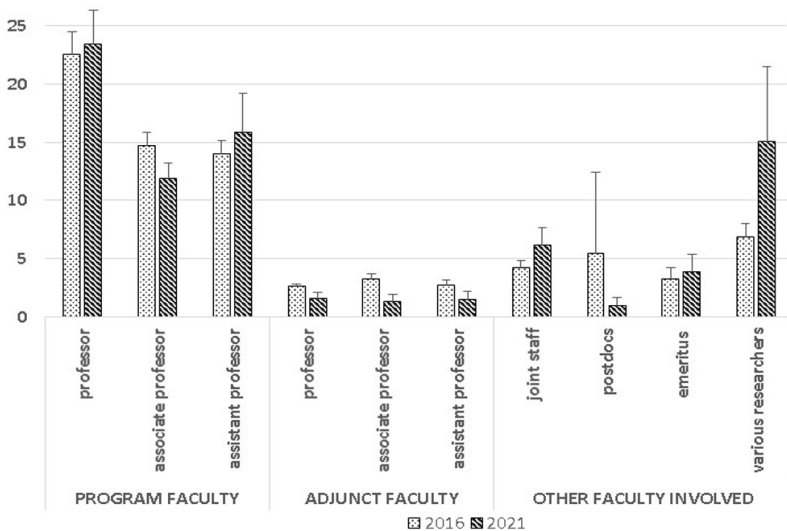


Figure 2. Mean numbers of academic staff of various categories showing composite means of combined 2016 and 2021 values (upper bar insert) and p values of the differences between 2016 and 2021 values using one tailed paired Student’s T-tests (lower bar insert).

“Various researchers” category was 219.9% of the 2016 value in 2021 during the COVID-19 pandemic and “postdoc” category was 19.1% of the 2016 value during the pandemic. These two categories appear as dynamic (Figure 1). Notably, 21 programs included various researchers in 2016 (numbers ranging from 1-27); 21 programs listed various researchers in 2021 (numbers ranging from 1-140); 17 programs listed postdocs in 2016 (numbers ranging from 1 – 26); and 4 programs listed postdocs in 2021 (numbers ranging from 10-84). One tailed paired Student’s T-tests showed $p>0.05$ for both categories compared between 2016 and 2021. Sample variance was very high for the postdoc category in 2016; 1190 compared to the general range of 1.36 – 92 in all other categories. Sample variance was very high for various researchers category in 2021; 1032 compared to the general range of 6-272 in all other categories (Table 3, Figure 2).

Comparing the composite data of 2016 and 2021, one tailed Student’s T-tests showed $p<0.05$ for the two categories: joint staff and emeritus professors, both showing an increase in 2021 during the COVID-19 pandemic. Together, joint staff, emeritus staff, post-docs, and various researchers categories appear as a dynamic pool of researchers. (Figures 1 and 2).

From amongst the professorial cadre were both PhD Pharmacology holders and holders of PhDs that were in other subjects. Notably, more than 25% and less than 50% of the three categories of professorial staff were non-pharmacology PhD holders (Figure 3).

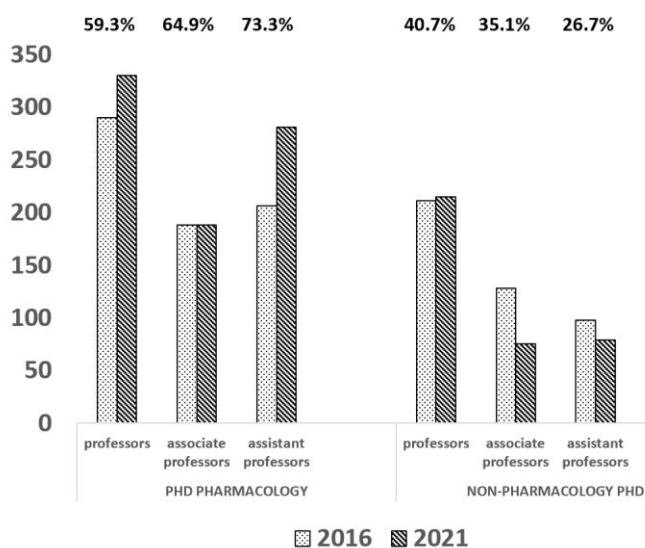


Figure 3. Professorial staff of PhD Pharmacology Programs showing diversity of research expertise

From the composite data of 2016 and 2021, mean staff per program were derived as depicted in Figure 2, giving 23 professors, 13 associate professors, and 15 assistant professors per program with 2 each of adjunct staff in the categories of professor, associate professors, and assistant professor. Mean per program were also 5 joint staff, 3 postdoctoral fellows, 4 emeritus professors, and 11 various researchers (Figure 2). A pattern of top heavy majority of

professors was derived from both the 2016 and 2021 investigations (Figure 4).

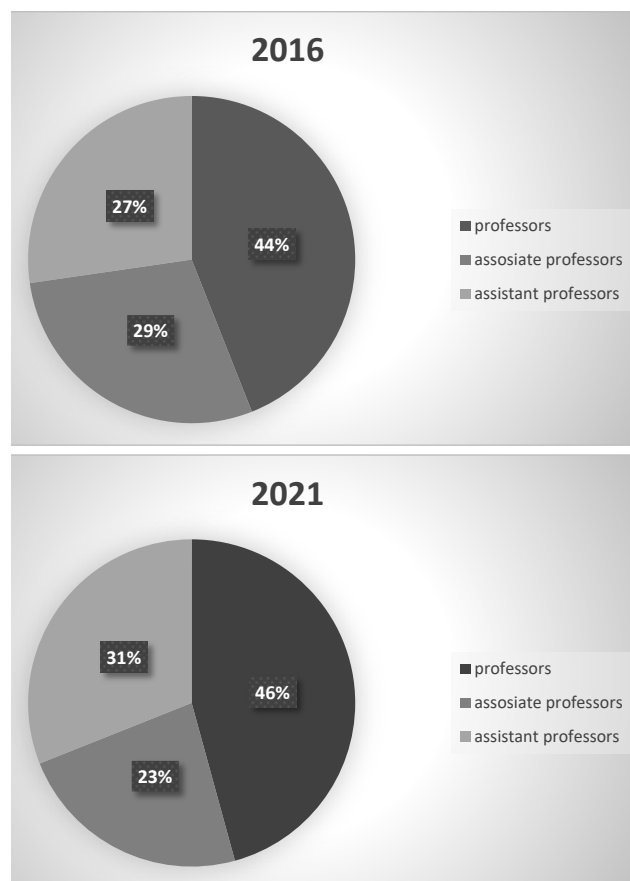


Figure 4 Top heavy consistency between 2016 and 2021 of program staff of pharmacology departments running PhD Pharmacology Programs in 25 North American universities.

The convenient data obtained from the eight best staffed Nigerian universities with the addition of The Premier University are shown in Tables 4 and 5. For Professor, the lowest number was 1 and the highest was 8, the mode was 1, the mean was 3.7, the median was 4 and the variance was 6.9. For Associate Professor, the lowest number was 1 and the highest was 3, the mode was 1, the mean was 1.5, the median was 1 and the variance was 0.7. For Senior Lecturer, the lowest number was 1 and the highest was 4, the mode was 2, the mean was 2.3, the median was 2 and the variance was 1.2. For Lecturer 1, the lowest number was 1 and the highest was 5, the mode was 3, the mean was 3.2, the median was 3, and the variance was 2.2. For Lecturer 2, the lowest number was 0 and the highest was 5, the mode was 2, the mean was 2.8, the median was 2 and the variance was 2.3. Other staff were varied across the departments.

DISCUSSION

Post graduate degrees in Pharmacology, Masters and PhDs, are research degrees and require teaching and research supervisory staff that can guide early career pharmacologists into successful careers. The academic departments require both capabilities and capacity for such a task.

Table 4.

Number of Professorial staff of pharmacology departments of the best-staffed Nigerian universities according to the Nigerian University System Statistical Digest, 2017 and the Premier University, UI.

		Source Of Information		Professor	Associate Professor
		Personal Contact	Personal contact		
Best staffed universities according to the Nigerian University System Statistical Digest, 2017	Ahmadu Bello University, Zaria (ABU)	NO	YES	2	
	University of Nigerian, Nsukka (UNN)	NO	NO		
	University of Benin, Benin City (UNIBEN)	NO	YES	6	2
	University of Calabar, Calabar (UNICAL)	NO	YES	1	1
	Bayero University, Kano (BUK)	NO	NO		
	Obafemi Awolowo University, Ile-Ife (OAU)	NO	YES	1	1*
	Nnamdi Azikiwe University, Awka (UNIZIK)	YES	YES	4**	1*
	University of Lagos, Lagos (UNILAG)	NO	YES	4	3
The Premier University	University of Ibadan, Ibadan (UI)	YES	YES	8***	1
Key: *Reader, **2 out of 4 are visiting, ***1 out of 8 has dual appointment					

Table 5.

Non-Professorial staff of pharmacology departments of the best-staffed Nigerian universities according to the Nigerian University System Statistical Digest, 2017 and the Premier University, UI.

	SL	LI	LII	AL	RA	LabS	Tech	Technicians	LA	LS	GA	Total non-professional lecturers	Total tech staff
ABU	2	3				1*						5	1
UNN													
UNIBEN	1	5			2		3					6	5
UNICAL	4		2	1			10**					7	10
BUK													
OAU	3		2				3	1		4***		5	8
UNIZIK	1	4	5				4		4		2	10	10
UNILAG	2	3	2									7	
UI	3	1					3					4	3
* From Department of Medicine overseeing Department of Pharmacology, ** Consists of 4 Technologists and 6 Junior Staffa, ***Consists of 2 Superintendents, 1 Supervisor, and 1 Attendant													

Keys: SL=Senior lecturer; LI = Lecturer grade I, LII = Lecturer grade II, AL = Assistant lecturer; RA = Research associate; LabS = lab supervisors; Tech = Technologist; LA = laboratory assistant; GA= Graduate assistant

Capability is defined as “the power or ability to do something” (Oxford Languages, accessed April 4 2022). Australian Curriculum website (accessed April 4 2022) lists seven important capabilities as: literacy, numeracy, information and communication technology capability, critical and creative thinking, personal and social capability, ethical understanding, and intercultural understanding. J Hamilton (2021) explains: “A capability is a set of related skills that are needed to rapidly drive the business forward.....Since capabilities help drive business impacts, think of them as strategic. They enable the business to move forward. Skills, on the other hand, are tactical. They are the granular, specific activities you do for a job.” With respect to specific employees within an organization, “Capability refers to an employee's ability to perform the work expected of them to the required standards. This may be assessed by reference to an employee's skill, aptitude, health or any other physical or mental quality in relation to the job that they are employed to do” (Fenton, 2020). Within an academic department such as a pharmacology department, staff would

have various capabilities, the most important of which may be teaching, mentoring, and research. One staff member would have the capabilities of one person; twenty staff members would have the capabilities of twenty persons which may all be similar or may all vary, bringing various contributions.

Modern biomedical science research involves integrative study of research topics from whole animal modelling to molecular biology techniques and requires various skills (John, 2013) originating from various subject bases but now shared across the biomedical sciences. These include cell biology techniques, immunological techniques, biochemical techniques, and various sub-cellular imaging techniques. In order for a pharmacology department to create an enabling research environment for a vibrant PhD program, it needs to have various staff with different or additive teaching, mentoring and research capabilities as well as varied general capabilities as mentioned by the Australian Curriculum website. Poverty of research staffing may result in poverty of research output. This is especially

important for a developing nation where research is imperative for development and growth.

The results of this investigation show that in the USA, academic staffing in universities, as far as pharmacology departments are concerned, shows both maturation and dynamism. From Figures 1 and 4, we see the consistency in the overall pattern of staffing between the 2016 and 2021 investigations in the professorial cadre. Professorial cadre was steady, meaning not fluctuating significantly. Non-professorial cadre was dynamic. Figure 2 and Table 3 show high variance in staffing of postdocs in 2016 and high variance in staffing of various (miscellaneous) other researchers in 2021. An average of 23 professors, 13 associate professors, and 15 assistant professors were available per program giving PhD students a broad opportunity for both mentorship and research resources. Each of these professorial staff have individual capabilities and individually attract resources which together add up to the research capacity of their respective departments.

Research capacity is the ability to define problems, set objectives and priorities, conduct sound scientific research, build sustainable institutions, and identify solutions to key (national) problems. This definition encompasses research capacity at the levels of individuals, research groups, institutions and countries. Research capacity strengthening is the process by which individuals, institutions and societies develop abilities – individually and collectively – to perform research effectively, efficiently and in a sustainable manner.” (Royal Academy of Overseas Sciences, 2022). Trostle (1992) includes in the definition: “a process of individual and institutional development which leads to higher levels of skills and greater ability to perform useful research. The short and longterm impacts of university research is societal development.”

Bornmann (2013) explains some societal impacts of research that are measurable: “Society can reap the benefits of successful research studies only if the results are converted into marketable and consumable products (e.g., medicaments, diagnostic tools, machines, and devices) or services.” He further discussed the “assessment of social, cultural, environmental, and economic returns (impact and effects) from results (research output) or products (research outcome) of publicly funded research.”

Research capacity building is viewed differently in various parts of the world. In Nigeria and in much of Africa, an emphasis may be placed on institutional or organizational capacity as this appears to be an area of lack. We presented the results of the initial investigation of academic staff strength of postgraduate training programs in pharmacology of North American Universities at the XXXIX Annual Conference of the West African Society for Pharmacology (WASP) / Société Ouest Africaine de Pharmacologie (SOAP) in 2016 (Ekerin and John, 2016). At this point in time, we could not locate local equivalent data for academic staff strengths of Nigerian universities. This is a problem for educational investigation. However, the Nigerian Universities Commission (NUC) has since investigated and published a useful resource that shows the general academic staff strengths of 146 universities existing in Nigeria in 2017 (NUC, 2018). Notably, measuring academic staff strength by number of academic staff members, the top universities were: Ahmadu Bello University (ABU), Zaria with 2,919; University of Nigeria, Nsukka (UNN) with 2,074;

University of Benin (UNIBEN) with 1,884; University of Calabar (UNICAL) with 1,745; Bayero University (BAYERO), Kano with 1,630; University of Lagos (UNILAG) with 1,627; Obafemi Awolowo University (OAU), Ile Ife with 1,399 and Nnamdi Azikiwe University (UNIZIK), Awka with 1,220 academic staff members in their entire university system serving all their programmes. Data from pharmacology programs could not be extracted from the publication but if they existed, they would be a fraction of these totals. For example, Yusuf *et al.*, (2010) determined that 6.4% of the total 3081 academic staff members working at University of Ibadan from 1961 to 2000 was from the College of Medicine and 0.1% was from the Faculty of Pharmacy. This presumably is not much different in the recent 2000’s.

We sought to find the numbers for some pharmacology departments. We made a convenient sampling of the top best staffed Nigerian universities’ pharmacology departments as shown in Tables 4 and 5. Website information on staff was available in one out of the eight best staffed universities. This one university was Nnamdi Azikiwe University which had a well-developed website. The remaining seven pharmacology departments websites were either non-functional at the time we visited (UNN, UNICAL) or had websites with inadequate information (ABU, UNIBEN, BAYERO, UNILAG, and OAU). The Nigerian universities, as seen from this sample, show poor documentation culture and weak social media culture. The premier university, University of Ibadan (UI), which was not amongst the eight conveniently sampled also provided information on academic staff of pharmacology departments and had a well-developed website.

From the NUC report of 2017, the lowest staff strengths were: from Eastern Palm University, Ogboko, Imo State and Kola-Daisi University, Ibadan, Oyo State both with 16 academic staff members; Dominican University, Ibadan with 22; Coal City University, Enugu State and The Tech University, Ibadan both with 23; Legacy University, Okija, Anambra State with 25; and Crown Hill University, Eiyenkorin, Kwara State with 26 academic staff members for their entire programmes. These numbers for whole Nigerian Universities are miniscule compared to numbers from single departments in American universities that we investigated (Table 3).

The NUC publication also gives data of number of full professors in all the 146 universities existing in Nigeria in 2017. Top amongst the universities were: Ahmadu Bello University, Zaria with 579 professors; University of Ibadan with 410; University of Benin with 365; University of Nigeria, Nsukka with 362; Obafemi Awolowo University, Ile-Ife with 324; University of Port Harcourt with 296; University of Calabar with 293; and Nnamdi Azikiwe University with 263 professors total across all their programmes respectively. The numbers of professorial staff in pharmacology departments could not be extracted but if they existed they would be a fraction of these totals. The lowest numbers of professors amongst the 146 universities existing in 2017 were: Ritman University with 1; Legacy University, Chrisland University, Dominican University, and Eastern Palm University all with 2 professors each; Anchor University, Coal City University, and Kola-Daisi University all with 3 professors each as total number of professors across their academic programs. We were unable

to locate updated publication and this 2018 publication remains our key reference for Nigerian universities. This data represents the pool of capabilities, not just pharmacology departments, in each university.

Amongst, the nine Nigerian universities that we sought information from recently, UI, had the highest number of professors (8) in its pharmacology department. From the eight-department convenient sample, two departments yielded no response online or via efforts at direct contact: BUK and UNN. The remaining six pharmacology departments had 1-6 professors. For professors across the nine departments, the mode was 1, the mean was 3.7, the median was 4 and the variance was 6.9. Notably, two departments each had only 1 professor and 1 associate professor (Table 4). This average of 3.7 professors in pharmacology departments of the sample of the best staffed Nigerian universities in 2022 is miniscule compared to the averages of 22.6 and 23.4 professors in US departments of pharmacology in 2016 and 2021 respectively. A similar contrast is seen in other categories of staff. In 2016 the American pharmacology department with the lowest number of professors had 7 professors and in 2021 the American pharmacology department with the lowest number of professors had 9 professors (Table 3). From our sample, in number of professors, only the pharmacology departments of UI (8 professors) and UNIBEN (6 professors) are comparable to the lowest-staffed US pharmacology departments.

Academic staff strength is an important component of the research machine and may actually be the key driver of the machine. It is noteworthy that 25 American universities have for 2016/2021 respectively, 711/722 professors (including 82/97 emeritus professors), 450/331 associate professors, and 418/434 assistant professors listed in the pharmacology departments plus 106/154 joint staff, 137/25 post-doctoral fellows, and 171/376 various researchers serving the PhD Pharmacology programs. Adding various categories of staff, this totals 1,993 academic staff members in 2016 and 2,042 academic staff members in 2021 - serving in the PhD Pharmacology programs alone. In contrast, Nigeria's top Ahmadu Bello University, Zaria had 2,919 academic staff total including 579 professors in all its programmes; a fraction of this, (2/579 or 0.004% professors) is for the pharmacology programme. Seemingly, the academic staff strengths of Nigerian Universities are much weaker than those of North American universities in general and the pharmacology programs in Nigerian universities are poorly staffed. This could be because of a focus on teaching and lack of vibrant research activities.

The National Universities Commission of Nigeria provides guidelines for university staffing through its Core Curriculum and Minimal Academic Standards (NUCCMAS). These minimal standards are generally to meet teaching requirements of the department. However, professional responsibilities beyond departmental borders include, reviewing of scientific papers, books, grant applications, and promotion papers, etc., which can be seriously hampered by the weak collective capacity of Nigerian universities whose strengths are only to meet minimal teaching requirements. Furthermore, individual departments' research ambitions would make them rise

above minimum teaching standards to improve their academic staff strength for vibrant research.

Bornmann (2013) describes societal impacts of research that are measurable. Reflecting on the contribution of university research to development in Nigeria, there is a need for Nigerian universities in general to expand their research capacities. Left to a natural evolution of research capacity, this may take a long time. The First Generation Nigerian Universities: University of Ibadan (1948); Ahmadu Bello University, Zaria (1960); University of Nigeria, Nsukka (1960); Obafemi Awolowo University, Ile-Ife (1962); University of Lagos (1962); and University of Benin (1972) are more than 50 years old (Awe, 2020) and are still inadequate in research capacity, judging by societal impact of research.

Growth can be stimulated by appropriate interventions which includes facilitating career options in Nigeria against chronic persistent brain drain. Brain drain of young scientists from Africa is recognized as a negative influence on Africa's development (NASAC, 2019). Lack of interest in science is an Achilles' heel in nation building and a factor of poverty and dependency. A look at the American staff strengths and the Nigerian system suggests a radical improvement in academic science is necessary for socio economic development in Nigeria. The young biomedical scientist needs careful mentoring and research support from the professorial cadre thus Nigerian universities need to take care of academic departments' staff strengths.

Academic departments in Nigeria may need to actively embark on expansion and to be dynamic in research staff composition. The US PhD Programs in Pharmacology have both PhD Pharmacology holders and non-Pharmacology PhD holders. Amongst the majority PhD Pharmacology holders in pharmacology departments or programs were 41% professors, 35% associate professors, and 27% assistant professors who had PhDs in subjects other than pharmacology (Figure 3). This kind of arrangement ensures state-of-the-arts research capacity allowing people of various capabilities to contribute necessary knowledge, skills, perspectives, and resources. Diverse expertise as highlighted by John (2013 and 2014) is also contributed by adjunct faculty. An average of 2 professors, 2 associate professors, and 2 assistant professors per PhD Pharmacology Program plus an average of 5 joint staff from cognate departments and an average of 4 emeritus professors (Figure 2) are seen per PhD Pharmacology Program of North American universities.

Another aspect of staffing for research capacity is the ability to buffer the staff composition according to particular needs, particular times, and changing environments. The year 2021 was two years into the COVID-19 Pandemic. The data in Table 3 shows that there was a general increase in sample variance in 2021, pertaining to 15 categories. This may indicate internal shifts in departments across the board during the pandemic. We note that collectively in 2021 there was a sharp fall in total number of postdocs though $p > 0.05$ because 2016 sample variance was very high. There was also a sharp rise in the various researchers category, a category of unclearly defined status, again $p > 0.05$ because of the high sample variance in the 2021 data. Here, it is not clear if these changes were pre-pandemic, before 2019, but we see that they certainly exist during the pandemic. These categories of staff might be described as non-permanent or

non-steady but serving important roles as needed from time to time and form a dynamic pool that can buffer staffing as needed (Figure 1). Nigerian institutions too can utilize flexible staffing with permanent and non-permanent staff for a more robust research environment. Research staffing requires institutional disposition to flexibility and adjustment.

The Nigerian universities system is clearly stressed by several issues. There is a general proliferation of universities and tertiary institutions. For example there were: 43 federal universities, 48 state universities, and 79 private universities recorded in February, 2021 (Sasu, 2022) and in January, 2022 there were 48 federal universities, 54 state universities and 99 private universities or tertiary institutions (Idoko, 2022). Nigerian university lecturers have been on strike 15 times between 1999 and 2020 (Awe, 2020). Focus on problems is certainly a distraction from capacity building. Awe (2020) discusses the Nigerian universities' problems of understaffing and underfunding. Use of temporary staffing for accreditation periods alone and over-enrolment of students to increase internally generated incomes are some survival strategies being used in Nigerian universities (Awe, 2020), both cosmetic strategies being complications. For science departments such as pharmacology departments, staffing is not just important in terms of numbers but is also important in terms of the research resources and research environment the professorial cadre provide for graduate students. Crucial is the fact that academic staff strength is the sum of the individual capabilities plus the sum of structural, functional, and financial contributions that individual academics (especially of professorial cadre) attract to their departments.

From the 2017 NUC data mentioned above, Nigerian universities, in general, need to develop improved business mentality. "As well as understanding abilities, capabilities and capacity it is important for an organization to be aware of its competence. This is the quality or state of being functionally adequate or having sufficient knowledge, strength and skill to deliver what is required" (for the Nigerian society and nation building), (Business Process Incubator, 2016). Nigerian universities' staffing determine their capacities to improve their current activities and to innovate new processes and contribute to socio-economic development. Their key capacities for institutional development are evidently human resources, financial resources, and enabling environment.

In conclusion, the academic staff strength available to graduate students per PhD Pharmacology Program in the USA are: 23 professors, 13 associate professors, and 15 assistant professors per program with 2 each of adjunct staff in the categories of professor, associate professors, and assistant professor. Mean available per program were also 5 joint staff, 3 postdoctoral fellows, 4 emeritus professors, and 11 various researchers. In totality, these programs were top-heavy experience and expert laden with the professorial cadre, diversified, and depicted steady professorial cadre and dynamic non-professorial cadre during COVID-19 pandemic. It follows that for Nigerian pharmacology departments, and universities in general, to match the research capabilities and ranking of American universities, one area of investment would be in human resources. Attraction of experts and people of experience from local

and global sources into African universities can help to wield the research needed for finding solutions to Africa's health problems and general development.

OPINION

Staff strength is important for capability and capacity of academic departments to wield state-of-the-arts research with societal impact. In Nigeria and perhaps in much of Africa, academic staff strength should be a key area for developmental efforts.

Contributions:

B. Ekerin mined the data on US websites; T. A. John conceived the idea, collected data from Nigerian universities, analysed all data, and wrote the paper.

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