

Productivity Characteristics of the Thesis Rate of PhD Students in Biomedical Areas of the Different Doctoral Programs in Lima, Peru: A 20-year Retrospective Study

Alicia Fernández-Giusti¹, Gerardo Ronceros¹, Juan Matzumura-Kasano¹, Luis Podestá¹, José Canchis-Aremburgo¹, Frank Mayta-Tovalino^{1,2}

¹Postgraduate Department, Faculty of Medicine, Universidad Nacional Mayor de San Marcos,

²Postgraduate Department, CHANGE Research Working Group, Faculty of Health Sciences, Universidad Científica del Sur, Lima, Peru

Received : 21-07-20
Revised : 05-08-20
Accepted : 06-10-20
Published : 30-01-21

ABSTRACT

Objective: The aim of this study was to determine the productivity characteristics related to the thesis rate of biomedical students of the PhD program in Health Sciences in Lima, Peru through a 20-year retrospective study. **Materials and Methods:** This was a retrospective, comparative, cross-sectional study. The evaluation period consisted of two time periods, 1999–2014 and 2015–2019, to differentiate thesis defense production both before and after the promulgation of the new University Law 30220 in Peru. The student population included graduates from different professional areas (Dentistry, Medicine, etc.). An electronic search for all the data was carried out by using the Universidad Nacional Mayor de San Marcos (UNMSM) SUM (Unique Registration System) software. **Results:** It was found that the highest prevalence of students who entered in the doctoral programs of the UNMSM Faculty of Medicine was 26.6% in 2013, whereas the highest prevalence of graduates was 24.4% in 2016. Finally, the highest prevalence of graduates who engaged in thesis defense was 41.4% in 2017. There has been a constant increase in thesis production, with the cutoff point being from 2014 onward. The Pearson's chi-square test showed a significant association between the type of PhD program and thesis defense ($P = 0.008$). **Conclusion:** The greatest production of thesis defense was carried out from 2014 to 2019. In addition, there was a significant association between thesis defense according to the PhD program and the professional career of the PhD student; however, none of the factors associated with the influence of obtaining a PhD degree in any of the programs evaluated was statistically significant.

KEYWORDS: Dentistry, PhD students, productivity characteristics, retrospective study, thesis

INTRODUCTION

The UNMSM, internationally known as “The Dean of America,” was founded on May 12, 1551 in Lima, Peru, and it is the oldest and one of the most prestigious universities in Latin America. The Office for Research and Postgraduate Studies of the Vice-Rector of the San Fernando Faculty of Medicine offers professionals a master's degree for doctorate

programs in Medicine, Health Sciences, Neurosciences, and Nursing, with the aim of training highly qualified

Address for correspondence: Dr. Frank Mayta-Tovalino, Postgraduate Department, Faculty of Health Sciences, Universidad Nacional Mayor de San Marcos and Universidad Científica del Sur, Av. Paseo de la República 5544, Miraflores 15074, Lima, Peru.
E-mail: fmaytat@unmsm.edu.pe

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Fernández-Giusti A, Ronceros G, Matzumura-Kasano J, Podesta L, Canchis-Aremburgo J, Mayta-Tovalino F. Productivity characteristics of the thesis rate of PhD students in biomedical areas of the different doctoral programs in Lima, Peru: A 20-year retrospective study. J Int Soc Prevent Communit Dent 2021;11:19-25.

Access this article online

Quick Response Code:



Website: www.jispcd.org

DOI: 10.4103/jispcd.JISPCD_332_20

academic, scientific, and competitive researchers, who are capable of innovating knowledge, techniques and methods with ethics, and critical attitudes and of making proposals for solutions to health problems in the population.^[1]

The Institutional Strategic Plan 2019–2023 approved by the UNMSM contemplates the improvement of quality academic training for doctoral students, with the indicator being to increase the percentage of graduates and postgraduates.^[1] The Doctorate Department is the first-line organ of the Vice-Rector's Office for Postgraduate Research at the Faculty of Medicine of the UNMSM; it aims at training researchers with a high academic level, who are capable of promoting teaching and health research that is more competitive at both national and international levels. Likewise, these researchers are expected to provide adequate service to ensure user satisfaction, which is in accordance with the regulations governing this section. Currently, there are four doctorates: Doctorate in Medicine, Doctorate in Health Sciences, Doctorate in Neuroscience, and Doctorate in Nursing, with a study plan of 72 credits to be carried out in six academic semesters.^[1,2]

Traditionally, training at the doctoral level implies generating greater job opportunities to carry out teaching (administrative) tasks. However, the development of research as a substantive activity is currently the highest priority.^[3] A doctoral degree is required to advance leadership within the fields of biomedical research. Consequently, admission to a graduate degree is a stepping stone to exercising scientific leadership. PhD programs generally receive qualified applicants, thereby translating into exhaustive competition during the college admissions process.^[4]

The profile of a candidate for a PhD program in biomedical sciences is critical to evaluate the objective factors of doctoral training to which the postgraduate student is subjected during academic training. It is known that a PhD program in biomedical science must guarantee a wide variety of training experiences involving specialists, data management, critical scientific literature, real problem solving, and communication skills.^[5,6] Doctoral students must actively participate in research programs during their doctoral training.^[7] Early exposure to research improves the profile of graduate students and stimulates their motivation in participating in research projects; this exposure is related to an evident improved academic and scientific productivity in the short term.^[7,8]

Thus, the aim of this study was to determine the productivity characteristics of the thesis rate of PhD

students in biomedical areas of the different doctoral programs in Lima, Peru in a 20-year retrospective study.

MATERIALS AND METHODS

STUDY DESIGN

A descriptive, cross-sectional, and retrospective 20-year study was carried out. The entire population of students of the four different PhD programs in Health Sciences of the Faculty of Medicine of UNMSM was evaluated. The retrospective evaluation consisted of two time periods, 1999–2014 and 2015–2019, to differentiate thesis defense production both before and after the promulgation of the new University Law 30220 in Peru. The student population included graduates from different professional areas (Medicine, Dentistry, Nursing, Nutrition, Psychology, Obstetrics, Biology, Chemistry, and Medical Technology, among others).

SEARCH STRATEGY

An electronic search for all the data was carried out by using the UNMSM SUM software, including the academic and administrative profiles of all the students of the PhD Program in Health Sciences, Medicine, Nursing, and Neuroscience over the past 20 years (1999–2019). In addition, information related to the doctoral theses made from January 1, 1999 to December 31, 2019 was searched in the database of the Research and Postgraduate Unit of the Faculty of Medicine of the UNMSM. The search and review of each graduate of the PhD programs was carried out by two researchers. The theses supported by the four different doctoral programs were examined in relation to the start and end date of the program, advisors, and thematic area (research line). The evaluation of each thesis was included by consensus among the authors.

DATA COLLECTION AND SELECTION CRITERIA

The main variables evaluated in the present investigation were as follows: PhD program, year of admission and graduation, and year of thesis defense. The productivity of the theses of the four doctorates of the Faculty of Medicine was examined by using the UNMSM database, in which the data for each graduate were recorded.

Selection criteria

- Inclusion criteria
- Work carried out from 1999 to 2019
- Student sheets with complete data

Exclusion criteria

- Author's duplicate works
- Graduates after 2019
- Graduates with incomplete data or with some administrative observation

- Students who, for some reason, dropped out from the doctoral program

STATISTICAL ANALYSIS

Univariate analysis was performed to obtain the frequencies and percentages for categorical variables, whereas the arithmetic mean and standard deviation were used as measures of central tendency and dispersion for numerical variables. Comparisons were made by using statistical inference through the Pearson's chi-square test. A significance level of $P < 0.05$ was established, and all the analyses were performed by using Stata v15.0 software.

RESULTS

In relation to the PhD programs, it was found that 48.9% of the graduates for the years 1999–2019 were from the PhD in Health Sciences, followed by the PhD in Medicine 38.3%; however, the prevalence of students doing their PhD in Neuroscience was the lowest with 6.3%. Regarding the professional career of doctoral students, the highest proportion of students were medical students (55.3%), followed by nurses (15.9%), and psychologists (6.3%). On the

contrary, the male sex was the most prevalent, with 51.0%; this was accompanied by the majority of Peruvian graduate students, with 75.5%. It was also found that the highest prevalence of thesis defenses occurred from 2014 to 2019, with 12.7%, 6.3%, 11.7%, 41.4%, 9.5%, and 9.5% of PhD students, respectively, during each year of this period. Finally, the average grade obtained by the doctoral students defending their thesis was 18.6 ± 8.4 , with an average age of 56.2 ± 8.2 years [Table 1].

The highest prevalence of students who entered in the doctoral programs of the UNMSM Faculty of Medicine was 26.6% in 2013, whereas the highest prevalence of graduates was 24.4% in 2016. Finally, the highest prevalence of graduates who engaged in thesis defense was 41.4% in 2017 [Table 2 and Graph 1].

The highest proportion of thesis defense was in the doctoral programs in Health Sciences and Medicine. There has been a constant increase in thesis production, with the cutoff point being from 2014 onward. Fisher's exact test showed a significant association between the type of PhD program and thesis defense ($P < 0.05$) [Table 3 and Graph 2].

Table 1: Sociodemographic characteristics of the PhD students

Variables	Groups	<i>f</i>	%
PhD program	Health Sciences	46	48.9
	Medicine	36	38.3
	Nursing	6	6.3
	Neurosciences	6	6.3
Profession of the PhD student	Medicine	52	55.3
	Psychology	6	6.3
	Dentistry	5	5.3
	Nursing	15	15.9
	Chemistry	4	4.2
	Nutrition	2	2.1
	Obstetrics	4	4.2
	Medical Technology	3	3.1
	Others	3	3.1
	Sex	Male	48
Female		46	48.9
Nationality of the PhD student	Peruvian	71	75.5
	Ecuadorian	23	24.4
Year of thesis defense	2008	1	1.0
	2013	7	7.4
	2014	12	12.7
	2015	6	6.3
	2016	11	11.7
	2017	39	41.4
	2018	9	9.5
Grade obtained in thesis defense		Mean	Standard deviation
		18.6	8.4
Age		56.2	8.2

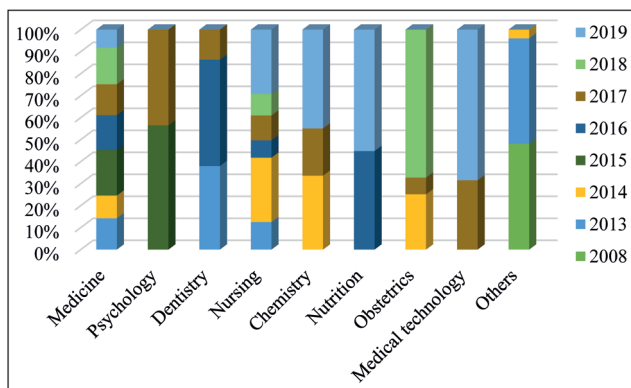
Table 2: Evaluation of the characteristics of the PhD students according to admission, graduation, and thesis defense

Admission			Graduation			Thesis defense		
Year	f	%	Year	f	%	Year	F	%
1999	3	3.1	2000	3	3.1	2008	1	1.0
2002	4	4.2	2003	3	3.1	2013	7	7.4
2004	8	8.5	2005	8	8.5	2014	12	12.7
2005	3	3.1	2006	3	3.1	2015	6	6.3
2006	6	6.3	2007	1	1.0	2016	11	11.7
2007	3	3.1	2008	3	3.1	2017	39	41.4
2008	4	4.2	2009	4	4.2	2018	9	9.5
2009	6	6.3	2010	6	6.3	2019	9	9.5
2010	6	6.3	2011	7	7.4			
2011	10	10.6	2012	10	10.6			
2012	12	12.7	2013	12	12.7			
2013	25	26.6	2014	5	5.3			
2014	8	8.5	2015	6	6.3			
2015	6	6.3	2016	23	24.4			
2016	18	10.1	2017	8	8.5			
2017	7	3.9	2018	18	10.1			
2018	18	10.1	2019	7	3.9			
2019	40	22.6						

Table 3 : Association of thesis defense according to the PhD program

Thesis defense	PhD program										P*
	Health sciences		Medicine		Nursing		Neurosciences		Dentistry		
Year	f	%	f	%	f	%	f	%	f	%	
2008	0	0.0	0	0.0	0.0	0.0	1	100	0	0.0	
2013	3	42.8	4	57.1	0.0	0.0	0	0.0	2	20.0	
2014	6	50	4	33.3	2	16.6	0	0.0	0	0.0	
2015	0	0.0	6	100	0.0	0.0	0	0.0	2	20.0	<0.05
2016	4	36.6	7	63.6	0.0	0.0	0	0.0	2	20.0	
2017	24	61.5	8	20.5	3	7.6	4	10.2	1	0.0	
2018	5	55.5	4	44.4	0.0	0.0	0	0.0	1	10.0	
2019	4	44.4	3	33.3	1	11.1	1	11.1	2	20.0	

All groups were measured according to the database of the Postgraduate Doctoral Unit of the Faculty of Medicine of the UNMSM
 * Fisher’s exact test $P < 0.05$ statistically significant



Graph 1: Graphical evaluation of thesis production of PhD students according to the biomedical career

The highest prevalence of thesis defense was held by medical professionals, followed by nurses and dentists. There was a notable increase in thesis production from 2014 to 2019. There was a significant association

between the type of biomedical career and thesis defense ($P = 0.018$) [Tables 4 and 5].

DISCUSSION

According to the international vision of the UNMSM, in 2013 the Faculty of Medicine signed an agreement with the Technical University of Babahoyo of Ecuador, including the admission process, which resulted in the entrance of students who sought to pursue PhD studies in Health Sciences.^[1] A requirement for admission to the doctorate program in Peru is to possess a master’s degree and present a research project according to the problematic reality of comprehensive health in the respective setting. Doctoral students of the Faculty of Medicine may modify their project during the development of the research seminar course in accordance with the current research lines published on the website of the university; they can select their project according to their academic profile.^[1]

Table 4: Association of thesis defense according to biomedical profession

Thesis defense	Profession of the PhD student									P
	Medicine	Psychology	Dentistry	Nursing	Chemistry	Nutrition	Obstetrics	Medical Technology	Others	
	%	%	%	%	%	%	%	%	%	
2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	
2013	57.1	0.0	14.2	14.2	0.0	0.0	0.0	0.0	100	
2014	41.6	0.0	0.0	33.3	8.3	0.0	8.3	0.0	8.3	0.018
2015	83.3	16.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2016	63.6	0.0	18.1	9.0	0.0	9.0	0.0	0.0	0.0	
2017	56.4	12.8	5.1	12.8	5.3	0.0	2.5	5.1	0.0	
2018	66.6	0.0	0.0	11.1	0.0	0.0	22.2	0.0	0.0	
2019	33.3	0.0	0.0	33.3	11.1	11.1	0.0	11.1	0.0	

All groups were measured according to the database of the Postgraduate Doctoral Unit of the Faculty of Medicine of the UNMSM Fisher's exact test $P < 0.05$ statistically significant

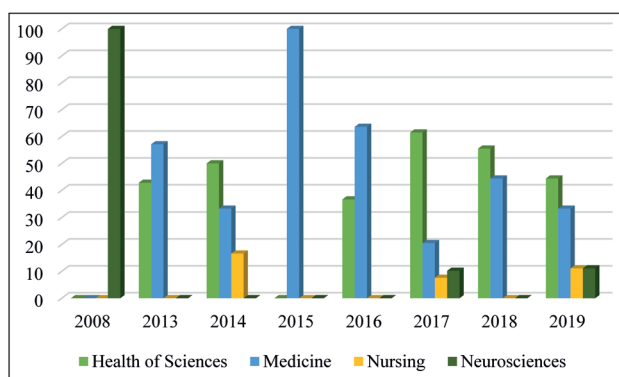
Table 5: Productivity of postgraduate students' research in Lima, Peru

Year	Country	Design	Program	Period (years)	Thesis defense N (%)	Time to publication	Citation	Author
2008	Peru	CSS	Doctoral	1999–2014	1(1)	Not yet	–	Zarate <i>et al.</i>
2013	Peru	CSS	Doctoral	1999–2014	7(7.4)	Not yet	–	Perry <i>et al.</i> ; Torres <i>et al.</i> ; Paredes <i>et al.</i> ; Lam <i>et al.</i> ; Villegas <i>et al.</i> ; Sanchez <i>et al.</i> ; Gomez <i>et al.</i>
2014	Peru	CSS/Exp	Doctoral	1999–2014	12(12.7)	Not yet	–	Timana <i>et al.</i> ; Munares <i>et al.</i> ; Blossiers <i>et al.</i> Diaz <i>et al.</i> ; Figueroa <i>et al.</i> Ortiz <i>et al.</i> ; Ruiz <i>et al.</i> ; Villarreal <i>et al.</i> ; Ronceros <i>et al.</i> ; Loli <i>et al.</i> ; Verastegui <i>et al.</i> ; Alvarez <i>et al.</i>
2015	Peru	CSS/Exp	Doctoral	2015–2019	6(6.3)	Not yet	–	Ticona <i>et al.</i> ; Huaroto <i>et al.</i> ; Bustamante <i>et al.</i> ; Araujo <i>et al.</i> ; Guevara <i>et al.</i> ; Mendoza <i>et al.</i>
2016	Peru	CSS/Exp	Doctoral	2015–2019	11(11.7)	Not yet	–	Palomino <i>et al.</i> ; Delgado <i>et al.</i> ; Hinostroza <i>et al.</i> ; Caceres <i>et al.</i> ; Morales <i>et al.</i> ; Mendoza; Villanueva <i>et al.</i> ; Limay <i>et al.</i> ; Li <i>et al.</i> ; Aparicio <i>et al.</i> ; Vera <i>et al.</i>
2017	Peru	CSS/Exp	Doctoral	2015–2019	39(41.4)	In process	–	–
2018	Peru	CSS/Exp	Doctoral	2015–2019	9(9.5)	In process	–	Paredes <i>et al.</i> ; Muñoz <i>et al.</i> ; Podesta <i>et al.</i> ; Ramirez <i>et al.</i> ; Martina <i>et al.</i> ; Monserrate <i>et al.</i> ; Contreras <i>et al.</i> ; Maggi <i>et al.</i> ; Arbelaez <i>et al.</i>
2019	Peru	CSS/Exp	Doctoral	2015–2019	9(9.5)	In process	–	Remuzgo <i>et al.</i> ; Perez <i>et al.</i> ; Vasquez <i>et al.</i> ; Villar <i>et al.</i> ; Camacho <i>et al.</i> ; Coras <i>et al.</i> ; Valdivia <i>et al.</i> ; Cabellos <i>et al.</i> ; Guija <i>et al.</i>

CSS = cross-sectional study, Exp = experimental study

Some doctoral theses receive financial support from the UNMSM or private entities. According to the topic and line of research, a project director is chosen from among the 50 research groups of the UNMSM Faculty of Medicine. Within the Strategic Plan of the Faculty of Medicine 2017–2019, the strategic objectives include: improving quality academic training for students and improving research and innovation for the production of knowledge in postgraduate studies. The indicators include the percentage of graduates and postgraduates

who complete their studies according to the duration of the established curricular program and the rate of research published in indexed journals, in relation to the first and second strategic objectives. On July 19, 2014, the UNMSM issued a Rectoral Resolution number 2415, which promoted the graduation of professors who had graduated from the program before 2014-I, according to the New University Law 30220, to promote the investigation and development of theses. This law contributed to the graduation of many



Graph 2: Graphic evaluation of thesis production according to the PhD program

graduate professors, who, for various reasons, failed to complete their thesis.^[1]

Therefore, according to the results of this study, students are currently pursuing doctorate studies in Neurosciences, Health Sciences, Nursing, and Medicine.^[1] Of these students, 48.9% are from Ecuador. They have a mean age of 56.2 years, and most of them are following a professional career in Medicine (55.3%). Furthermore, there has been a notable increase in thesis defense from 2014 to 2019 (12.7%, 6.3%, 11.7%, 41.4%, 9.5% and 9.5%, respectively, for each year). According to some studies, medical research activities involve full-time dedication. The submission of a satisfactory thesis describing the results of a supervised study is a prerequisite for the completion and awarding of a PhD. Furthermore, the subsequent publication of the project results in peer-reviewed journals and is a fundamental requirement for awarding this degree.^[9,10]

For instance, according to the study by Urrunaga-Pastor *et al.*,^[11] research is paramount for future professionals. At present, there is little literature measuring the academic–scientific production of medical students in Latin America. However, this group performed a cross-sectional study evaluating eight professional medical schools in Lima, Peru; it concluded that one in seven students had published at least one article, one in twelve students had published at least one original article, and one in forty students had published at least one original article in an indexed journal, demonstrating that scientific production is heterogeneous.

Al-Busaidi *et al.*^[12] stated that medical students play a fundamental role in promoting scientific research and scientific publication, although there are a few studies on the impact of research production on future academic achievements. These authors evaluated factors related to gender, university, and year of graduation with a ratio of 2:1 (two control factors for each student author). Scientific publication in medicine was identified as

being associated with academic achievement. Therefore, studies are needed to explore the factors associated with student research production. However, our study found no factor to be associated with thesis defense and obtaining a doctoral degree, with the predictive factors being nonstatistically significant ($P > 0.05$).

In New Zealand, there are also few studies evaluating the publication rates of theses by medical students. A study carried out by Al-Busaidi *et al.*^[10] showed similar results to ours, and they reported that publication in journals with a peer-review process is the measure of choice to publish knowledge. Therefore, it is important to determine the frequency and characteristics of publications derived from the thesis of the University of Otago School of Medicine, New Zealand. Among their main results, they found that most of the publications were original articles (84%) and concluded, as in our study, that the factors that prevent medical students from publishing their theses should be formally evaluated, being even more important among students doing doctoral studies.

According to the study by Fosbøl *et al.*,^[13] the scientific performance of medical doctorate programs in all Danish universities is poorly studied. Therefore, they conducted a retrospective study including three doctoral schools in Denmark to assess postdoctoral research output over 18 years through individual publications accessed by PubMed. They evaluated 2686 medical doctoral students (1995–2013) with a history of scientific production and concluded that the greatest production in medicine occurred mainly at the time of obtaining a doctoral degree. After obtaining a doctorate, scientific output decreased, suggesting that progress fails and resources are not being tapped. Similarly, the study by Obuku *et al.*^[14] described a low rate of research production by graduate students in developing countries. We did not find any study evaluating strategies to increase productivity, indicating the need for policies to promote research, especially in health science schools. In addition, it is important to develop capacities in the doctoral process to ensure that students are more efficient and productive.^[15,16]

The main limitation of this study was that the database of PhD students with incorrect data registration had to be refined, since the digitization process showed that there were some weaknesses in the registries. Another limitation was that other possible significantly associated factors were not evaluated and could not, thus, help to understand the real reason as to why many Peruvian PhD students fail to complete the thesis defense process. However, despite these limitations, the results of this study enable a tangible visualization of how the scientific production of the doctoral students of the programs of the Faculty of Medicine of the UNMSM has notably

increased, thereby contributing to the generation of scientific evidence to carry out strategies to enhance academic production. Following the promulgation of the new University Law 30220 and the management of the university authorities, a significant number of doctoral graduates were promoted and obtained their corresponding academic degrees.

Finally, this study recommends taking into account that most of the doctoral theses in the different areas of health in Peru are not sent or published in high-impact scientific journals, so it is not possible to cite them. For this reason, it should be required that the theses to be compulsorily supported must first be published in a national or international indexed journal, since this condition greatly affects scientific productivity in the country.

CONCLUSION

Within the limitations of this study and according to the results obtained, it is concluded that the greatest production of thesis defense was obtained from 2014 to 2019 (Year of Promulgation of the New University Law 30220), with 12.7%, 6.3%, 11.7%, 41.4%, 9.5%, and 9.5%, respectively. In addition, there was a significant association between thesis defense according to the PhD program and the professional career of the PhD student.

ACKNOWLEDGEMENT

We wish to thank the Faculty of Medicine of the *Universidad Nacional Mayor de San Marcos* for providing the logistical facilities for the development of this research. We also acknowledge the *Universidad Científica del Sur (UCSUR)* for constantly supporting us in the elaboration of the manuscript.

FINANCIAL SUPPORT AND SPONSORSHIP

Not applicable.

CONFLICTS OF INTEREST

AFG is Head of the Doctorate Section, GR is dean, JPMK is Vice-Dean of Research, LP is the Head of the Master's Section, and JC and FMT are postgraduate students of the *Universidad Nacional Mayor de San Marcos*.

AUTHOR CONTRIBUTIONS

Study conception (AFG, JLC, and FMT), data collection (JLC and AFG), data acquisition and analysis (GR, JPM, and FMT), data interpretation (LP, AFG, GR, JPM, and FMT), and manuscript writing (FMT, AFG, and JLC).

ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

This project is exempt from ethical approval, because it was a study that worked with secondary data from the Faculty of Medicine. However, all the procedures that had been carried out according to the ethical guidelines established by the Declaration of Helsinki were treated confidentially.

PATIENT CONSENT STATEMENT

Not applicable.

DATA AVAILABILITY STATEMENT

The data that support the study results are available from the corresponding author (Dr. Frank Mayta-Tovalino, e-mail: fmaytat@unmsm.edu.pe) on request.

REFERENCES

1. Facultad de Medicina. Plan Estratégico [Internet]. Universidad Nacional Mayor de San Marcos. 2020. Available from: https://medicina.unmsm.edu.pe/images/Facultad_Medicina/Facultad/plan-estrategico-RR-05319-R-17.pdf [Accessed 19 Apr 2020].
2. Superintendencia Nacional de Educación Superior Universitaria. Nueva Ley Universitaria 30220–2014 [Internet]. [2020]. Available from: <https://www.sunedu.gob.pe/nueva-ley-universitaria-30220-2014/> [Accessed 19 Apr 2020].
3. Padrón HS, Cabrera AR, Calvo SM. Performance of students graduated from the doctoral program of health sciences in Tabasco, México. *Rev Cuba Educ Medica Super* 2018;32:1-11.
4. Gonzales LM, Allum JR, Sowell RS. Graduate Enrollment and Degrees: 2002 to 2012. Washington, DC: Council of Graduate Schools; 2013.
5. Weiner OD. How should we be selecting our graduate students? *Mol Biol Cell* 2014;25:429-30.
6. Hall JD, O'Connell AB, Cook JG. Predictors of student productivity in biomedical graduate school applications. *PLoS One* 2017;12:e0169121.
7. Amgad M, Man Kin Tsui M, Liptrott SJ, Shash E. Medical student research: An integrated mixed-methods systematic review and meta-analysis. *PLoS One* 2015;10:e0127470.
8. Al-Busaidi IS, Wells CI. Stimulating the clinical academics of tomorrow: A survey of research opportunities for medical students in New Zealand. *N Z Med J* 2017;130:80-8.
9. Al-Busaidi IS, Al-Shaqsi SZ. Students' contribution to the New Zealand medical journal: A 14-year review. *N Z Med J* 2015;128:47-52.
10. Al-Busaidi IS, Alamri Y. Publication rates and characteristics of undergraduate medical theses in New Zealand. *N Z Med J* 2016;129:46-51.
11. Urrunaga-Pastor D, Alarcon-Ruiz CA, Heredia P, Huapaya-Huertas O, Toro-Huamanchumo CJ, Acevedo-Villar T, *et al.* The scientific production of medical students in Lima, Peru. *Heliyon* 2020;6:e03542.
12. Al-Busaidi IS, Wells CI, Wilkinson TJ. Publication in a medical student journal predicts short- and long-term academic success: A matched-cohort study. *BMC Med Educ* 2019;19:271.
13. Fosbøl EL, Fosbøl PL, Rerup S, Østergaard L, Ahmed MH, Butt J, *et al.* Low immediate scientific yield of the PhD among medical doctors. *BMC Med Educ* 2016;16:189.
14. Obuku EA, Lavis JN, Kinengyere A, Ssenono R, Ocan M, Mafigiri DK, *et al.* A systematic review on academic research productivity of postgraduate students in low- and middle-income countries. *Health Res Policy Syst* 2018;16:86.
15. Manabe YC, Namboozee H, Okello ES, Kanya MR, Katabira ET, Ssinabulya I, *et al.* Group mentorship model to enhance the efficiency and productivity of PhD research training in sub-Saharan Africa. *Ann Glob Health* 2018;84:170-5.
16. Pacheco WI, Noel RJ Jr, Porter JT, Appleyard CB. Beyond the GRE: Using a composite score to predict the success of Puerto Rican students in a biomedical PhD program. *CBE Life Sci Educ* 2015;14:13-20.