ORIGINAL ARTICLE

Association between prior extracurricular publications and the intent of students publishing their theses in scientific journals: A Cross-Sectional Study of 40 Medical Schools in Latin America

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ABSTRACT

Aimm: To determine the association between prior extracurricular publication and the intention of medical students in Latin America publishing theses in scientific journals.
Methods: Cross-sectional study, where the main variable was the intent to publish a thesis, investigatingan association with prior extracurricular publication and other co-variables of interest. Prevalence ratios (PR) were estimated using generalized linear multilevel models.
Results: Of 11,587, 7.9% self-reported previous publications and 2,9% had interest inpublishing their thesis. We found that having previously published, increased the intention to publish a thesis in scientific journals (PR: 6.72, 95% CI: 5.12-8.84, p <0.001). Also positively associated with publishing a thesis included; being Peruvian (PR: 1.80, IC95%: 1.08-2.98, p = 0.023), being female (PR: 1.24, IC95%: 1.00-1.54, p = 0.046), being afifth year student (PR: 2.26 , 95% CI: 1.55-3.29, p <0.001), havingan intermediate proficiency of the English language (PR: 1.62, 95% CI: 1.14-2.32, p = 0.008) and database training (PR: 1.58, 95% CI 1.14-2.18, p = 0.005).
Conclusion: The intention of publishing theses in scientific journals is very low,however, having prior extracurricular publications increases the level of interest. These findings provide medical schools with information that will enable them to help reinforcethe student'senthusiasmto publish and, thereby, greatlyincrease their decision to complete and publish a thesis.
Key words: Academic Dissertations; Latin America; Publishing; Scholarly Communication; Students, Medical. (Source: MeSH NLM).

INTRODUCTION

The undergraduate thesis in medicine contributes to the understanding and generate solutionsto public health problems, which exposes interested students to evidence generating research experiences[1,2].In Germany, the thesis is a mandatory requirement for medical school graduation; however, insomeLatin American countries like Peru, the thesis is optional and completely absent in others like Colombia[1].The existence of other graduation methodsoutside of the thesis,resultsin a relegation of research in the majority of Latin medical schools, although it is almost the only compulsory scientific product during undergraduate studies. This leads to a low frequency of theses being published in scientific journals[3,4], culminating in arange of 3-18% of theses published coming from Latin American medical schools[3,4,5], while the vast majority of thesesare never published in indexed journals.

There is evidence to support the premise that priorextracurricular publications by students leads to the completion and subsequent publication of theses in scientific journals[1,3]. However, at present, Latin American extracurricular scientific production from undergraduate medical programs is low6[7,6,8]. As a solution to this problem, strategies have been generated which include the creation of student scientific journals[9], resourcesused to facilitate free access to articles necessary for research[10] and the affiliation with theMedical Students´ Scientific Societies (SOCEM), which has led to an increase in student scientific productivity in recent years[8,11].

Here we hypothesize, that the intent of medical students to publishtheir theses in scientific journals could be higher iftheyhavepreviousresearch experiencesthat includeepidemiological methods, and biostatisticsleading to publication,especially if the students participated in thescientific writing and editorial process. Despite there being a high level of interest, there are still very few theses that are carried out[2].A number of possible explanations for such low outcomes could be due to complicated administrative procedures, difficulty in making the report, difficulty in obtainingresearch protocol approval, limited funding and qualified methodological-thematic advice, as well as self-perception of deficiencies in research due to lack of acquired knowledge during training profound knowledge imparted during the career[1,12,13].Many thesesend updistributed through various repositories that, in general, are undervalued in investigations.Our objective is to determine the association between prior extracurricular publication and the intention of publishing theses in scientific journals, based on the evaluation of students from 40 medical schools in Latin America.

METHODS

The research had a cross-sectional analytical design of secondary data analysis ofstudents from 40 medical schools in Latin America.The population studied were students from 40 medical schools in Latin America during the I semester of the 2016-2017 academic year. Students who agreed to participate in the studyand adequately

completed the variables of interest were included. Students who were in their medical internship year were excluded from the study. Stratified random sampling was used, for which the year of study was considered as stratum, requesting official lists or number of students in each year of studies.

The research group presented the project atthe maximum scientific-student event in Latin America in the city of Panama, 2015. A collaborative research group of at least three medical students was formed, who requested verbal consent from potential candidatesin the classroom and then randomly selected participantsthrough odd jumps to obtain the minimum sample size estimated for that academic year, finally the survey was self-administered for an average of 15 minutes. The study instrument consisted of sections on areas of information and communication technologies (ICT) and other variables to evaluate medical education. We validated the survey in a similar multicentre study conducted in Peru[15].

Ethics: The original study was approved by the Ethics Committee of the Hospital San Bartolomé from Lima-Peru; which is endorsed by the National Institute of Health of said country. The present study is an analysis of secondary data; therefore, it was not necessary to obtain approval from an ethics committee. We assigned codes to each participant and medical school, and the surveys were self-administered and anonymous. Consent was obtained from students prior to administering the survey.

Statistical analysis: In the descriptive analysis, frequencies were reported, as well as percentages, for categorical variables, while measures of central tendency and dispersion for quantitative variables, previously having evaluated the normality analytically and graphically.

In the bivariate analysis, the chi-square independence test was used, after evaluating the assumption of expected values. In the case of quantitative variables, we used Mann Whitney U test.

In the simple and multiple regression analysis, multilevel random-effects models were used to estimate the prevalence ratio (PR) of the study's association of interest; using multilevel generalized linear models (MEGLM), Poisson distribution family, link function log and and robust variances and the university was also used as a cluster. In the multiple regression, the potential confounding variables were used as adjustment. Statistical analysis was performed in the STATA program v.15.0.

RESULTS

Of 11,587 participants, 4,962 (42.8%) were Peruvian, 6,224 (53.7%) were female, and the median age was 21 years. Regarding the training received in essential components of research, in two cases the percentages of training for their use were higher than 50%, being databases 6,148 (53.7%) and bibliographic search 6,894 (60.2%). Only 893 (7.9%) self-reported having published an extracurricular scientific article. 11,278 (97.3%) did not intend to publish a thesis in a scientific journal (Table 01).

The highest percentage students with intent topublish theses in scientific journals was registered in students from Honduras (4.4%), followed by Colombia (4.36%) (Figure 1). Similarly, weobservedthat the upperclassmen in the medical programsaccounted for a higher percentage of students interestedin publishing their theses in scientific journalswhen compared to underclassmen (Figure 2).

Table 1. Socio-educational characteristics of students from 40 medical schools in Latin America.

Characteristics		N (%)
Sex		
	Male	5363 (46.3)
	Female	6224 (53.7)
Age (years)*		21 (15-44)
Country		.
	Ecuador	638 (5.5)
	Panama	634 (5.5)
	Paraguay	1073 (9.3)
	Bolivia	960 (8.3)
	Peru	4962 (42.8)
	Argentina	636 (5.5)
	Chile	238 (2.0)
	Colombia	849 (7.3)
	Honduras	318 (2.7)
	Venezuela	643 (5.5)
	México	636 (5.5)
Typeofuniversity		.
	National	6119 (52.8)
	Particular	5648 (47.2)
Yearofstudies+		
	First	2575 (22.2)
	Second	2486 (21.5)
	Third	2053 (17.7)
	Quarter	1969 (17)
	Fifth	1585 (13.7)
	Sixth	918 (7.9)
SOCEM		
	No	10138 (87.5)
	Yes	1449 (12.5)
English proficiency+		
	Don´tspeak	2028 (17.6)
	Basic	4666 (40.6)
	Intermediate	3187 (27.7)
	Advanced	1618 (14.1)
Writing training+		
	No	7428 (65.1)
	Yes	3989 (34.9)
Training databases+		
	No	5300 (46.3)
	Yes	6148 (53.7)
Training bibliographicsearch+		
	No	4564 (39.8)
	Yes	6894 (60.2)
Zotero Training+		
	No	9485 (83.1)
	Yes	1923 (16.9)
Previouspublication+		
	No	10423 (92.1)
	Yes	893 (7.9)
Intentpublicationthesis		
	No	11278 (97.3)
	Yes	309 (2.7)

* Mean ± standard deviation
+Some values do not add up to 11,587 due to missing data
SOCEM: Scientific Society of Medical Students

Previous extracurricular publication appeared to correlate with a higher frequency of intent to publish theses in a scientific journal(Tablae 02). Using asimple regression analysis, we realized that those students who self-reported having prior publicationswere 5.7 times more likely to publish their academic theses in scientific journals. After adjusting for potential confounders, the positive association was maintained. Additionally, beingfrom Peru, female,a fifthyear student, having an intermediate level of English and having self-reported training in scientific databases were positively associated with the intent to publish academic theses, while self-reported Zotero training was found to have a negative association. (Table 03**).**

Table 2. Factors associated with the intention of publishing a thesis in the bivariate analysis.

Variables		Intentpublicationthesis		*p*++
		No (n=11278)	Yes (n=309)	
Gender				0.486
	Male	5226 (97.4)	137 (2.6)	
	Female	6052 (97.2)	172 (2.8)	
Age (years)*#		20.9 ± 2.82	22.7 ± 3.55	<0.001
Country				<0.001
	Ecuador	620 (97.2)	18 (2.8)	
	Panama	623 (98.3)	11 (1.7)	
	Paraguay	1069 (99.6)	4 (0.4)	
	Bolivia	949 (98.8)	11 (1.2)	
	Peru	4777 (96.3)	185 (3.7)	
	Argentina	625 (98.3)	11 (1.7)	
	Chile	235 (98.7)	3 (1.3)	
	Colombia	812 (95.6)	37 (4.4)	
	Honduras	304 (95.6)	14 (4.4)	
	Venezuela	636 (98.9)	7 (1.1)	
	Mexico	628 (98.7)	8 (1.3)	
Typeofuniversity				0.101
	National	5970 (97.6)	149 (2.4)	
	Particular	5308 (97.1)	160 (2.9)	
Yearofstudies+				<0.001
	First	2534 (98.4)	41 (1.6)	
	Second	2441 (98.2)	45 (1.8)	
	Third	2025 (98.6)	28 (1.4)	
	Quarter	1940 (98.5)	29 (1.5)	
	Fifth	1463 (92.3)	122 (7.7)	
	Sixth	874 (95.2)	44 (4.8)	
SOCEM				0.268
	No	9874 (97.4)	264 (2.6)	
	Sí	1404 (96.9)	45 (3.1)	
English proficiency+				<0.001
	Don´tspeak	1992 (98.2)	36 (1.8)	
	Basic	4573 (98.0)	93 (2.0)	
	Intermediate	3043 (95.5)	144 (4.5)	
	Advanced	1584 (97.9)	34 (2.1)	
Writing training+				<0.001
	No	7253 (97.6)	175 (2.4)	
	Yes	3858 (96.7)	131 (3.3)	
Training databases+				<0.001
	No	5202 (98.1)	98 (1.9)	
	Yes	5939 (96.6)	209 (3.4)	
Training bibliographicsearch+				<0.001
	No	4473 (98.0)	91 (2.0)	
	Yes	6677 (96.8)	217 (3.2)	
Zotero training+				0.231
	No	9222 (97.2)	263 (2.8)	
	Yes	1879 (97.7)	44 (2.3)	
Previouspublication+				<0.001
	No	10217 (98.0)	206 (2.0)	
	Yes	792 (88.7)	101 (11.3)	

* Mean ± standard deviation
\+ Some values do not add up to 11587 due to missing data
SOCEM: Scientific Society of Medical Students
++ Values p calculated with the Chi-Square test of independence
\# Value p calculated with the Student's t-test

Table 3. Simple and multiple regression of factors associated with thesis publication intention

Characteristics		Simpleregression			Multipleregression*		
		PR	95% CI	*p*++	PR	95% CI	*p*++
Gender							
	Male	Ref.			Ref.		
	Female	1.08	0.87 - 1.35	0.487	1.24	1.00 - 1.54	0.046
Age (years)		1.15	1.13 - 1.18	<0.001	1.10	1.08 - 1.13	<0.001
Country							
	Ecuador	Ref.			Ref.		
	Panama	0.61	0.29 - 1.29	0.199	0.64	0.31 - 1.35	0.246
	Paraguay	0.13	0.04 - 0.39	<0.001	0.10	0.03 - 0.31	<0.001
	Bolivia	0.41	0.19 - 0.85	0.018	0.25	0.11 - 0.55	<0.001
	Peru	1.32	0.82 - 2.13	0.252	1.80	1.08 - 2.98	0.023
	Argentina	0.61	0.29 - 1.29	0.196	0.61	0.27 - 1.37	0.231
	Chile	0.45	0.13 - 1.50	0.193	0.33	0.10 - 1.06	0.063
	Colombia	1.54	0.89 - 2.69	0.124	1.34	0.72 - 2.49	0.354
	Honduras	1.56	0.79 - 3.10	0.203	0.87	0.45 - 1.68	0.682
	Venezuela	0.38	0.16 - 0.92	0.031	0.65	0.27 - 1.56	0.333
	Mexico	0.44	0.19 - 1.02	0.055	0.40	0.17 - 0.90	0.027
Typeofuniversity							
	National	Ref.			Ref.		
	Particular	1.20	0.96 - 1.50	0.102	1.07	0.83 - 1.37	0.605
Yearofstudies+							
	First	Ref.			Ref.		
	Second	1.14	0.75 - 1.73	0.549	0.97	0.63 - 1.48	0.874
	Third	0.86	0.53 - 1.38	0.525	0.57	0.35 - 0.93	0.026
	Quarter	0.92	0.58 - 1.48	0.746	0.59	0.36 - 0.95	0.030

	Fifth	4.83	3.41 - 6.85	<0.001	2.26	1.55 - 3.29	<0.001
	Sixth	3.01	1.98 - 4.57	<0.001	1.21	0.76 - 1.92	0.428
SOCEM							
	No	Ref.			Ref.		
	Yes	1.19	0.87 - 1.63	0.267	0.95	0.68 - 1.33	0.790
English proficiency+							
	Don´tspeak	Ref.			Ref.		
	Basic	1.12	0.77 - 1.64	0.551	0.81	0.56 - 1.18	0.275
	Intermediate	2.54	1.77 - 3.65	<0.001	1.62	1.13 - 2.32	0.008
	Advanced	1.18	0.74 - 1.88	0.476	0.95	0.59 - 1.52	0.824
Writing training+							
	No	Ref.			Ref.		
	Yes	1.39	1.11 - 1.74	0.004	1.15	0.89 - 1.49	0.282
Training databases+							
	No	Ref.			Ref.		
	Yes	1.84	1.45 - 2.33	<0.001	1.58	1.14 - 2.18	0.005
Training bibliographicsearch+							
	No	Ref.			Ref.		
	Yes	1.58	1.24 - 2.01	<0.001	1.10	0.80 - 1.52	0.549
Zotero training+							
	No	Ref.			Ref.		
	Yes	0.82	0.60 - 1.13	0.233	0.40	0.28 - 0.57	<0.001
Previouspublication+							
	No	Ref.			Ref.		
	Yes	5.72	4.55 - 7.19	<0.001	6.72	5.11 - 8.84	<0.001

* Adjusted by the variable age, sex, type of university, country, extracurricular groups, level of English, training and use of PubMed / SCOPUS / ScIELO

+ Some values do not add up to 11587 due to missing data

++ *p* values obtained with Generalized Linear Multilevel Mixed Effects Models (MEGLM), Poisson family, log link function, robust variance, and using university as a cluste

Figure 1. Percentage of the intention of thesis publication according to country.

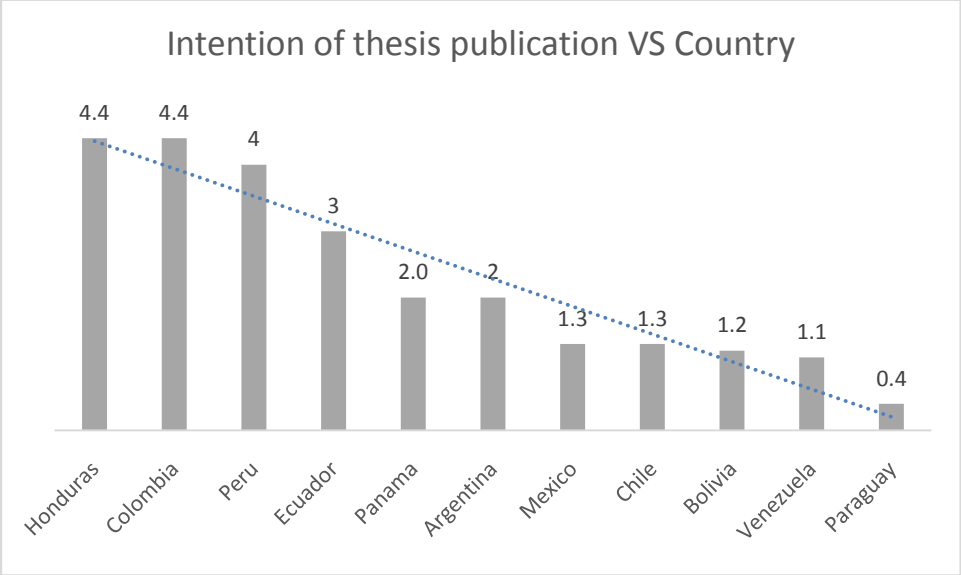
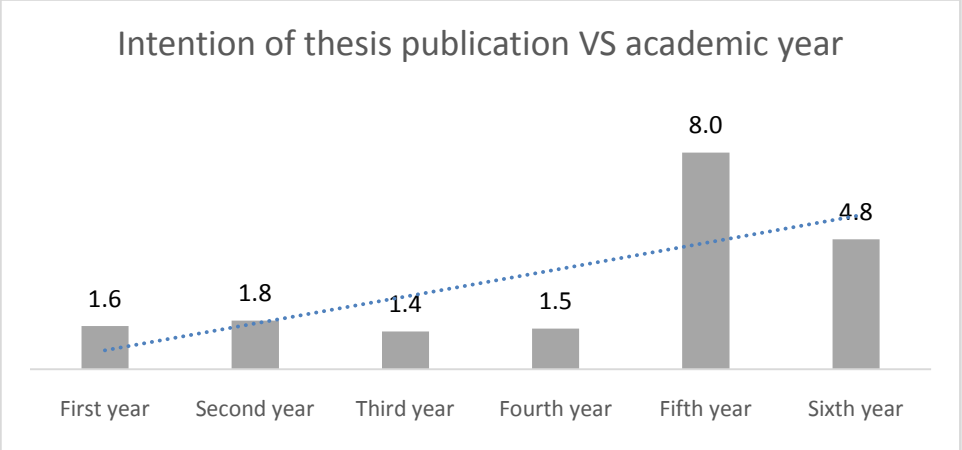


Figure 2. Percentage of the intention of thesis publication according to the year of studies.



DISCUSSSION

We found that students who previously published an extracurricular research article through a medical journal, reported having nearlyseven times more interestin publishing their theses in scientific journals, which supports the ideathat being exposed to the research process results in a greater culture of scientific publication[16,17]. This is futher demonstrated by students who have previously published being more motivated to publish the findings of their thesis final report. Thesestudents feel that their results can become validated and qualifiedby being sentout- for peer review in scientific journals. This same sentimentdoes not exist in those students whose thesis is their first attemptatresearch due to a prior lack of interest, unfamiliarity, low motivation, as well as a feeling of only presenting the work to meet a mandatory requirement,given their lack of vision of their work being of direct benefit in research and publishing[1,12,13,17,18].

Although there is currently no literature to corroborate our hypothesis regardingthe student-physician population, there isresearch that provides evidence of an association between the intent of medical students publishing their thesis and having previously completedextracurricular work; however, when adjusted for other factors, the association was not supported[1]. Similarly, Bullen CR et al. reported that 58% of the students who published their theses had previous scientific publications, concluding that there would be a higher probability in the scientific diffusion of the results of their theses in medical journals; nevertheless, no association was observed[19]. A possible explanation for the non-association observed, could be the fact that scientific publication was measured, but not the students' intent to publish, referring the enthusiasm that theirthesis could be published in the future. It is important to highlight that since intent can be overestimated,by the students' perception, what is often put into practice yields a differentoutcome[1,17]. Often, the thesis is never even started, while in some cases the student opts not to present it because it is not finalized or because of other difficulties already mentioned, rooted in the whole process of completion. On the other hand, weobserved that 50% of the thesis track graduates in a Peruvian university[13], carried out extracurricular research, providing evidence that those who do a theses, at some point end up publishing it, are also those who have previous experiences in scientific research.

Approximately 3 out of every 10 students reported intent to publish their thesis in a scientific journal, which suggeststhat most students have little or no interest in communicating their thesis findings to the scientific community. Thisis consistent with the findings that 2.7% of Peruvian medical students published their final thesis in scientific journals[3], which agrees with the observation in another study, where only 4.1% of the theses were published in scientific journal indexes[20]. However, a studyfrom New Zealand reported contradictory findings, where 3/4 of the students whoreportedhaving an interest in publishing their theses, resulted in a 45% submissionof theses to a scientific journal, with 14% sending more than two articles of based on their thesis[19]. The differencesnoted in the New Zealand study may be due to the fact that they surveyedmaster's students, whose experience, responsibility, and training are much higher than that of an undergraduate students, thereby, further motivating their interest in publishing their results. Similarly, a study carried out in medical students of a public university in Peru, reported that 23.7% had interestin developing a thesis to complete their degree, likelyresulting in less interest of a future publication[1],while stomatology students at a Peruvian university reported 54.7% who intended to pursure a thesis[2]. These discrepancies can be explained by our study focusing on the intention of publishing theses, while the other two reports from Peru only determined the intention to complete a thesis as a mechanism for graduating, thus generating much higher results. Despite all this, many studies report quite low numbers of thesis publication by undergraduate students in scientific journals, with shallow percentage ranges that reach a maximum of 17.6%[3–5,17,20–22].

On the other hand, we found a positive association between sex and the desire to publish the thesis. Similar to that described by Bullen CR et al., although men published more, women maintained a much more positive attitude at the beginning of the thesis about the future of publishing[19]. These results are differ from the findings in the literature, where there is no difference between gender and the intention to publish theses[1,2,13,23], much less with the rate of

publication of scientific articles base on the theses[24]. However, in Peru, women completed the thesis more frequently[22]. This association in our study could likely be explained bythe fact that females in medicine arequite discontinuous andare faced with various barriers to generating science, providing forthe predominant tend to be male scientific publications[25]. The frequency of female first authorship is almost 34%, with a similar number of publications by women (33.7); which in turn, leads to a very uneven h index being higher in men[26]. Although this significant gender gap has decreased over the years[27]; it is still, however, pending a resolution to the issues regarding gender based inequality resulting in lower salary subsidiesand unequal evaluations towards investigations carried out by women without valid justifications to qualify them[28].

As students progresses downtheir academic career and neartheir graduation, whether they have chosento complete a thesis or whether it is compulsory; their time becomes increasingly centered on carrying out the task of completing their thesis[13,29]. So much so, that when reaching the last academic years before the medical internship, at which time they will have little time for other activities, it is possible that the student intends to complete his thesis, making his publication intention very high compared to other years of study. In the same way, it should be taken into account that as the career progresses, more research experience and research courses are given by the university or extracurricular will be available[1,16,17]. But, restrictions are given by the same faculties so that they present the minimum thesis from the fifth academic year and not before[1,16,17]. At the same time, more diseases are known, as well as doctors interested in investigating[1,19]; which could be a possible clarification to why the present study showed a higher intention of publishing academic theses at an older age, as well as being in the fifth academic year of the professional career. It is also possible that the more years you have the better self-perception and responsibility you have of the activities carried out; generating a higher intention of publication to believe that it is before a thesis of good quality, worthy of being sent to a scientific journal.

Being from Peru was associated with an increased intent of publishing theses in scientific journals. This could be due to the fact that in Peru, a research centerd thesis to obtain the degree can either be undertaken optionally or obligatory if the student has a nationally demarcated score[12,13]. Additionally, this could be attributed to the increase in Peruvian scientific productivity in the Latin America in the lateryears[30]of the medical program. This generates an increasing facility in the medical-scientific incursion by part of the learner and, therefore, in the desire to publish in the future, the results obtained through extensive studies such as the theses achieved during undergraduate.

Finally, we found a positive association between training in databases and the intent to publish theses in scientific journals. Research training in Latin American universities is deficient[31,32],therefore, not having participated in courses or training focused on a proper research method, conditioned to a much lower scientific production[11].Moreover, another study found an association between the frequent use of databases and carrying out research, hence, leading to scientific publications[15]. All this, in some way, determines that having research training, such as thatcarried out in databases, generates a higher interest to publish theses in medical-scientific journals.

The present study has limitations, including measurement bias.The intent to publish the thesis was measured and not thesis publication, also student's self-reported measure of extracurricular scientific publication was variable. The random selection bias of the participating medical schools, because we only included universities that had SOCEM; therefore, we cannot extrapolate our results to the entire student population across all of Latin America. Despite these caveats, this article opens the doors to new research focused on determining the causes of non-intention of thesis publication, which allows intervention measures to be taken to promote their publication in each of the universities. This could be through graduation modality by the publication of a thesis article, asis done in Peru[33].

CONCLUSION

For all the above, it is possible to conclude that the intent to publish theses is very low, however, having prior extracurricular publications increases both the frequency anddesire to submitthesis to scientific journals, in addition to the associationwith age and academic year of medical training. Furthermore, being female, Peruvian or having training in databases were also positively correlated. Conversely, being trained in the use of Zotero demonstrated a decreased intent to publish theses.

Acknowledgment: The authors would like to thank the Working Group of the Multicentric Latin America Project for their contributions, guidance, and suggestions in the collection of data.

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Funding: The Peru Infectious Diseases Epidemiology Research Training Consortium (D43 TW007393), awarded by the Fogarty International Center of the US National Institutes of Health, sponsored Dr. Valladares's work. Dr. Valladares has received support from National Institute of Mental Health, NIH D43TW009343training Award and the University of California Global HealthInstitute.The funders had no role in study design, data analysis, decision to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist

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