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Determinants of Scientific Article Publication Among Peruvian Physicians and Orthopedic Residents

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Abstract

Background: Orthopedic scientific publications play an important role worldwide. Because of the limited evidence in the Latin American literature, we aimed to evaluate the determinants of scientific publication among Peruvian orthopedics as an approach to the Latin American context. Methods: Analytical cross-sectional study. Orthopedic specialists and residents were enrolled during the 52nd Peruvian National Congress of Orthopedics and Traumatology. A form validated by experts was applied to collect variables. The crude and adjusted coefficients were calculated using bivariate and multivariate regression with 95% confidence intervals. Results: A total of 310 participants were included in our study. The prevalence of the scientific orthopedic publication was 34.84%. Multivariate regression showed that, working in a private hospitals, having an interest in tumors and pediatric orthopedics, being involved in teaching activity, belonging to a scientific society other than the Peruvian Society of Orthopedics and Traumatology, having more than one research project, having an international rotation, and active participation in meetings were factors associated with publishing orthopedic scientific articles, while coming from a university in the highlands as an undergraduate and having more than ten shifts per month was associated with publishing fewer scientific articles. Among residents, having had an international rotation was associated with publishing scientific articles. Conclusions: The determinants of scientific production described will serve to increase scientific production in different contexts considering the orthopedist's training stage.

Keywords: orthopedics; publishing; scholarly communication; Latin America; bibliometrics

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1. Introduction

Article publication stands as the primary means of communication for scientific research, particularly within the medical environment (Asdrubal & María, 2019). Thus, fostering research across all tiers of medical education, including specialists, is pivotal (Valle & Perales, 2016).

Despite the global upsurge in scientific output (Anegón, 2021), Peru ranks among the lowest countries for scientific production within Latin America (Huamaní et al., 2012). Structural deficiencies in our university system hinder scientific productivity even among physicians (Angulo-Fernandez et al., 2023; Herrera-Añazco et al., 2018a; Pereyra-Elías et al., 2014). A nationally representative study revealed that merely 11.4% of physicians published articles in indexed journals. The significance of holding a specialty is evident in Peru, where specialized doctors are 2.5 times more likely to have scientific output than their nonspecialized counterparts (Córdova Salcedo et al., 2020), albeit with variations based on the specialty and database consulted. According to Google Scholar results, gastroenterology (46.3%), dermatology (44.4%), and neurology (42.5%) exhibit the highest percentage of the published scientific articles, while Scopus identifies neurology (15.0%), gastroenterology, and dermatology (both 11.1%) (Mejia et al., 2021). In Peru, research among physicians specializing in orthopedics is deficient, with only 3.6% having published scientific articles in 2017 (Mejia et al., 2021).

Also, it is important to highlight that most studies about scientific production in this field are based on bibliometric analyses, which examine the number of publications per year, citation counts, publication trends across subspecialities, collaboration networks and leading authors, including studies conducted within national contexts (Cheng, 2012; Dartus et al., 2019; Gürbüz et al., 2015; Hohmann et al., 2017; Karlapudi et al., 2022; Mejia et al., 2021; Saab et al., 2019; Said et al., 2018; Shon et al., 2019; Sun et al., 2018), as well as studies with an international comparative scope (Xin et al., 2016; Zou et al., 2016). It is also important to note that growing global awareness of the importance of research has led scientific society leaders and orthopedics professors to actively promote its development, even among residents in training (Al-Mohrej et al., 2021; Dartus et al., 2019; Saab et al., 2019; Zou et al., 2016).

There is a notable paucity of empirical data regarding the factors that influence the prevalence and underlying causes of scientific publication or its absence among Peruvian orthopedic surgeons and residents. Elucidating these determinants, whether individual, institutional, or contextual in nature, is critical for informing the development of targeted and evidence-informed strategies aimed at strengthening research capacity. By characterizing the conditions associated with scientific output, this study seeks to contribute to a broader institutional and policy-level reflection that may promote initiatives such as protected research time, the establishment of research support units, and increased funding opportunities.

Also, to the best of our knowledge, this is the first study in Latin America to move beyond descriptive bibliometric analyses and systematically investigate the multifactorial drivers of scientific productivity within the field of orthopedic surgery. Accordingly, the objective of this study was to identify the factors associated with scientific publication among Peruvian orthopedic surgeons and residents, with the aim of laying a foundation for future structural improvements and the sustainable advancement of orthopedic research.

2. Methods

2.1. Design and Context

An analytical cross-sectional study conducted among Peruvian orthopedic surgeons and residents during the 52nd Peruvian National Meeting of Orthopedics and Traumatology (52nd PMOT) between the 21st and 24th of September 2022. The PMOT is the most prominent national congress in the field, organized annually by the Peruvian Society of Orthopedics and Traumatology (SPOT). It gathers a substantial proportion of orthopedic professionals from across the country, including residents, specialists, and subspecialists, making it a strategic and nationally relevant setting for data collection among this population.

2.2. Study Population and Sample

All orthopedic surgeons attending the 52nd PMOT were invited to participate through a census sampling approach. However, for methodological reference, a sample size calculation was performed using Epidat v4.2, based on a 32.4% expected proportion of publication based on a previous study conducted among Peruvian gastroenterologists as a "proxy", with a 95% confidence level, 5% precision, a design effect of 1.0, and a population of 179 specialists. The estimated minimum sample was 117 participants.

2.3. Selection Criteria

All orthopedic surgeons and residents were considered. Retired orthopedists, those of non-Peruvian nationality, and those whose surveys were filled out incorrectly or with incomplete data were excluded.

2.4. Instrument

An ad hoc survey consisting of 32 items, encompassing five sections, was crafted to gather data relevant to the study, including (a) specialty level, (b) sociodemographic, (c) work environment, (d) academic setting, and (e) research. It included subsections tailored specifically for specialists, fellowships, subspecialists, and residents. The approximate time for survey completion was 8 min. Prior to its application, the survey's content was psychometrically validated by eight orthopedic surgeons through the judgement of experts. An Aiken's V of 0.83 (95% confidence interval [CI] 0.64–0.92) was obtained, validating our survey (Aiken, 1980, 1985) (Supplementary Materials, Table S1). After validation, a pilot was conducted with 15 orthopedic specialists and 15 orthopedic residents to assess comprehension of the questionnaire. All evaluators agreed that no modifications were required.

2.5. Data Collection

The surveys were conducted primarily in person at a designated stand during the 52nd PMOT, where the attendees were invited to participate after providing written informed consent. Complementarily, a QR code linking to an online version of the survey (Google Forms, Google Inc., Mountain View, CA, USA) was displayed during breaks between the conference sessions. Virtual participants were first presented with an electronic informed consent form and could choose to accept or decline participation before continuing. To avoid duplicating virtual entries, the online surveys were configured to allow only one response per participant. The survey was voluntary, self-administered, and aided by the authors and two trained medical students, in case participants had any questions regarding the survey. The full version of the survey used in this study is available in Supplementary Materials, Survey S2.

2.5.1. Dependent Variable

Publication of orthopedic scientific articles (yes or not).

2.5.2. Independent Variables

Specialty level, sex, age, civil status, number of children, undergraduate and postgraduate university type (private/public) and region (coast, Andes, rainforest, and trained abroad, currently practicing in Peru "overseas"), postgraduate studies, English proficiency level, and monthly income. In the work segment: workplace, number of workplaces, work region, monthly shifts, weekly surgeries, and involvement in teaching. In the research segment: participation in research-related courses, compensation for research, and the number of research projects undertaken. Among specialists, subspecialists, and fellowships: field of interest within orthopedic surgery, international rotations, participation in meetings, and years of professional experience. For residents: admission modality, year of residency, international rotations, and number of co-residents.

2.6. Data Analysis

Data were transcribed into a Microsoft Excel® spreadsheet using an independent double-coding process to enhance data quality. Subsequently, we conducted a database cross-check to identify and correct coding errors and to address any instances of no plausible data. When a coding error was detected, the entire survey was reviewed again. After this, the database was exported to Stata® v.16.0 (Stata Corporation, College Station, TX, USA) for analysis.

A descriptive analysis was conducted using absolute frequencies and weighted proportions. In the bivariate analysis, independent variables were juxtaposed against the outcome variable. A chi-squared test or Fisher's exact test was used depending on the percentage of expected values being ≤ 5.

For multivariate analysis, generalized linear regression models (GLM) of the Poisson family with a log link function and robust standard errors were used to calculate crude and adjusted prevalence ratios (PR) and their 95% confidence intervals. This approach was preferred over logistic regression because, in cross-sectional studies with non-rare outcomes (prevalence > 10%), odds ratios can substantially overestimate the association measure, leading to potential misinterpretation (Barros & Hirakata, 2003; Coutinho et al., 2008). Variables exhibiting a p-value < 0.05 in the crude analysis were included in the multivariate analysis. An assessment for multicollinearity via the variance inflation factor indicated the absence of multicollinearity across all models.

All statistical tests were performed considering a confidence level of 95% and a statistically significant p-value < 0.05.

2.7. Ethics and Participant Consent

The study protocol was approved by the Institutional Research Ethics Committee of Avendaño Clinic (033-2022-CIEI) and by the SPOT. Consent was obtained from all participants, and the study was conducted in accordance with the Declaration of Helsinki.

3. Results

3.1. General Characteristics

Figure 1 shows the selection process of the 310 professionals ultimately enrolled in this study, among whom only 34.40% (n = 108) had published articles in orthopedics. A total of 89.03% (n = 276) were male, and the most prevalent age group was the 30–39-year-old group (40.97%) (Table 1). Arthroscopy emerged as the predominant field of interest among the professionals (n = 88), with 47.73% having published at least one scientific article (Figure 2). Additionally, case reports (20.7%) constituted the most frequently published article type, followed by the original articles (14.8%) (Figure 3).

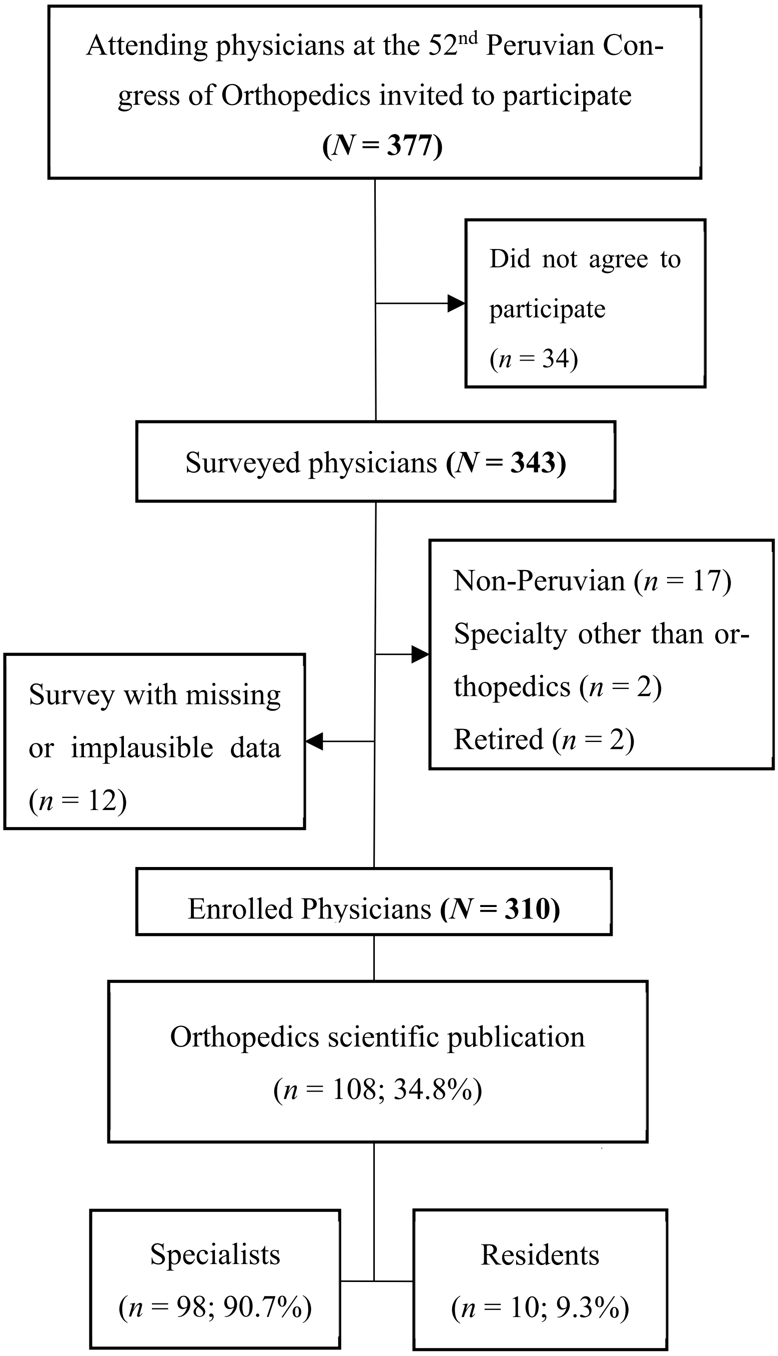

Figure 1. Flowchart.

Table 1. Baseline characteristics of the study population according to orthopedic scientific publication (*n* = 310) *.

Characteristics	Overall *N* (%)	Orthopedics Scientific Publication		*p*
		Yes (*n* = 108)	No (*n* = 202)	
Academic level in Orthopedics				<0.001 [a]
Resident	69 (22.26)	10 (14.49)	59 (85.51)	
Specialist	183 (59.03)	64 (34.97)	119 (65.03)	
Fellow	10 (3.23)	4 (40.00)	6 (60.00)	
Subspecialist	48 (15.48)	30 (62.50)	18 (37.50)	

Table 1. *Cont.*

Characteristics	Overall *N* (%)	Orthopedics Scientific Publication		*p*
		Yes (*n* = 108)	No (*n* = 202)	
Sociodemographic data				
Sex, male	276 (89.03)	99 (35.87)	177 (64.13)	0.278 [a]
Age, years				0.008 [a]
24–29	29 (9.35)	5 (17.24)	24 (82.76)	
30–39	127 (40.97)	37 (29.13)	90 (70.87)	
40–49	76 (24.52)	28 (36.84)	48 (63.16)	
50–59	44 (14.19)	19 (43.18)	25 (56.82)	
>60	34 (10.97)	19 (55.88)	15 (44.12)	
Civil status				<0.001 [a]
Lives with a partner	132 (42.58)	31 (23.48)	101 (76.52)	
Lives without a partner	178 (57.42)	77 (43.26)	101 (56.74)	
Number of children				0.134 [a]
None	131 (42.26)	38 (29.01)	93 (70.99)	
1–2	131 (42.26)	49 (37.40)	82 (62.60)	
>2	48 (15.48)	21 (43.75)	27 (56.25)	
University				
Undergraduate				
Type, public	188 (60.65)	66 (35.11)	122 (64.89)	0.902 [a]
Region				0.001 [b]
Coast	245 (79.03)	98 (40.00)	147 (60.00)	
Andes	42 (13.55)	5 (11.90)	37 (88.10)	
Rainforest	6 (1.94)	2 (33.33)	4 (66.67)	
Overseas [†]	17 (5.48)	3 (17.65)	14 (82.35)	
Postgraduate				
Type, public	199 (64.19)	74 (37.19)	125 (62.81)	0.245 [a]
Region				0.121 [b]
Coast	279 (90.00)	98 (35.13)	181 (64.87)	
Andes	18 (5.81)	3 (16.67)	15 (83.33)	
Rainforest	3 (0.97)	1 (33.33)	2 (66.67)	
Overseas [†]	10 (3.23)	6 (60.00)	4 (40.00)	
Postgraduate degree				0.001 [b]
Not postgraduate	154 (49.68)	42 (27.27)	112 (72.73)	
Master student	88 (28.39)	30 (34.09)	58 (65.91)	
Master	45 (14.52)	22 (48.89)	23 (51.11)	
PhD student	18 (5.81)	9 (50.00)	9 (50.00)	
PhD	5 (1.61)	5 (100.00)	0	
English level				0.002 [a]
Elementary	92 (29.68)	21 (22.83)	71 (77.17)	
Intermediate	148 (47.74)	52 (35.14)	96 (64.86)	
Advanced	70 (22.58)	35 (50.00)	35 (50.00)	
Monthly income per month [‡]				<0.001 [a]
<5	37 (11.94)	5 (13.51)	32 (86.49)	
5–10	136 (43.87)	36 (26.47)	100 (73.53)	
10–15	78 (25.16)	27 (34.62)	51 (65.38)	
15–20	29 (9.35)	19 (65.52)	10 (34.48)	
>20	30 (9.68)	21 (70.00)	9 (30.00)	
Work environment				
Headquarter				
MINSA	157 (50.65)	40 (25.48)	117 (74.52)	<0.001 [a]
Private hospital	132 (42.58)	63 (47.73)	69 (52.27)	<0.001 [a]
EsSalud	99 (31.94)	41 (41.41)	58 (58.59)	0.096 [a]
Private office	59 (19.03)	27 (45.76)	32 (54.24)	0.050 [a]
Armed forces	24 (7.74)	10 (41.67)	14 (58.33)	0.465 [a]

Table 1. *Cont.*

Characteristics	Overall N (%)	Orthopedics Scientific Publication Yes (n = 108)	No (n = 202)	p
Workplaces				0.005 [a]
1	114 (36.77)	27 (23.68)	87 (76.32)	
2	117 (37.74)	51 (43.59)	66 (56.41)	
>2	79 (25.48)	30 (37.97)	49 (62.03)	
Region				0.120 [a]
Capital city (Lima)	203 (65.48)	76 (37.44)	127 (62.56)	
Rest of coast	57 (18.39)	22 (38.60)	35 (61.40)	
Andes	39 (12.58)	8 (20.51)	31 (79.49)	
Rainforest	11 (3.55)	2 (18.18)	9 (81.82)	
Medical shifts per month				<0.001 [a]
None	56 (18.06)	33 (58.93)	23 (41.07)	
1–5	74 (23.87)	35 (47.30)	39 (52.70)	
6–10	138 (44.52)	32 (23.19)	106 (76.81)	
>10	42 (13.55)	8 (19.05)	34 (80.95)	
Surgeries per week				0.478 [a]
<5	140 (45.16)	48 (34.29)	92 (65.71)	
5–9	103 (33.23)	40 (38.83)	63 (61.17)	
≥10	67 (21.61)	20 (29.85)	47 (70.15)	
Teaching activity	112 (36.13)	63 (56.25)	49 (43.75)	<0.001 [a]
Academic setting				
Subscriber to orthopedics journals	105 (33.87)	48 (45.71)	57 (54.29)	0.004 [a]
Member of the SPOT	142 (45.81)	66 (46.48)	76 (53.52)	<0.001 [a]
Member of scientific society other than the SPOT	117 (37.74)	65 (55.56)	52 (44.44)	<0.001 [a]
Research setting				
Research courses	123 (39.68)	59 (47.97)	64 (52.03)	<0.001 [a]
Payment for research	11 (3.55)	8 (72.73)	3 (27.27)	0.007 [a]
Research projects				<0.001 [a]
None	200 (64.52)	56 (28.00)	144 (72.00)	
1	64 (20.65)	24 (37.50)	40 (62.50)	
≥2	46 (14.84)	28 (60.87)	18 (39.13)	
Specialist Subanalysis [ǂ]				
Orthopedics field				
Arthroscopy	88 (36.1)	42 (47.73)	46 (52.27)	0.090 [a]
Trauma	71 (29.46)	26 (36.62)	45 (63.38)	0.409 [a]
Joint replacement	55 (22.82)	23 (41.82)	32 (58.18)	0.843 [a]
Hip	41 (17.01)	17 (41.46)	24 (58.54)	0.909 [a]
Upper limb	40 (16.60)	12 (30.00)	28 (70.00)	0.133 [a]
Lower limb	38 (15.77)	16 (42.11)	22 (57.89)	0.844 [a]
Hand	28 (11.62)	8 (28.57)	20 (71.43)	0.166 [a]
Pediatrics	24 (9.46)	14 (58.33)	10 (41.67)	0.063 [a]
Spine	11 (4.56)	5 (45.45)	6 (54.55)	0.761 [b]
Tumors	11 (4.56)	8 (72.73)	3 (27.27)	0.054 [b]
International clerkship	74 (30.71)	50 (67.57)	24 (32.43)	<0.001 [a]
Participation in meeting [§]	51 (21.16)	41 (80.39)	10 (19.61)	<0.001 [a]
Years of work				0.817 [a]
0–4	87 (28.06)	27 (31.03)	60 (68.97)	
5–9	41 (13.23)	14 (34.15)	27 (65.85)	
10–14	37 (11.94)	13 (35.14)	24 (64.86)	
≥15	145 (46.77)	54 (37.24)	91 (62.76)	

Table 1. *Cont.*

Characteristics	Overall *N* (%)	Orthopedics Scientific Publication		*p*
		Yes (*n* = 108)	No (*n* = 202)	
Residents Subanalysis [ǂ]				
Modality of admission to residency				0.999 [b]
Free	56 (81.16)	9 (16.07)	47 (83.93)	
Detached	3 (4.35)	0	3 (100.00)	
Captive	10 (14.49)	1 (10.00)	9 (90.00)	
Year of residency				0.999 [b]
First year	11 (15.94)	1 (9.09)	10 (90.91)	
Second year	48 (69.57)	8 (16.67)	40 (83.33)	
Third year	10 (14.49)	1 (10.00)	9 (90.00)	
International clerkship	10 (14.49)	6 (60.00)	4 (40.00)	<0.001 [a]
Number of coresidents				0.823 [b]
0–1	25 (36.23)	3 (12.00)	22 (88.00)	
2–3	29 (42.03)	4 (13.79)	25 (86.21)	
≥4	15 (21.74)	3 (20.00)	12 (80.00)	

MINSA: Spanish acronym of Ministry of Health; EsSalud: Spanish acronym of Peruvian Social Health Insurance; SPOT: Spanish acronym of Peruvian Society of Orthopedics and Traumatology. [a] Pearson's chi-squared test; [b] Fisher's exact test; * Data are presented as n (%) or mean ± SD or median [interquartile range]. [†] Peruvian physicians trained abroad (undergraduate or specialty) currently practicing in Peru. [‡] Monthly income was measured in thousands of soles (S/.1000 is approximately USD 277). [§] Active participation in the congress was considered if the participant presented a scientific poster or made an oral presentation of their own research work or about a specific topic assigned. [ǂ] Subanalysis was conducted according to the number of physicians who had at least a specialist degree (*n* = 241), and similarly for residents (*n* = 69).

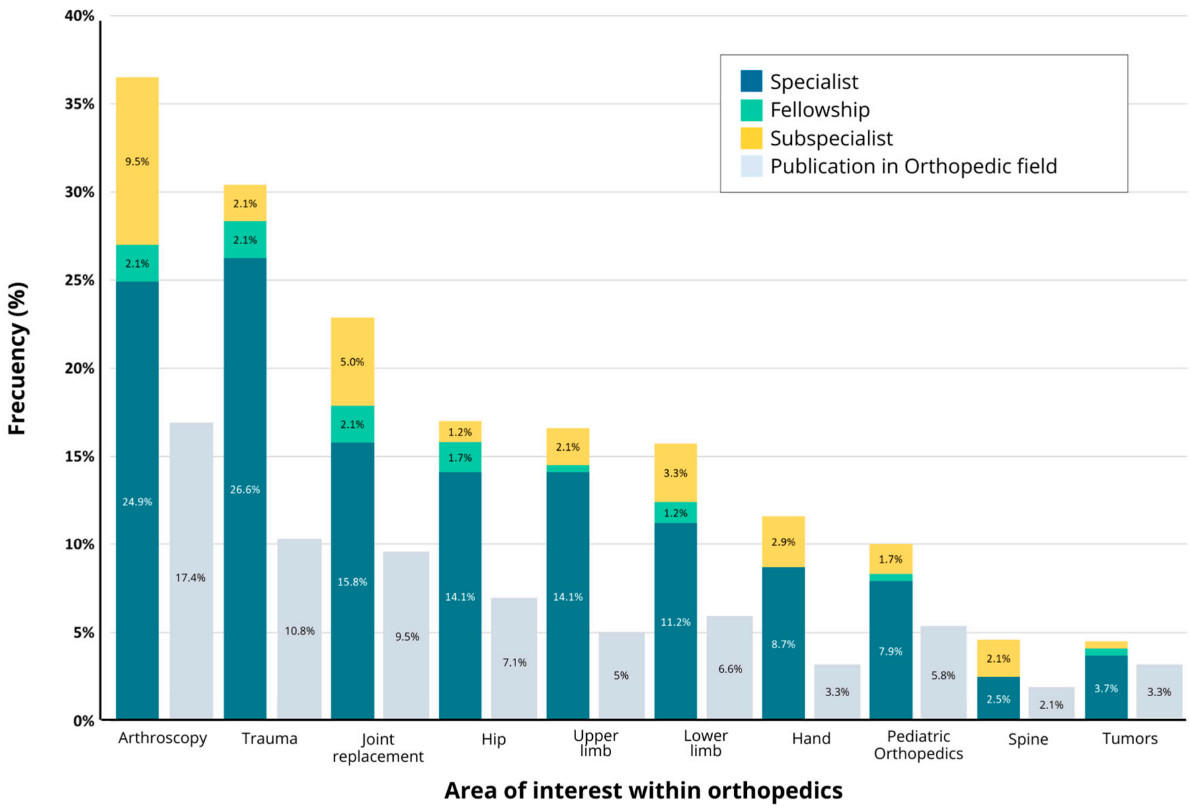

Figure 2. Segmented bar chart of areas of interest within orthopedics (*n* = 241).

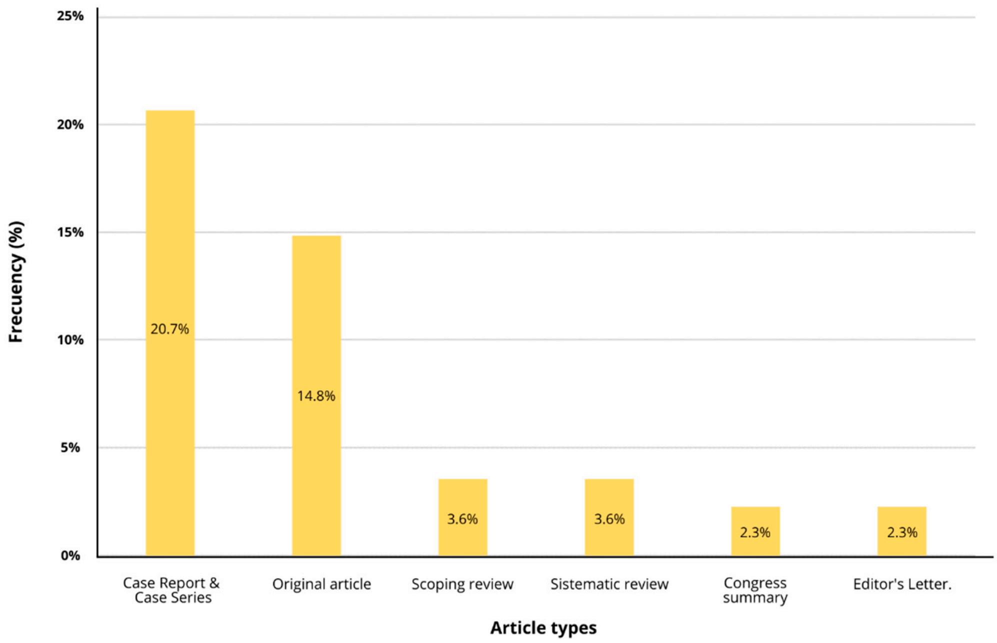

Figure 3. Article type productivity according to orthopedics scientific publication (n = 310).

3.2. Characteristics of Participants According to Orthopedic Scientific Publication

We found statistically significant differences in the bivariate analysis between the criterion "have published a scientific article" and the following sociodemographic characteristics: specialty level, age, civil status, undergraduate college region, postgraduate studies, English proficiency level, and monthly income ($p < 0.05$). Furthermore, work environment, number of jobs, number of shifts per month, and professionals engaged in teaching activities at MINSA or private hospitals showed a statistically significant difference ($p < 0.05$). Similarly, in the academic setting, we found significant differences among the professionals who are subscribed to an orthopedics journal, and those who are members of SPOT or other scientific societies ($p < 0.05$). In addition, in the research setting, those who took research courses, had received payments for research, and had current research projects showed statistically significant differences in the bivariate analysis with general scientific publication ($p < 0.05$).

In the subanalysis for specialists, fellows, and subspecialists, we found significant differences among those who actively participated in a meeting. Significant differences were observed for those who had an international rotation in the specialist's group and residents ($p < 0.001$ and $p = 0.001$), respectively. The remaining variables did not show significant differences (Table 1).

3.3. Factors Associated with Orthopedic Scientific Publication

The adjusted statistical regression model showed a higher prevalence of orthopedic scientific publication among the professionals who worked in private hospitals (aPR = 1.51; 95% CI: 1.10–2.25; $p = 0.014$), conducted teaching activities (aPR = 1.97; 95% CI: 1.39–2.79; $p < 0.001$), and belonged to a scientific society other than SPOT (aPR = 1.75; 95% CI: 1.22–2.51; $p = 0.002$). Similarly, compared to the professionals who do not have any research project, having one (aPR = 1.64; 95% CI: 1.07–2.51; $p = 0.025$) or more than two research projects (aPR = 1.60; 95% CI: 1.14–2.26; $p = 0.007$) were associated with a higher prevalence for orthopedic publication. We found a lower prevalence of orthopedic publication among those with undergraduate studies at universities located in the Andes or the rainforest (aPR = 0.38; 95% CI: 0.22–0.64; $p < 0.001$) than among those who had studies on the coast. In addition, having more than ten medical shifts per month (aPR = 0.46; 95% CI: 0.24–0.90;

$p < 0.024$) was associated with a lower prevalence for orthopedic publication than those who did not. Additionally, for specialists, fellowships, and subspecialists, an interest in pediatric orthopedics (aPR = 1.43; 95% CI: 1.01–2.02; $p = 0.042$) or musculoskeletal tumors (aPR = 1.71; 95% CI: 1.17–2.50; $p = 0.005$), having had an international rotation (aPR = 1.60; 95% CI: 1.15–2.23; $p = 0.006$), and having actively participated in meetings (aPR = 2.07; 95% CI: 1.55–2.74; $p < 0.001$) were associated with a higher prevalence for publication. International rotations were associated with a higher prevalence for publication in orthopedics for residents (aPR = 8.63; 95% CI: 2.62–28.43; $p < 0.001$) (Table 2).

Table 2. Crude and adjusted generalized linear models of the Poisson family with a logarithmic link to evaluate the factors associated with scientific publication among orthopedics professionals ($n = 310$).

Characteristic	Orthopedics Scientific Publication					
	Crude Model			Adjusted Model		
	cPR	(95% CI)	p	aPR	(95% CI)	p
Academic level in Orthopedics						
Resident/Fellow	Ref			Ref		
Specialist	1.97	1.18–3.30	0.010	0.92	0.51–1.67	0.785
Subspecialist	3.53	2.09–5.96	<0.001	0.83	0.42–1.67	0.608
Sociodemographic data						
Sex, male	0.74	0.41–1.32	0.307		Not included *	
Age, years						
24–29	Ref			Ref		
30–39	1.69	0.73–3.93	0.223	0.80	0.30–2.12	0.651
40–49	2.14	0.91–5.01	0.080	0.69	0.24–1.95	0.483
50–59	2.50	1.05–5.97	0.038	0.53	0.17–1.60	0.257
>60	3.24	1.38–7.60	0.007	0.66	0.22–1.97	0.460
Civil status						
Lives with a partner	Ref			Ref		
Lives without a partner	1.84	1.30–2.62	0.001	0.89	0.60–1.33	0.570
Number of Children						
None	Ref					
1–2	1.29	0.91–1.83	0.152		Not included *	
>2	1.51	0.99–2.29	0.054			
University						
Undergraduate						
Type, private	0.98	0.72–1.34	0.903		Not included *	
Region						
Coast	Ref			Ref		
Andes/Rainforest	0.37	0.18–0.74	0.005	0.38	0.22–0.64	<0.001
Overseas †	0.44	0.16–1.25	0.123	0.54	0.17–1.79	0.316
Postgraduate						
Type, private	0.82	0.59–1.15	0.255		Not included *	
Region						
Coast	Ref			Ref		
Andes/Rainforest	0.54	0.22–1.33	0.181	1.77	0.73–4.30	0.207
Overseas †	1.71	1.00–2.91	0.048	1.64	0.74–3.66	0.224
Postgraduate degree						
Not postgraduate	Ref			Ref		
Master's student	1.25	0.85–1.84	0.261	1.20	0.85–1.71	0.301
Master	1.79	1.21–2.66	0.004	1.01	0.65–1.58	0.965
PhD student	1.83	1.08–3.11	0.025	0.96	0.53–1.74	0.884
PhD	3.67	2.83–4.75	<0.001	1.54	0.84–2.81	0.163

Table 2. *Cont.*

Characteristic	Orthopedics Scientific Publication					
	Crude Model			Adjusted Model		
	cPR	(95% CI)	*p*	aPR	(95% CI)	*p*
English level						
Elementary	Ref			Ref		
Intermediate	1.54	0.996–2.38	0.052	1.09	0.73–1.60	0.683
Advanced	2.19	1.41–3.41	0.001	1.08	0.68–1.74	0.740
Monthly income ‡						
<5	Ref			Ref		
5–10	1.96	0.83–4.64	0.127	1.19	0.47–2.97	0.715
10–15	2.56	1.07–6.12	0.034	1.26	0.48–3.31	0.638
15–20	4.85	2.06–11.44	<0.001	1.77	0.70–4.47	0.226
>20	5.18	2.22–12.11	<0.001	2.10	0.83–5.33	0.188
Work environment						
Headquarter						
MINSA	0.57	0.42–0.79	0.001	0.86	0.62–1.21	0.392
Private hospital	1.89	1.38–2.57	<0.001	1.51	1.10–2.25	0.014
Private medical office	1.42	1.02–1.98	0.039	1.18	0.91–1.90	0.361
EsSalud	1.30	0.96–1.77	0.090		Not included *	
Armed forces	1.22	0.74–2.01	0.444			
Workplaces						
1	Ref			Ref		
2	1.84	1.25–2.72	0.002	1.12	0.74–1.70	0.584
>2	1.60	1.04–2.48	0.033	0.71	0.41–1.22	0.210
Region						
Capital city (Lima)	Ref					
Rest of coast	1.03	0.71–1.50	0.873		Not included *	
Andes	0.55	0.29–1.04	0.067			
Rainforest	0.49	0.14–1.73	0.264			
Medical shifts per month						
None	Ref			Ref		
1–5	0.80	0.58–1.11	0.186	1.21	0.84–1.75	0.317
6–10	0.39	0.27–0.57	<0.001	0.68	0.45–1.04	0.074
>10	0.32	0.17–0.63	0.001	0.46	0.24–0.90	0.024
Surgeries per week						
<5	Ref					
5–9	1.13	0.81–1.58	0.465		Not included *	
≥10	0.87	0.56–1.34	0.531			
Teaching activity	2.475	1.83–3.36	<0.001	1.97	1.39–2.79	<0.001
Academic field						
Subscriber to orthopedic journals	1.56	1.16–2.10	0.003	0.84	0.61–1.16	0.281
Member of the SPOT	1.86	1.36–2.55	<0.001	1.13	0.80–1.60	0.495
Member of scientific society other than the SPOT	2.49	1.83–3.40	<0.001	1.75	1.22–2.51	0.002
Research						
Research courses	1.83	1.35–2.48	<0.001	1.27	0.93–1.74	0.140
Payment for research	2.18	1.46–3.23	<0.001	1.13	0.65–1.97	0.670
Projects						
None	Ref			Ref		
1	1.34	0.91–1.97	0.139	1.64	1.07–2.51	0.025
≥2	2.17	0.58–3.00	<0.001	1.60	1.14–2.26	0.007

Table 2. *Cont.*

Characteristic	Orthopedics Scientific Publication					
	Crude Model			Adjusted Model		
	cPR	(95% CI)	p	aPR	(95% CI)	p
Specialist §						
Field of orthopedic interest						
Infant	1.51	1.03–2.20	0.034	1.43	1.01–2.02	0.042
Tumors	1.86	1.25–2.76	0.002	1.71	1.17–2.50	0.005
Arthroscopy	1.30	0.96–1.77	0.086	Not included *		
Spine	1.12	0.58–2.19	0.731			
Trauma	0.86	0.61–1.23	0.420			
Joint replacement	1.04	0.72–1.48	0.842			
Hip	1.02	0.69–1.53	0.909			
Upper limb	0.70	0.42–1.16	0.165			
Lower limb	1.04	0.69–1.57	0.843			
Hand	0.68	0.37–1.24	0.207			
International clerkship	2.35	1.76–3.13	<0.001	1.60	1.15–2.23	0.006
Active participation in meeting †	2.68	2.07–3.46	<0.001	2.07	1.55–2.74	<0.001
Years of work						
0–4	Ref			Ref		
5–9	1.10	0.65–1.87	0.723	1.12	0.69–1.83	0.642
10–14	1.20	0.66–1.94	0.652	0.79	0.48–1.31	0.366
≥15	1.94	1.29–2.70	0.001	1.43	0.99–2.07	0.057
Residents §						
Modality of admission to residency						
Free	Ref			Ref		
Detached/Captive	0.48	0.07–3.50	0.468	1.12	0.13–9.65	0.916
Year of residency						
First year	Ref			Ref		
Second year	1.83	0.25–13.38	0.550	1.44	0.46–4.46	0.531
Third year	1.10	0.08–15.66	0.944	1.17	0.09–15.61	0.907
International clerkship	8.85	3.00–26.08	<0.001	8.63	2.62–28.43	<0.001
Number of coresidents						
0–1	Ref			Ref		
2–3	1.15	0.28–4.70	0.846	1.08	0.25–4.70	0.917
≥4	1.67	0.38–7.30	0.498	1.30	0.39–4.31	0.670

cPR, crude prevalence ratio; aPR, adjusted prevalence ratio; MINSA, Spanish acronym of Ministry of Health; EsSalud, Spanish acronym of Peruvian Social Health Insurance; SPOT, Spanish acronym of the Peruvian Society of Orthopedics and Traumatology. * Variable not included in the multivariate adjusted model because of a $p > 0.05$ value. † Peruvian physicians trained abroad (undergraduate or specialty) currently practicing in Peru. ‡ Active participation in the meetings was considered if the participant presented a scientific poster or made an oral presentation of their own research work or about a specific topic assigned. § Subanalysis was conducted according to the number of physicians who had at least a specialist degree ($n = 241$), and similarly for residents ($n = 69$).

4. Discussion

4.1. Main Findings

We have successfully identified the key factors that affect publication prevalence among our specialists. Approximately two out of ten individuals had previously published scientific articles, with case reports being the most prevalent, followed by original articles. The factors contributing to publishing among the specialists included working in a private clinic, interest in tumors and pediatric orthopedics, having a teaching position, membership in societies other than SPOT, involvement in multiple research projects, international rotations, and active participation in meetings. Conversely, the factors associated with lower scientific publication rates included graduating from a university from non-coastal regions and having more than ten shifts per month. Among residents, having completed an international rotation was linked to publishing scientific articles.

4.2. Comparison with Other Studies and Interpretation of Outcomes

While some studies have outlined the aspects of scientific production in orthopedics (Al-Mohrej et al., 2021; Dartus et al., 2019; Saab et al., 2019; Zou et al., 2016), no studies, to our knowledge, have evaluated the factors associated with scientific production among these specialists independently. However, a study among 2108 Peruvian physicians in 2017 (Mejia et al., 2021), found that 1167 were orthopedists, and only 3.6% had publications indexed in these databases. Nonetheless, this study only included original articles, while our research encompassed all types of research.

A study among dermatologists found that the size of the resident program, the amount of time specifically dedicated to research, a lower clinical workload, and the number of clinical trials conducted in the previous year were associated factors for publication (Molina-Leyva et al., 2019). In a study of trauma surgeons, the associated factors were the time devoted only to research, having a mentor, practicing in a teaching hospital, having publications before completing residency, having institutional resources dedicated to research, and being male (Elkbuli et al., 2020). Research among burn surgeons highlighted mentorship, pre-residency research experience, and institutional research provisions as contributing to increased scientific output (Elkbuli et al., 2019). A study involving gastroenterologists in Peru outlined factors such as literature search approach, scientific article comprehension, research amenities, society membership, and number of jobs (Parra-Pérez et al., 2009).

These results show that there are aspects of opportunity that increase the possibilities of research, and therefore of publishing scientific articles, which are also consistent with our results. Factors like working in a university environment (Elkbuli et al., 2020), scientific society membership (Parra-Pérez et al., 2009), and research project engagements (Elkbuli et al., 2019, 2020; Molina-Leyva et al., 2019) have consistently surfaced in studies involving physicians from other specialties. However, these factors are logical given their association with environments where research is a prevalent activity. Moreover, these factors are not equally accessible to all. This reflects the "Matthew Effect" in academia, where early access to research or mentorship environments may lead to disproportionate long-term gains in recognition and increased access to project funding and employment (Bol et al., 2018; Feichtinger et al., 2021), potentially widening productivity gaps in resource-limited settings like Peru.

Notably, having an international rotation and some areas of interest are also associated with scientific article publication. Rotations in areas of interest in hospitals from high-income countries were able to improve the research skills of the professionals (von Kaeppler et al., 2020). This is also an aspect that influences residents, as our results show, and that is also common in all residents in the country regardless of their specialty (Herrera-Añazco et al., 2018b). This may probably be due to the interaction with research teachers with a high scientific productivity (Polasek et al., 2006) in those hospitals.

Time dedicated to research has been emphasized in other articles evaluating the subject (Elkbuli et al., 2020; Molina-Leyva et al., 2019). Therefore, a high number of hospital shifts correlates with lower article publication probabilities. Also, a study showed that residing in Lima was associated with publishing scientific articles (Córdova-Salcedo et al., 2021), supporting our findings regarding medical school location.

For orthopedic residents, a study reported long working hours as a hindrance to academic work, while a positive correlation was observed between having associate/assistant professors and academic productivity (Demirtaş et al., 2020). The organization of the residents' work to find time for academic activities could favor research. Another study showed that, in an American hospital, the presence of research coordinators increased the number of publications at specialty congresses (Berger et al., 2021), a strategy that could be implemented here.

4.3. Underlaying Mechanisms

The underlying mechanisms of variable scientific publication among orthopedic professionals reflect a combination of individual, institutional, and contextual and formative factors. At the individual level, limited time is due to high clinical workloads, particularly among those with more shifts per month, and the need to maintain multiple jobs to achieve financial stability significantly reduce the capacity to engage in research activities. This is often coupled with insufficient formal training in research methodology, scientific writing, and publication processes, as well as a lack of dedicated mentorship. At the institutional level, many healthcare centers do not provide protected research time or the necessary infrastructure to support scientific output. This includes the absence of active research units, ethics committees, biostatistical support, electronic clinical records, and funding mechanisms. Moreover, research is seldom incentivized financially or recognized within professional advancement pathways, leading many to pursue it primarily for personal fulfillment rather than institutional benefit. Contextual and formative factors play a crucial role: physicians who took undergraduate courses in resource-limited academic settings, such as universities located in the highlands, may have had limited exposure to research opportunities and mentorship early in their careers. Conversely, positive associations, such as international rotations, involvement in teaching, membership in multiple scientific societies, and interest in subspecialties like pediatric orthopedics or musculoskeletal oncology, likely reflect environments that promote academic engagement, offer access to research networks, and reinforce the value of scientific activity. Together, these mechanisms illustrate how scientific productivity in orthopedics is shaped not only by personal motivation but by systemic, institutional, and educational structures that can either facilitate or constrain academic development.

4.4. Implications and Strategic Recommendations for Orthopedic Research

According to our findings, postgraduate research training within orthopedic residency programs should be strengthened by moving beyond the current protocol-based model and promoting the development of full, publishable theses. At the institutional level, hospitals should allocate protected research time or fund additional hours for scientific work, while also investing in infrastructure such as clinical research departments, ethics committees, and support units for statistical and editorial assistance. Financial and logistical support should be provided to facilitate participation in academic events. At the level of professional societies, such as SPOT, efforts should focus on identifying experienced researchers to lead mentorship programs, to promote international collaborations, and to offer training opportunities and research fellowships. Additionally, improving the editorial management and indexing of SPOT's official journal is essential to increase the visibility of national orthopedic research. These recommendations, coupled with the individual factors identified in this study, could help foster a more equitable, productive, and globally visible orthopedic research environment in similar low- and middle-income settings.

4.5. Limitations

Our study has some limitations. First, due to its cross-sectional design, the associated factors do not necessarily establish a causal relationship. Second, because the data were collected through self-administered surveys, participants were exposed to recall and social desirability bias. However, the survey was validated by experts, and it was conducted anonymously in a space where the participant's privacy was respected. Third, it is possible that there are other determinants that have not yet been explored. Fourth, although this study is based on quantitative, closed-ended survey data, certain systemic or cultural factors may require deeper exploration. Future research could benefit from incorporating qualitative or mixed methods approaches to gain richer insights and a more comprehensive understanding of the barriers involved. Fifth, our study did not include information on the specific journals or publishing venues where the reported articles were published. As such, we were unable to perform a bibliographic and bibliometric analysis that could have offered additional insights into the visibility, indexing status, and editorial quality of those publications. Despite these limitations, this study is, to our knowledge, the first in orthopedics to examine the factors associated with scientific publication. This allows for the identification of factors that promote scientific publication, which would allow for the creation of strategies to increase the rate of evidence generation in our field and to better understand the current reality of research in this specialty, such as promoting scientific activities within SPOT, establishing research funds, and forging agreements with foreign institutions for member rotations which could prove beneficial. Similarly, logistical and human resources should be reinforced in provincial universities to enhance research.

5. Conclusions

The determinants found must be considered to achieve interventions to improve scientific production in orthopedists, considering whether the professional is a resident or a specialist, since different factors were found for each of them.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/publications13040052/s1, Table S1: Aiken's V average per item according to clarity, coherence and relevance of the survey; Survey S2: Structured Questionnaire for Data Collection.

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Conflicts of Interest: A.B.-R. is a member of the Board of Directors of the Peruvian Society of Orthopedics and Traumatology, period 2022–2024. The other authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

PMOT	Peruvian National Meeting of Orthopedics and Traumatology
SPOT	Peruvian Society of Orthopedics and Traumatology
MINSA	Ministry of Health
EsSalud	Peruvian Social Health Insurance
CI	Confidence interval
PR	Prevalence ratios

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