



# Research Involvement during Orthopedic Surgery Training in Chile. How Frequently Do Residents Publish?

## *Participación en investigación durante la formación en Traumatología y Ortopedia en Chile ¿Con qué frecuencia publican los residentes?*

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### Abstract

**Objective** To determine the average number of indexed articles published per orthopedic resident in Chile, and, secondarily, to establish if protected research time for residents was associated with a higher number of publications.

**Methods** A transverse descriptive study was developed. A search for publications authored by orthopedic residents who graduated from Chilean programs between 2012 and 2016 was performed on the PubMed database. Articles with a publication date between 6 months after the beginning of the residency and 12 months postgraduation were included. Letters to the editor, articles not related to orthopedic surgery, and research projects with an institutional affiliation other than their training programs were excluded. Each residency curriculum was reviewed for protected time for research.

**Results** A total of 272 residents from 10 programs were included, and 72 articles fulfilled the selection criteria. The average rate of publication was of  $0.26 \pm 1.13$  articles (range 0 to 13 articles) per resident during training. In total, 2 programs had an average publication rate higher than 1, and 89.4% of the Chilean residents did not publish an article during their training. None of the programs specified protected time for research.

**Conclusions** To our understanding, the present is the first study to describe the current state of research involvement among Chilean orthopedic residents. The average number of publications indexed on PubMed per orthopedic resident during training was  $0.26 \pm 1.13$  articles. Only 10% of the residents publish an article during their residency. No correlation between protected time for research and the number of publications could be established.

### Keywords

- resident
- research
- orthopedics

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## Resumen

**Objetivo** Determinar el promedio de artículos indexados publicados por residente de traumatología en Chile y, en segundo lugar, establecer si el tiempo protegido para investigación se asociaba con un mayor número de publicaciones.

**Métodos** Se desarrolló un estudio descriptivo transversal. Se realizó una búsqueda en la base de datos de PubMed para identificar publicaciones escritas por residentes egresados de programas chilenos entre 2012 y 2016. Se incluyeron artículos con fecha de publicación entre 6 meses después del inicio de su residencia y 12 meses después de la graduación. Se excluyeron las cartas al editor, los artículos no relacionados con la cirugía ortopédica, y los proyectos de investigación con una afiliación institucional distinta a sus programas de formación. Cada currículo de los programas de residencia fue revisado para que se identificara la mención de tiempo protegido para investigación.

**Resultados** Se incluyó a un total de 272 residentes de 10 programas, y 72 artículos cumplieron los criterios de selección. La tasa de publicación promedio fue de  $0,26 \pm 1,13$  artículos (rango: 0 a 13 artículos) por residente durante su formación. En total, 2 programas tuvieron una tasa de publicación promedio superior a 1, y un 89,4% de los residentes chilenos no publicó ningún artículo durante su formación. Ninguno de los programas especificó tiempo protegido para la investigación.

**Conclusiones** A nuestro entender, este es el primer estudio que describe el estado actual de la participación en la investigación entre los residentes de traumatología chilenos. El número promedio de publicaciones indexadas en PubMed por residente durante la formación en Chile fue de  $0.26 \pm 1.13$  artículos. Sólo el 10% de los residentes publica un artículo durante su residencia. No se pudo establecer una correlación entre el tiempo protegido para la investigación y el número de publicaciones.

## Palabras clave

- residente
- investigación
- ortopedia

## Introduction

Involvement in research has become a fundamental aspect during residency training of orthopedic surgeons, as it has shown to develop critical-thinking skills that are necessary for the clinical practice.<sup>1-4</sup> The Accreditation Council for Graduate Medical Education (ACGME) and the Royal College of Physicians and Surgeons of Canada (CanMEDS) advocate for training programs to encourage research participation.<sup>5,6</sup> Accordingly, interest has increased on the variables that make an impact on the rate of publication by orthopedic residents.<sup>2,3,7</sup> Protected time for research appears to play a significant role in the rate of publication, which is significantly different among residents from different programs.<sup>5,7</sup> The same interest in resident publications has been reported in Latin American countries.<sup>8,9</sup> However, a recent study<sup>10</sup> showed that only 1% of the orthopedic literature published between 1988 and 2013 originated from this region. Different questions arise based on this evidence: are orthopedic residents from Latin America actively involved in research? How many articles do they publish? Is there a disparity with North American countries? To our knowledge, there is insufficient published data to answer these questions. The primary objective of the present study was to determine the average number of indexed articles published per orthopedic resident in Chile, and, secondarily, to establish if protected research time for residents was associated with a higher number of publications.

## Methods

A transverse descriptive study was developed. A list of all orthopedic residency programs in Chile was obtained from the Chilean Society of Orthopedic Surgery (SCHOT). Every institution's curriculum was reviewed, and any mention of protected time for research was recorded. The full names of the residents who graduated between 2012 and 2016 was recorded, and, if a program did not have graduates in this period, it was excluded from the analysis. Lastly, each program was contacted directly to confirm the information.

Search criteria: articles indexed on PubMed authored or co-authored by the orthopedic residents with a publication date between 6 months after the beginning of their training and 12 months postgraduation were included. Letters to the editor, articles not related to orthopedic surgery, and those with an institutional affiliation other than their training program were excluded. The first and last names of each resident were searched on the electronic database. To prevent data from being tainted due to the possibility of multiple researchers having the same names, the names and institutional affiliations of the co-authors were checked as well.

The number of articles published by each resident was recorded to determine the publication rate per resident and per program. A subsequent analysis was performed according to each journals' impact factor (at the time of the review)

and the level of evidence of each article. Clinical trials were classified according to the Oxford Centre for Evidence-Based Medicine Levels of Evidence.<sup>11</sup>

The electronic search was performed in August 2017 by two independent researchers. All data was stored using Google Sheet (Alphabet), and data analysis was performed using the Stata (StataCorp, LLC, College Station, TX, US) software, version 12.0.

## Source of Funding

No funding from any source was received for this investigation.

## Results

Twelve orthopedic surgery residency programs in Chile were identified, all with a training duration of three years. Two were excluded from the analysis because no residents had graduated from them at the time of analysis. In total, 272 residents were included, with an average of  $27.2 \pm 22.9$  (range: 7 to 85) residents per program. The inclusion criteria were fulfilled by 72 studies (2 articles were excluded because they were letters to the editor). The studies were authored by 29 (10.6%) of the 272 residents. The publication rate was  $0.26 \pm 1.13$  (range: 0 to 13) articles per resident during training. Overall, 2 programs stood out, with an average of more than 1 article published per resident (2.6 and 1.3 articles). Half of the programs had at least one resident who had published an article during their residency (► Fig. 1). Among the published articles, there were 42 clinical trials, 12 experimental studies, and 18 reports, including surgical technique guides and the validation of clinical

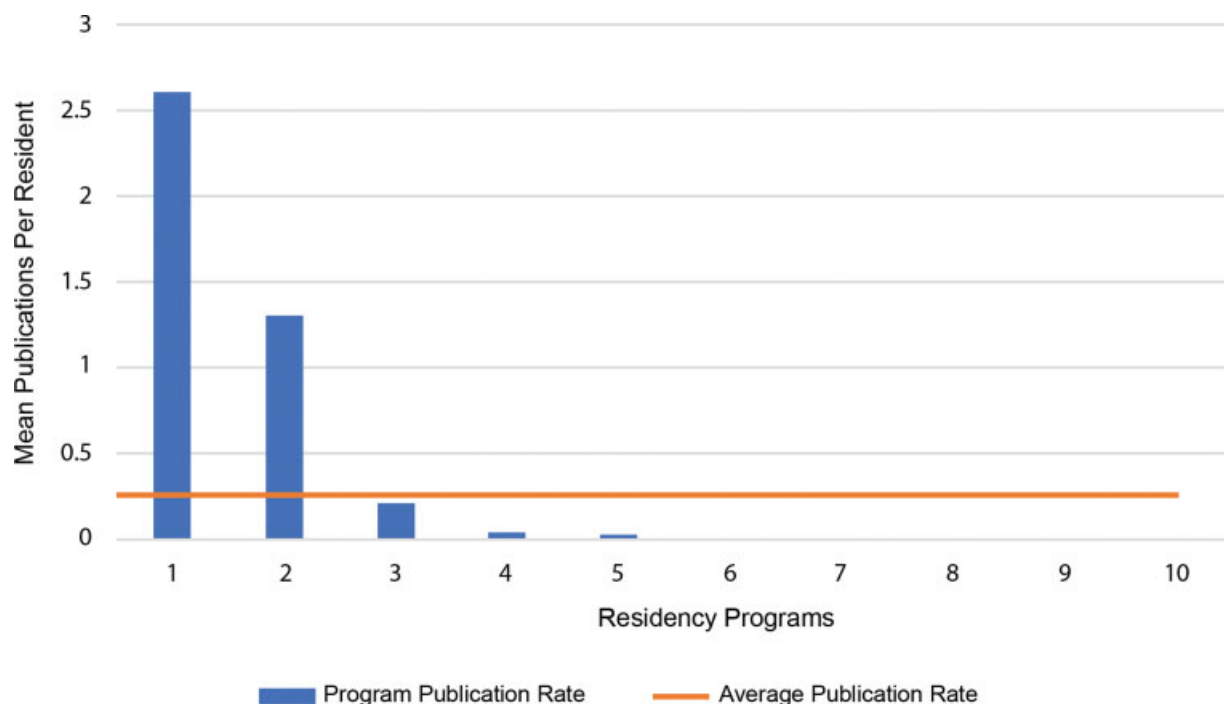
**Table 1** Proportion of clinical trial articles included according to their level of evidence (Oxford Centre for Evidence-Based Medicine Levels of Evidence)

Level of evidence	Number of publications
I	0
II	4
III	5
IV	29
V	4

outcome measures and disease classification systems. The level of evidence for each clinical trial is shown in ►Table 1, with the majority corresponding to level-IV or -V studies (78.5%). The journals in which Chilean residents published the most and their corresponding impact factors are summarized in ►Table 2. None of the ten training programs mentioned protected time for research; therefore, no analysis could be made to establish if the existence of protected time for research correlated with the number of publications.

## Discussion

There is a rising interest in research in Latin American countries,<sup>8,9</sup> but the number of indexed publications on orthopedics is still lacking from this region when compared with others.<sup>10</sup> Encouraging residents to perform scientific research could be of great interest to these countries, as it has been shown that residents who publish during their training programs tend to continue working on research projects during their careers.<sup>4,6,12,13</sup> However, we do not know what



**Fig. 1** Average number of articles published by residents per program. The orange line indicates the average publication rate of all residents.

**Table 2** The ten most frequent journals with publications by residents

Journal	Scimago Journal & Country Rank	Number of publications
<i>Spine</i>	1.736	10
<i>European Spine Journal</i>	1.535	8
<i>Revista Española de Cirugía Ortopédica</i>	0.28	8
<i>Knee</i>	1.244	7
<i>International Orthopaedics</i>	1.502	5
<i>Arthroscopy</i>	1.459	5
<i>Foot and Ankle International</i>	1.626	4
<i>Injury</i>	0.99	4
<i>Revista Médica de Chile</i>	0.26	4
<i>American Journal of Sports Medicine</i>	3.949	3

proportion of residents actually do manage to successfully publish an article. To our understanding, there are no reports describing the involvement in research by Latin American orthopedic surgery residents.

The results of the present study showed that a Chilean orthopedic surgery resident publishes on average  $0.26 \pm 1.13$  articles in a 3-year period. A recent study<sup>7</sup> from the United States, which included 1,690 residents from 125 orthopedics programs, showed a publishing rate of  $1.2 \pm 2.4$  articles per resident in a 5-year period. Among Canadian orthopedic residents, the publication rate during 1 year of training was of  $0.42 \pm 0.9$ , which is also higher than the Chilean rate.<sup>5</sup> Multiple factors could explain this difference, such as the total duration of the training (5 years versus 3 years), language, a dedicated research program,<sup>14,15</sup> faculty mentorship commitment,<sup>4,14,16,17</sup> access to a research medical editor, the provision of grants,<sup>14</sup> the possibility of primary authorship,<sup>18</sup> the possibility of an elective research year,<sup>19</sup> work hour restrictions,<sup>5,20,21</sup> and protected time for research.<sup>5,7,14</sup>

Some of these factors could be of interest to apply in local residency programs, as restructuring them has resulted in a significant increase in grants and publications in other regions such as North America.<sup>14,15,22</sup> Robbins et al.,<sup>14</sup> for example, showed an increase in the publication rate from 1.3 to 9.3 articles per resident during orthopedic training after adjustments in the research curriculum.

Regarding protected time for research, the study by Williams et al.<sup>7</sup> showed that American orthopedic surgery residents who had designated time for research published significantly more than those who had not. The same has been demonstrated by Chan et al.<sup>5</sup> regarding Canadian orthopedic residents, with a mean amount of protected time of  $5 \pm 7.3$  months. In their study,<sup>5</sup> they also showed that 41% of the surveyed residents answered that time was the biggest obstacle for research. In the present analysis,

none of the Chilean programs reported protected time for research.

It is important to remark that there is a wide range of articles published among Chilean residents (0 to 13 publications). When comparing the different residency programs, we identified that two of them concentrated those residents who published the most. These were the only ones with a publication rate of more than one article per resident, reaching the North American average.<sup>7</sup> In the other eight programs, the publication rate was near zero. The possible explanations for these differences include the aforementioned reported variables, but we also believe that the research background of the student is also a factor that could impact publication rates, as some programs might have a higher proportion of residents that already have a baseline experience and interest in research.

The analysis of the articles published by the Chilean residents showed that many were published in high-impact orthopedic journals (►Table 1). However, this does not necessarily guarantee the quality of the article.<sup>15</sup> Furthermore, most of the clinical trials included in the present study (78.5%) had a level of evidence of IV or V (►Table 2).

The present study has limitations that may have led to selection bias. First, the database search was conducted exclusively on PubMed; therefore, publications that were not indexed on PubMed were excluded. This database was used because it is the leading search engine for scientific evidence,<sup>23</sup> it includes all major journals,<sup>24</sup> and is consistent with the methods of the current literature.<sup>5,7</sup> Second, the time limit set for the inclusion criteria for published articles (6 months after beginning the residency up to 12 months postgraduation) was arbitrarily defined in a way to ensure only the inclusion of articles that were developed by residents during their training. These criteria might have caused the publication rate to be under- or overrated. As with several descriptive studies, the generalization of our results is also limited, because some comparisons were made using the published literature. For a more accurate analysis, future investigations could focus on conducting transverse comparative studies between Latin and North American orthopedic residents.

Based on our knowledge, the present is the first study to report the current state of involvement in research and the number of publications by orthopedic residents in a Latin American country. Upcoming studies in Chile should focus on identifying the differences between orthopedic residency programs, to recognize the key variables that lead a group of students from the same country to stand out among their peers. It would also be valuable to assess the resident's opinion about factors that influence their success in developing and publishing research.

## Conclusions

The present study determined that the average number of publications indexed on PubMed per orthopedic resident in Chile is of  $0.26 \pm 1.13$  articles, which is lower than that of their North American counterparts. Only 10% of them

publish an article during their residency. None of the Chilean programs specified protected time for research; therefore, no correlation between this variable and the number of articles published by residents could be established.

#### Conflict of Interests

The authors have no conflict of interests to declare.

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