



Research article

Differences in scientific collaboration and their effects on research influence: A quantitative analysis of nursing publications in Latin America (Scopus, 2005–2020)

Diana Marcela Achury-Saldaña^a, Lidier Andres Castañeda-Rodriguez^b, Antonio Perianes-Rodriguez^{c,*}^a Facultad de Enfermería, Pontificia Universidad Javeriana, Cra. 7, 40-62, Bogota, Colombia^b Dirección de Investigación e Innovación, Universidad del Rosario, Cra. 7, 12b-41, Bogota, Colombia^c Departamento de Biblioteconomía y Documentación, Universidad Carlos III de Madrid, C/ Madrid, 128, 28903 Getafe (Madrid), Spain

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ABSTRACT

This work is mainly aimed at the detection, visualization and description of the scientific collaboration patterns in the Nursing field in Latin America as a response to the lack of evidence on the implications of collaboration and its effects on the scientific influence in the Nursing field.

For this purpose, a retrospective quantitative analysis was conducted by including all the publications classified under the code 2900 in All Science Journal Classification Codes of Scopus, corresponding to the field of General Nursing during 2005–2020. A total of 40 countries and 362,354 unique publications were analyzed, although the main subset herein consists of 18,371 unique publications authored by Latin-American institutions.

World proportion of Latin-American publications in Nursing is higher than all the publications in the region. This increase is especially remarkable in the latest year of the studied period, which may result from the progressive increase in the numbers of nursing schools, the diversity in the graduate and specialization programs, the creation of scientific societies, and the many conferences carried out recently on Nursing.

1. Introduction

The word collaboration embraces a wide range of relationships and joint activities between research groups and institutions. Accordingly, the nature and extent of a contribution may vary. A type of collaboration occurs when authors educated in the same college or country collaborate, even though they work in different institutions or countries. The most complex form of collaboration comprises many institutions from several countries, thus contributing to create extensive collaboration networks (Sancho et al., 2006). In fact, scientific collaboration between countries has significantly grown up, particularly since the mid-20th century, which has favored the increasingly extensive creation of research groups and scientific networks. In turn, it brings interdisciplinarity, as well as internationalization and globalization of science, on the spot (Bordons, 2000).

The main aspects influencing collaboration include the opening of the scientific community to take part in research projects with colleagues from different organizations and/or different specialties. The intensity of

collaboration varies depending on whether it is a national, regional or international project, a basic or applied approach of the research, the involved scientific areas, and the types of organizations taking part, among others. Being open to international collaboration is strongly related to language issues, geographical closeness, scientific excellence of a country, research facilities, and even for political reasons (García Hernández, 2013).

Lassi and Sonnenwald (2010) mention some advantages of scientific collaboration and highlight works conducted by co-authors are more cited for longer periods; research sponsors are encouraging the collaborative research; collaboration improves the efficiency of existing resources; research groups can deal with higher-sized projects; it improves both learning and training; and finally, being a member of a reputed research group increases one's prestige. The higher visibility of publications based on international collaboration is often grounded on the strong demands of such collaborative studies that, in turn, result in a higher influence on the scientific community (Almero-Canet, 2013).

* Corresponding author.

E-mail address: antonio.perianes@uc3m.es (A. Perianes-Rodriguez).<https://doi.org/10.1016/j.heliyon.2022.e11047>

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In the case of Nursing, scientific production has also increased in the last years, particularly after it was consolidated as an academic and research field, which also strengthened its traditional practical and applied nature (Aguirre Raya, 2011). Numerous publications regarding the development of the Nursing research in the scientific context at a national, regional and international extent have been produced during the last years. This is intended to enhance the information available and improve the decision-making on both the practice and research of Nursing. Some of these works provide a comprehensive overview of the quantitative research in Nursing (Thelwall, 2020), the disciplinary context (Pardo et al., 2001) or the detailed historic description of literature that explores the bibliometrics of Nursing research (Kokol, 2019).

Most of these publications include production and visibility analyses (Alfonzo et al., 2014; Eastbrooks et al., 2004; Gimenez-Espert et al., 2019) and, to a lower extent, network analysis techniques by using co-occurrence of citations or words (Zelevnik, 2017). However, scientific collaboration based on co-authorship has been poorly studied despite it is a fundamental aspect for the solution of increasingly complex and global problems (Xiao-Ni et al., 2016). This type of studies, focused on collaboration, will allow measuring the effect of personal, institutional and national relationships on the visibility and influence of research results, and then establishing public and private measures to improve the resource exchange and foster synergies between researchers, so they may build a critical pool of knowledge more efficiently and quickly.

1.1. Objectives

As a response to the lack of evidence on the implications of collaboration and its effects on the scientific influence in the Nursing field, this work is mainly aimed at the detection, visualization and description of the scientific collaboration patterns in the Nursing field in Latin America for a better understanding of disciplinary disparities or similarities across countries. This main objective will be accomplished by gathering information about the following items:

- The role played by Latin America in the world scientific production in Nursing.
- Identification of leading countries Nursing research in Latin America.
- Measurement of visibility of the Latin-American production in Nursing.
- Proportion of highly cited publications from the region.
- Analysis of the effect(s) that different types of collaboration have on the visibility and influence of the Latin-American publications in Nursing.
- Visualization of similarities/differences in the national collaboration strategies by comparing them to the international collaboration networks.

In fact, dissemination of these quantitative works in the region is an ongoing concern among scholars and professionals due to the barriers existing in the region like difficulty to access to recent works, the need to be competent in other languages or low numbers of indexed specialized journals in the main databases (Scopus, Web of Science, Dimensions, etc.).

1.2. Methods

A retrospective quantitative analysis was conducted by including all the publications classified under the code 2900 in All Science Journal Classification Codes of Scopus, corresponding to the field of General Nursing during 2005–2015 with a cumulative citation window until 2017. The 40 countries in this analysis are from the subregions: Central America, Latin America and the Caribbean, and South America (see the comprehensive list of countries in the supplementary material). An in-

house version of Scopus database was used. The access to Scopus is provided by FECYT in Spain.

In total, 362,354 unique publications were analyzed using the multiplicative counting method (Perianes-Rodriguez, 2015), although the main subset herein consists of 18,371 unique publications authored by Latin-American institutions. The analysis includes all type of publications (articles, editorials, letters, notes, reviews, etc.), without language restrictions. Regarding the analysis units, this work focuses exclusively on the referred countries, even though the data allow for different aggregates (institutions, departments, etc.).

The indicators used herein are:

- a) P and PP: total number and proportion of publications from one country.
- b) P (top 1) and PP (top 1): total number and proportion of publications highly cited from one country, of the same specialty, the same document type and the same year, included in the 1% of those with higher visibility (Clarivate, 2021).
- c) C and PC: total number and proportion of citations from the publications of one country.
- d) C/D: average number of citations from the publications of one country.
- e) MCN: average number of citations from the publications of the aggregate, normalized by specialty, document type and year.
- f) Solo and PSolo: publication and proportion of publications authored by a unique institution.
- g) Nal and PNal: publications and proportion of publications authored by two or more institutions of the same country.
- h) LATAM and PLATAM: publications and proportion of publications authored by two or more Latin-American institutions.
- i) Internal and PInternal: publications and proportion of publications authored with non-Latin-American international institutions.
- j) LATAM and Internal and PLATAM and Internal: publications and proportion of publications authored by Latin-American institutions and non-Latin-American institutions.
- k) Internal col and PInternal col: publications and proportion of publications authored by organizations from other countries (h + i + j).

The software Pajek was used for the visualization and the similarity relationships were based on the algorithm Kamada et al. (1989) after using the multiplicative counting method (Perianes-Rodriguez, 2015; Perianes-Rodriguez et al., 2016).

Another data sources using the same or a very similar period of analysis are the following: World Bank and World Health Organization for socioeconomic indicators, and Unpaywall for Open Access status of journals (the publication gets the classification from its journal).

2. Results

2.1. Production and visibility

The representativeness of Latin-America in the world production: publications specialized in Nursing show a higher percentage than the total publications since 2007 (Figure 1).

Likewise, when comparing the number of citations to the total Latin-American publications on one hand, and, to the Nursing specialized publications on the other hand (Figure 2), results are similar. The visibility of Nursing publications is also higher than the total production from 2009.

Now then, the country with the highest number of publications and citations is Brazil, the biggest producer of Nursing publications in the region accounting for more than 65% of published papers. Their proportion of citations is also the highest, but it is still 8% below their own proportion of publications. Notwithstanding, citations per document put

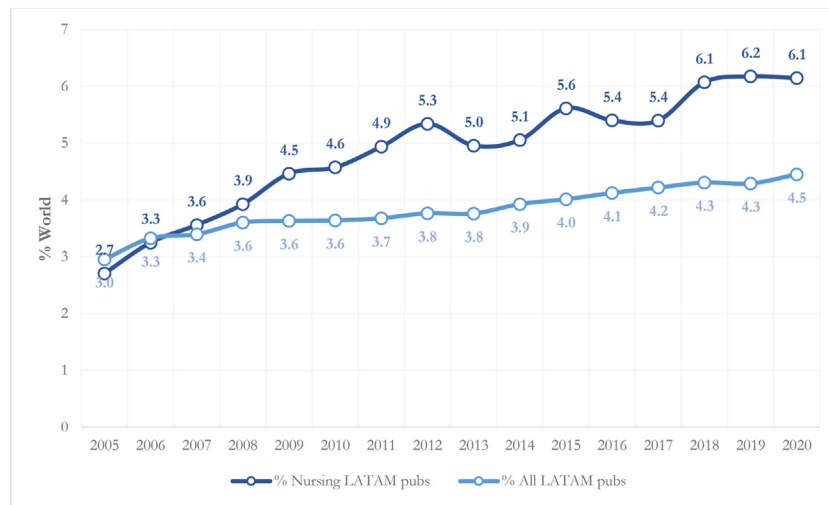


Figure 1. Proportion of World publications. Nursing and all-publications in Latin-America. Source: Scopus.



Figure 2. Proportion of World citations. Nursing and all-publications in Latin-America. Source: Scopus.

Brazil in the 19th position and the southeastern countries (Argentina, Paraguay and Uruguay) and Puerto Rico show the highest proportions in this indicator (Table 1).

Figure 3 presents both the production and citation proportions in the five countries with more than 500 publications during the analyzed period (hereinafter, ‘most productive countries’). Differences between numbers of both indicators can be easily observed, indicating that Brazil and Colombia have a lower visibility, both indicators are in balance in Chile and a higher visibility in Mexico and Argentina.

Per-year unaggregated publication data show a large difference between Brazil and the other countries in the region and, on the other hand, how Brazil shows a slight decrease in productivity since 2011 (Figure 4). Additionally, a moderate increase in the publication percentage can be observed in Colombia and Chile. By contrast, Argentina presents a strong decrease.

Table 2 shows the publications in the Top 1% of highly cited publications in Nursing. Again, the visibility of the Brazilian production shows weakness symptoms and remains far below the expected position, thus becoming the country with the second worst ratio of highly cited works. On the contrary, Argentina has a total production quite lower than Mexico and a very similar total number of highly cited works. In this point, it is important to note that the proportion of highly cited publications in LATAM is 1.6%.

2.2. Scientific collaboration

Now, in the analysis of the types of collaboration, Table 3 presents the number of publications in countries with more than 100 documents published in the studied period. The countries with higher proportion of solo papers—which some authors call the isolation or insularity index—are Venezuela, Cuba and Brazil. The countries with higher ratios of international collaboration (including works authored with third countries and/or countries of the region) are Guatemala, Uruguay and Peru whose numbers are between 75% and 86%. The Brazilian case is very noteworthy as only 21% of their production is co-authored with foreign institutions.

Table 4 presents the visibility proportion by type of collaboration. These data complete the previous data and are quite revealing. The countries with the highest performance in their international production—defined as the difference between the proportion of citations and the proportion of publications with any type of international collaboration—are Venezuela (40.4%) and Cuba (51.5%). This huge difference is explained because of the poor visibility of the publications either without collaboration or with national collaboration (11.4% in Cuba and 23.5% in Venezuela).

In all cases, citation proportion for international co-authored publications is higher than their percentage of publications. This increase in

Table 1. Publications and citations of Latin American countries.

Country	P	PP	C	PC	C/D
Brazil	25053	65.89	253219	57.83	10.11
Mexico	3658	9.62	54985	12.56	15.03
Chile	2722	7.16	35826	8.18	13.16
Colombia	1575	4.14	18402	4.20	11.68
Argentina	1437	3.78	28993	6.62	20.18
Peru	585	1.54	7118	1.63	12.17
Cuba	494	1.30	2493	0.57	5.05
Venezuela	473	1.24	4908	1.12	10.38
Uruguay	329	0.87	8500	1.94	25.84
Ecuador	299	0.79	2729	0.62	9.13
Guatemala	243	0.64	4169	0.95	17.16
Costa Rica	224	0.59	3572	0.82	15.95
Jamaica	180	0.47	2546	0.58	14.14
Puerto Rico	171	0.45	3975	0.91	23.25
Trinidad and Tobago	93	0.24	1255	0.29	13.49
Panama	55	0.14	681	0.16	12.38
Bolivia	49	0.13	579	0.13	11.82
Dominican Republic	49	0.13	578	0.13	11.80
Paraguay	48	0.13	849	0.19	17.69
Grenada	40	0.11	527	0.12	13.18
Barbados	39	0.10	689	0.16	17.67
Honduras	36	0.09	361	0.08	10.03
Nicaragua	30	0.08	170	0.04	5.67
El Salvador	27	0.07	153	0.03	5.67
Dominica	21	0.06	142	0.03	6.76
Guyana	15	0.04	31	0.01	2.07
Guadeloupe	14	0.04	31	0.01	2.21
Martinique	12	0.03	115	0.03	9.58
Belize	8	0.02	62	0.01	7.75
Aruba	7	0.02	8	0.00	1.14
Saint Kitts and Nevis	7	0.02	62	0.01	8.86
Suriname	7	0.02	49	0.01	7.00
Haiti	6	0.02	0	0.00	0.00
Saint Vincent and the Grenadines	6	0.02	34	0.01	5.67
Cayman Islands	4	0.01	19	0.00	4.75
French Guiana	2	0.01	2	0.00	1.00
Saint Lucia	2	0.01	15	0.00	7.50
Montserrat	1	0.00	0	0.00	0.00
Virgin Islands US	1	0.00	0	0.00	0.00

P: publications. PP: proportion of publications. C: citations. PC: proportion of citations. C/D: cites per document. *Source:* Scopus.

the visibility of documents with international collaboration is also observed in the Brazilian case in which 21.3% of their international production reports 37.4% of the total citations in Nursing publications.

2.3. Scientific influence

Going deeper in the scientific influence, the publications were classified according to their visibility, taking as a benchmark the world average citations in Nursing (8.1 citations per publication). This way, four categories were identified: uncited documents, low citation (publications with less than 8 citations), average citation (publications with 8–10 citations) and high citation (publications with more than 10 citations). [Figure 5](#) shows the proportion of publications that were never cited (Orange) and those highly cited (Blue) by type of collaboration and country.

In general, the proportion of uncited publications is higher among those conducted without any collaboration or just with national collaboration. On the contrary, the highest ratio of highly cited publications

occurred among documents authored with international collaboration or international and regional collaboration. On the other hand, 30% of the publications from these 12 countries report citations equal or higher than the average value, although less than 2% of the publications are in the world top 1% for Nursing production.

2.4. Open access status

Unpaywall data are integrated into databases such as Scopus, Web of Science or Dimensions. This source classified publications into four categories: Gold: published in an open-access journal that is indexed by the DOAJ; Green: toll-access on the publisher page, but there is a free copy in an OA repository; Hybrid: free under an open license in a toll-access journal; Bronze: free to read on the publisher page, but without a clearly identifiable license ([Piwowar, 2018](#)).

[Figure 6](#) displays that half of the publications are freely available. [Figure 6](#) also highlights the popularity of Gold journals in Brazil, Mexico and Argentina. Hybrid articles are prevalent in Mexico and Chile.

[Figure 7](#) depicts the proportion of publications by country. Mexico and Brazil stands out with almost half of the production in Gold journals (48.3% and 47.8% respectively), followed by Argentina (46.7%), Colombia (42.5%), and Chile (40.8%).

2.5. Socio-economic indicators

This section analyzed three indicators related to Nursing research in LATAM: investment in R&D, investment in Health, and investment in Higher Education. Those three indicators could help to explain some of the results based on the quantitative analysis of scientific publications and the representativeness of the region in the World production and visibility of the field.

[Figure 8](#) shows the R&D investment of the most productive countries. Colombia presents the highest growth rate in the period. However, the five countries present a declining growth rate in the last five years analyzed.

[Figure 9](#) depicts the health investment of the most productive countries. Chile presents the highest growth rate in the period. By contrast, Mexico is now investing less proportion of the GDP in Health than in 2005.

The last socio-economic indicator depicted in [Figure 10](#) presents the investment per student in Higher Education of the most productive countries. It is important to note that the values of the last years of the period are missing for many countries (not only in LATAM). Brazil and Mexico present a negative growth rate during the period. On the contrary, Chile shows the highest growth rate, followed by Argentina.

2.6. International collaboration networks

Finally, [Figures 11, 12, 13, 14, and 15](#) present the international collaboration networks of the most productive countries. Each node represents a country. The thicker and more intense the color of the links, the higher co-authorship. The node size indicates the number of works with collaboration (the scale is described in the image caption). The node color indicates the region (colors are defined in the caption). The methodology described by [Rafols et al.](#) to create base maps was used for the spatial representation of the nodes (2010). The template herein was built based on the international collaboration in the Latin-American global production dealing with Nursing. Some networks have undergone slight modifications in the positions of the nodes affected by overlapping resulting from the variable size of the countries. To improve the visualization and make the analysis easier, the networks only show the relationships between third countries and LATAM countries. Links with less than 4 publications were also pruned.

Argentina has collaborations with 99 countries ([Figure 11](#)). Their most frequent partners are USA (19%), Spain (9%) and UK (7%). The 10

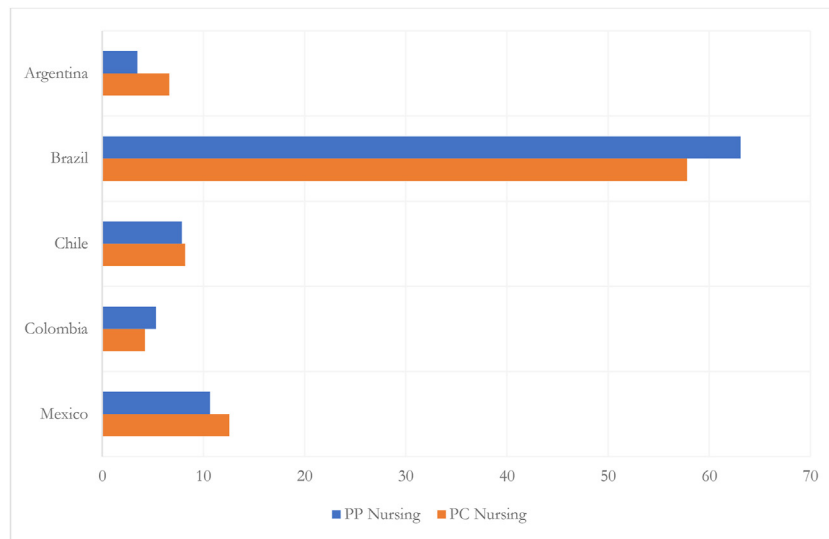


Figure 3. Proportion of publications and citations. Most productive countries. PP: proportion of publications. PC: proportion of citations. Source: Scopus.

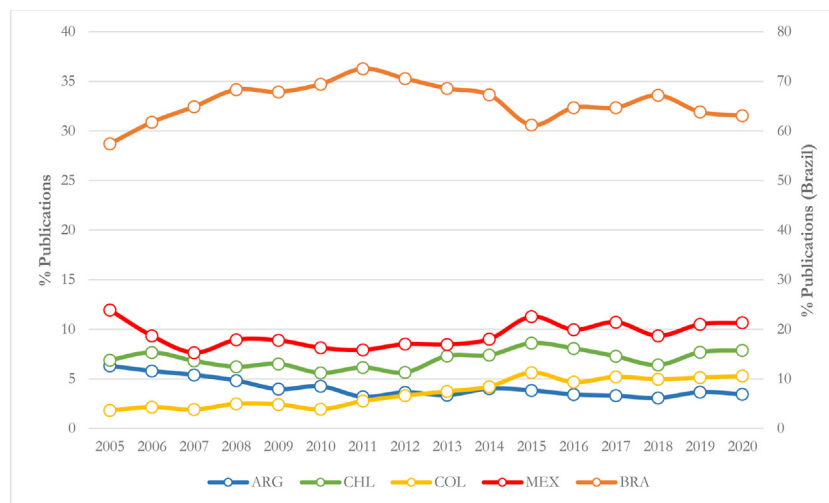


Figure 4. Trends in the proportion of publications. Most productive countries. Source: Scopus.

countries with which Argentina has collaborated the most include two LATAM neighbors, Brazil (5%) and Chile (2.8%).

Brazil has collaborations with 124 countries (Figure 12). Their most frequent partners are USA (28%), UK (9%) and Canada (8%). There is only one LATAM country in the 10 countries with which Brazil has collaborated the most, Mexico (2.7%).

Chile has collaborations with 93 countries (Figure 13). Their most frequent partners are USA (23%), Spain (17%) and UK (7%). The 10 countries with which Chile has collaborated the most include three LATAM countries, Colombia (6%), Mexico (5%) and Peru (2%).

Colombia has collaborations with 96 countries (Figure 14). Their most frequent partners are USA (30%), Spain (13%) and UK (6%). The 10 countries with which Colombia has collaborated the most include only one LATAM country, Mexico (4.7%).

Mexico has collaborations with 86 countries (Figure 15). Their most frequent partners are USA (26%), Spain (10%) and Brazil (6%). The 10

countries with which Mexico has collaborated the most include one LATAM country besides Brazil, i.e., Chile (2%).

3. Discussion and conclusions

From 2007 on, the world proportion of Latin-American publications in Nursing is higher than all the publications in the region. This increase is especially noticeable in the latest year of the studied period, which may result from the progressive increase in the numbers of nursing schools, the diversity in the graduate and specialization programs, the creation of scientific societies, and the many conferences carried out recently on the Nursing field that, as whole, consolidate their knowledge as a science (Ailinger, 2005; Alarcon et al., 2007; Canever et al., 2012).

In the same vein, the proportion of citations of Nursing documents is significantly higher than that of all the publications of the region. Both indicators clearly reveal that the Latin-American publications in Nursing

Table 2. Highly cited publications in nursing (top 1%). LATAM.

Country	P	P (top1)	PP (top1)
Haiti	24	1	4.2
Uruguay	329	10	3.0
Argentina	1437	40	2.8
Puerto Rico	171	4	2.3
Paraguay	48	1	2.1
Bolivia	49	1	2.0
Panama	55	1	1.8
Venezuela	473	8	1.7
Mexico	3658	53	1.4
Colombia	1575	20	1.3
Guatemala	243	3	1.2
Peru	585	7	1.2
Jamaica	180	2	1.1
Cuba	494	4	0.8
Chile	2722	22	0.8
Ecuador	299	2	0.7
Brazil	25053	159	0.6
Costa Rica	224	1	0.4

P: publications. P (top1): highly cited publications. PP (top1): proportion of highly cited publications. *Source:* Scopus.

have made the region more relevant and made their scientific influence stronger in the world arena. These facts evidence that some of the recurring problems in the Nursing discipline, like the lack of research experience due to the shortage of higher education programs (Harrison et al., 2005; Mendoza-Parra et al., 2009; Paho, 1997), are starting to be overcome (Bortoli Cassiani, 2017).

On the other hand, these countries have seen an increase in the offer of postgraduate programmes in which the number of publications is directly related to some kind of academic or scientific requirement. The largest number is among undergraduate students, who have theses or dissertations as a graduation requirement, followed by postgraduate students, including master's and doctoral students.

Regarding the analysis per country, Brazil is undoubtedly the biggest producer of Nursing publications and reports the highest number of total citations, as shown by previous results (Sing et al., 2018). In any case, it is the most populated country in the region, with the largest territory and the highest per capita income and R&D investment, and the highest number of researchers (Guerrero-Casado, 2017). Brazil has also been the pioneer in the creation of both undergraduate and graduate nursing schools (masters and PhD programs included). All this justify that massive research production in the field (Duque-Paramo, 2013). However, when the total data are transformed to make comparisons easier, the proportional results for Brazil do not seem so amazing. The difference between the proportion of citations and scientific production is the most unfavorable among the most productive countries. Additionally, the

Table 3. Proportion of publications by type of collaboration. Countries (>100 publications).

Country	PSolo	PNal	PLATAM	PInternal	PLATAM and internal	Internal col
Argentina	26.10	23.06	5.20	37.48	8.16	50.84
Brazil	38.55	40.14	1.10	19.12	1.09	21.31
Chile	35.87	23.79	10.13	24.85	5.36	40.34
Colombia	36.52	15.13	8.97	31.02	8.36	48.35
Cuba	45.21	17.73	3.33	28.84	4.89	37.06
Guatemala	11.22	2.18	7.93	62.15	16.52	86.6
Jamaica	32.75	5.23	3.18	51.32	7.52	62.02
Mexico	29.65	25.51	5.12	33.4	6.32	44.84
Peru	13.14	11.55	11.11	47.22	16.98	75.31
Puerto Rico	22.51	3.26	0.89	66.62	6.72	74.23
Uruguay	11.1	13.02	8.01	53.52	14.35	75.88
Venezuela	49.14	14.85	4.28	26.2	5.53	36.01

Solo: no collaboration. Nal: national collaboration. LATAM: regional collaboration. Internal: international collaboration. LATAM and internal: regional and international collaboration. Internal col: foreign institutions. *Source:* Scopus.

Table 4. Proportion of citations by type of collaboration. Countries (>100 publications).

Country	PSolo	PNal	PLATAM	PInternal	PLATAM and internal	Internal col
Argentina	14.36	11.84	3.93	54.85	15.02	73.80
Brazil	31.31	31.24	1.31	33.02	3.12	37.45
Chile	28.11	22.48	4.32	34.10	10.99	49.41
Colombia	12.58	5.15	5.42	45.72	31.13	82.27
Cuba	8.03	3.36	1.87	58.62	28.12	88.61
Guatemala	10.87	5.56	3.08	51.98	28.51	83.57
Jamaica	14.80	11.58	0.41	62.62	10.59	73.62
Mexico	15.86	15.92	2.21	50.89	15.12	68.22
Peru	2.90	2.00	12.33	55.50	27.27	95.10
Puerto Rico	17.33	2.95	0.12	67.48	12.12	79.72
Uruguay	12.49	5.03	1.76	63.71	17.01	82.48
Venezuela	17.80	5.74	2.97	48.40	25.09	76.46

Solo: no collaboration. Nal: national collaboration. LATAM: regional collaboration. Internal: international collaboration. LATAM and internal: regional and international collaboration. Internal col: foreign institutions. *Source:* Scopus.

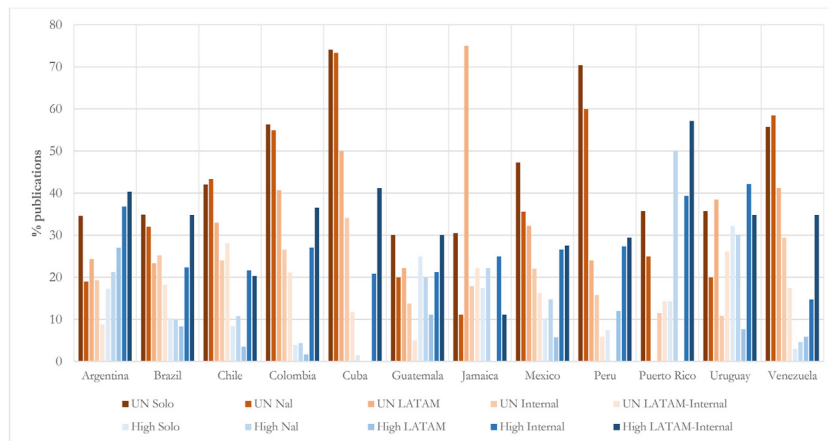


Figure 5. Uncited and highly cited publications by country (>100 publications). UN: uncited. High: highly cited. Source: Scopus.

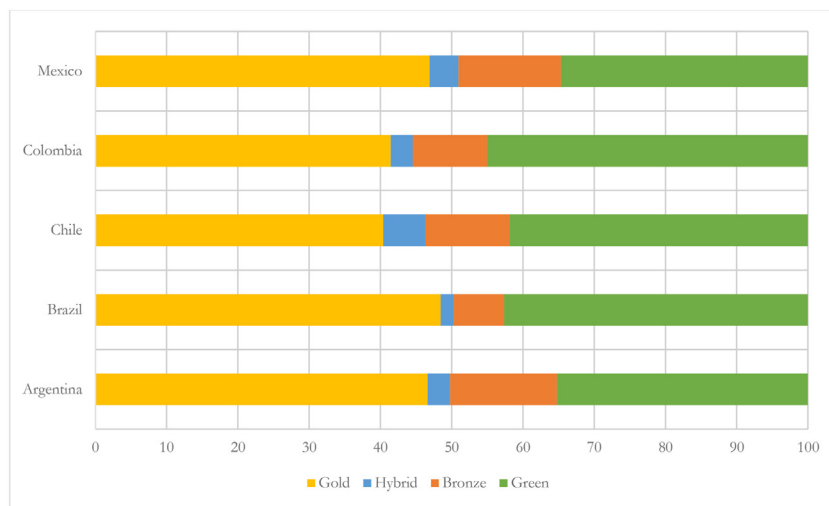


Figure 6. Proportion of publications by access type. Most productive countries. Source: Scopus.

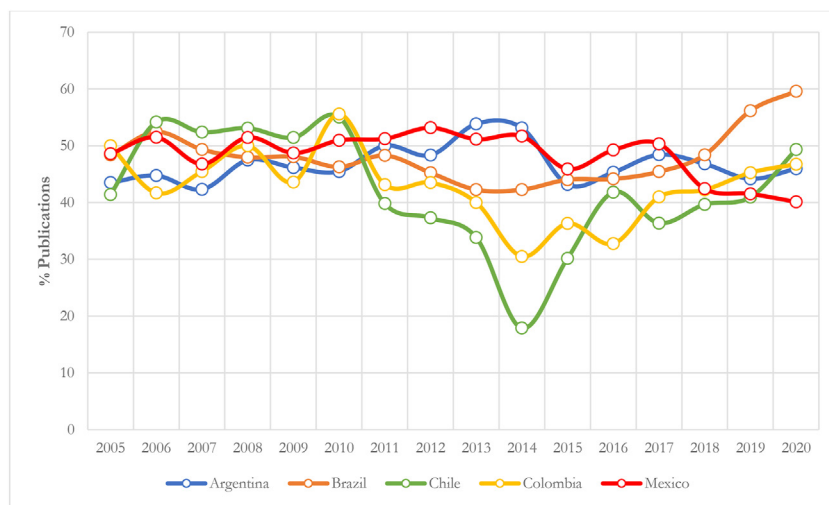


Figure 7. Trends in proportion of Nursing publications in Gold journals. Most productive countries. Source: Scopus.

proportion of publications decreases especially in the latest year of the studied period, which coincides with the growing in Colombia and Chile.

Likewise, when analyzing the highly cited production, the leadership of Brazil is questioned once again. It is the country with the second lowest

proportion in this indicator among those with publications in the top 1% (0.6%). Brazil is very far from the expected 1% and is even farther from countries like Uruguay, Argentina or Paraguay that widely exceed the average value in the region (1.6%).

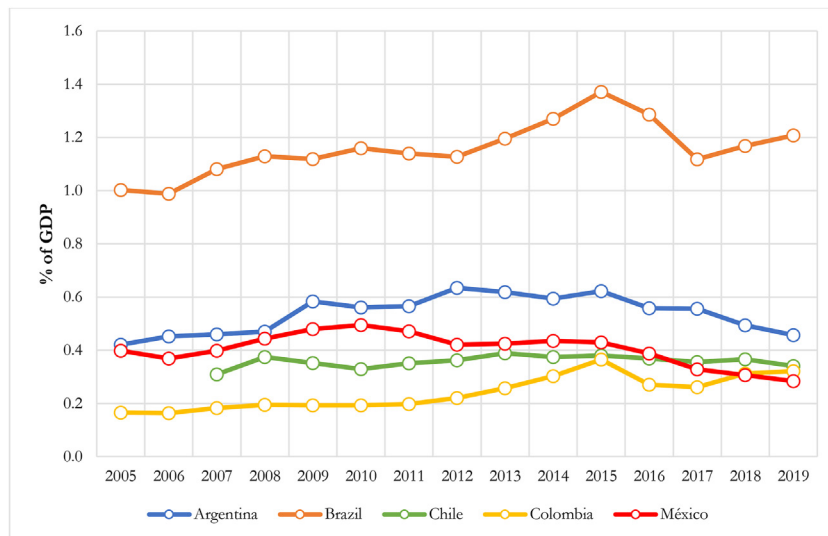


Figure 8. Trends in Research and Development investment. Most productive countries. Source: World Bank.

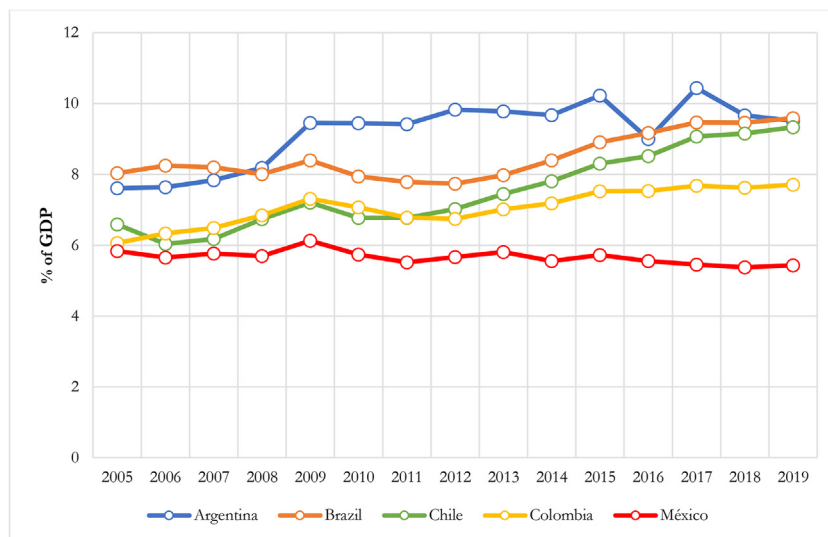


Figure 9. Trends in Health investment. Most productive countries. Source: World Health Organization.

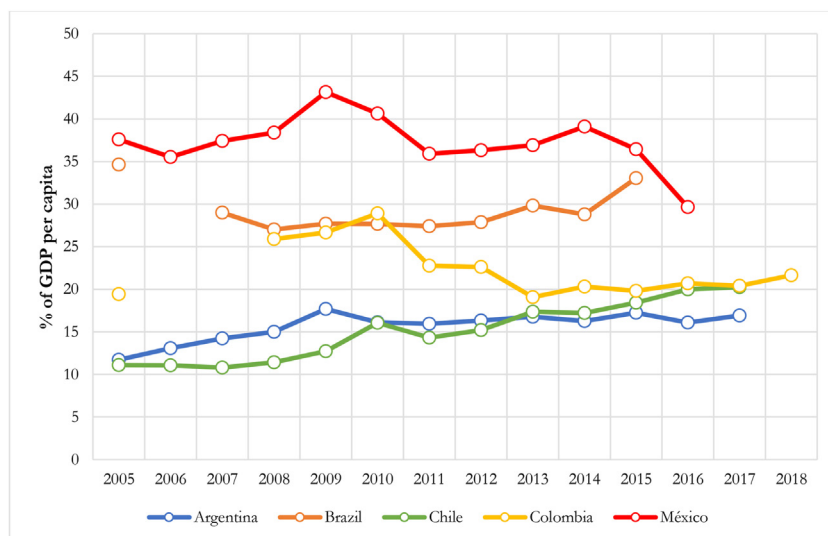


Figure 10. Trends in Higher Education investment per student. Most productive countries. Source: World Bank.

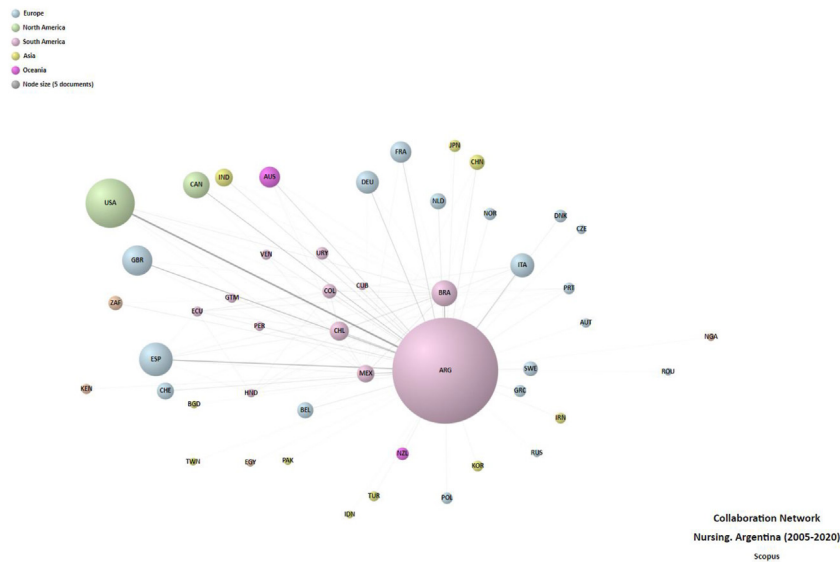


Figure 11. Collaboration network. Argentina. Source: Scopus.

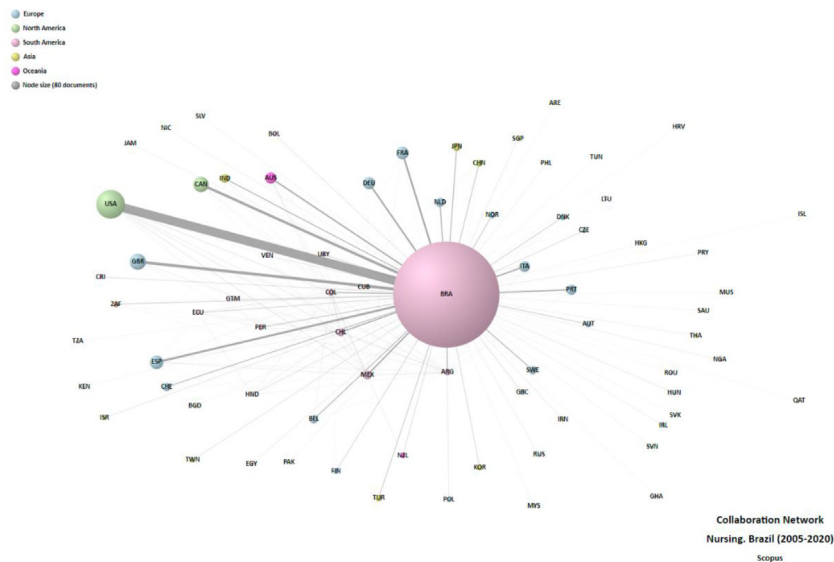


Figure 12. Collaboration network. Brazil. Source: Scopus.

Then, how these differences between gross and relative data of production and citation are to be explained?

There is not a sole explanation for a phenomenon as complex as this one. As a matter of fact, the socioeconomic indicators analyzed (Figures 8, 9, and 10) do not provide clear explanations or justifications of the results obtained. Policies of investment in R&D, Health and Higher Education are unequal across countries and do not seem to have a significant influence on the improvement of production and citation indicators in Nursing.

The results obtained from the analyses of scientific collaboration, however, do help to understand some of these differences. Brazil is the country with the lowest percentage of publications co-authored with foreign institutions (high isolation). Almost 80% of their production is national and reports only 62% of citations. Consequently, only 20% of their production with any type of international collaboration (regional, international or regional & international) accounts for a 40% of the remaining citations. In other words, the performance of their production without international collaboration is poor, which reveals that a

flourishing context for the development of sciences requires an important pillar as the collaboration, as an unbreakable couple (scientific performance and collaboration) to contribute to the knowledge advancement (Gonzalez-Alcaide, 2014). These findings match other results obtained in recent studies about the Latin-American global production (Adams et al., 2021).

But is it important to count on the international collaboration, as traditionally stated, in order to achieve better influence? Does international collaboration really improve visibility? It is evident that visibility is not automatically achieved because of the fact that a work is authored by international co-authors, as shown in Figure 5. However, aggregated data indicate there is a clear positive influence. In 11 of the 15 countries with more than 50 publications during the studied period, the proportion of citations of international production accounts for more than 70% of the total citations.

This effect is outstanding in countries with high isolation like Cuba and Venezuela, where 37% and 36% of the works co-authored with international partners get 88.6% and 76.4% of the total citations in

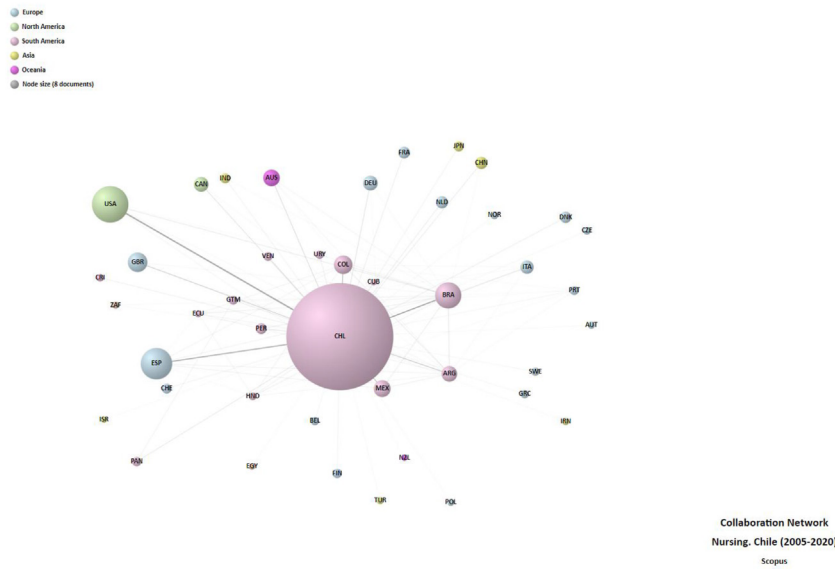


Figure 13. Collaboration network. Chile. Source: Scopus.

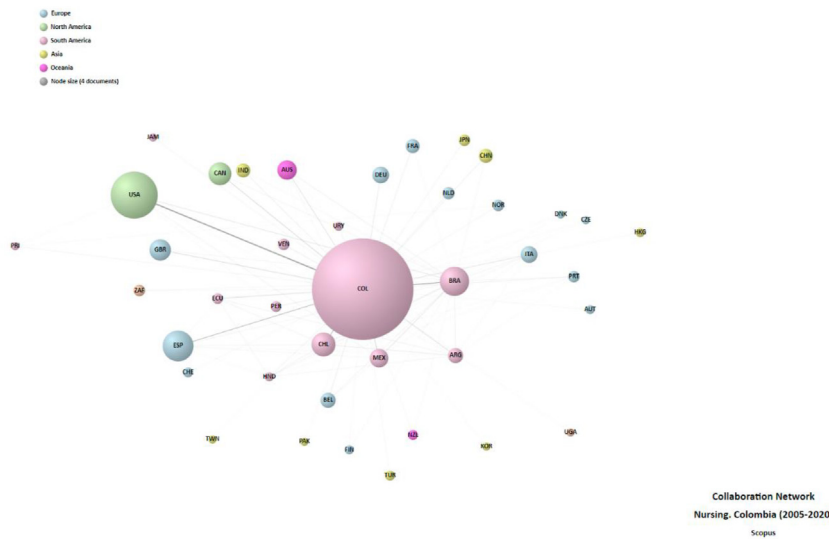


Figure 14. Collaboration network. Colombia. Source: Scopus.

Nursing, respectively. Although this percentage is lower in countries with higher internationalization proportion like Peru (75.3%), the reported citation is still remarkable (95.1%).

The results obtained for uncited publications and publications with high citations provide additional information confirming the importance of international collaboration and their proven benefits like greater visibility, better research financing and enhanced social impact of the results (Asubiaro, 2019; Wang et al., 2019). Therefore, publications without international collaboration are the ones with higher proportion of uncited documents. On the contrary, publications with international collaboration are the ones getting higher proportion of highly cited publications. In addition, in most of the countries the proportion of highly cited publications become higher when international documents include a Latin-American partner. On the other hand, the level of international research collaboration is inversely proportional to the scientific size of the country (Frame, 1979).

Finally, international collaboration networks in the most productive countries enable quick and easy comparisons between collaboration patterns, which unveils similarities and differences in their preferences,

behaviors and varying prominence granted to the partners. In the same vein, despite the variability, the most frequent partners are USA, Spain and UK. Paradoxically, collaborations with Latin-American institutions are not usually the most prevailing in spite the fact, as mentioned above, that publications with any regional partner tend to get more visibility.

In short, scientific collaboration has an effective influence in the improvement of productivity and visibility indicators. However, the socioeconomic indicators showed do not seem to have a clear influence on those collaboration patterns and are unable to detect national strategies leading to enhance internationalization. Other authors suggest that national and institutional policies for hiring and promoting scientists, focused on personal reward systems based on productivity and visibility in international sources influence the scientist's behavior (Guzman-Vallenuela et al., 2022).

Lastly, something similar happens with the relationship between the Open Access status and the visibility of publications by country. In this case, this relationship is inversely proportional: the proportion of highly cited publications (top 1%) is higher in countries such as Argentina and Mexico with a lower proportion of works published in Gold journals.

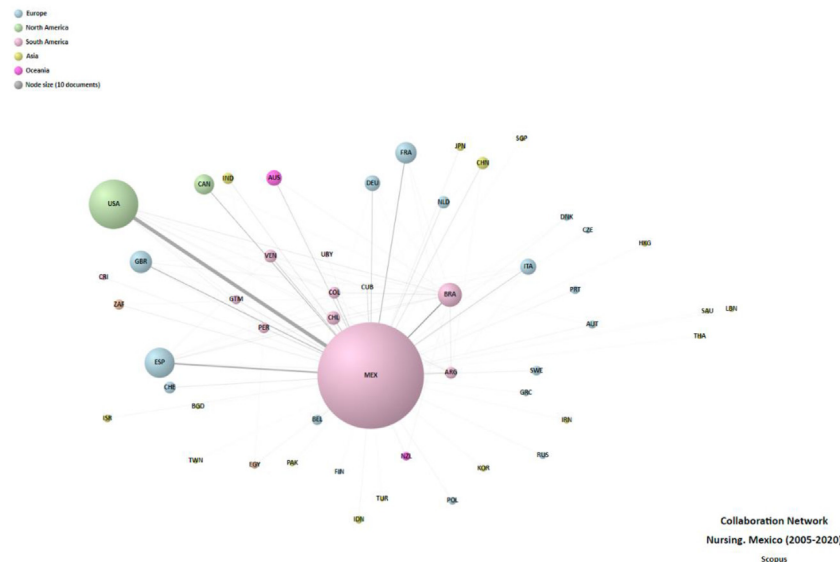


Figure 15. Collaboration network. Mexico. Source: Scopus.

3.1. Practical implications

Generally speaking, the results reveal that Latin America has enhanced its representativeness in Nursing as compared to the previous decades and, in turn, it explains why some LATAM countries have climbed their positions in different rankings (Santin, 2020).

Nursing presents a growing productivity and higher visibility than the global production in the region. However, there are remarkable imbalances, especially in the largest producer, Brazil, with citation and highly cited publications ratios below its huge productivity. Results as these presented in this analysis can help to improve the decision-making of national managers identifying specific policies with negative effects on the dissemination and influence of scientific publications. Just as an example, it could be the case of Qualis, the Brazilian system of journal evaluation whose main drawbacks have already been described (Martinez-Avila, 2019), and it is apparently under revision (Martinez-Avila et al., 2020).

3.2. Limitations and further research

Although this work avoids the disadvantages associated with extracting samples, analyzing all the Nursing publications in Scopus is not free from limitations due to the classification of the publications or the document typology (only works published in journals), which provides a partial view that should be completed with other types of publications.

On the other hand, future works intended to analyze in detail the different aspects of journals where Latin-American authors use to publish—such as language, country or publisher—(Moed, 2020) will enable to pinpoint some findings from this work and determine how much these variables influence the production and visibility of publications in Nursing. This is a key issue, particularly when it comes to improve the understanding of the effects of collaboration on the Nursing scientific production in Brazil.

Finally, it is important to remember that the results from quantitative analyses provide valuable insights that, taken alone, are not enough to make any decision unless all this is combined with additional qualitative analyses conducted by experts. It should be done before proceeding with any action by politicians, managers and decision makers in general, who are often tempted to go the shortest road, not always the most pertinent.

Declarations

Author contribution statement

Diana Marcela Achury-Saldaña: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data.

Lidier Andres Castañeda-Rodriguez: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

Antonio Perianes-Rodriguez, Ph.D: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

The authors do not have permission to share data.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

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