

## Bibliometric indicators in Physical Education research: Brazil in comparison

### Indicadores bibliométricos na pesquisa em Educação Física: o Brasil em comparação

### Indicadores bibliométricos en la investigación en Educación Física: Brasil en comparación

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#### Keywords:

Impact;  
Collaboration;  
International;  
Open Access.

#### ABSTRACT

Scopus and Web of Science were used to evaluate papers on Physical Education worldwide and in Brazil. Most documents are published in the USA and England, Brazil being the 6<sup>th</sup> largest. Brazilians tend to publish in Brazil. Countries with a higher % of documents in Q1 journals have higher % of top 10% cited documents. Most countries increase their Top 10% score when publishing in open access, while Brazil decreases. Differentiation between country clusters is due to % documents in Q1 journals, international collaboration, Open Access, citations/paper and documents in Top 10%. Brazil researches similar topics to those worldwide. Publishing in Q1 journals, and more industry and international collaboration can increase the impact of publications by Brazilian authors.

#### Palavras-chave:

Impacto;  
Colaboração;  
Internacional;  
Acesso livre.

#### RESUMO

Scopus e Web of Science foram usados para avaliar artigos sobre Educação Física no mundo e no Brasil. A maioria dos documentos é publicada nos EUA e na Inglaterra, sendo o Brasil o 6<sup>o</sup> maior. Brasileiros tendem a publicar no Brasil. Os países com maior % de documentos em periódicos do 1<sup>o</sup> quartil têm maior % dos citados. A maioria dos países aumenta seu impacto publicando em acesso aberto, enquanto o Brasil diminui. A diferença entre países deve-se à % de documentos em periódicos do 1<sup>o</sup> quartil, colaboração internacional, acesso aberto, citações/artigos e documentos no Top 10%. O Brasil pesquisa temas semelhantes aos do mundo. A publicação em periódicos do 1<sup>o</sup> quartil, mais colaboração industrial e internacional podem aumentar o impacto das publicações de autores brasileiros.

#### Palabras-clave:

Impacto;  
Colaboración;  
Internacional;  
Acceso abierto.

#### RESUMEN

Scopus y Web of Science se utilizaron para evaluar artículos sobre Educación Física en el mundo y Brasil. La mayoría de los documentos se publican en EEUU e Inglaterra, siendo Brasil el sexto más grande. Los brasileños tienden a publicar en Brasil. Los países con un % más alto de documentos en revistas Q1 tienen un % más alto citados en el 10% superior, y publican en acceso abierto, mientras que Brasil disminuye. La diferenciación entre países se debe a % de documentos en revistas Q1, colaboración internacional, acceso abierto, citas/artículo y documentos en el 10% superior. Brasil investiga temas similares a los del mundo. La publicación en revistas Q1, una mayor colaboración internacional y de la industria pueden aumentar el impacto de las publicaciones de autores brasileños.

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## INTRODUCTION

Physical education (PE) is often advocated as a lifelong process, with physical activity is universally acknowledged as an important part of well-being (Cope and Parnell, 2015). These authors recognise its impacts in several domains such as Emotional, Financial, Individual, Intellectual, Physical and Social. Themes also include holistic well-being and alternative leisure activities (yoga, meditation, Gerdin and Pringle, 2017), as well as nutritional and health benefits (Boguszewski et al., 2014). The themes researched in PE have changed over time (Enright & O'Sullivan, 2012) and may be contradictory (Devecioglu et al., 2012). Changes may involve the use of digital technologies (Bodsworth and Goodyear, 2017), attitudes towards physical education (Wilhelmsen and Sørensen, 2017), autonomy-supportive climates (Hastie et al., 2013), public health (Pate et al., 2011) and disabilities (Tant and Watelain, 2016), among others.

Given the wide variation of its impact, studies in PE have been increasing (Hastie et al., 2011). These range from primary school (Andrieieva et al., 2017), adolescents (Dalen et al., 2017), to adults (Loprinzi et al., 2015) and geriatrics (Kosse et al., 2013), sports (Petrovska et al., 2020) as well how the sports industry interacts with an active economy (Solntsev, 2012) and investment opportunities (Letiagina et al., 2019). Professionals work in schools, sports clubs, or community centres (Nahas and Garcia, 2010) as well as in private facilities. Ratten & Jones (2018) studied the university curriculum stating there is a need for education in entrepreneurship, as more alumni are opening businesses (Maritz, 2017), as well as a move away from “children in school” to adult education (Formica, 2002). Several countries are also discussing breaking away from westernization of PE and construction of practices based on local culture and history (Amusa and Toriola, 2010). This is also true in Brazil (Betti et al., 2015), whereby cultural diversity should be taken into account when discussing the PE agenda.

This paper aimed to examine the quantity and performance of publishing in physical education and related areas worldwide and compare with Brazil. This can help in constructing policies for improving physical education in Brazil and aid in identifying where improvements can be made in this area within the country.

## MATERIAL AND METHODS

Data worldwide and from Brazil were collected from two databases: i) InCites® from Clarivate Analytics based on Web of Science from 2005 – 2020. This was limited to Physical Education (PE) as defined by the Coordenação de Aperfeiçoamento de Pessoal do Nivel Superior (CAPES); ii) SciVal® from Elsevier from the Scopus database from 2014-2020 (as these were the years available). Only organizations with more than 10 publications/year were included. This left 2536 of the 11482 organizations. Data were then limited to the top 15 countries as these represented 77.5% of all publications in the period.

The final data set had 1809 institutions and 32384 researchers.

In SciVal® the same subareas were researched as in Incites® to find major topics. If the same topic was found in more than one area the second was deleted. These included Biophysics, Aging, Physiology, Endocrinology, Rehabilitation, Orthopaedics and Sports Medicine, and Physical Therapy, in accordance with areas identified in CAPES database. Quantitative, structural and performance information was collected.

Quantitative and Structural: Total number of Papers, % Documents Cited, Citation Impact (CI), Times Cited, % papers in 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Quartile journals (%Q1, %Q2, %Q3, %Q4), Average Percentile, publication location, and cited funding agencies. For universities, information was also available on % 1<sup>st</sup> Author, % Last Author, and % Corresponding author from the institutions as well as Open Access (OA). Word Clouds were created for the 500 most prominent topics (SciVal®) using wordart.com.

Performance: % Papers in Top 1% and Top 10% of citations, Impact Relative to the World (IRW), Category Normalised Citation Impact (CNCI) and Journal Normalised Citation Impact (JNCI), % Hot Papers, and % Highly Cited Papers.

Statistical analyses included correlation (PROC CORR), regression (PROC REG) and principal component/factor (PROC FACTOR) to assess the relationship between quantity and performance indicators, as well as cluster analyses (PROC FASTCLUS) to group countries and universities according to their production and impact. According to Cohen (1988), correlations from 0.10 to 0.29 are considered weak, 0.30 to 0.49 are moderate and 0.50 to 1.0 are strong.

A MANOVA test (PROC GLM) was carried out followed by a Dunnett test to compare other countries with Brazil. To evaluate the factors affecting CNCI, a multiple regression was carried out. Variables with a Variance Inflation Factor (VIF) > 10 were deleted. Discriminant Analysis (PROC STEPDISC) was carried out to verify which indicators separated the clusters. Canonical Analysis (PROC CANDISC) was used for countries with > 6000 publications. Path analyses were used to identify paths to publishing higher impact papers (PROC CALIS). All analyses were carried out in SAS® v.9.4 (Statistical Analysis System Institute, Cary, NC).

## RESULTS

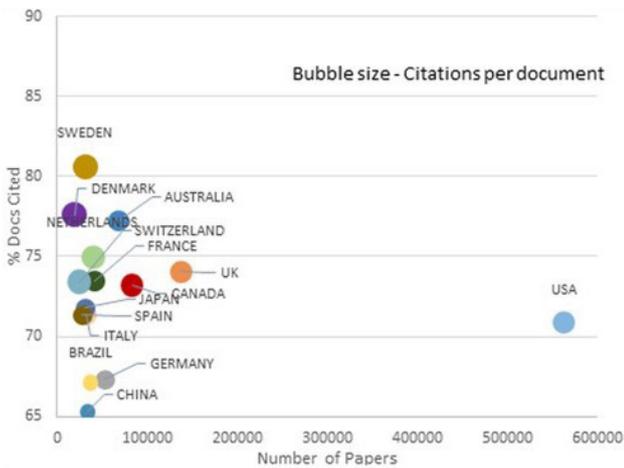
There was a total of 882,171 papers published in the period, in 2,559 journals, of which 1,920 published less than 50 papers. Those that published most papers were *Medicine & Science in Sports & Exercise*, *American Journal of Tropical Medicine & Hygiene*, and *International Journal of Environmental Research & Public Health*. The first Brazilian Journal is 32<sup>nd</sup> in number of papers published (*Ciência & Saúde Coletiva*). Brazilian authors published 33,126 papers in 608 journals with 509 with less than 50 papers. Other Brazilian journals with a high number of papers include *Cadernos de Saúde Pública*, *Revista de Saúde Pública* and *Saúde e Sociedade*.

Papers published in Brazil were 100% OA, compared with 33% in the USA, 24% in the Netherlands or 54% in England. Supplementary Table S1 shows the % OA and CNCI by publishing country and journal quartile, worldwide (A) and Brazilian papers (B).

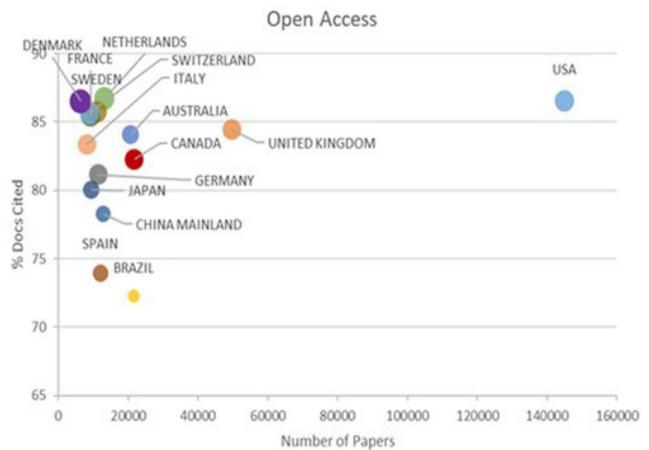
The correlation worldwide between % OA and CNCI was 0.23 (P<0.01) (overall) and 0.09 (P>0.05) for Brazil. Worldwide, the correlation between CNCI and % documents in Q1 journals was 0.11 (P<0.01), 0.00 (P>0.05; Q2), -0.06 (P<0.01; Q3), and -0.13 (P<0.01; Q4), showing that a decrease in journal quartile had tendency to decrease CNCI. For papers with at least one Brazilian author this was -0.09 (P>0.05) (overall), 0.22 (P<0.01; Q1), -0.02 (P>0.05; Q2), -0.35 (P<0.01; Q3), and -0.19 (P<0.01; Q4). More open access in Q1 journals led to higher CNCI for Brazilian authors but in the other quartiles an increase in OA had no effect on CNCI (Equation 1)<sup>1</sup>.

$$Q1 \text{ Journals: } CNCI = 1.437 + 0.016 * \%Open \text{ Access} \quad (1)$$

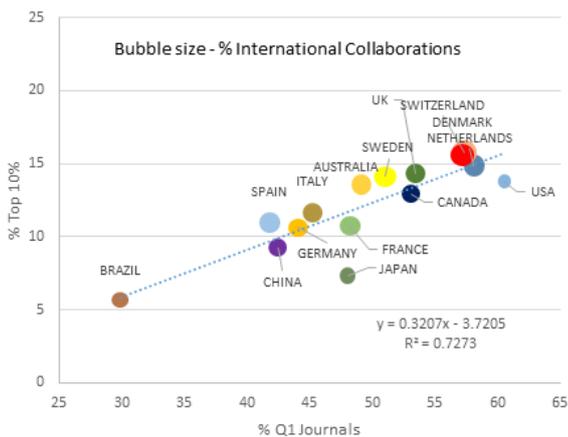
Higher percentages of documents were cited when published in Q1 (P<0.01), open access journals (P<0.01) across major publishing countries (Figure 1). Although some of them have higher increases when comparing all publishing to only open access (USA +15%; Germany +14%; China +13%), Brazil only goes up by 5% and Spain by 2.5%. There is a tendency for the countries with higher percentage of documents in Q1 journals to have higher percentage of top 10% cited documents (R<sup>2</sup>=0.73 for all documents and 0.92 for OA). When comparing all documents with those in OA, most countries increase their Top 10% score, while Brazil decreases by 1%. Brazil also shows a lower % of their documents with international collaboration (20%) than other major publishing countries (μ=52%) when looking only at OA articles (P<0.01). Major impact in publishing is mostly in European countries. The USA shows the largest number of papers but with a lower percentage of these being cited (71% vs 77% for Australia or 81% for Japan).



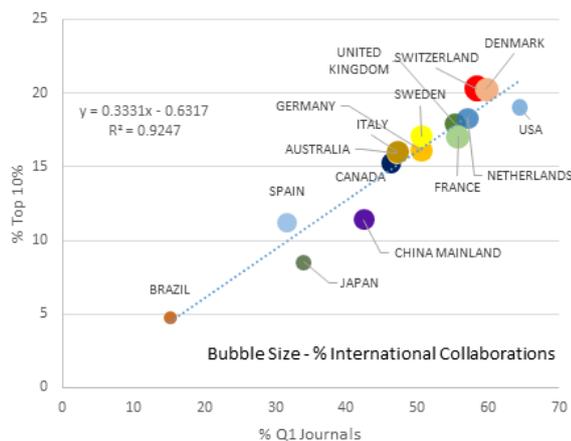
(A)



(B)



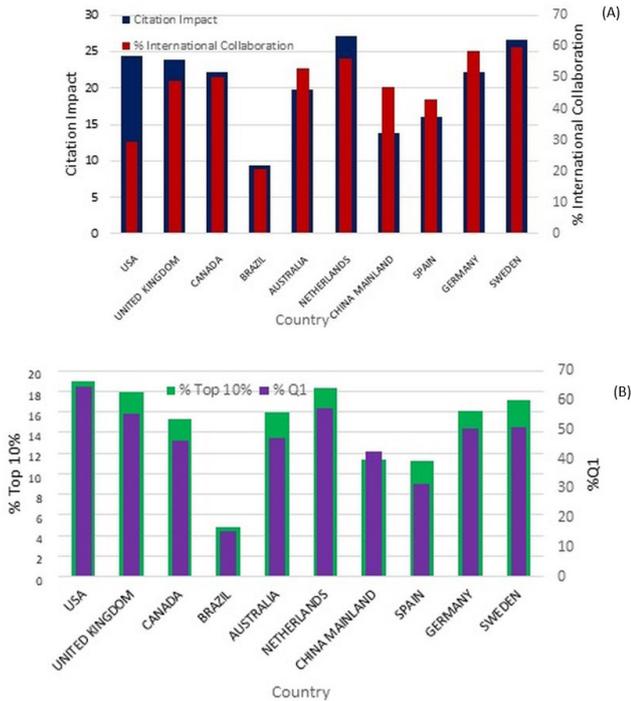
(C)



(D)

**Figure 1.** Effect of number of papers (A and B) and % of papers in Q1 journals (C and D) for publishing countries in Physical Education on % of documents cited and % of papers in top 10% cited for all types of publication (1<sup>st</sup> column) and only Open Access (2<sup>nd</sup> column) (InCites®).

<sup>1</sup> Category Normalised Citation Impact.



**Figure 2.** Performance indicators for Open Access Publishing in Physical Education by top 10 Author Countries (InCites®) including (A) Citation Impact (citations/paper) and % International Collaboration and (B) percentage of papers in Q1 and % of Top 10% of cited papers.

The lowest % of international collaborations are seen with Brazilian (27%) and USA (19%) papers ( $P < 0.01$ ; Figure 2). China (13.8) and Spain (15.9) also show low citation impact. These countries also show the lowest % papers in Q1 journals and % of Top 10% cited papers ( $P < 0.01$ ).

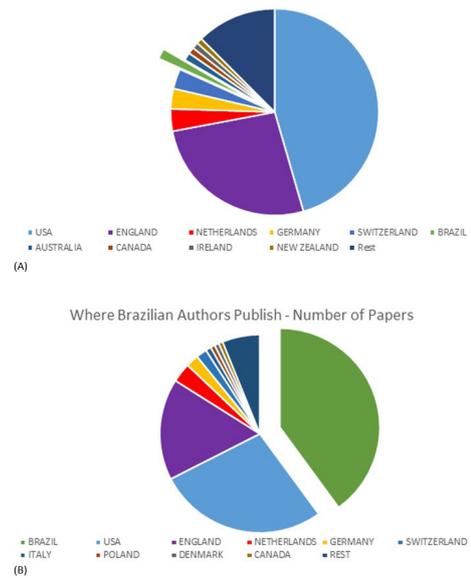
Most documents worldwide (Figure 3) are published in the USA (46%) and England (26%), followed by three other European nations, with Brazil being the 6<sup>th</sup> largest publishing country (1.7%). In contrast, Brazilian authors tend to publish more within their own country (40%).

Even though Brazil publishes the vast majority of their documents in OA journals, the average citation impact pales in comparison to other large publishing nations (Figure 4). Publishing Brazilian papers in Italy and Poland also show low CNCI (One (1) is the world mean). The Journal Impact factors do not show large variations between countries, except for Switzerland. When Brazilian authors publish in Brazil or Poland, they tend to publish a high % in OA, while publishing in Denmark or Canada they have low OA rates. This does not affect the percentage of papers cited.

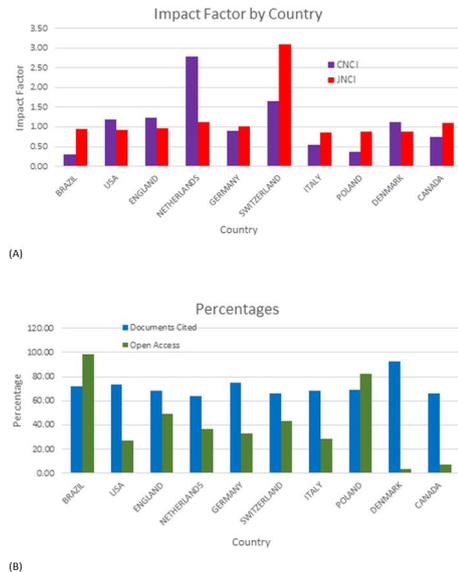
Brazil does not follow the same pattern (Figure 5) compared to other countries for the effect of OA on CNCI (Equations 2 and 3). Although  $R^2$  is low it is still significant.

$$CNCI_{Without\ Brazil} = 0.144(\%OA) + 0.790 R^2 = 0.19; P < 0.01 \quad (2)$$

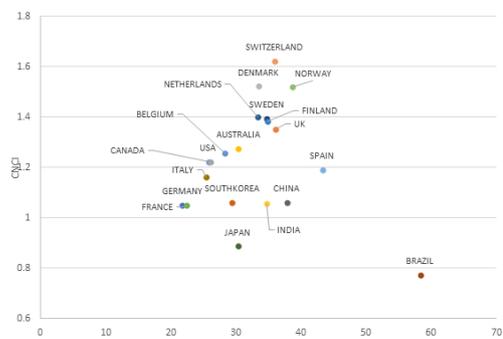
$$CNCI_{With\ Brazil} = -0.003(\%OA) + 1.306 R^2 = 0.01; P > 0.05 \quad (3)$$



**Figure 3.** Publishing Localities in Physical Education (A) Worldwide authors and (B) Brazilian authors (InCites®).



**Figure 4.** Journal (JNCI) and Citation (CNCI) impact factors (A) and percentages of cited documents and open access papers (B) by journal country (InCites®) for Physical Education papers from Brazil.

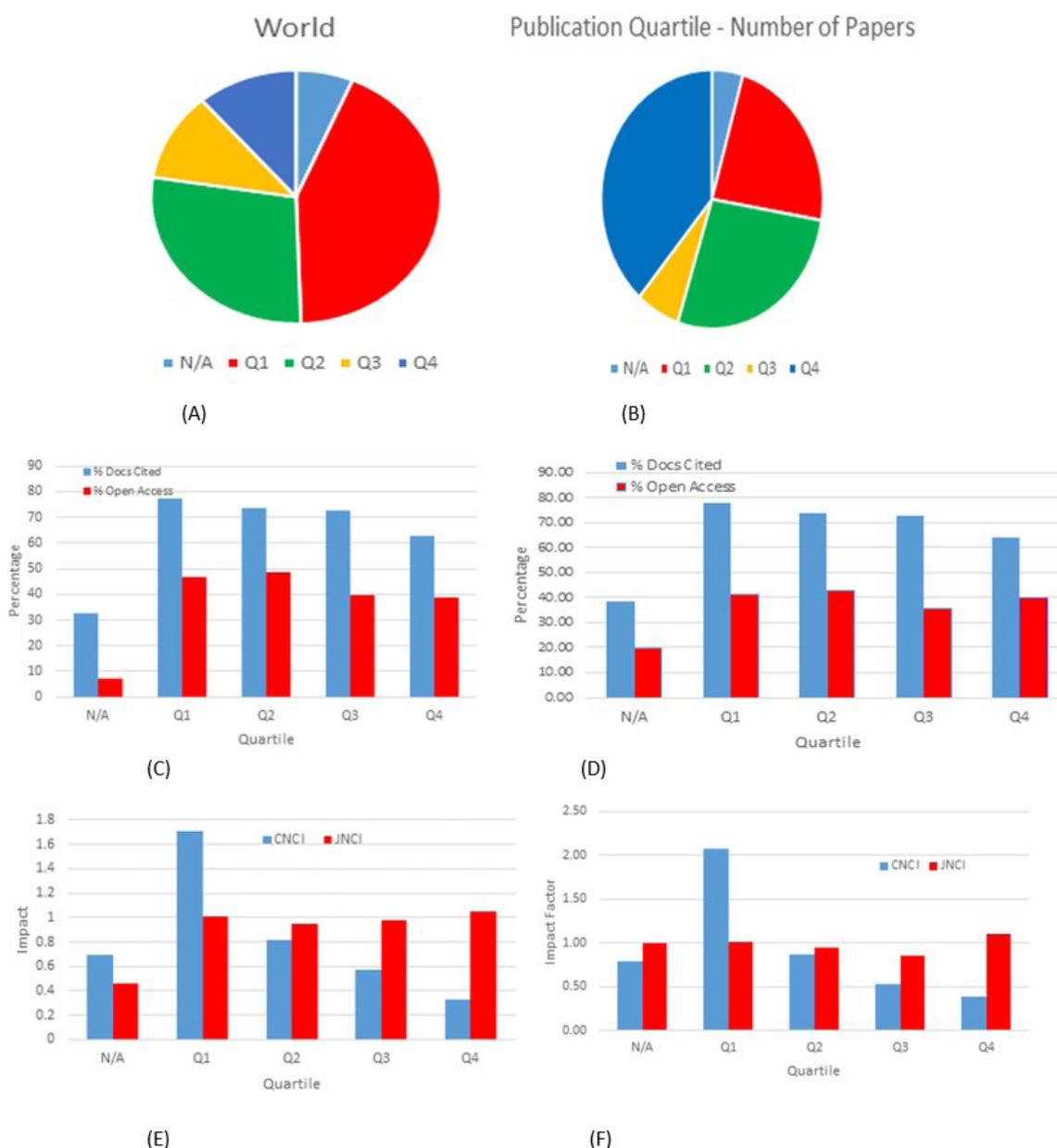


**Figure 5.** Effect of % Open Access Papers on Category Normalised Citation Impact (CNCI) for Physical Education for the top 20 publishing countries (InCites®).

The worldwide tendency is to publish more papers in Q1 (43%), followed by Q2 (28%), Q3 (11%) and Q4 (11%) journals, respectively (Figure 6). In Brazil the sequence is Q4 (39%), Q2 (27%), Q1 (23%) and Q3 (6%). Comparing Brazil to the rest of the world, the documents published in each journal category follow the same overall pattern in % Documents Cited, % Open Access and Impact Factor. Papers in Q1 show highest citation rates and impact factors, with a higher % of cited documents. When Brazilian researchers publish in Q1 journals, their impact tends to be higher than the worldwide average for the area.

For Brazilian (-0.40) and worldwide (-0.36) authors, the % of OA documents led to a decrease in the % of

documents in Q1 journals (Figure 7; Table 1), but the percentage of papers in collaboration with international authors led to an increase of % in Q1 (0.47 and 0.11, respectively). The increase in international collaborations led to a decrease in % OA publishing (-0.28 and -0.24 worldwide and Brazil, respectively), with a corresponding increase in Q4 (0.24 and 0.43, respectively). This may be related to the increase in Q1 documents for which APCs are higher. Publishing in Q4 was seen to decrease % Documents cited, which increased opportunities to be within the top 10% cited, increasing citation index and therefore CNCI. For Brazilian authors, their place on the author list (first, last or corresponding) did not affect CNCI.



**Figure 6.** Effect of Journal Quartile on Quality Indicators in Physical Education worldwide (Column A) and in Brazil (Column B) (Incltes<sup>®</sup>). Q1, Q2, Q3, Q4 are publishing quartiles, N/A refers to books and congress proceedings. Percentage of papers per journal quartile for Brazil (A) and the World (B); Percentage of papers cited and % papers open access by journal quartile for Brazil (C) and World (D); and Citation impact for papers (CNCI) and journals (JNCI) for Brazil (E) and World (F).

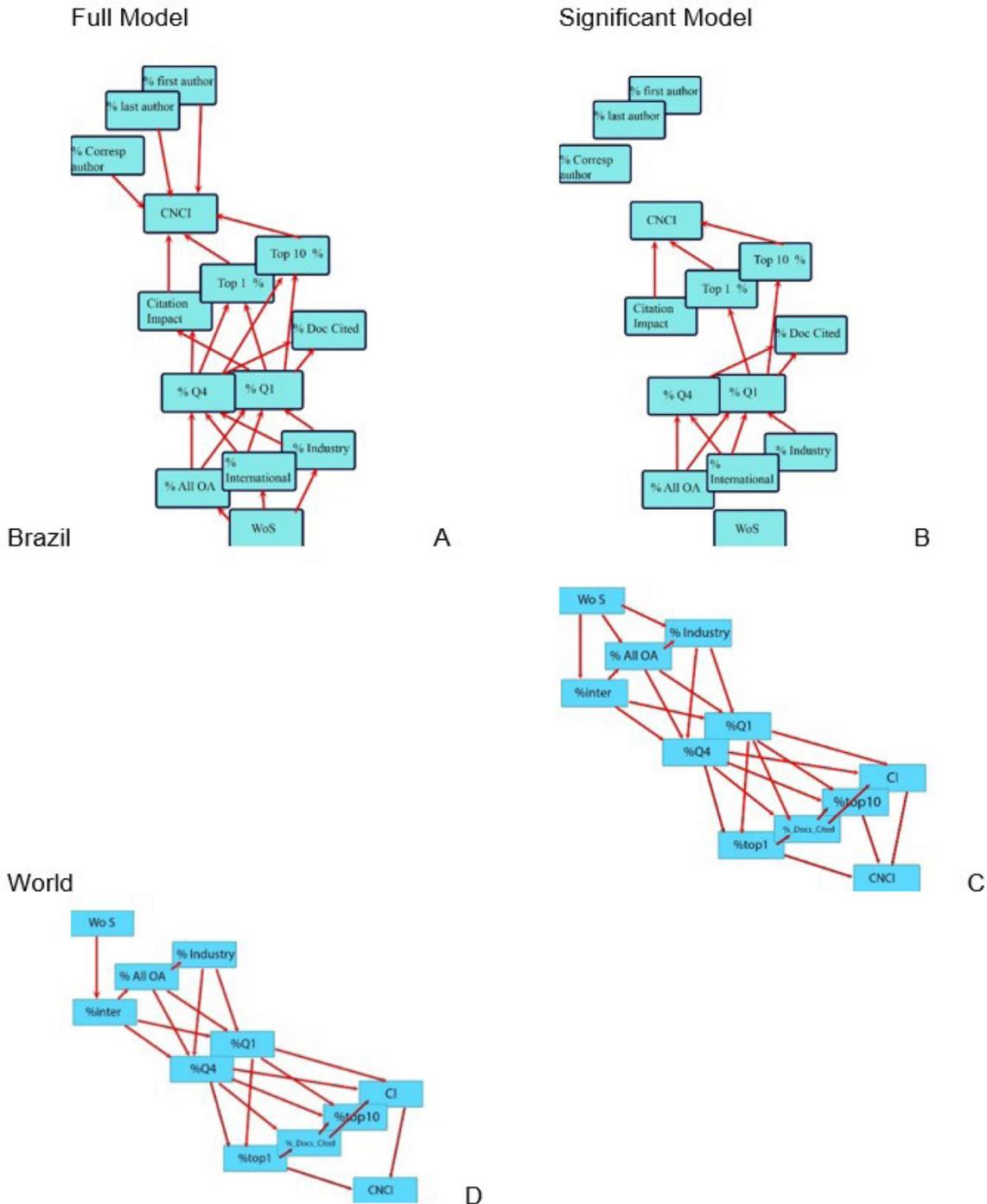
An increase in %Q1 journals, led to more cited documents, which in turn led to an increase in the percentage of documents in Top 10%, Top 1% and Citation Impact, thereby increasing the CNCI. The number of papers in WoS was related to % international papers.

Multiple regression of Brazil's path analysis (Equations 4 and 5) shows that the only variable that influence impact factor (CNCI) is where it is being publishes (JNCI), although the determination coefficient ( $r^2=0.22$ ) shows this does not explain the situation completely

(probably other undetermined variables play a role). Worldwide the impact factor is influenced by % of international collaboration, % of papers published in Q1 journals and % of documents cited.

$$CNCI_{Brazil} = -0.299 + 0.949 * JNCI \quad R^2 = 0.22 \quad (4)$$

$$CNCI_{World} = -0.537 + 0.007 * \%International\ Collaboration + 0.008 * \%Q1 + 0.015 * \%Docs\ Cited \quad R^2 = 0.67 \quad (5)$$



**Figure 7.** Paths to Citation Impact tested and significant for (A) and (B) Brazilian and (C) and (D) worldwide authors in Physical Education (Incites®), in line with Table 1. A and C reflect the full model, B and D reflect significant ( $P<0.05$ ) paths. Abbreviations in Material and Methods

**Table 1.** Paths for Impact for Brazilian and Worldwide Authors.

From	To	Standardised Estimate	
		Worldwide	Brazil
No. Papers	% International	-0.34**	0.05
% Industry	% OA	0.24*	0.02
% International	% OA	-0.28*	-0.24**
% OA	% Q1	-0.36**	-0.40***
% OA	% Q4	0.28*	0.43***
% International	% Q1	0.47***	0.13*
% International	% Q4	-0.34**	-0.20*
% Industry	% Q1	0.38**	-0.11*
% Industry	% Q4	-0.35*	0.03
% Q4	% Docs Cited	-0.48**	-0.24**
% Q1	% Docs Cited	0.08	-0.09*
% Docs Cited	CI	0.53**	0.21**
% Q1	CI	0.75***	0.05
% Q4	CI	0.38*	-0.05
% Docs Cited	% Top 10%	0.31*	0.22**
% Docs Cited	% Top 1%	0.31*	0.11*
% Q1	% Top 10%	0.80***	0.09*
% Q1	% Top 1%	0.72***	0.13*
% Q4	% Top 10%	0.19*	-0.02
% Q4	% Top 1%	0.34**	0.01
CI	CNCI	0.26**	0.89***
% Top 10%	CNCI	0.08	0.09*
% Top 1%	CNCI	0.65**	0.28*

OA – Open Access; CI – Citation Impact (Citations/Paper). \*P<0.05; \*\*P<0.01; \*\*\*P<0.001.

## DISCUSSION

Tijssen and Kraemer-Mbula (2018) state that, to be excellent, research should be: 1) visible and recognizable; 2) attributable; 3) comparable; and 4) categorized in terms of quality judgement. The use of metrics is well known, with Aksnes et al. (2019) suggesting that citation metrics are not suitable for evaluating the plausibility, originality and societal value of research. Nevertheless, they function as proxies for scientific relevance and impact, rather than as a direct indicator of quality (Wilsdon et al., 2015).

Most research in Brazil is produced in higher education institutions, and many have more than one postgraduate (PG) program. There are 81 physical education PG programs in Brazil (Plataforma Sucupira, 2021) (36 academic masters, 4 professional masters, 40 academic masters and doctorates and one professional masters and doctorate). The major knowledge areas for physical education in Brazil include physical education (39 programs), physical and occupational therapy (30) as well as speech therapy (12).

In general, an increase in % of papers published in OA journals leads to an increase in Citation Impact (CI), except for Brazil (Figure 1 and 5). The lower percentage of increase in citations from Brazilian OA publishing may be a reflection of publishing in journals registered in platforms such as Scielo (scielo.org) and Redalyc (https://www.redalyc.org/).

These register OA journals which tend to be younger than more established data bases used here, but their journals have increased in international databases recently (McManus et al., 2020, 2021). Other factors influencing CI may include: i) failure to publish in high impact journals; ii) lack of resources to pay OA abroad, preferring lower fees in Brazil; iii) lack funding agency policies for OA publishing; iv) the themes studied and v) publishing in Portuguese. While there may be a perceived lower quality of research from Brazilian researchers, when Brazilian researchers publish in Q1 journals, their impact tends to be higher than the worldwide average for the area.

The preference for publishing in Brazilian journals is in line with other areas in Brazil (McManus and Baeta Neves, 2021a). With Iranian publications (Rajabi et al., 2021), these authors also found that most papers are published in domestic journals in the Web of Science Emerging List, as with Brazilian papers. Looking at education journals, Repiso et al. (2017) show that Scielo (125) and Redalyc (99) have a significantly higher number of journals than Scopus (66) and Social Sciences Citation Index (9), indicating that international databases may not capture their citations. Van Raan et al. (2011) show that fewer citations are received by non-English language publications. This can create a bias due to language deficiencies (Waltman, 2016), with most local journals being invisible internationally (Li and Yang, 2020).

The number of papers in the most popular themes studied worldwide and in Brazil showed a correlation of 0.79 ( $P > 0.01$ ), indicating similarity between the two datasets. Nevertheless, papers published in journals not registered in Scopus and Web of Science were not included in this analysis and a significant fraction of the “topics” defined by SciVal does not perfectly fit the article’s field (Zanotto and Carvalho, 2021) which may lead to bias. Nascimento (2010), in a survey of thesis themes in physical education, found that the main areas of research were Physical/Sports Training (12.9%). Biomechanics (8.7%). Physical Activity/Sports in special groups (8.4%); Teacher Training/Physical Education and curriculum (8.1%); Physiology (7.5%); Sociology (6.6%) and Physical Education/sports in schools (6.3). This author showed a large number of research lines with low production, while Manoel and Carvalho (2011) showed concentration in biodynamics, in detriment of sociocultural and pedagogical areas of research, and Lazzarotti et al. (2012) noticed a wide dispersion in the themes studied.

In the present study (Supplementary Table S2) questions linked to older ages such as osteoarthritis, knee, *Medialis oblique*, bone density, frailty (elderly, phenotype), Alzheimer’s, as well as life style such as diabetes remission, body mass index, behaviour and prolonged sitting etc are also more prevalent and showed significant growth in recent years. Formica (2002) and Green (2002) also showed a move away from studies with children in school towards adult physical education and life-style choices. Important research areas centre around conditions such as aging (Osteoarthritis, fragility), lifestyle (diabetes, body mass index (BMI), hypertension, obesity) and illnesses (such as cancer, diabetes, hypertension etc). Given the effect that earlier experiences with physical education have on adult physical activity and life style choices (Ladwig et al., 2018), these authors suggest that research efforts should include how childhood memories affect physical activity and health in terms of attitude, intention and sedentary behaviour in adulthood. Balwan and Kour (2021) state that Lifestyle Disease are a major health problem worldwide, with cardiovascular, cancers, respiratory and diabetes linked diseases accounting for over 80% of non-communicable disease deaths (WHO, 2017). Many of the most prevalent techniques seen in Supplementary Table S2 have been used in the control of these conditions. Quennerstedt (2019) argues for the use of health in physical education, and the themes studied here confirm this tendency, through promoting activities and behaviour that reduce the risk of disease, at present or in the future.

International and industry collaboration in Brazilian physical education is low (Figure 2) which may affect impact (Figure 7). Other studies (McManus et al., 2020; McManus and Baeta Neves, 2021b) have shown the importance of these sectors in improving citation impact, through improving quality, competition, knowledge and resource transfer, among others (Boekholt et al., 2009).

Rosa and Leta (2010, 2011) concluded that research in PE in Brazil has low visibility, based on studies in physiology. Nevertheless, areas such as Sociology and Psychology, as well as biophysics, were predominant. Part of the lack of visibility may be due to the fact that Brazilian authors tend to show low international collaboration compared with other countries (Figure 2), although Brazil was within the top ten publishing countries in physical education. This may be because this area is a relatively new in Brazil. Motta et al. (2018) looks at ways of increasing linkages between physical education sectors in industry and academy, but identified resistance on both parts.

Brazilian authors tend to publish more in Q4 journals (Fig 6), so efforts should be made to publish in Q1 journals and increase industry relations (Figure 7). This obviously is impacted by the quality of the research being carried out. Changes in public policies can change this, as was seen with the Russian Project 5-100 (Matveeva and Ferligoj, 2020), and increasing international collaborations. The number of papers and impact (Figure 1) is in line with statistics on Brazilian publishing (McManus et al., 2020), with the domination of the USA. Brazil’s location in this analysis is also in line with the general evaluation. The low number of papers in Q1 and high impact open access journals may be because of the lack of financial resources (Pavan and Barbosa, 2018) to pay Article Processing Charges (APCs).

Several recent papers have discussed the impact of research in Brazil relative to its social and cultural relevance, other than scientific (McManus and Baeta Neves, 2021a). According to Vitor-Costa et al. (2012), bibliographic measures are more suitable to measure production in the basic and not professional sciences, such as physical education. Lazzarotti et al. (2012) also noticed a mixture of themes related to the soft and hard sciences in physical education journals in Brazil, and Hallal and Melo (2017) indicate that research in physical education has a tendency to be more interdisciplinary than other areas, but consider “over-fragmentation” may be a problem in the future, thereby making it an appendix of other more consolidated areas.

## CONCLUSIONS

To increase impact, Brazilian authors should aim to increase the number of papers published abroad, in open access Q1 journals. As a large portion (>60%) of Brazilian papers in Q1 journals are published closed access there needs to be financial resources to pay Article Processing Charges. Increases in collaboration with industry and internationally are indicated for increasing impact by Brazilian authors in physical education. This study is limited by the heterogeneous nature of physical education studies in Brazil. We based our studies on how the area is defined in the Web of Science and Scopus, and used by CAPES, yet there are many publications in other areas such as education, sociology, or history which are not well captured in the data bases used and may not be within the broad definition of the area in the international databases.

Those that are captured have a tendency to be within the medical and biological fields, and are therefore “competing” with higher citation rates and a wider audience in these fields, which may in part lead to lower normalised citation rates.

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## CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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## **Supplementary Material**

Supplementary material accompanies this paper.

Supplementary Table S1. Percentage Open Access and CNCI by Journal Quartile and Publishing Country in Physical Education.

Supplementary Table S2. Growth, Impact and Prominence of Topics by Brazilian authors with more than 100 papers sorted by growth of topic (Scival® 2015-2020).

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