The fifty most cited Latin-American articles in the orthopaedic literature

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Abstract

Purpose The number of citations of an article is a marker of its academic influence. Several medical specialties, including orthopaedics, have ranked the articles with more citations. We identified the 50 most cited orthopaedic articles from Latin-America and analyzed the characteristics that made them citable.

Methods Science Citation Index Expanded was searched for citations of articles originated in Latin-America, published in any of the 63 journals in the category “Orthopaedics” from 1988 to 2013. We created a list ranking the 50 most commonly cited articles and determined the citation density (Citations/years since publication). Information noted for each article included authors, year of publication, country of origin, source journal, article type, and field of research.

Results Latin-American countries were the origin of 1 % of orthopaedic articles. The top 50 most cited articles had between 29 and 150 citations (mean, 44.48); the citation density ranged from 1.43 to 15.5 citations/years (mean, 5.25). The articles were published in 19 of the 63 journals (11 general and eight sub-specialty journals), and all were published in English. Most articles (n=29) were published in 2000 or later. The majority were clinical articles (n=40), and the most common fields were arthroscopy (n=15) and hip surgery (n=13). The top 50 articles originated mainly from Brazil (n=20) and Argentina (n=15).

Conclusions This top 50 list displays articles that have become important references for the orthopaedic scientific community. Researchers may use this work to make their future publications more influential on future investigators.

Keywords Orthopaedic literature · Cited articles · Latin-American orthopaedics

Introduction

The frequency with which a scientific article is cited by other studies is one way to measure its academic influence. The number of citations that one article has received is not necessarily a measure of its quality; however, it reflects how much influence that particular study has had in generating discussion, controversy and further research in its field. Moreover, citation analysis has become a common method to evaluate scientific journals, articles or authors.

The number of publications on orthopaedic surgery has experienced a remarkable expansion; however, the influence of studies from Latin-America in the orthopaedic literature has been limited, with a relatively small number of studies published in orthopaedic journals that were conducted in Latin-America. Recently, multiple medical specialties have ranked articles within their fields by citation frequency [1–6]. With regards to the orthopaedic literature, a study from Lefavre et al. [7] recently identified which articles have been more frequently cited; in addition, other authors have specifically determined which are the most commonly cited articles in some sub-specialties, such as pediatric orthopaedics, shoulder, spine, and hand surgery [8–11]. Nevertheless, none of the most frequently cited studies in either general orthopaedics or in sub-specialties were conducted in Latin-America.

To our knowledge, no studies have specifically addressed the influence of certain geographic areas or group of countries on the orthopaedic literature. The aim of this study was to identify the 50 most frequently cited orthopaedic journal articles originating in Latin-American countries and to analyse the characteristics that have made them important to the orthopaedic community. Identifying the most frequently cited

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Latin-American articles in the orthopaedic literature could help future research in this vast geographic area to have higher relevance to the scientific community.

Material and methods

Sixty-three journals are categorized under the topic heading of “Orthopedics” in the Institute for Scientific Information (ISI) Web of Science (Thompson Reuters, New York, New York, USA). These 63 journals include general clinical orthopaedic journals, subspecialty journals, basic science journals and physical therapy journals. The Thomson Reuters search engine provides information regarding the number of times that a particular article has been cited by other articles. In addition, the same engine allows the results to be filtered by country.

Using the Science Citation Index Expanded Database through the ISI Web of Knowledge, in July 2013, we performed a comprehensive search for article citations published in the subject category “Orthopedics” in the Journal Citation Report Science Edition from 1988 to 2013 (years available on the Science Citation Index Expanded Database), including publications in English or in any other language. We next filtered by country to exclude articles not originating from a Latin-American country, as defined by the Organization of American States Charter (Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela). We additionally included articles from Puerto Rico in the search.

We first identified the 200 most frequently cited articles with an address in any of the 20 countries (and Puerto Rico) considered part of Latin-America. Each of these 200 articles was reviewed to exclude articles without a primary address or a reprint address from one of the Latin-American countries (even if one or more co-authors had an address in a Latin-American country); thus, we tried to avoid including articles that originated outside Latin-America, but with one or more Latin-American co-authors. Hence, the 50 most frequently cited articles originating from Latin-America were identified. In addition, we determined the citation density (total number of citations/years since publication) to adjust the results by time since publication, and we ranked the top 50 articles by the number of citations and by citation density.

The data collected for each article included the journal title, authors' names, country of origin of the authors (if there was more than one country of origin, the country of origin was considered to be that of the first author), year of publication, research type (basic science or clinical research), article sub-type (original study, review article, case report, or expert opinion), and the field of research (general orthopaedics or sub-specialties: hip and knee arthroplasty, sports medicine and arthroscopy, spine, pediatric orthopaedics, hand and upper

extremity, foot and ankle, orthopaedic oncology, physical therapy and rehabilitation).

A correlation analysis (Pearson) of the impact factor of the journal of publication, and the number of citations was performed; in addition, we correlated the impact factor and the citation density of the top 50 articles. A value of $p < 0.05$ was considered to be statistically significant. Data were analyzed using SPSS™ version 18 (SPSS, Chicago, IL).

Results

A total of 132,270 articles were published in orthopaedic journals between 1988 and July 2013; however, only 1,371 of those articles originated from a Latin-American country (1 %).

The number of citations for the top 50 most frequently cited Latin-American articles ranged between 29 and 150 (mean, 44.48). Ranked by citation density, the top 50 articles ranged between 1.43 and 15.5 citations/years (mean, 5.25). The most frequently cited articles, along with their authors, total number of citations and their citation density are listed in Table 1.

All the articles were published in English and were published in 19 of the 63 journals, including 11 general orthopaedic journals and eight sub-specialty journals (Table 2).

The publication years of the top 50 most frequently cited articles spanned from 1988 to 2010. Two articles were published before 1990, 19 articles were published between 1990 and 1999, and 29 were published in 2000 or later.

The majority of the top 50 most frequently cited articles were clinical articles ($n = 40$), followed by experimental articles; four articles corresponded to other categories (three reviews and one translation/validation of a score). Of the 40 clinical articles, the most frequent study design was uncontrolled case series ($n = 33$), with only three randomized trials in the top 50 list.

The field of research of the articles was primarily sports medicine and arthroscopy ($n = 15$), followed by hip surgery ($n = 13$) and hand surgery ($n = 8$), as shown in Table 3.

With regards to the country of origin, these articles originated mainly from Brazil ($n = 20$) and Argentina ($n = 15$), as shown in Table 4.

The effect of the impact factor of the journal on the ranking was evaluated using a correlation analysis; however, there was no correlation between the impact factor and the number of citations ($r = -0.149$; $p = 0.302$) or the citation density ($r = 0.179$; $p = 0.214$).

Discussion

Identification of the most frequently cited articles has been performed in different specialties, including orthopaedics. In this study, we identified the 50 most frequently cited articles in the orthopaedics field originating from Latin-American

Table 1 List of top 50 cited Latin-American orthopaedic articles

Rank	Top 50 publications	Country of origin	Count	Citation density (cites per year)
(1)	Zaidenberg C, Siebert JW, Angrigiani C. A new vascularized bone graft for scaphoid nonunion. <i>J Hand Surg Am.</i> 1991 May;16(3):474–8.	Argentina	150	6.82
(2)	Lage LA, Patel JV, Villar RN. The acetabular labral tear: an arthroscopic classification. <i>Arthroscopy.</i> 1996 Jun;12(3):269–72.	Brazil	102	6
(3)	Zancolli EA, Angrigiani C. Posterior interosseous island forearm flap. <i>J Hand Surg Br.</i> 1988 May;13(2):130–5.	Argentina	93	3.72
(4)	Ilizaliturri VM, Jr., Orozco-Rodriguez L, Acosta-Rodriguez E, Camacho-Galindo J. Arthroscopic treatment of cam-type femoroacetabular impingement: preliminary report at 2 years minimum follow-up. <i>J Arthroplasty.</i> 2008 Feb;23(2):226–34	Mexico	71	14.2
(5)	Bertelli JA, Ghizoni MF. Reconstruction of C5 and C6 brachial plexus avulsion injury by multiple nerve transfers: spinal accessory to suprascapular, ulnar fascicles to biceps branch, and triceps long or lateral head branch to axillary nerve. <i>J Hand Surg Am.</i> 2004 Jan;29(1):131–9	Brazil	64	6.4
(6)	Ellera Gomes JL. Medial patellofemoral ligament reconstruction for recurrent dislocation of the patella: a preliminary report. <i>Arthroscopy.</i> 1992;8(3):335–40.	Brazil	63	3.
(7)	Ilizaliturri VM, Jr. Complications of arthroscopic femoroacetabular impingement treatment: a review. <i>Clin Orthop Relat Res.</i> 2009 Mar;467(3):760–8.	Mexico	62	15.5
(8)	Ellera Gomes JL, Stigler Marczyk LR, Cesar de Cesar P, Jungblut CF. Medial patellofemoral ligament reconstruction with semitendinosus autograft for chronic patellar instability: a follow-up study. <i>Arthroscopy.</i> 2004 Feb;20(2):147–51.	Brazil	60	6.67
(9)	Costa-Paz M, Muscolo DL, Ayerza M, Makino A, Aponte-Tinao L. Magnetic resonance imaging follow-up study of bone bruises associated with anterior cruciate ligament ruptures. <i>Arthroscopy.</i> 2001 May;17(5):445–9.	Argentina	60	5
(10)	Volpon JB. Footprint analysis during the growth period. <i>J Pediatr Orthop.</i> 1994 Jan-Feb;14(1):83–5	Brazil	53	2.79
(11)	Zancolli EA, Zancolli ER, Jr. Palliative surgical procedures in sequelae of obstetric palsy. <i>Hand Clin.</i> 1988 Nov;4(4):643–69	Argentina	53	2.12
(12)	Muscolo DL, Ayerza MA, Aponte-Tinao L, Ranalletta M, Abalo E. Intercalary femur and tibia segmental allografts provide an acceptable alternative in reconstructing tumor resections. <i>Clin Orthop Relat Res.</i> 2004 Sep;426:97–102.	Argentina	47	5.22
(13)	Kouri JB, Jimenez SA, Quintero M, Chico A. Ultrastructural study of chondrocytes from fibrillated and non-fibrillated human osteoarthritic cartilage. <i>Osteoarthritis Cartilage.</i> 1996 Jun;4(2):111–25.	Cuba	47	2.76
(14)	Fernandez-Palazzi F, Rivas S, Cibeira JL, Dib O, Viso R. Radioactive synoviorthesis in hemophilic hemarthrosis: materials, techniques, and dangers. <i>Clin Orthop Relat Res.</i> 1996 Jul(328):14–8.	Venezuela	44	2.59
(15)	Sodre H, Bruschini S, Mestriner LA, Miranda F, Jr., Levinsohn EM, Packard DS, Jr., et al. Arterial abnormalities in talipes equinovarus as assessed by angiography and the Doppler technique. <i>J Pediatr Orthop.</i> 1990 Jan-Feb;10(1):101–4.	Brazil	44	1.91
(16)	Braga-Silva J. The use of silicone tubing in the late repair of the median and ulnar nerves in the forearm. <i>J Hand Surg Br.</i> 1999 Dec;24(6):703–6.	Brazil	43	3.07
(17)	Martinez-Lavin M, Vidal M, Barbosa RE, Pineda C, Casanova JM, Nava A. Norepinephrine-evoked pain in fibromyalgia. A randomized pilot study [ISRCTN70707830]. <i>BMC Musculoskelet Disord.</i> 2002;3:2.	Mexico	42	3.82
(18)	Muscolo DL, Petracchi LJ, Ayerza MA, Calabrese ME. Massive femoral allografts followed for 22 to 36 years. Report of six cases. <i>J Bone Joint Surg Br.</i> 1992 Nov;74(6):887–92.	Argentina	42	2
(19)	Arias JL, Nakamura O, Fernandez MS, Wu JJ, Knigge P, Eyre DR, et al. Role of type X collagen on experimental mineralization of eggshell membranes. <i>Connect Tissue Res.</i> 1997;36(1):21–33.	Chile	41	2.56
(20)	Ilizaliturri VM, Jr., Villalobos FE, Jr., Chaidez PA, Valero FS, Aguilera JM. Internal snapping hip syndrome: treatment by endoscopic release of the iliopsoas tendon. <i>Arthroscopy.</i> 2005 Nov;21(11):1375–80.	Mexico	40	5
(21)	Muscolo DL, Costa-Paz M, Makino A, Ayerza MA. Osteonecrosis of the knee following arthroscopic meniscectomy in patients over 50-years old. <i>Arthroscopy.</i> 1996 Jun;12(3):273–9.	Argentina	40	2.35
(22)	Buttaro MA, Farfalli G, Paredes Nunez M, Comba F, Piccaluga F. Locking compression plate fixation of Vancouver type-B1 periprosthetic femoral fractures. <i>J Bone Joint Surg Am.</i> 2007 Sep;89(9):1964–9.	Argentina	39	6.5
(23)	Silva LE, Valim V, Pessanha AP, Oliveira LM, Myamoto S, Jones A, et al. Hydrotherapy versus conventional land-based exercise for the management of patients with osteoarthritis of the knee: a randomized clinical trial. <i>Phys Ther.</i> 2008 Jan;88(1):12–21.	Brazil	37	7.4
(24)	Ilizaliturri VM, Jr., Nossa-Barrera JM, Acosta-Rodriguez E, Camacho-Galindo J. Arthroscopic treatment of femoroacetabular impingement secondary to paediatric hip disorders. <i>J Bone Joint Surg Br.</i> 2007 Aug;89(8):1025–30.	Mexico	37	6.17

Table 1 (continued)

Rank	Top 50 publications	Country of origin	Count	Citation density (cites per year)
(25)	Orrego M, Larrain C, Rosales J, Valenzuela L, Matas J, Durruty J, et al. Effects of platelet concentrate and a bone plug on the healing of hamstring tendons in a bone tunnel. <i>Arthroscopy</i> . 2008 Dec;24(12):1373–80.	Chile	37	7.4
(26)	Gustavo Parreira J, Coimbra R, Rasslan S, Oliveira A, Fregoneze M, Mercadante M. The role of associated injuries on outcome of blunt trauma patients sustaining pelvic fractures. <i>Injury</i> . 2000 Nov;31(9):677–82	Brazil	37	2.85
(27)	Fernandez-Palazzi F, Hernandez SR, De Bosch NB, De Saez AR. Hematomas within the iliopsoas muscles in hemophilic patients: the Latin-American experience. <i>Clin Orthop Relat Res</i> . 1996 Jul(328):19–24.	Venezuela	37	2.18
(28)	Lourenco AF, Morcuende JA. Correction of neglected idiopathic club foot by the Ponseti method. <i>J Bone Joint Surg Br</i> . 2007 Mar;89(3):378–81.	Brazil	36	6
(29)	Larrain MV, Botto GJ, Montenegro HJ, Mauas DM. Arthroscopic repair of acute traumatic anterior shoulder dislocation in young athletes. <i>Arthroscopy</i> . 2001 Apr;17(4):373–7.	Argentina	36	3
(30)	Arruda VR, Belangero WD, Ozelo MC, Oliveira GB, Pagnano RG, Volpon JB, et al. Inherited risk factors for thrombophilia among children with Legg-Calve-Perthes disease. <i>J Pediatr Orthop</i> . 1999 Jan-Feb;19(1):84–7	Brazil	36	2.57
(31)	Cohen M, Amaro JT, Ejnisman B, Carvalho RT, Nakano KK, Peccin MS, et al. Anterior cruciate ligament reconstruction after 10 to 15 years: association between meniscectomy and osteoarthritis. <i>Arthroscopy</i> . 2007 Jun;23(6):629–34.	Brazil	34	5.67
(32)	Vigatto R, Alexandre NM, Correa Filho HR. Development of a Brazilian Portuguese version of the Oswestry Disability Index: cross-cultural adaptation, reliability, and validity. <i>Spine (Phila Pa 1976)</i> . 2007 Feb 15;32(4):481–6.	Brazil	34	5.67
(33)	Piccaluga F, Gonzalez Della Valle A, Encinas Fernandez JC, Pusso R. Revision of the femoral prosthesis with impaction allografting and a Charnley stem. A 2- to 12-year follow-up. <i>J Bone Joint Surg Br</i> . 2002 May;84(4):544–9.	Argentina	34	3.09
(34)	Cordeiro EN, Costa RC, Carazzato JG, Silva Jdos S. Periprosthetic fractures in patients with total knee arthroplasties. <i>Clin Orthop Relat Res</i> . 1990 Mar(252):182–9	Brazil	34	1.48
(35)	Radice F, Yanez R, Gutierrez V, Rosales J, Pinedo M, Coda S. Comparison of magnetic resonance imaging findings in anterior cruciate ligament grafts with and without autologous platelet-derived growth factors. <i>Arthroscopy</i> . 2010 Jan;26(1):50–7	Chile	33	11
(36)	Bertelli JA, Ghizoni MF. Transfer of the accessory nerve to the suprascapular nerve in brachial plexus reconstruction. <i>J Hand Surg Am</i> . 2007 Sep;32(7):989–98.	Brazil	33	5.5
(37)	Muscolo DL, Ayerza MA, Calabrese ME, Redal MA, Santini Araujo E. Human leukocyte antigen matching, radiographic score, and histologic findings in massive frozen bone allografts. <i>Clin Orthop Relat Res</i> . 1996 May(326):115–26.	Argentina	33	1.94
(38)	Buttaro MA, Pusso R, Piccaluga F. Vancomycin-supplemented impacted bone allografts in infected hip arthroplasty. Two-stage revision results. <i>J Bone Joint Surg Br</i> . 2005 Mar;87(3):314–9.	Argentina	32	4
(39)	Barquet A, Francescoli L, Rienzi D, Lopez L. Intertrochanteric-subtrochanteric fractures: treatment with the long Gamma nail. <i>J Orthop Trauma</i> . 2000 Jun-Jul;14(5):324–8.	Uruguay	32	2.46
(40)	Sanchez-Rodriguez MA, Ruiz-Ramos M, Correa-Munoz E, Mendoza-Nunez VM. Oxidative stress as a risk factor for osteoporosis in elderly Mexicans as characterized by antioxidant enzymes. <i>BMC Musculoskelet Disord</i> . 2007;8:124.	Mexico	31	5.17
(41)	Larrain MV, Montenegro HJ, Mauas DM, Collazo CC, Pavon F. Arthroscopic management of traumatic anterior shoulder instability in collision athletes: analysis of 204 cases with a 4- to 9-year follow-up and results with the suture anchor technique. <i>Arthroscopy</i> . 2006 Dec;22(12):1283–9	Argentina	31	4.43
(42)	Toro G, Roman GC, Navarro-Roman L, Cantillo J, Serrano B, Vergara I. Natural history of spinal cord infarction caused by nucleus pulposus embolism. <i>Spine (Phila Pa 1976)</i> . 1994 Feb 1;19(3):360–6.	Colombia	31	1.63
(43)	Ilizaliturri VM, Jr., Martinez-Escalante FA, Chaidez PA, Camacho-Galindo J. Endoscopic iliotibial band release for external snapping hip syndrome. <i>Arthroscopy</i> . 2006 May;22(5):505–10.	Mexico	30	4.29
(44)	Checchia SL, Doneux PS, Miyazaki AN, Silva LA, Fregoneze M, Ossada A, et al. Biceps tenodesis associated with arthroscopic repair of rotator cuff tears. <i>J Shoulder Elbow Surg</i> . 2005 Mar-Apr;14(2):138–44.	Brazil	30	3.75
(45)	Muscolo DL, Ayerza MA, Aponte-Tinao LA, Ranalletta M. Partial epiphyseal preservation and intercalary allograft reconstruction in high-grade metaphyseal osteosarcoma of the knee. <i>J Bone Joint Surg Am</i> . 2004 Dec;86-A(12):2686–93.	Argentina	30	3.33
(46)	Livani B, Belangero WD. Bridging plate osteosynthesis of humeral shaft fractures. <i>Injury</i> . 2004 Jun;35(6):587–95.	Brazil	30	3.33
(47)	Fogagnolo F, Kfuri M, Jr., Paccola CA. Intramedullary fixation of pertrochanteric hip fractures with the short AO-ASIF proximal femoral nail. <i>Arch Orthop Trauma Surg</i> . 2004 Jan;124(1):31–7.	Brazil	30	3.33

Table 1 (continued)

Rank	Top 50 publications	Country of origin	Count	Citation density (cites per year)
(48)	Neder JA, Nery LE, Shinzato GT, Andrade MS, Peres C, Silva AC. Reference values for concentric knee isokinetic strength and power in nonathletic men and women from 20 to 80 years old. <i>J Orthop Sports Phys Ther.</i> 1999 Feb;29(2):116–26.	Brazil	30	2.14
(49)	Uriburu JJ, Olazabal AE, Ciaffi M. Trapeziometacarpal osteoarthritis: surgical technique and results of "stabilized resection-arthroplasty". <i>J Hand Surg Am.</i> 1992 Jul;17(4):598–604.	Argentina	30	1.43
(50)	Checchia SL, Santos PD, Miyazaki AN. Surgical treatment of acute and chronic posterior fracture-dislocation of the shoulder. <i>J Shoulder Elbow Surg.</i> 1998 Jan-Feb;7(1):53–65.	Brazil	29	5.8

countries between 1988 and 2013, and we evaluated the characteristics that made these articles citable. Our data show that Latin-American countries have been under-represented in the orthopaedics literature, with only 1 % of orthopaedic studies conducted in Latin-America. The most frequently cited articles were all published in English, primarily corresponded to clinical articles, most commonly covering sports medicine/arthroscopy or hip surgery and were more frequently conducted by Brazilian and Argentinean authors.

The number of citations an article receives is influenced by different factors, including the quality of the research or review conducted, the specific field, the overall interest of the topic, and the ability of the article to generate further research or to change clinical practice. In our study, the most frequently cited article from Latin-America had 150 citations, while a recent study by Lefaivre et al. showed that the top 100 most frequently cited articles in the orthopaedics literature citations ranged between 1,748 and 343 citations [7]. Interestingly, an analysis

of the most frequently cited articles in orthopaedics [7] and in some sub-specialties [8–10] shows that the introduction of a frequently used classification or score is a major factor associated with a large number of citations and a large citation density, mainly because such classifications or scores are commonly used in the methodology of other studies. Among the top 50 most frequently cited Latin-American orthopaedic articles, only one article described a new classification [12]; that article had the second largest number of citations in our list. The absence of more articles introducing new classifications may be one possible explanation of the relative dearth of citations for articles originating from Latin-America.

It has been noted that the country of origin is an important factor influencing the frequency with which an article is cited. In fact, the majority of the top 100 most frequently cited orthopaedic articles [7] were from the United States of America; these data are consistent with similar studies in anaesthesiology [5], pediatrics [1], plastic surgery [2], general surgery

Table 2 Number of articles on top 50 list by source journal

Journal name	Number of publications	Journal impact factor
Arthroscopy	12	3.1
Clinical Orthopaedics And Related Research	6	2.78
Journal of Bone And Joint Surgery–British Volume	5	2.68
Journal of Hand Surgery–American Volume	4	1.57
Journal of Pediatric Orthopaedics	3	1.16
BMC Musculoskeletal Disorders	2	1.87
Injury—International Journal Of The Care Of The Injured	2	1.93
Journal of Bone And Joint Surgery–American Volume	2	3.23
Journal of Hand Surgery–British And European Volume	2	1.22
Spine	2	2.15
Journal of Shoulder and Elbow Surgery	2	2.31
Connective tissue research	1	1.78
Journal of Arthroplasty	1	2.11
Hand Clinics	1	0.94
Physical Therapy	1	2.77
Journal of Orthopaedic Trauma	1	1.75
Osteoarthritis and Cartilage	1	4.26
Journal of Orthopaedic & Sports Physical Therapy	1	2.94
Archives of Orthopaedic and Trauma Surgery	1	1.35

Table 3 Number of articles by field

Subspecialty	Number of publications
Sports medicine / Arthroscopy	15
Hip surgery	13
Hand surgery	8
Basic science	6
Pediatric orthopaedics	3
Oncology	2
Spine	2
Foot and ankle	1

[3], emergency medicine [4], and orthopaedic sub-specialties [8–10]. In our study, the majority of articles originated in Brazil and Argentina; however, after adjusting by population size (Table 4), Argentina, Uruguay and Chile lead the ranking. The observed differences may be a sign of the differences in development of Latin-American countries, which may be echoed by the research maturity of their orthopaedic groups, making their studies more interesting to other authors.

Of note, our list of the top 50 most frequently cited articles is composed of articles that cover different topics and extend across multiple fields. However, the majority of articles included in our ranking pertain to sports medicine and arthroscopy (n=15), hip surgery (n=13) and hand surgery (n=8). This may reflect the development of those fields in some groups in Latin-America, which allow these researchers to publish articles that have become relevant to other scientists. However, this finding may also reflect self-citations from high-volume authors, who may be prone to cite their own papers, thereby increasing their citation numbers.

The source journal was also an important factor affecting the number of citations in our study. It is not surprising that the journal in which an article is published is relevant to the likelihood that it will be cited; in fact, the impact factor of a journal is determined by the average number of citations received per paper published in that journal during the two

preceding years. Moreover, it is likely that papers published in journals with higher impact factors could more easily be used as future references by other authors. Nonetheless, newer journals may have fewer opportunities to be cited, an effect not necessarily related to the quality of the journal. In addition, the phenomenon known as Bradford's law indicates that many researchers obtain their citations from a few core journals from their field of study [13], leading to a large percentage of citations coming from a small number of journals (usually those with high impact factors). In our study, "Arthroscopy" was the source journal of 12 articles on the most frequently cited list, which, as previously discussed, may indicate the potential superior development of this subspecialty in Latin-America compared to other fields. However, the concentration of an important number of papers from the top 50 list in a few journals as shown in Table 2 may explain the absence of a correlation between the impact factor and the number of citations or the citation density in our top 50 list.

It is worth considering the duration that each article has been in circulation, as articles that have been in circulation for a longer time have had more opportunities for citation; this time effect poses a potential disadvantage for the most recently published articles. To address this effect, we determined the citation density, which reflects the relative impact of articles regardless of the year of publication by adjusting for time since publication. However, we based our ranking on the number of citations (and not on the citation density) to allow our study to be comparable to previous studies conducted in general orthopaedics, orthopaedic sub-specialties, and in other fields [1–11]. Nevertheless, 29 of the top 50 most frequently cited articles were published in 2000 or later. This finding may be explained because orthopaedics is strongly influenced by new technologies, but also because the easy availability of online papers make more recently published articles more likely to be cited.

There are several potential reasons to explain why Latin-American orthopaedic articles represent such a small proportion of the global orthopaedic literature, and the limited number of citations those articles have compared to the most influential orthopaedic articles originated in other countries. Noteworthy, all the articles in our ranking were published in English, and writing in a foreign language may be a barrier for some researchers in Latin-America. Furthermore, limited access to funding for research in Latin-American countries may be another reason explaining the low orthopaedic scientific productivity in this region. Usually, academic institutions in this geographic area set their priorities on teaching activities and clinical care; therefore, few orthopaedic surgeons in Latin-America may achieve the training to apply to grants and obtain the funding required to develop original data that would be published in high-impact journals. These funding limitations can also affect the possibility for Latin-American researchers to present their studies in international meetings, thus limiting discussion of their data before publication.

Table 4 Publications on top 50 list by country of origin

Country of origin	Number of publications	Publications per million people
Brazil	20	0.1
Argentina	15	0.36
Mexico	7	0.05
Chile	3	0.18
Venezuela	2	0.06
Colombia	1	0.02
Cuba	1	0.09
Uruguay	1	0.33

Finally, another reason that may limit the number of highly cited articles may be that few orthopaedic researchers in Latin-America are involved in multi-center studies that could lead to recruitment of a large number of study subjects.

We should highlight the need to develop policies to overcome the limitations that exist in orthopaedic research in Latin-America. Local universities and governmental offices should increase the stimuli and funding for research and publications in order to advance in health promotion in Latin-America. Moreover, industry may also have a role supporting novel research and travelling expenses for researchers, rather than providing support based on surgical volumes and goals.

Understanding the characteristics that make articles citable by other scientists can help researchers, institutions and governments in Latin-America to promote quality research that could become more influential for the international orthopaedic scientific community.

References

1. Quinn N, Hensey O, McDowell DT (2013) A historical perspective of pediatric publications: a bibliometric analysis. *Pediatrics* 132:406–412. doi:[10.1542/peds.2013-0283](https://doi.org/10.1542/peds.2013-0283)
2. Loonen MP, Hage JJ, Kon M (2008) Plastic surgery classics: characteristics of 50 top-cited articles in four plastic surgery journals since 1946. *Plast Reconstr Surg* 121:320e–327e. doi:[10.1097/PRS.0b013e31816b13a9](https://doi.org/10.1097/PRS.0b013e31816b13a9)
3. Paladugu R, Schein M, Gardezi S, Wise L (2002) One hundred citation classics in general surgical journals. *World J Surg* 26:1099–1105. doi:[10.1007/s00268-002-6376-7](https://doi.org/10.1007/s00268-002-6376-7)
4. Tsai YL, Lee CC, Chen SC, Yen ZS (2006) Top-cited articles in emergency medicine. *Am J Emerg Med* 24:647–654. doi:[10.1016/j.ajem.2006.01.001](https://doi.org/10.1016/j.ajem.2006.01.001)
5. Baltussen A, Kindler CH (2004) Citation classics in anesthetic journals. *Anesth Analg* 98:443–451, table of contents
6. Heldwein FL, Rhoden EL, Morgentaler A (2010) Classics of urology: a half century history of the most frequently cited articles (1955–2009). *Urology* 75:1261–1268. doi:[10.1016/j.urology.2009.09.043](https://doi.org/10.1016/j.urology.2009.09.043)
7. Lefaivre KA, Shadgan B, O'Brien PJ (2011) 100 most cited articles in orthopaedic surgery. *Clin Orthop Relat Res* 469:1487–1497. doi:[10.1007/s11999-010-1604-1](https://doi.org/10.1007/s11999-010-1604-1)
8. Baldwin KD, Kovatch K, Namdari S, Sankar W, Flynn JM, Dormans JP (2012) The 50 most cited articles in pediatric orthopedic surgery. *J Pediatr Orthop B* 21:463–468. doi:[10.1097/BPB.0b013e328354b0cf](https://doi.org/10.1097/BPB.0b013e328354b0cf)
9. Namdari S, Baldwin K, Kovatch K, Huffman GR, Glaser D (2012) Fifty most cited articles in orthopedic shoulder surgery. *J Shoulder Elbow Surg* 21:1796–1802. doi:[10.1016/j.jse.2011.11.040](https://doi.org/10.1016/j.jse.2011.11.040)
10. Murray MR, Wang T, Schroeder GD, Hsu WK (2012) The 100 most cited spine articles. *Eur Spine J* 21:2059–2069. doi:[10.1007/s00586-012-2303-2](https://doi.org/10.1007/s00586-012-2303-2)
11. Eberlin KR, Labow BI, Upton J III, Taghinia AH (2012) High-impact articles in hand surgery. *Hand* 7:157–162. doi:[10.1007/s11552-011-9388-7](https://doi.org/10.1007/s11552-011-9388-7)
12. Lage LA, Patel JV, Villar RN (1996) The acetabular labral tear: an arthroscopic classification. *Arthroscopy* 12:269–272
13. Brookes BC (1969) Bradford's law and the bibliography of science. *Nature* 224:953–956