Feature

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Influence of PAHO Publications on Scientific Production in the Health Field in Latin America and the Caribbean[1]

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The influence and impact of PAHO publications on scientific production in the field of health in Latin America and the Caribbean was the subject of a study based on a sample of 45 biomedical journals published between 1985 and 1992 in 17 countries of the Region. A total of 8 644 works (mostly articles), containing 82 143 citations, were studied. Of these, 3 806 citations were found to refer to works published by PAHO Headquarters in Washington, D.C.—the Boletín de la Oficina Sanitaria Panamericana *receiving 1 444 (38% of the total), the English-language* Bulletin of PAHO *receiving 222 (6%), works in PAHO's Scientific Publications Series receiving 1 064 (28%), and works in other PAHO publications receiving 1 076 (28%). Overall, PAHO publications appeared to account for a significant share of the citations studied.*

One of PAHO's prime aims is to provide technical cooperation contributing to dissemination of scientific knowledge in the health field. The Organization's publications serve as vehicles for performing that task while also encouraging health research in the Americas. The work reported here was carried out in an effort to assess how effectively these publications were furthering those purposes—by studying the influence they have exerted on biomedical work in the Region.

In recent years, bibliometric studies have been used increasingly as an appropriate tool for estimating such influence. However, the use of bibliometric citation indicators to evaluate the use and impact of scientific publications has significant limitations. Among other things, the different forms of bibliographic reference citations, marked variability of citations in different fields of knowledge, and varying distributions of the works cited may limit access to particular journals for many users (*1, 2*). Despite these difficulties, bibliometric methods have gained popularity, and communications and scientific information media frequently report the many advances achieved and analyses performed in this field.

Scientific health communication, like any editorial activity, is an intricate process susceptible to the influence of socioeconomic conditions. Accordingly, study of its impact should not be limited to measurement of bibliographic citations generated. Rather, such study should include analysis of things like its impact on education, its formative influence on scientific opinion, and

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its effectiveness as a tool for facilitating relationships among scientists.

By way of taking an initial step toward this sort of complex examination, the apparent influence of PAHO publications on the biomedical journals of Latin America and the Caribbean was assessed. For this purpose, it was assumed that the authors who published in such journals constituted one of the audiences at which PAHO publications were directed. (The subjects most frequently cited, and hence of the greatest apparent interest to health researchers, are identified below.) In addition, an estimate was made of the time elapsing between publication of a public health article and its citation by other authors.

The current literature on this subject is limited: few studies refer to the impact of biomedical journals, even fewer to the influence of those published in Latin America and the Caribbean. With the exception of studies carried out by the Institute of Scientific Information (ISI) (*3*) and occasional incipient investigations conducted by Latin American biomedical journals (*4, 5*), little source literature on this subject was encountered.

MATERIALS AND METHODS

To analyze the influence of works appearing in PAHO publications, the works were divided into four groups: those appearing in the *Boletín de la Oficina Sanitaria Panamericana*, the *Bulletin of the Pan American Health Organization*, PAHO's Scientific Publications Series, and other PAHO publications. The latter category included works appearing in official documents, monographs, books, consultant reports, nonserial publications, and a wide range of serial publications including *Educación Médica y Salud*, the *Epidemiological Bulletin*, and others.

Since many PAHO publications are not included in specialized automated citation indexes such as ISI's *Science Citation Index*, all of the data used in this study were collected manually. The author consulted collections available at the PAHO Headquarters library in Washington, DC; the National Library of Medicine in Bethesda, Maryland; the Latin American and Caribbean Center on Health Sciences Information (BIREME) in São Paulo (*6*); and the Library of the *Sindicato Médico de Montevideo* in Montevideo.

The study, which covered the period 1985–1992, was based on a sample of 45 biomedical journals — including 3 PAHO journals published in the United States and 42 journals published in 16 Latin American and Caribbean countries. Overall, 84% of the issues published by these journals were located and reviewed. The PAHO journals were included partly because they were distributed widely in Latin America and the Caribbean and partly because information about PAHO self-references (works in PAHO journals referring to other works in PAHO journals) was desired. In selecting the sample of Latin American and Caribbean publications from those available, an effort was made to fulfill several criteria. First, it was felt that the journals selected should be representative in terms of both geography and subject matter. In addition, they needed to satisfy several other conditions relating to coverage, circulation, number of articles per issue, article length, journal scope, degree of development, and extent of international recognition (as determined by inclusion in international indexes).

Table 1 lists each of the selected journals—showing its country of origin, language(s) of publication, frequency of publication, type(s) of research reported, medical specialty covered, and whether or not it was listed in each of three major data bases. In listing the frequency of publication the numbering system used by the publisher was accepted. Thus, if four numbers were published the journal was considered a quarterly, even though two num-

Table 1. A list of the 44 selected journals included in the study showing each journal's country, language(s), and frequency of publication; areas of research and specialization; and inclusion in the LILACS,* *Index Medicus*, or *Science Citation Index* (SCI) data bases.

Title	Country	Language	Type of research	Specialty	Inclusion in international data bases		
					LILACS	*Index Medicus*	SCI
Acta Gastroenterológica Latinoamericana	Argentina	Sp	Biomedical	Gastroenterology	X	X	
Acta Médica Dominicana	Dominican Rep.	Sp	Clinical	Medicine			
Archivos Argentinos de Pediatría	Argentina	Sp	Clinical	Pediatrics	X		
Archivos de Investigación Médica (Mexico)	Mexico	Sp 85-91,	Biomedical	Medicine	X	X	X
Archives of Medical Research (Mexico)	"	Eng 92	"	"	X	X	X
Archivos Latinoamericanos de Nutrición	Guatemala	Sp/Eng/ Fr/Port	Clinical/ public health	Nutrition	X	X	
Archivos de Medicina Interna	Uruguay	Sp	Clinical	Medicine	X		
Archivos de Pediatría del Uruguay	Uruguay	Sp	Clinical	Pediatrics	X		
Boletín de la Asociación Médica de Puerto Rico	Puerto Rico	Sp/Eng	Clinical	Medicine	X	X	
Boletín de la Oficina Sanitaria Panamericana	USA (PAHO)	Sp/Port	Public health		X	X	
Boletín Chileno de Parasitología	Chile	Sp	Clinical	Parasitology	X	X	
Boletín Epidemiológico de Antioquia	Colombia	Sp	Public health	Epidemiology	X		
Boletín Médico del Hospital Infantil de México	Mexico	Sp	Clinical/ public health	Pediatrics	X	X	
Bulletin of PAHO	USA (PAHO)	Eng	Public health			X	
Cadernos de Saúde Pública	Brazil	Port	Public health		X		
Cuadernos Médico Sociales (Rosario)	Argentina	Sp	Public health		X		
Cuadernos Médico Sociales (Santiago)	Chile	Sp	Public health		X		
Educación Médica y Salud	USA (PAHO)	Sp/Port/Eng	Public health	Human resources	X		
Gaceta Médica de México	Mexico	Sp	Clinical/ biomedical	Medicine	X	X	
Ginecología y Obstetricia de México	Mexico	Sp/Eng	Clinical	Gynecology	X	X	
Medicina (Bogotá)	Colombia	Sp	Clinical	Medicine	X		
Medicina (Buenos Aires)	Argentina	Sp/Eng	Clinical	Medicine	X	X	X
Memorias do Instituto Oswaldo Cruz	Brazil	Eng	Biomedical	Tropical medicine	X	X	X
Revista de Biología Tropical	Costa Rica	Sp/Eng	Biomedical	Biology	X	X	
Revista Brasileira de Saúde Ocupacional	Brazil	Port	Public health		X		
Revista Chilena de Nutrición	Chile	Sp/Eng	Clinical/ public health	Nutrition	X		

Revista Chilena de Pediatría	Chile	Sp	Clinical	Pediatrics	X	X	
Revista Costarricense de Ciencias Médicas	Costa Rica	Sp	Clinical/ public health	Medicine	X		
Revista Cubana de Higiene y Epidemiología	Cuba	Sp	Clinical/ public health	Epidemiology	X		
Revista Cubana de Medicina Tropical	Cuba	Sp	Clinical	Tropical medicine	X	X	
Revista Cubana de Pediatría	Cuba	Sp	Clinical	Pediatrics	X		
Revista Cubana de Salud Pública	Cuba	Sp	Public health		X		
Revista del Hospital de Niños de Buenos Aires	Argentina	Sp	Clinical	Pediatrics	X		
Revista do Instituto de Medicina Tropical de São Paulo	Brazil	Eng	Biomedical	Tropical medicine	X	X	X
Revista Latinoamericana de Perinatología	Ecuador	Sp/Port/Eng	Clinical	Perinatology	X		
Revista Médica de Chile	Chile	Sp	Clinical	Internal medicine	X	X	X
Revista Médica de Costa Rica	Costa Rica	Sp	Clinical	Medicine	X		
Revista Médica del IMSS	Mexico	Sp	Clinical	Medicine	X	X	
Revista Médica de Panamá	Panama	Sp	Clinical	Medicine	X	X	
Revista Médica del Uruguay	Uruguay	Sp	Clinical	Medicine	X		
Revista de Obstetricia y Ginecología de Venezuela	Venezuela	Sp	Clinical	Gynecology	X		
Revista Sanidad Fuerzas Policiales	Peru	Sp	Clinical/ public health		X		
Revista do Saúde Pública	Brazil	Port/Eng	Public health		X	X	
Revista de la Sociedad Brasileira de Medicina Tropical	Brazil	Port/Eng	Biomedical	Tropical medicine	X	X	
Salud Pública de México	Mexico	Sp	Public health		X	X	X
West Indian Medical Journal	Jamaica	Eng	Clinical	Medicine	X	X	

* LILACS = Latin American Literature in the Health Sciences (*Literatura Latinoamericana en Ciencias de la Salud*).

bers were issued under one cover (a fairly common practice).

Overall, the 17 countries involved constituted nearly half the nations of the inter-American system (PAHO member countries). The United States was only included as the site of PAHO Headquarters; its inclusion did not reflect any attempt to represent U.S. scientific production. Excluding the United States, the remaining 16 countries had a total population of 412 million (93.6% of the Region's non-U.S. population) and reflected the Region's social and economic diversity (*7*). With regard to the regional criterion, it should be pointed out that all of the various subregions of the Americas were represented in the sample, which included 6 journals from Mexico in North America, 5 from Central America, 7 from the Caribbean, 5 from the Andean subregion, and 19 from the Southern Cone.

The sample also reflected the fact that certain countries had greater amounts of scientific production and publication than others. Especially because most such production and publication is concentrated in a small number of countries, an attempt was made to achieve a distribution of selected journals by country that was roughly proportional to each country's volume of biomedical publishing.

Prior studies had indicated that 90% of such production in Latin America and the Caribbean was taking place in six countries (Argentina, Brazil, Chile, Cuba, Mexico, and Venezuela) (*8*). Reflecting this fact, selected journals published in these six countries accounted for 60% of the journals included in the sample (27 out of 45), with Mexico and Brazil being represented by six journals each and Argentina and Chile by five.

With regard to language, the sample included journals published in Spanish, Portuguese, English, and French. A fair number (see Table 1) were published in two or more languages, though in most of these cases Spanish contributions predominated, with only a smattering of non-Spanish works being offered.

The variety of subjects included in the journals was quite broad, because the journals themselves were devoted to public health research (11 journals), clinical research (20 journals), and biomedical research (6 journals). The 8 remaining journals published material in two of these three fields at the same time (*9*). The journals selected did not precisely reflect the proportions of editorial production devoted to each of these fields (*10*), greater weight being given to public health journals because of the public health orientation of PAHO's publications.

Regarding specific areas of specialization, the sample included journals dedicated to epidemiology, gynecology, nutrition, pediatrics, perinatology, tropical medicine, and clinical and internal medicine — these latter being referred to simply as "medicine" in Table 1.

The sample also included journals that were international in terms of the research results reported and the organizations responsible for their publication, and most of the selected journals were indexed in one or more international indexes or data bases. With regard to this latter point, 6 of the 42 Latin American and Caribbean journals were indexed by the *Science Citation Index* (SCI) (*11*), accounting for 66% of all of the biomedical journals from that region included in the SCI in 1992; 20 were indexed by the *Index Medicus* (*12*), accounting for 41% of all of the journals from the region in that data base; and 40 were included in *Literatura Latinoamericana en Ciencias de la Salud* (LILACS), accounting for 8% of the journals in that data base (*13, 14*). Of the 42 Latin American and Caribbean journals, only 1 was not included in any of these data bases, 20 were included in one, and 21 were included simultaneously in two or three.

Between 1985 and 1992, 1 792 numbers of the study journals were published. Partly because access to the collections was

manual, it was possible to study only 1 507 numbers, i.e., 84% of those published.

Within the 1 507 journal numbers reviewed, a total of 8 644 works, a large portion of them original, were examined. Besides research articles, the issues also contained review articles, letters to the editor, brief contributions, and short items of current interest — but only those containing at least two citations were included in the study. Overall, the aforementioned 8 644 works contained a total of 82 143 bibliographic citations.

Because computerized information on the cited PAHO publications was not available, data compilation was performed manually. Data were recorded in each case where a PAHO publication in any of the four previously mentioned groups was cited. Where items appearing in the *Boletín de la OSP* or the *Bulletin of PAHO* were cited, the recorded data included the subject of the work where the citation occurred together with the name(s) of the author(s), the name of the responsible journal, and the year, month, journal volume, and pages of the work. The accuracy of each citation was individually confirmed (*15*). Where a work in PAHO's Scientific Publications Series was cited, the name of the responsible journal and the series number and title of the cited publication were recorded. Where *Educación Médica y Salud* was cited, the name of the responsible publication and the number of citations involved were recorded. And finally, where other PAHO publications aside from *Educación Médica* were cited, only the citations were counted, without regard to the publications in which they appeared.

Once the complete list of articles cited and the number of times each was cited had been obtained, each article was assigned a single subject heading. The subject headings were then grouped into appropriate categories in accord with a classification employed by BIREME (*16, 17*). Although the use of these single subject headings limited the scope of the study (because multiple topics dealt with by a single article or other work could go unrecorded), this approach was adopted in order to avoid overlaps and to help ensure that the heading selected was that best describing the article's main topic.

Besides being arranged by subject heading, the articles and other works were grouped by type (original articles, review articles, letters to the editor, editorials, director's messages, etc.). In addition, the total number of citations in each article or other work studied was recorded, in order to permit evaluation of the citations provided by each journal relative to the entire group of journals studied.

RESULTS

The *Boletín de la OSP*

The monthly *Boletín de la OSP* was cited 1 444 times in 1 080 works distributed through all but four of the journals studied (see Annex 1). The number of times it was cited in these journals ranged from 1 to 271, the average number of citations being 35; however, there were only 28 journals in which the number of citations recorded exceeded 11.

While the 1 444 citations referred to 688 articles published in the *Boletín de la OSP* from 1922 to 1992, most of the citations related to articles published in the 1980s. Specifically, 65% of the citations referred to articles published from 1980 through 1989, while 50% referred to articles appearing from 1981 through 1987.

Table 2 shows the number of citations per year from 1985 through 1992. The average number of citations per year in that period was 180.5. The table shows that the peak number of citations (16% of the 1985–1992 total) occurred in 1986. However, the number of "self-citations" (where *Boletín de la OSP* articles cited other articles in the *Boletín de la OSP*) that year was quite high (66),

Table 2. The frequency with which contributions to the *Boletín de la Oficina Sanitaria Panamericana* were cited in the journals studied, by year of publication of those journals.

Year	No. of times cited
1985	160
1986	225
1987	181
1988	164
1989	189
1990	183
1991	151
1992	191

considerably higher than the average yearly number of self-citations for the 1985–1992 period (33.8).

Regarding distribution by subject of the 668 cited articles, the individual works were assigned a total of 166 subject headings. The 25 headings most frequently cited, as shown in Table 3, accounted for 785 of the 1 444 citations, slightly over 50% of the total. The largest number of articles with the same subject heading (137 articles, 9.5% of the total) dealt with trypanosomiasis. In addition, the single article cited most frequently dealt with this same subject.[3]

Regarding distribution according to the BIREME classification (*16, 17*), 701 of the 1 444 citations (48.5%) referred to articles dealing mainly with diseases, 520 of these involving communicable diseases and 181 other diseases (Table 4). Articles in the public health category (including the subcategories of health care, nutrition, environmental health, epidemiology, demography, and administration and planning) received 590 (40.9%) of these citations, while 11 remaining categories (including techniques, sociology, and biologic sciences) received 153 (10.7%).

The *Boletín de la OSP* has modified its sections over time—presumably in order to adapt its content to new concepts or developments as they occur or to better satisfy reader demand. While the content has retained its profile, section titles have changed; and at times new sections, such

Table 3. The 25 *Boletín de la OSP* subjects most often cited by study journal contributors.

Subject	Number of citations
Trypanosomiasis	137
Aedes/dengue	51
Maternal-child health	41
Alcoholism	38
Prenatal care	35
Hepatitis	34
Leishmaniasis	34
Child mortality	34
Health plans and programs	31
Respiratory diseases	30
Mental health	28
Traffic accidents	27
Onchocerciasis	26
Cancer	25
Health services	23
Hydatidosis	22
Child health	22
AIDS	22
Diarrhea	19
Health education	19
Nutrition	19
Tuberculosis	18
Epidemiologic studies	17
Breast-feeding	17
Smoking	16

[3] Of the 688 articles, the most frequently cited were as follows: Cerisola JA, Rabinovich A, Álvarez M, di Corleto CA, Pruneda J. La enfermedad de Chagas y la transfusión de sangre. *Bol Oficina Sanit Panam* 1972;73:203–221 (cited 18 times in 11 journals in 1985–1992, between 14 and 20 years after publication) and Suárez Ojeda E. El enfoque de riesgo en la atención perinatal y maternoinfantil. *Bol Oficina Sanit Panam* 1982;96:482–493 (cited 18 times in 13 journals in 1985–1992, between 4 and 10 years after publication).

Table 4. Distribution by major topics employed by BIREME (descriptores en ciencias de salud [DeCS]—*16, 17*) of *Boletín de la OSP* works cited in 1 444 instances by study journal contributions.

DeCS codes	Category	Citations received	
		No.	%
C1–C3	Communicable diseases	520	36.0
N–SP2	Public health (health care)	293	20.3
C4–C23	Other diseases	181	12.5
SP6	Nutrition	81	5.6
SP4	Environmental health	68	4.7
SP5	Epidemiology	58	4.0
SP3	Public health (demography)	53	3.7
SP1	Administration and health planning	37	2.6
Other	Various	153	10.6
Total		1 444	100

as *"Información farmacológica"* or *"Comunicación biomédica,"* have been added. Despite this, however, and despite the long time period over which the cited works are distributed, it is possible to group them by general type. In this regard, the most frequently cited works were articles reporting original research. Specifically, works of this type accounted for 597 (87%) of the 688 works cited and also for 1 300 (90%) of the 1 444 citations.

Most of these 1 444 citations referring to works in the *Boletín de la OSP* appeared in public health journals or in journals that were not wholly dedicated to this field but that set aside some pages to present the results of public health research. In all, 12 public health journals accounted for 776 citations (54%), while 5 biomedical journals specializing in tropical medicine or parasitology contained 231 citations (16%), 7 journals with a clinical orientation specializing in pediatrics or perinatology contained 188 citations (13%), and 17 clinical journals with diverse areas of specialization contained the remaining 249 citations (17%) (Table 5).

Regarding journals whose contents were indexed by the *Index Medicus* and SCI, those 23 listed in the *Index Medicus* contained 1 050 citations of works published in the *Boletín de la OSP* (73% of the total). Similarly, the 6 journals indexed by the SCI contained 300 citations of works published in the *Boletín de la OSP* — yielding an average (50 citations per journal) that was well above the general average of 32. In other words, articles published in journals indexed by the *Index Medicus* and SCI tended to cite works published in the *Boletín de la OSP* more frequently than articles appearing in journals not indexed in these data bases. In 28 journals the number of citations found exceeded 11.

Of the 1 080 works citing *Boletín de la OSP* material, 489 (45%) dealt with communicable diseases, and 122 (11%) dealt with maternal and child health.

The *Bulletin of PAHO*

Eighteen of the selected journals contained works that cited material published in the *Bulletin of PAHO* from 1972 through

Table 5. Study journals citing *Boletín de la OSP* contributions, by the field of the journal, showing the number of times *Boletín* works were cited.

Journal	No. of citations
Public health journals:	
Boletín de la OSP	271
Salud Pública de México	140
Revista de Saúde Pública	102
Bulletin of PAHO	70
Cadernos de Saúde Pública	44
Boletín Epidemiológico de Antioquia	32
Revista Cubana de Higiene y Epidemiología	32
Cuadernos Médico Sociales (Rosario)	21
Archivos Latinoamericanos de Nutrición	20
Cuadernos Médico Sociales (Santiago)	19
Revista Cubana de Salud Pública	17
Revista Brasileira de Saúde Ocupacional	8
Biomedical journals:	
Boletín Chileno de Parasitología	67
Revista Cubana de Medicina Tropical	52
Revista do Instituto de Medicina Tropical de São Paulo	43
Revista de la Sociedad Brasileira de Medicina Tropical	39
Memorias do Instituto Oswaldo Cruz	30
Clinical journals (pediatrics and perinatology):	
Boletín Médico del Hospital Infantil de México	49
Archivos Argentinos de Pediatría	42
Revista Chilena de Pediatría	38
Revista Cubana de Pediatría	30
Revista Latinoamericana de Perinatología	12
Revista Hospital de Niños de Buenos Aires	11
Archivos de Pediatría	6
Other journals	249
Total	1 444

1990, the total number of such citations being 222. (The *Bulletin of PAHO* is the quarterly English-language counterpart of the monthly *Boletín de la OSP* that publishes some but not all of the works appearing in the *Boletín* as well as certain works of interest primarily to English-language readers that do not appear in the other journal.) In all, 136 articles and other works published in the *Bulletin of PAHO* from 1972 through 1990 were cited.

Obviously, the pattern and overall number of citations was influenced by language. As Table 1 indicates, Spanish and Portuguese were the sole or dominant languages of nearly all the selected journals, and since 123 (90%) of the cited works published in the *Bulletin* were also published in Spanish or Portuguese in the *Boletín*, there was relatively little need to cite the *Bulletin's* English-language material.

Within this context, it is noteworthy that the 18 selected journals failing to cite *Bulletin* material included three of the four that did not cite works in the *Boletín*. However, the English-language *West Indian Medical Journal*, which did not cite *Boletín* material during the study period, contained articles that cited works in the *Bulletin* on 10 occasions.

In general, the previously described trends for categories and types of *Boletín* material cited were similar to those observed for cited *Bulletin* material. In particular, references to works dealing with communicable diseases (dengue, trypanosomiasis, onchocerciasis, etc.) were the most frequent, with contributions on bacterial, fungal, viral, and parasitic diseases receiving 117 (53%) of the citations. Also, articles reporting original research received the bulk of the attention, accounting for 202 (91%) of the citations.

PAHO's Scientific Publications Series

PAHO's Scientific Publications, nearly all of them published in Spanish, were cited 1 064 times by works in all but three of the selected journals. In all, 203 PAHO titles published between 1959 and 1992 were cited. The number of citations per journal ranged from 1 to 263. In general, the journals that did not cite PAHO's Scientific

Publications tended to be the same as those that cited PAHO's periodicals very infrequently, and in many cases the number of times the Scientific Publications were cited by a journal tended to roughly equal the number of times works in the *Boletín de la OSP* were cited by that journal.

Overall, the selected journals most often cited PAHO Scientific Publications published in 1973, 1976, 1977, 1985, and 1986. With regard to subject matter, Scientific Publications in the health statistics field were the most frequently cited. Within this field *Las Condiciones de Salud en las Américas* (eight editions), *Condiciones de Salud del Niño en las Américas*, and *Características de la Mortalidad Urbana* were cited 172 times, accounting for 16% of the 1 064 citations.

Regarding other subject headings, it was found that the largest single group of citations (90) focused upon four scientific publications dealing with American trypanosomiasis. More generally, works dealing with communicable diseases accounted for an important share (250, or 23%) of all the occasions on which PAHO's Scientific Publications were cited. In other areas, PAHO Scientific Publications dealing with maternal and child health were cited 54 times, and those on the subject of health services were cited 27 times. The remaining 561 citations referred to publications dealing with a wide range of topics.

Other PAHO Publications

Other PAHO publications were cited 1 076 times by the selected journals during the study period. Of this number, 391 referred to works in *Educación Médica y Salud*; however, 80% of these were "self-citations" appearing in the same journal. In general, journals that frequently cited works appearing in the *Boletín de la OSP* and PAHO's Scientific Publications Series also tended to cite other PAHO publications.

To summarize, the journals studied contained 3 806 citations referring to works appearing in PAHO publications. These were distributed as follows: 1 444 (38%) referred to works in the *Boletín de la OSP*; 1 064 (28%) referred to works in PAHO's Scientific Publications Series; 1 076 (28%) referred to other PAHO publications — 391 (10%) to works in *Educación Médica y Salud*; and 222 (6%) referred to works in the *Bulletin of PAHO*.

DISCUSSION AND CONCLUSIONS

The study reported here had certain clear limitations. To begin with, it was apparently possible to gain access to only 84% of the issues published by the study journals, although this figure may have been affected by the irregularity with which many Latin American health journals are published. That is, it was often difficult to determine the actual publication schedule — because various journals failed to issue several successive numbers, temporarily suspended publication, or published two or more numbers together. Also, the study dealt with a relatively small sample of the universe it sought to represent (almost 1 000 biomedical journals are published in Latin America and the Caribbean) (*6*). In addition, the sample was not selected randomly, but rather on the basis of specific selection criteria. For these reasons, generalizations about the findings obtained have been made cautiously, and a conscious effort has been made not to limit conclusions to strictly bibliometric measurements.

A recent study (*18*) found that 70–75% of the citations in a group of journals published in selected Latin American countries referred to works published outside the area, 5–10% (excluding self-citations) referred to publications within the area, and 12–20% were self-citations (referring to other works in the journal studied). It seems noteworthy that during our study period (1985–1992) the percentages of self-

citations in the *Boletín de la OSP* and *Educación Médica y Salud* fell within this latter range, 12.3% of all the citations appearing in the *Boletín de la OSP* and 15.9% of all those in *Educación Médica y Salud* being self-citations.

The foregoing citation pattern suggests that the PAHO publications referred to above probably accounted for at least half of all citations appearing in Latin American and Caribbean biomedical journals that referred to periodicals and other publications concerned primarily with that region. The fact that PAHO publications were cited by works in all but three (93.3%) of the selected journals also indicates that PAHO's publications are widely cited. Within this context, it is worth noting that the *Boletín de la OSP* was the most frequently cited Spanish-language publication found, works published in that journal being cited in all but four of the study journals.

A study conducted by the Institute of Scientific Information (ISI) using 1981 data (*3*) ranked 78 biomedical journals included in the *Science Citation Index* (SCI) according to the number of times the 279 690 articles contained in those journals were cited. The first eight journals on the list (which included *The Lancet, The New England Journal of Medicine,* and *The Journal of the American Medical Association*) accounted for 74% of the citations. The journal ranked ninth (*Acta Medica Scandinavica*) received just 2% of the citations. Only three Latin American journals, containing less than 0.2% of the total number of citations, were included on the list.

The current study found that over 4% of all citations contained in the selected Latin American biomedical journals referred to works in PAHO publications, with works in the *Boletín de la OSP* receiving roughly two-fifths of that total. These figures suggest that the impact of PAHO publications, especially of the *Boletín de la OSP*, is quite high in the field of Latin American research.

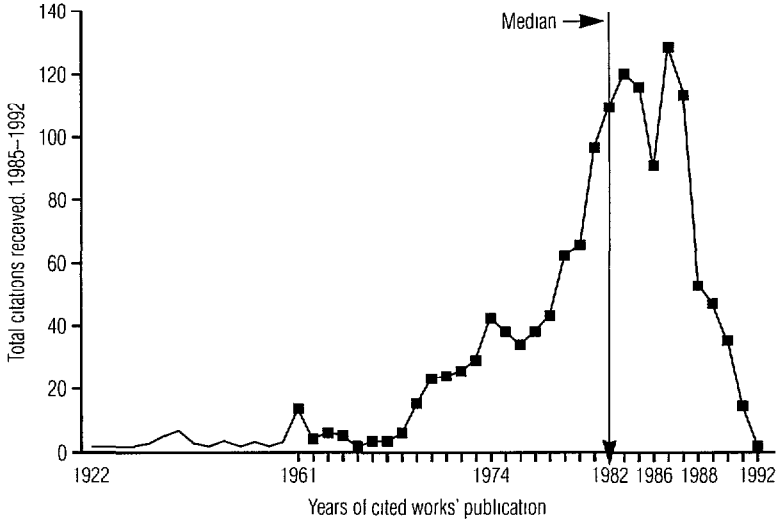
This impact cannot be determined from information appearing in the SCI data base because so few Latin American periodicals are represented there. In general, the ISI criteria for selecting journals appear to favor certain regions (*19*), as indicated by the fact that North America, Australia, Japan, and Europe provide more than 3 100 of its periodicals (98.5% of the total indexed), while Asia (excluding Japan), Africa, and Latin America combined account for only 46 (1.5% of the total) (*11*). As of 1992, the SCI included only 9 Latin American biomedical journals (*20*).

It was possible to calculate what are termed the "citation impact factor" and the "total impact factor" using an ISI algorithm and data obtained in the current study.[4] When this was done for the *Boletín de la OSP*'s 1990 articles it yielded citation and total impact factors (as indicated by citations in the first two years after publication) of 1.56 and 0.22, respectively. When the year 1986 and a longer citation period (from 1986 through 1992) were used, these figures increased to 2.80 and 0.75, respectively.

In general, the study found that articles on public health in Latin America and the Caribbean are often cited for a considerable number of years following publication. For example, as Figure 1 shows, citations in the 1985–1992 study journals referred to an array of works in the *Boletín de la OSP* whose median year of publication was 1982. Moreover, certain articles tended to be cited more than a decade after their publication; and in-

[4] The citation impact factor of a publication (scientific journal) for a particular year is defined as the number of times articles published by that journal are cited in the two years immediately following publication divided by the number of articles cited. Thus, if Journal A published 200 articles in 1993, of which 25 were cited a total of 150 times in 1994 and 1995, the citation impact factor of that journal would be 6 (150/25). In turn, the total impact factor is defined as the number of citations received by the journal's articles divided by the number of articles published. Thus, in the case just described the total impact factor of Journal A would be 0.75 (150/200).

Figure 1. Distribution of the 1 444 study journal citations of works published in the *Boletín de la Oficina Sanitaria Panamericana*, showing the years in which the cited works appeared.



deed, one of the two most frequently cited *Boletín* articles continued to be frequently cited more than 20 years after its publication.

Because of this, certain bibliometric indicators such as those commonly used to assess short-term impact may be inadequate for drawing more general conclusions, as they are typically calculated on the basis of citations received by a work during the first and second years following its publication (*3*). Not only does this tend to favor periodicals that publish works of very current interest, but it also hinders comparisons between different fields of investigation, because the typical "useful life" of knowledge in different fields tends to differ.

This long-term citation phenomenon results from the interaction of several factors. For one thing, partly because of the range of disciplines involved, the results of public health research studies tend to remain relevant for considerably more than two or three years following publication. Also, publication distribution systems in Latin America and the Caribbean tend to be slow. (A study conducted by the PAHO Publications Program determined that most readers receive the *Boletín de la OSP* with some delay—*21.*) In addition, the peer review and editing periods for articles appearing in Latin American biomedical journals tend to be quite long, the average time between submission of an article and its publication being on the order of 12 months (*14*).

In general, it appears that the various groups of PAHO publications dealt with in this study are cited with considerable frequency by the biomedical journals of Latin America and the Caribbean, particularly by those specializing in the field of public health and particularly by those indexed in the *Index Medicus* and SCI. Indeed, the *Boletín de la OSP* was found to be the most frequently cited journal of this type in the region, citations of its articles being contained in 91% of the journals included in the study sample.

REFERENCES

1. Nisonger T. The relationship between price and citation data for journals in two subject areas. *J Inf Sci* 1985;11:151–159.
2. Seglen PO. Causal relationship between article citedness and journal impact. *J Am Soc Inf Sci* 1994;45:1–12.
3. Garfield E. Which medical journals have the greatest impact? *Ann Intern Med* 1986;105: 313–320.
4. Grupo de Editores de Revistas Médicas. Sistemas de valoración de calidad de las revistas biomédicas mexicanas. *Rev Med IMSS* 1988;26:49–57.
5. Monge-Nájera J, Díaz L. Thirty-five years of tropical biology: a quantitative history. *Rev Biol Trop* 1988;36(2B):347–359.
6. LILACS. Literatura Latinoamericana en Ciencias de la Salud [CD-ROM data base updated every four months]. Version 16a. São Paulo: BIREME, OPS, OMS; 1993.
7. Banco Interamericano de Desarrollo. *Progreso económico y social en América Latina: informe 1988.* Washington, DC: BID; 1989.
8. Organización Panamericana de la Salud. Vol II: *Las condiciones de salud en las Américas.* 1994 ed. Washington, DC: OPS; 1994:395. (Publicación científica 549).
9. Frenk J, Bobadilla JL, Sepúlveda J, Rosenthal J, Ruelas E. Un modelo conceptual para la investigación en salud pública. *Bol Oficina Sanit Panam* 1986;101:477–492.
10. Organización Panamericana de la Salud. Vol I: *Las condiciones de salud en las Américas.* 1994 ed. Washington, DC: OPS; 1994:396–397. (Publicación científica 549).
11. Institute of Scientific Information. *Publications for the Science Citation Index.* Philadelphia: ISI; 1992.
12. National Library of Medicine. *List of journals indexed in* Index Medicus. Bethesda: NLM; 1994.
13. BIREME. *Directorio de publicaciones periódicas indexadas en la base de datos LILACS: metodología LILACS-6.* São Paulo: Organización Mundial de la Salud, Organización Panamericana de la Salud; 1990.
14. Zaher C. *Procedimientos editoriales empleados en la evaluación de artículos para publicación en periódicos de ciencias de la salud de América Latina y el Caribe.* Washington, DC: Organización Panamericana de la Salud; 1993.
15. Organización Panamericana de la Salud. *Bibliografía 70 años: Boletín de la Oficina Sanitaria Panamericana 1922–1992.* Washington, DC: OPS; 1992.
16. BIREME. *Descriptores en ciencias de la salud (DeCS): lista jerárquica.* São Paulo: Organización Mundial de la Salud, Organización Panamericana de la Salud; 1987.
17. BIREME. *Manual de indización: categoría SP-salud pública.* São Paulo: Organización Mundial de la Salud, Organización Panamericana de la Salud; 1990.
18. Programa de Publicaciones, Organización Panamericana de la Salud. *Situación de la comunicación científico-técnica en salud: estudio en países seleccionados.* Washington, DC: OPS; 1993. (Document OPS/HBI/93.01;1993).
19. Garfield E. How ISI selects journals for coverage: quantitative and qualitative considerations. *Curr Contents Life Sci* 1986;33:5–13.
20. Garfield E. Análisis cuantitativo de la literatura científica y sus repercusiones en la formulación de políticas científicas en América Latina y el Caribe. *Bol Oficina Sanit Panam* 1995;118:448–457.
21. Adler Opinion Research. Boletín's *readers: an analysis of the readers of the* Boletín de la Oficina Sanitaria Panamericana *and of their preferences and interests.* [Consultant report]. Washington, DC: Pan American Health Organization; 1993.

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Annex 1. Citations of PAHO publications by the study journals reviewed, by type of PAHO publication.

Title	Citations of PAHO publications				
	Boletín de la OSP	*Bulletin of PAHO*	Scientific publications	Other publications	Total
Acta Gastroenterológica Latinoamericana	6	0	5	0	11
Acta Médica Dominicana	1	0	0	1	2
Archivos Argentinos de Pediatría	42	0	38	23	103
Archivos de Investigación Médica and *Archives of Medical Research* (Mexico)	15	2	4	3	24
Archivos Latinoamericanos de Nutrición	20	1	19	6	46
Archivos de Medicina Interna	0	0	1	0	1
Archivos de Pediatría del Uruguay	6	0	11	5	22
Boletín de la Asociación Médica de Puerto Rico	1	0	3	1	5
Boletín Chileno de Parasitología	67	6	54	7	134
Boletín Epidemiológico de Antioquia	32	1	27	47	107
Boletín Médico del Hospital Infantil de México	49	3	32	21	105
Boletín de la Oficina Sanitaria Panamericana	271	38	183	92	584
Bulletin of PAHO	70	54	54	26	204
Cadernos de Saúde Pública	44	16	48	33	141
Cuadernos Médico Sociales (Rosario)	21	0	11	24	56
Cuadernos Médico Sociales (Santiago)	19	2	18	19	58
Educación Médica y Salud	22	0	55	460	537
Gaceta Médica de México	13	2	5	16	36
Ginecología y Obstetricia de México	5	0	3	3	11
Medicina (Bogotá)	0	0	0	0	0
Medicina (Buenos Aires)	13	2	12	12	39
Memorias do Instituto Oswaldo Cruz	30	13	29	12	84
Revista de Biología Tropical	0	0	0	0	0
Revista Brasileira de Saúde Ocupacional	8	1	4	5	18
Revista Chilena de Nutrición	17	2	15	8	42
Revista Chilena de Pediatría	38	9	33	22	102
Revista Costarricense de Ciencias Médicas	39	3	14	13	69
Revista Cubana de Higiene y Epidemiología	32	0	36	11	79
Revista Cubana de Medicina Tropical	52	4	25	11	92
Revista Cubana de Pediatría	30	2	18	14	64
Revista Cubana de Salud Pública	17	0	8	11	36
Revista del Hospital de Niños de Buenos Aires	11	1	3	7	22
Revista do Instituto de Medicina Tropical de São Paulo	43	6	24	14	87
Revista Latinoamericana de Perinatología	12	1	11	3	27
Revista Médica de Chile	59	14	58	16	147
Revista Médica de Costa Rica	6	0	3	6	15
Revista Médica del IMSS	15	0	11	8	34
Revista Médica de Panamá	2	0	10	6	18
Revista Médica del Uruguay	26	1	11	8	46
Revista de Obstetricia y Ginecología de Venezuela	6	0	12	1	19
Revista Sanidad Fuerzas Policiales	3	0	3	1	7
Revista do Saúde Pública	102	6	52	13	173
Revista de la Sociedad Brasileira de Medicina Tropical	39	7	23	2	71
Salud Pública de México	140	15	73	73	301
West Indian Medical Journal	0	10	5	12	27
Total	1 444	222	1 064	1 076	3 806