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# Who cites non-English-language pharmaceutical articles?

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## Abstract

### PURPOSE

The objective was to determine a link between the number of non-English language references in the bibliographies of publications in international pharmaceutical journals and the geographic origin of these publications.

### METHODS

A systematic prospective analysis of 7 international pharmaceutical journals in 2005–2006. All research articles whom corresponding author was a pharmacist were included. For each article, were recorded:

- the geographic origin of the corresponding author (classified in: North America, Latin America, Oceania, Europe, Asia, others);
- the title of the journal;
- the number of non-English language references in the bibliography (classified in: Spanish, German, French, Portuguese, Dutch, Russian, Japanese, Chinese, others).

### RESULTS

1,568 articles were included, corresponding to 45,949 bibliographic references, of whom 542 where non-English references. North America is the geographic zone of the world with the lowest rate of non-English language references in bibliographies of published articles; significant differences appear between North America and Europe, Latin America and Asia. A sub-analysis by countries shows that United States, United Kingdom, Australia and China present a specific low rate of non-English language references. The two journals with the lowest rate of non-English language references in bibliographies of published articles are edited in the USA.

### CONCLUSIONS

Despite some limitations, this study shows that pharmacists from regions where English language is the only or predominant language are refractory to include non-English language references in the bibliographies of their publications. The fundamental reasons of this restriction are not clear.

**MESH Keywords** Authorship ; Language ; Periodicals as Topic ; statistics & numerical data ; Pharmacists

**Author Keywords** English language ; publication ; pharmacy

## INTRODUCTION

By writing a scientific paper, a practical but crucial question is to realize an almost comprehensive analysis of the literature (this point is even more relevant for review articles and meta-analysis) (1 –3 ). But this approach is not easy because the various databases do not cover the totality of the scientific production on a specific topic (4 ). Furthermore, even if English seems to become the quasi-universal language of science (5 –10 ), many high-quality papers are published in others languages. It can be questioned if pharmacists of various countries actually realize as authors a comprehensive bibliographic analysis of the topic of their manuscripts (1 , 11 –13 ) by searching also non-English language articles. Until yet, there was no evidence to conclude.

## OBJECTIVE

The objective of the study was to determine a link between the number of non-English language references in the bibliographies of publications in international pharmaceutical journals and the geographic origin of these publications.

## METHODS

A systematic prospective analysis of 7 international pharmaceutical journals (Cf table I ) published in 2005–2006 was performed. All research articles whom corresponding author was a pharmacist were included. The corresponding author was determined as a pharmacist if

his/her title was mentioned, or if his/her professional affiliation or e-mail address mentioned a pharmaceutical entity (i.e. pharmacy department of a medical center, college of pharmacy of a university...). Every issue of the journals was analyzed, except the supplements. The articles where the whole title of the bibliographic references was not mentioned were not included.

For each article included, were recorded:

- the geographic origin of the corresponding author (classified in: North America, Latin America, Oceania, Europe, Asia, Africa);
- the country of the corresponding author;
- the title of the journal;
- the number of non-English language references in the bibliography (classified in: Spanish, German, French, Portuguese, Dutch, Russian, Japanese, Chinese, Italian, others).

The main outcome was the percentage of non-English language references in the bibliographies of publications for each geographic origin of the corresponding author. Secondary outcomes were: percentage of non-English language references in the bibliographies of publications for each country of the corresponding author, for each journal. Significant differences were searched for each criterion by Chi-squared test.

## RESULTS

1,568 articles were included (Table 1 ), corresponding to 45,949 bibliographic references, of whom 542 where non-English references (1.18%).

The percentage of non-English language references in the bibliographies of publications for each geographic origin of the corresponding author (main outcome) is shown in Table 2 : the homogeneity Chi-squared test is very significant ( $p < 0.0001$ ). North America is the geographic zone of the world with the lowest rate of non-English language references in bibliographies of published articles; significant differences appear between North America and Europe, Latin America and Asia.

The percentage of non-English language references in the bibliographies of publications for each nationality of the corresponding author is shown in Table 3 (only the 15 countries with the largest number of articles appear): the homogeneity Chi-squared test is very significant ( $p < 0.0001$ ). For Australia, all references without exceptions were in English. United States, United Kingdom and China present also a specific low rate of non-English language references. Significant differences appear between USA and almost all countries except United Kingdom, Australia and China.

The percentage of non-English language references in the bibliographies of publications for each journal is shown in Table 4 : the homogeneity Chi-squared test is very significant ( $p < 0.0001$ ). The two journals with the lowest rate of non-English language references in bibliographies of published articles are edited in the USA (Am J Health-System Pharm, J Pharm Sc); in opposition, the two journals with the highest rate of non-English language references in bibliographies of published articles are edited in Europe (Pharm World Sci, Eur J Hosp Pharm).

## DISCUSSION

### Study limitations

First is the role of self-citation (14 ). It is a commonplace that authors are likely to cite their own previous papers: thus, it is not illogical that - let's say: a Spanish pharmacist writing in English in international journals could easily cite its own previous articles published in Spanish. So, a greater frequency of non-English references in articles written by non-English native language pharmacists is not surprising.

The citation of regulatory texts of the country where the study was performed is not unusual and pharmacists often work in their own country. This could also explain this greater frequency of non-English references in articles written by non-English native language pharmacists.

A third limitation is linked to the role of the co-authors. As we only recorded the geographic origin of the corresponding author, it cannot be excluded that the bibliographic analysis was performed by co-authors of this paper, who could be of other native languages than the corresponding author.

Fourth, the panel of journals that we choose was not proved to be representative of pharmaceutical international journals; we selected journals on a practical considerations basis (availability in our University library). Even, some issues of Am J Health-System Pharm were not included because they vanished from the library before being examined.

A potential bias is the lack or the low number of pharmaceutical colleges in universities of some countries (i.e.: Belgium, Luxemburg, Russia...), which could draw pharmacists researchers to work in medical or scientific universities. This could impeach such people to be determined as pharmacists in our study. In fact, we do not identify a single Russian author in our study. Thus, we cannot exclude that our study is not comprehensive. Papers from Latin America, from Africa and, in lower manner, from Oceania, were in such low number that a valid statistical analysis could not be drawn.

Moreover is the case of non-Latin alphabets (i.e.: Cyrillic, Japanese, Korean, Chinese...). Bibliographic references in languages using such alphabets may be translated in English without mention of the original publication language; thus, it could prevent us to identify, for example, non-English references in Chinese manuscripts.

We initially planned to analyze the native language of the authors as a factor of citation of non-English language references, but we were not able to; indeed, if we could assume that, for instance, the native language of a German or Austrian author will be German, the situation of Canadian, Belgian or Swiss pharmacists could not be easily solved (5).

We only include articles written by pharmacists; our results cannot be generalized to others types of health professionals.

### **Rate of non-English language references: role of English native language?**

Globally, the rate of non-English language references that we observed (1.18%) is very lower than the rates which may be noted in non-English language journals (up to 7.9%) (15, 16).

Our study shows slight differences between geographic zones (table II). Pharmacists from Latin America, Europe and Asia are more likely to reference non-English language articles in their publications than North Americans. A sub-analysis on major-publishing countries (table III) revealed that pharmacists from only-English-speaking countries (USA, United Kingdom, Australia) were particularly refractory to include non-English language references in the bibliographies of their publications (rate of non-English language references from 0.00% to 0.26%). On the contrary, pharmacists from countries where English is not the only language (continental Europe, Canada, Japan) cite relatively often (1 to 6%) non-English language articles; in fact, they cite often works written in their own language: for example, in our study, 100% of non-English languages references cited by Japanese authors are in Japanese; 95% of non-English languages references cited by Spanish authors are in Spanish; 91% of non-English languages references cited by German (respectively French) authors are in German (respectively in French) (data not shown). The role of English native language is partly supported by the low rate of non-English language references in articles written by pharmacists from various countries where English is the official language or is dominant, but even in this group, slight differences between geographic zones remain: in our study, the rate is 1.23% in Irish articles, 1.04% in Nigerian articles, and 0.00% in articles from Hong-Kong, Singapore, New-Zealand, South Africa and India (data not shown). At the opposite, China has a very low rate of non-English language references, but it has been reported that Far-East countries were supposed to accept easily linguistic hurdles (7).

### **Rate of non-English language references: hypotheses**

It may be questioned why some pharmacists do not include non-English language references in the bibliographies of their published articles:

- they did not read these articles (they are not able to read others languages than English/they are not able to obtain non-English languages journals);
- they read these articles, but they considered that their quality was too poor to cite them;
- they initially included non-English language references in the bibliographies of their manuscripts, but the reviewers or editors suggested that these citations would be retracted (6, 17, 18).

While English is widely spoken by scientists all around the world (5, 6), it is possible on the contrary that only few English native language pharmacists can read or even scan a foreign language article (19): as 30% of US adult residents have not taken any foreign language instruction in schools (20) and 64% of community pharmacies in Milwaukee County (USA) are not able to communicate verbally with patients in non-English languages (21), it cannot be excluded that most US pharmacist-researchers only read English.

We may also speculate about a low diffusion of foreign pharmaceutical journals in North-American medical centers or universities (22, 23), but without serious basis; on the contrary, the low number of non-English languages journals in international databases could

prevent English native language pharmacists to identify relevant articles written in others languages ( 4 , 14 , 19 ). The poor quality of non-English language papers could be a speculative reason of their exclusion of bibliographic references, in spite several studies have shown that quality of papers and language were not correlated ( 12 , 24 , 25 ). But this idée reçue is still widely spread: in a Spanish study about nursing journals, the low citation of English documents was presented as a marker of scientific insularity ( 16 ).

Concerning the role of reviewers or editors, Ross et al . ( 26 ) provided evidence of bias in peer-review of cardiology papers, favoring authors from English-speaking countries. Man et al . ( 27 ) showed that English proficiency was strongly associated with publication output in the highest ranked medical journals. Tortosa-Serrano et al . ( 28 ) observed in a Spanish critical care journal a larger diversity of origins of bibliographic references than our series.

Last, the hypothesis that English native language pharmacists could concentrate on English-language references because it is easier to do is not to be rejected.

## CONCLUSION

We showed that non-English language works are seldom cited as bibliographic references in articles written by North-American pharmacists. This attitude is also frequent in articles written by British and Australian pharmacists. The role of native English language is probable, but the fundamental reasons of this restriction are not clear. However, it may lead in such cases to a partial bibliographic analysis and produce results different from those which have been obtained without restriction ( 3 ): this fact cannot be admitted by scientists ( 1 , 2 , 6 , 13 ). The assistance of multi-lingual documentalists to only-English-speaking pharmacists to access to international literature should be considered.

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**Table 1**

Journals analyzed

Title of journals	Number of articles included
American Journal of Health-System Pharmacy	315
Annals of Pharmacotherapy	467
Drug Delivery and Science Technology	110
European Journal of Hospital Pharmacy	36
European Journal of Pharmaceutical Sciences	204
Journal of Pharmaceutical Sciences	337
Pharmacy World and Science	99

**Table 2**

Percentage of non-English language references and geographic origin of author

Origin	Number of articles	Number of references	Number of non-English language references	Percentage of non-English language references	$\chi^2$ test (to North America)
North America	866	26,070	78	0.30%	/
Latin America	10	261	20	7.66%	p < 0.0001
Oceania	34	995	1	0.10%	NA
Europe	479	13,676	412	3.01%	p < 0.0001
Asia	166	4,631	27	0.58%	p < 0.01
Africa	13	316	4	1.27%	NA

NA: not applicable

**Table 3**

Percentage of non-English language references and country of author

Country	Number of articles	Number of references	Number of non-English language references	Percentage of non-English language references	$\chi^2$ test (to USA)
USA	816	24,354	49	0.20%	/
United Kingdom	93	2,649	7	0.26%	NS
Japan	54	1,675	18	1.07%	p < 0.0001
Netherlands	53	1,523	71	4.66%	p < 0.0001
Canada	50	1,716	29	1.69%	p < 0.0001
Spain	48	1,164	84	7.22%	p < 0.0001
Italy	42	1,305	10	0.77%	p < 0.0001
France	40	965	46	4.77%	p < 0.0001
Germany	31	1,239	75	6.05%	p < 0.0001
Denmark	27	805	13	1.61%	p < 0.0001
Australia	24	719	0	0.00%	NA
Sweden	24	733	27	3.68%	p < 0.0001
China	22	444	1	0.23%	NA
Belgium	21	539	14	2.60%	p < 0.0001
Switzerland	21	475	12	2.53%	p < 0.0001

NA: not applicable; NS: not significant

**Table 4**

Percentage of non-English language references and journal of publication

<b>Journal</b>	<b>Number of articles</b>	<b>Number of references</b>	<b>Number of non-English language references</b>	<b>Percentage of non-English language references</b>
Am J Health-Syst Pharm	315	7,877	45	0.45%
Ann Pharmacother	467	13,132	218	1.66%
Drug Delivery Sc Technol	110	2,834	19	0.67%
Eur J Hosp Pharm	36	659	21	3.19%
Eur J Pharm Sc	204	7,548	75	0.99%
J Pharm Sc	337	11,572	50	0.43%
Pharm World Sci	99	2,295	111	4.84%