ABSTRACT
Only one study evaluated the scientific activity in community pharmacies in Spain, and it was restricted to articles published in just two journals. Objective: To assess the scientific activity in community pharmacies in Spain through a bibliometric analysis of the original papers published during the years 1995-2005. Methods: IPA, MEDLINE, CSIC database and the journals Seguimiento Farmacoterapéutico and Pharmaceutical Care España were used as data sources. Production indicators, consumption indicators and the impact factor (IF) as a repercussion index were analyzed. Results: 122 articles were included in the review. The articles were published in 12 journals, 78.7% of them in Pharmaceutical Care España and Seguimiento Farmacoterapéutico. The mean number of authors per article was 4.2 (SD=2.1). The transitivity index was 71.3%. The total number of references cited in the articles was 2110. The mean number of references per article was 17.3 SD=9.3. The value of the insularity index was 57.6%. Self citation was 6.8% and the Price index was 66.5%. No impact factor was available for 6 journals. Conclusions: Publication of articles on community pharmacy-based research in Spain has undergone an important increase in the last 5 years. The existence of authors who publish very few studies, the high insularity index and the lack of randomized, controlled trials may be considered as negative indicators in community pharmacy-based research in Spain.

Keywords: Pharmacies. Bibliometrics. Authorship. Spain.

RESUMEN
Sólo existe un estudio bibliométrico conocido sobre investigación en farmacia comunitaria en España, y estaba centrado en los trabajos publicados únicamente en dos revistas. Objetivo: Evaluar la actividad científica en investigación en farmacia comunitaria en España realizando un análisis bibliométrico de los artículos originales publicados entre los años 1995-2005. Métodos: Se utilizaron como fuentes de datos IPA, MEDLINE, la base de datos del CSIC y las revistas Seguimiento Farmacoterapéutico y Pharmaceutical Care España. Se analizaron indicadores de producción, indicadores de consumo e indicadores de repercusión de los artículos publicados. Resultados: Se incluyeron 122 artículos en la revisión. Los artículos fueron publicados en 12 revistas, el 78.7% en Pharmaceutical Care España y Seguimiento Farmacoterapéutico. El número medio de autores por artículo fue 4,2 (DE=2,1). El índice de transitoriedad fue de 71,3%. El número total de referencias encontradas en los artículos fue de 2110 (17,3 DE=9,3 por artículo). El índice de aislamiento fue de 57,6%, el porcentaje de autocitación de 6,8% y el índice de Price de 66,5%. No se pudo estudiar el FI de 6 revistas. Conclusiones: La publicación de artículos de investigación en la farmacia comunitaria en España ha experimentado un crecimiento importante en los últimos 5 años. La existencia de autores que publican muy poco, el elevado índice de aislamiento y la falta de estudios experimentales controlados y aleatorizados pueden considerarse como indicadores negativos de la investigación en farmacia comunitaria en España.


INTRODUCTION
In the last decade, Spanish community pharmacies have incorporated into their existing services a series of extra activities included within the concept of Pharmaceutical Care, with the aim of achieving the maximum benefit from patients' therapy. These activities are endorsed by the new Spanish law of Guarantees and Rational Use of Medicines and Medical Devices.
Although implementation of these activities in daily practice has generally been lower than initially hoped, the challenges inherent in pharmaceutical care and pharmacists’ services in general, have been taken on by a large number of pharmacists in Spain. As evidence of this is the appearance of specialized journals such as Seguimiento Farmacoterapéutico and Pharmaceutical Care España. There has also been a noteworthy increase in the number of communications presented at conferences focusing in community pharmacies and pharmaceutical care. At the last Spanish National Congress on Pharmaceutical Care, held in Valencia in 2005, the number of communications was three times the number at the First National Congress on Pharmaceutical Care, held in San Sebastián in 1999.6

To achieve greater dissemination and implementation of pharmaceutical care and to confirm the value of the system, research to demonstrate the effectiveness of interventions by community pharmacists must be undertaken. This can be extended to the other services that community pharmacies offer, such as pharmacovigilance and health promotion.

Review of the scientific literature helps researchers to obtain information about the current state of research in particular areas, and how the system is working and designs being used. This allows researchers to identify and undertake new lines of research. Bibliometric analysis is a useful tool for obtaining information about scientific activity in a certain field or area.

Reviews of the scientific literature concerning community pharmacies in different countries and of pharmaceutical care in particular have been made, but there is no up-to-date review of research carried out in Spanish community pharmacies. The last known bibliometric study of community pharmacy research in Spain was carried out a decade ago and was centred on articles published in just two journals.

The aim of this study was to assess the scientific activity in Spanish community pharmacy through a bibliometric analysis of the original papers published during the years 1995-2005.

METHODS

A search for community pharmacy-based research published in biomedical journals in Spain in the period between January 1995 and December 2005 was carried out by using the following databases: International Pharmaceutical Abstracts (IPA), Medline, and the Spanish National Research Council (CSIC).8 A direct search was made in primary sources, specifically in the journals Seguimiento Farmacoterapéutico and Pharmaceutical Care España.

For the PubMed/MEDLINE search, the term community was used in combination with farmac* and Spain, and the search was limited to the period above mentioned. In another search the term community was combined with farmac* and the search was limited to articles originally published in Spanish. The term “pharmacy office” was used in another search.

For the search involving the CSIC database, the keywords farmacia* comunitaria*, oficina* de farmacia and atención farmacéutica y farmacia were used. These searches were conducted in the IME (biomedicine) and ICYT (science and technology) summaries.

In the IPA search the terms “community pharmac*”, “pharmaceutical care and community”, “community pharm* and Spain” were used and the search was limited to the period between 1995-2005.

The title and the abstract of the documents retrieved were examined to identify original articles, i.e., those presenting the results of original research, which has not been published previously and the structure of which usually follows the IMRD format (Introduction, Methods, Results and Discussion). Short communications presenting original research were also revised. When it was not clear from the abstract whether the study was original or not, the text of the article was revised. Articles that did not present the results of original work -such as review articles, articles expressing opinions or describing protocols- were excluded from review. Original articles by authors who were not community pharmacists (none of the authors), or studies that did not involve at least the participation of community pharmacists in the design and development of the research, were also excluded. The selection was made independently by two reviewers.

The articles retrieved were entered into a Microsoft Access database. The variables registered for each article were: main author, number of authors, year of publication, journal, objective, design and area of study, existence of grants or official funding and the number, year and origin of the bibliographic references.

Production indicators: The change in the number of publications in the period studied, the number of authors per publication, transitivity index (percentage of occasional authors with respect to total number of authors) and the scientific productivity per autonomous community were used as production indicators. To measure authors’ productivity, Lotka’s law was applied. The Lotka productivity index (decimal logarithm of the number of articles published) enabled grouping of authors according to their level of productivity: low productivity (1 publication and productivity index equal to 0), intermediate productivity (2-9 published articles and productivity index greater than 0 and less than 1) and high productivity (10 or more published articles and productivity index greater than or equal to 1).

Consumption indicators: The number of references per article, the percentage of self citations, the number of references in languages other than Spanish, the insularity index (percentage of references from the same country as the journal in which they were cited), Price index (percentage of references published within the past 5 years), the
different types of sources of the references and dispersal of references from primary sources, according to Bradford’s Law, were all recorded to obtain information about which journals are most commonly used by community pharmacists in their research. To identify the body of journals that comprise Bradford’s nucleus, the method proposed by Ferreiro was used.

Repercussion indicators: The impact factor of the journals in which the articles were published was studied as an indicator of repercussion.

The data obtained in the study was analysed by the G-Stat 2.0 statistical programme. Qualitative data were expressed as percentages and quantitative data as means (standard deviation).

RESULTS

491 articles were retrieved from the databases, and after excluding duplicated articles, only 26 complied with the inclusion criteria. A further 22 valid articles were found in Seguimiento Farmacoterapéutico, and 74 in Pharmaceutical Care España; a total of 122 articles were therefore included in the review. Of the articles retrieved, 11.5% were short communications, and 15.6% of the studies acknowledged receipt of some kind of grant or funding. The increase in the number of articles published in the period under consideration is shown in Figure 1. The articles finally included for consideration were published in 12 journals (Table 1), and 78.7% of the articles were published in Pharmaceutical Care España or Seguimiento Farmacoterapéutico. In 8 of the articles (6.6%) the original language was English, whereas the remaining articles were written in Spanish. These 8 articles were included in journals published in The Netherlands (Pharmacy World & Science), United States (Headache, The Annals of Pharmacotherapy and American Journal of Health-System Pharmacy) and New Zealand (Clinical Pharmacokinetics).

Of all of the articles selected, 24.6% were written by research groups, led by the Pharmaceutical Care Research group at the University of Granada (GIAF-UGR), with 9 studies of their own and 3 studies in collaboration with the Applied Pharmacology and Pharmacotherapy research group at the University of Seville (who also produced 2 articles of their own) and followed by the Berbés Pharmaceutical Care group (Pontevreda), with 4 articles.

The total number of references cited in the articles was 2110. The mean number of references per article was 17.3 (SD=9.3). The number of references in languages other than Spanish was 887 (42.0% of the total number of references), of which 99.7% were in English, and with a mean number of 7.3 (SD=8.2) references per article in a language other than Spanish. The value of the index of isolation was 57.6%. The percentage of self citation was 6.8 and the value of Price index was 54.5.
66.5%. 1608 (76.2%) references were to journal articles, 254 (12.0%) to book and dissertations, 79 (3.7%) references to legislative documents, 60 (2.8%) references to clinical guides and monographs, 56 (2.7%) to the Internet and press, and 53 (2.6%) to courses and communications in congresses. The 1608 references from primary sources appeared in a total of 349 journals. The journals comprising Bradford’s nucleus, calculated according to the method of Ferreiro1 are shown in Table 3.

The 122 articles on community pharmacy-based research in Spain during the period considered may correspond to community pharmacy-based sources examined, not all original articles have been retrieved.

Furthermore, as three databases and two primary sources were examined, not all original articles available to pharmacists for carrying out research were included in the analysis of consumption of information in journals in other fields and disciplines such as Hospital pharmacy. Hospital pharmacists participated in an exceptional manner in scientific research, which is largely due to the lack of time available to pharmacists for carrying out research studies. The transitivity index observed was high, with 71.3% of the authors included only having published one article. Some 223 of the authors showed low productivity, 89 authors intermediate activity and only one author was rated as highly productive. The fact that most authors have published only one article reflects a lack of continuity in research, partly attributed to the fact that one of the three specialized journals in which pharmacists can publish their work. The fact that in 2005 there was a decrease in the number of original articles may be partly attributed to the fact that one of the three-monthly issues of the journal Pharmaceutical Care España was not published.

The research groups make an important contribution to community pharmacy-based research. Most of the studies carried out by these groups were published in the latter years of the period considered, which demonstrates consolidation and an increase in the number of groups. The work carried out by these groups is not limited to research or collaboration with other researchers and their activities also include training and dissemination of pharmaceutical care.

The number of articles published appears to be related to the appearance in Spain of specialized journals such as Pharmaceutical Care España and Seguimiento Farmacoterapéutico. The number of original articles published rose from 1 in 1998 to 13 in 1999, coinciding with the release of the first volume of Pharmaceutical Care España, and from 17 in 2002 to 25 in 2003, the year in which the journal Seguimiento Farmacoterapéutico first appeared. The two journals published 78.7% of the articles considered, which demonstrates their importance in diffusion of community pharmacy-based research in Spain, and indicates the need for such specialized journals in which pharmacists can publish their work. The fact that in 2005 there was a decrease in the number of original articles may be partly attributed to the fact that one of the three-monthly issues of the journal Pharmaceutical Care España was not published.

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Some 40.7% of the references were in a language other than Spanish, and most were in English. The insularity index (57.6%) was higher than that observed in the analysis of consumption of information in journals in other fields and disciplines such as Farmacia Hospitalaria (25%)137, Cirugía

**Table 3. Journals in Bradford’s nucleus**

<table>
<thead>
<tr>
<th>Journals</th>
<th>References</th>
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<tbody>
<tr>
<td>Pharmaceutical Care</td>
<td>221</td>
</tr>
<tr>
<td>Atención Primaria</td>
<td>92</td>
</tr>
<tr>
<td>Medicina Clínica</td>
<td>58</td>
</tr>
<tr>
<td>American Journal of Health-System Pharmacy</td>
<td>55</td>
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<tr>
<td>British Medical Journal</td>
<td>49</td>
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<tr>
<td>El farmacéutico</td>
<td>40</td>
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<tr>
<td>Ars Pharmaceutica</td>
<td>36</td>
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<tr>
<td>Journal of the American Pharmacists Association</td>
<td>35</td>
</tr>
<tr>
<td>ITSNS/ Annals of Pharmacotherapy</td>
<td>34</td>
</tr>
<tr>
<td>Atención Farmacéutica/ JAMA†</td>
<td>32</td>
</tr>
<tr>
<td>Farmacia Profesional</td>
<td>26</td>
</tr>
<tr>
<td>Archives of Internal Medicine/ Lancet</td>
<td>25</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>794</strong></td>
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</tbody>
</table>

† JAMA: Journal of the American Medical Association

The impact factors (IF) of the journals in which the articles were published are shown in Table 1.

As regards the study design, 86.9% of the studies were descriptive, 11.5% quasiexperimental and 1.6% controlled, randomized experimental studies.

**DISCUSSION**

A fundamental part of research involves communication of the results in any way. In the present study, bibliometric indicators were used to describe the scientific activity in community pharmacies in Spain between 1995 and 2005. The bibliometric indicators used showed certain limitations, but allowed some understanding of the research activity for the period considered135. Furthermore, as three databases and two primary sources were examined, not all original articles corresponding to community pharmacy-based research in Spain during the period considered may have been retrieved.

The 122 articles on community pharmacy-based research (11.1 articles per year) represented a low rate of production compared with the rate of production of original articles in other fields in which there exists more experience in scientific research, such as hospital pharmacy. Hospital pharmacists published 260 articles in Farmacia Hospitalaria between 1995 and 2005.136 Production of scientific articles in community pharmacies in Spain is, however, similar to that in other countries, such as for example, Canada; in Canada, 38 original articles2 were published between 1995 and 2001, and 40 original articles were published in Spain in the same period. In a study of worldwide research in Pharmaceutical Care in the past 5 years, Spain occupied a high position in terms of production, below the USA, at the same level as the UK and above countries such as France, Italy and Germany.

Our study showed that scientific output in community pharmacy research has notably increased in the study period. Only 25 articles were published in the first 6 years, between 1995 and 2000, whereas some 97 articles were published between 2001 and 2005. However, in 2005 there was a slight decrease in the numbers of articles published.

The increase in the number of articles published appears to be related to the appearance in Spain of specialized journals such as Pharmaceutical Care España and Seguimiento Farmacoterapéutico. The number of original articles published rose from 1 in 1998 to 13 in 1999, coinciding with the release of the first volume of Pharmaceutical Care España, and from 17 in 2002 to 25 in 2003, the year in which the journal Seguimiento Farmacoterapéutico first appeared. The two journals published 78.7% of the articles considered, which demonstrates their importance in diffusion of community pharmacy-based research in Spain, and indicates the need for such specialized journals in which pharmacists can publish their work. The fact that in 2005 there was a decrease in the number of original articles may be partly attributed to the fact that one of the three-monthly issues of the journal Pharmaceutical Care España was not published.

The research groups make an important contribution to community pharmacy-based research. Most of the studies carried out by these groups were published in the latter years of the period considered, which demonstrates consolidation and an increase in the number of groups. The work carried out by these groups is not limited to research or collaboration with other researchers and their activities also include training of other pharmacists in research methods and in pharmaceutical practice, and the promotion and diffusion of pharmaceutical care.

The transitivity index observed was high, with 71.3% of the authors included only having published one article. Some 223 of the authors showed low productivity, 89 authors intermediate activity and only one author was rated as highly productive. The fact that most authors have published only one article reflects a lack of continuity in research, partly resulting from the exceptional nature of the research carried out by some authors and also the lack of consolidation in community pharmacy-based research, which is largely due to the lack of time available to pharmacists for carrying out research studies.

Some 40.7% of the references were in a language other than Spanish, and most were in English. The insularity index (57.6%) was higher than that observed in the analysis of consumption of information in journals in other fields and disciplines such as Farmacia Hospitalaria (25%)137, Cirugía
Española (13.2%) and Medicina Clínica (14%). This indicates a lack of quality in the bibliographic review, which is often restricted to the most accessible sources of information.

Some 75.7% of the references originated from primary sources of information, which indicates the importance of journals as the main mechanisms of research diffusion.

The high Price index (66.9%) may be attributable to the early stage of development of community pharmacy-based research and therefore the relative recentness of the studies that can be cited.

Analysis of primary sources scattering used revealed a nucleus of 15 journals, which are the most commonly used for carrying out research studies. Pharmaceutical Care España was the most important of these journals. Bradford’s nucleus did not contain the journal Seguimiento Farmacoterapéutico, probably because of its short life since the first volume was published in 2003. The nucleus of publications represented 4.3% of the total number of primary publications, but contained 49.4% of the total number of references cited. Of the 15 journals, 7 (46.7%) are published in English.

The Institute for Scientific Information (ISI: Philadelphia, USA) calculates the yearly IF for all journals included in the Science Citation Index, the Social Science Citation Index and the Arts & Humanities Citation Index databases and publishes them in the Journal Citation Reports (JCR). Many Spanish journals are not included in these databases, and thus a study entitled “Potential impact factors of Spanish medical journals”, was carried out with the purpose of determining the national and international IF of Spanish biomedical journals. The international IF is the impact factor that would be assigned to the databases considered by the ISI.

A single IF was assigned to the journals for the period considered because the interannual variation in IF is very low. The absence of IF for several of the journals, including the two in which most of the articles were published places doubts on the usefulness of IF to indicate the state of community pharmacy-based research in Spain.

Most studies carried out in community pharmacies are descriptive, and there is a lack of analytical studies, particularly those involving controlled, randomized experiments. This appears to be a common situation in research in Pharmaceutical Care.

Controlled, randomized experimental studies provide the best scientific evidence and are necessary for demonstrating that interventions by community pharmacists have positive repercussions on the health of patients. Furthermore, the researchers should meet the standards of quality for these types of studies.

CONCLUSIONS

Publication of articles on community pharmacy-based research in Spain has undergone an important increase in the last 5 years, partly due to the appearance of specialized journals.

The contribution of research groups is fundamental for the future of community pharmacy-based research.

The existence of authors who publish very few studies and the high insularity index observed in the articles may be considered as negative indicators in community pharmacy-based research in Spain.

The research carried out in community pharmacies should include more scientific evidence, obtained by correctly designed controlled, randomized experiments.

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