

Original article

Characteristics and Longevity of Electronic Citations in Four Leading Biomedical Journals in Spain



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ABSTRACT

Introduction and objectives: We aimed to determine the frequency of use and accessibility over time of electronic citations in *Revista Española de Cardiología* and 3 other Spanish biomedical journals, and to identify the factors that influence the accessibility and retrievability of these links.

Methods: A cross-sectional, descriptive study was performed of all the references in articles published in the first issue of each even year from 2002 to 2012 in selected journals. Data were collected on the journal, publication, references, and links. The variables analyzed were the percentage of articles with at least 1 electronic citation, the percentage of electronic citations with respect to the total number of citations in the full sample, and the percentages of link accessibility and retrievability.

Results: We included 377 articles, of which 73 (19.4%; 95% confidence interval, 15.2%-23.5%) had at least 1 electronic citation, and a total of 7077 references, of which 164 (2.3%; 95% confidence interval, 2.0%-2.7%) were electronic citations. *Revista Española de Cardiología* had 17 (15.2%) and 38 (1.3%), respectively. Use of electronic citations significantly increased over time (linear tendency, $P < .001$); 58 (35.4%; 95% confidence interval, 27.7%-43.0%), links were accessible, and information was retrieved in 55 cases (51.9%; 95% confidence interval, 41.9%-61.9%). Accessibility significantly decreased over time (linear tendency, $P < .001$); 45 electronic citations (27.5%; 95% confidence interval, 20.3%-34.6%) had complete additional information. Retrievability was significantly associated with the amount of additional information (linear tendency, $P < .001$).

Conclusions: Electronic citations are increasingly used in some Spanish biomedical journals. Access to electronic citations is lost over time, and the probability of its retrieval is associated with the existence of additional information.

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Características y evolución temporal de las citas electrónicas de cuatro de las principales revistas biomédicas españolas

RESUMEN

Introducción y objetivos: El objetivo es determinar la frecuencia de uso y la disponibilidad en función del tiempo de las citas electrónicas recogidas en *REVISTA ESPAÑOLA DE CARDIOLOGÍA* y otras tres revistas biomédicas españolas, así como los factores que pueden influir en la disponibilidad y la recuperabilidad de los enlaces.

Métodos: Estudio descriptivo transversal que incluyó todas las citas de los trabajos publicados en el primer número del año de las revistas seleccionadas en los años pares desde 2002 hasta 2012. Se recogieron datos de revista, publicación, citas y enlaces. Las variables resultado fueron: porcentaje de artículos con al menos una cita electrónica, porcentaje de cita electrónica respecto al total de citas y porcentaje de accesibilidad y recuperabilidad de los enlaces.

Palabras clave:

Citas electrónicas

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Web

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Resultados: Se incluyeron 377 trabajos, de los que 73 (19,4%; intervalo de confianza del 95%, 15,2-23,5) incluyeron al menos una cita electrónica, y 7.077 citas bibliográficas, de las que 164 (2,3%; intervalo de confianza del 95%, 2,0-2,7) fueron citas electrónicas. REVISTA ESPAÑOLA DE CARDIOLOGÍA incluyó 17 (15,2%) y 38 (1,3%) respectivamente. La frecuencia de uso se incrementó significativamente con el tiempo (tendencia lineal, $p < 0,001$); 58 (35,4%; intervalo de confianza del 95%, 27,7-43,0) enlaces estaban accesibles y la información se recuperó en 55 casos (51,9%; intervalo de confianza del 95%, 41,9-61,9). La disponibilidad disminuyó significativamente con el tiempo (tendencia lineal, $p < 0,001$); 45 citas electrónicas (27,5%; intervalo de confianza del 95%, 20,3-34,6) presentaban toda la información adicional. La recuperabilidad se ha relacionado significativamente con la cantidad de información adicional (tendencia lineal, $p < 0,001$).

Conclusiones: Se está haciendo un uso cada vez más frecuente de citas electrónicas en ciertas revistas biomédicas españolas. La disponibilidad se pierde con el tiempo, y la probabilidad de recuperarla se relaciona con la información adicional.

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Abbreviations

EC: electronic citation

REC: *Revista Española de Cardiología*

INTRODUCTION

Electronic citations (EC) have become more common in biomedical journal publications in the past decade. In 2003, a study of 3 international, high-impact journals reported that 30% of articles contained at least 1 EC, accounting for 2.6% of all references at that time.¹ Electronic citations are now used to such an extent that they are ranked third in terms of reference type, after biomedical journal articles and books.²

Electronic resources have major advantages over traditional print publications because information can be updated quickly, constantly, and efficiently and can be distributed to potential readers almost instantly. In addition, electronic resources can supply supplementary material without space restrictions and in alternative formats, such as videos, high resolution images, simulations, audio files, databases, and program source code.¹⁻³ However, they have 2 main drawbacks: identifying who is responsible for them, and ensuring their quality, accessibility, and permanence.⁴ Unlike print media, information on the Internet may suddenly disappear.⁵ In fact, it has been observed that a web page has an average life of just under 2 years,⁶ a period that is reduced to 100 days in some contexts.⁷ In the case of biomedical publications, 1 study reported that 4.4% of ECs in leading journals were inaccessible just 3 months after publication.⁸

Some articles that analyze the frequency of use or accessibility of ECs in specific journals and areas of knowledge have been published in non-English language journals,^{1,2,9,10} but very few have been published in Spain. In the case of *Revista Española de Cardiología* (REC), there are no studies on the use of ECs in its articles. Therefore, in view of the above, this study aimed to: a) determine the frequency of use and longevity of ECs in articles published in REC and 3 other leading Spanish biomedical journals; b) study the quality of the ECs and the characteristics of the links; c) analyze the factors that may influence link accessibility and retrievability, and d) perform a comparative analysis between REC and the other selected medical journals.

METHODS

Study Design

A cross-sectional, descriptive study was performed using systematic sampling to cover all the references in articles

published in the first issue of each even year from 2002 to 2012 in REC, *Emergencias*, *Revista Clínica Española* and *Medicina Clínica*. We selected these Spanish medical journals due to their wide dissemination and scientific impact in 2011 (with respective impact factors for that year of 2.530, 2.486, 2.008, and 1.385, and quartile scores of Q2, Q1, Q2 and Q2 in their subject categories, according to *Journal Citation Reports Science Edition 2011*, which was the latest version available when we planned this study).¹¹ We excluded supplements, special issues, and monographs sponsored by the pharmaceutical industry.

Study Protocol

We performed a search of all articles and references in the selected journals using their electronic versions between October 15, 2012 and November 15, 2012.

Independent variables were journal name, publication year, article type, total number of references, and the number of ECs. An EC was defined as a reference to a source document or resource published electronically on the Internet. For this study, we included any references with a hyperlink in the form of a uniform resource locator (URL) to a web page as the main source document. Links to articles in electronic format with a DOI (digital object identifier) and publishers with journals indexed by *Journal Citation Reports* were not considered ECs. To determine the frequency of EC use, we calculated the percentage of articles with at least 1 EC and the percentage of ECs out of all references as dependent variables.

In addition to accessibility, the presence of additional information recommended by the International Committee of Medical Journal Editors¹² was also reported for each EC. The recommended additional information was defined as complete if it included the URL, date of any review, and the citation date. For links, we collected data on the publisher, link type, the presence of a quality seal, and localization.

To analyze EC accessibility, we copied the URL from the reference in the article and pasted it in the Google search engine. If the link did not work on at least 2 different days, we then tried the Bing search engine. Links that opened an active web page but not the page referenced in the EC were classified as "accessible but imprecise". If links were inaccessible or imprecise, we analyzed the error type and degree of retrievability using the additional information provided in the EC.

Statistical Analysis

Qualitative variables were expressed as absolute and relative frequencies and the association between them was analyzed using Pearson's chi-square test or Fisher's exact test, as appropriate. Linear tendency was also studied for ordinal variables. To assess

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