

BMJ Open National citation patterns of *NEJM*, *The Lancet*, *JAMA* and *The BMJ* in the lay press: a quantitative content analysis

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ABSTRACT

Objectives To analyse the total number of newspaper articles citing the four leading general medical journals and to describe national citation patterns.

Design Quantitative content analysis.

Setting/sample Full text of 22 general newspapers in 14 countries over the period 2008–2015, collected from LexisNexis. The 14 countries have been categorised into four regions: the USA, the UK, Western World (European countries other than the UK, and Australia, New Zealand and Canada) and Rest of the World (other countries).

Main outcome measure Press citations of four medical journals (two American: *NEJM* and *JAMA*; and two British: *The Lancet* and *The BMJ*) in 22 newspapers.

Results British and American newspapers cited some of the four analysed medical journals about three times a week in 2008–2015 (weekly mean 3.2 and 2.7 citations, respectively); the newspapers from other Western countries did so about once a week (weekly mean 1.1), and those from the Rest of the World cited them about once a month (monthly mean 1.1). The New York Times cited above all other newspapers (weekly mean 4.7). The analysis showed the existence of three national citation patterns in the daily press: American newspapers cited mostly American journals (70.0% of citations), British newspapers cited mostly British journals (86.5%) and the rest of the analysed press cited more British journals than American ones. *The Lancet* was the most cited journal in the press of almost all Western countries outside the USA and the UK. Multivariate correspondence analysis confirmed the national patterns and showed that over 85% of the citation data variability is retained in just one single new variable: the national dimension.

Conclusion British and American newspapers are the ones that cite the four analysed medical journals more often, showing a domestic preference for their respective national journals; non-British and non-American newspapers show a common international citation pattern.

INTRODUCTION

Citations of medical journals by other journals included in the Journal Citation Reports are critical for scientific publications. They are used to calculate the journal impact factor, which the academic community views as a proxy for its scientific relevance and influence. It is important to remember that medical journals are also cited by general

Strengths and limitations of this study

- This is the first study that analyses the citations of the four leading general medical journals in the lay press.
- This study shows the existence of a national factor in science communication that needs to be further monitored and analysed.
- Citation and correspondence analyses offer a new way to quantify and monitor the media impact of scientific journals.
- This study is observational and descriptive; thus, it does not allow direct inference of causality.
- This study is limited in scope, since the 22 international newspapers from 14 countries as well as the 4 journals from 2 countries are selected according to their relevance; but they are not a representative random sample of the enormous diversity of the lay and scientific publications around the world.

newspapers and that these press citations—the number of press articles in which the name of a specific medical journal is cited—are also important for medical journals,¹ since press citations increase the visibility of papers and boost the number of citations in scientific journals.^{2–5} Therefore, they are an indication of relevance and influence, although in this case it is social rather than scientific. For these and other reasons, most leading medical publications issue press releases.⁶

Despite this relevance, citations in the lay press have been studied very little, and only a few small-scale studies have counted the citations of some medical journals in the press of a single country.^{1,7} Quantifying how often medical journals are mentioned in the lay press would provide an estimate of the social impact and influence of those journals and an indicator of the media's coverage of biomedicine and how relevant medical journalism is in different newspapers and countries. With the first objective of answering these questions, we performed the first analysis of press citations of the four leading general medical



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journals in a set of selected newspapers from countries all over the world.

A previous study showed that most of the authors of original papers published in *NEJM*, *The Lancet*, *JAMA* and *The BMJ* were more frequently affiliated to institutions in the same country as the journal; one exception was *The Lancet*, which is the journal with the highest proportion of papers from a country other than the journal.⁸ We hypothesise that both the nationality of the journal and the nationality of the authors who publish in that journal are related to the number of citations, and that it is possible to identify some national citation patterns in the international lay press. Thus, it may be that American and British newspapers have a domestic preference for American or British journals, while other newspapers cite *The Lancet* more, as this journal has been shown to publish more papers from non-American and non-British authors of medical research.⁸ Our second objective in collecting this citation data was to study the relationships ('correspondences') between newspapers and journals (which journals are cited by which newspapers) and to what extent these might be linked to national patterns.

METHODS

We selected the four journals with the highest number of total cites from the 2015 Journal Citation Reports (JCR, Medicine, General and Internal): *NEJM*, *The Lancet*, *JAMA* and *The BMJ*. We then used the LexisNexis database to search through the full text of 22 daily newspapers, seeking any 2008–2015 citations to the four journals. The newspapers were selected according to four criteria; they had to be written in English, Spanish, French, German or Italian; considered a national quality newspaper; ranked the highest in circulation in its country and included in LexisNexis during the study period. The selected newspapers are listed in [table 1](#) and classified under four areas of the world: the USA, the UK, the Western World (Canada, Australia, New Zealand and European countries other than the UK) and the Rest of the World.

We counted as a journal citation every newspaper article in which the journal is cited, no matter how many times. The citation search in LexisNexis was performed between May and July 2016.

We applied the correspondence analysis technique⁹ to the citation data in order to display the data on a two-dimensional plot showing the relationships or similitudes between the 22 newspapers and the 4 medical journals. Thereby, the more a newspaper cited a medical journal, the closer they were on the plot. This descriptive statistical technique, which allows a visual examination of any structure or pattern in the data, was performed to show the best two-dimensional approximation of the relationships between rows (newspapers) and columns (medical journals).

RESULTS

Of the 22 analysed newspapers, *The New York Times* is by far the one that cited the four analysed medical journals more often (weekly mean of 4.7 citations in the period 2008–2015). Overall, the British and American newspapers mentioned a journal on average two to three times a week (weekly mean of 3.2 and 2.7 citations, respectively); the newspapers from the Western World region did so about once a week (weekly mean of 1.1 citations); and the newspapers from the Rest of the World region cited a journal about once a month (monthly mean of 1.1 citations) ([table 1](#) and [figure 1](#)).

The Lancet was the most cited journal in the lay press of almost all analysed Western countries except the USA (which favoured *NEJM*) and the UK and Australia (where *The BMJ* ranked first).

The US newspapers cited mostly the US medical journals (2352 citations out of 3360, 70.0%), while the UK press cited almost exclusively British journals (3466 citations out of 4008, 86.5%). The remaining lay press that was analysed cited British journals rather more than American, by a ratio of 2 to 1 (3474 citations out of 5450, 63.7%) ([figure 2](#)).

The correspondence analysis performed with the citation data in [table 1](#) provided a two-dimensional plot ([figure 3](#)), showing two new calculated orthogonal dimensions that maximise the information retained in terms of relationships between rows (newspapers) and columns (medical journals). In other words, the plot displays the relationships between newspapers and medical journals according to citations data while creating new dimensions that independently retains the maximum possible information.

The plot ([figure 3](#)) retains 98.55% of all the citation data variability in [table 1](#): horizontal dimension 1, labelled as the national dimension, retains 85.42% in new coordinates while the vertical dimension 2 retains 13.13% variability. British newspapers are closer to the British journals, *The Lancet* and *The BMJ*, while the same occurs with American newspapers and journals. The lay press from the Western World and the Rest of the World are represented around the centre of the plot. The new coordinates in dimension 1 quantify the distribution of relationships between newspapers and journals from -1 to 1. The USA and the UK mostly exhibit some extreme coordinates on the plot: among the American newspapers, *The New York Times* is represented at around 0.9 while both the *USA Today* and *Washington Post* remained at around 0.7; among the British press, the *Telegraph* scored around 0.6 while both *The Times* and *The Guardian* remained at around 0.5.

DISCUSSION

We present here a description of the number of press citations from the four leading general medical journals in 22 newspapers in the period of 2008–2015. Our analysis shows quantitatively and graphically some expected results. First, *The Lancet* is the most cited journal overall.

This result was expected because the *NEJM*, which is ranked as the first in JCR (Medicine, General and Internal), does not issue press releases and this, in theory, penalises its impact on the press.

Second, the citations of the four analysed medical journals are significantly higher in the American and British newspapers than in the rest of the world's lay press. This pre-eminence of medical journalism from the UK and the USA corresponds to their greater scientific tradition and its dominant position in the scientific literature. The four analysed journals are either British or American, and so are the next six highest rankings in JCR (Medicine, General and Internal), as well as many of the top 100. What is more interesting is the fact that the majority of authors who publish in these four journals are also either British or American.⁸

Third, the newspaper that cites the four journals the most is The New York Times. This is not a surprise because of its tradition of quality and supporting medical and scientific journalism (in 1978, it was the first media publication in the world to issue a large science and medicine section, with a staff of 10 science and medical reporters—which, 25 years later, grew to 5 editors and 16 reporters).¹⁰

Fourth, correspondence analysis (figure 3) confirms the existence of a British-American polarity, shown in dimension 1 (horizontal). On the left are the newspapers and medical journals that make up the British pole and on the right are those that make up the American pole. The international press occupy intermediate coordinates, many of them next to *The Lancet*. The three identified patterns of citations (American, British and international)

Table 1 Citations of *NEJM*, *The Lancet*, *JAMA* and *The BMJ* in 22 newspapers in 14 countries and 4 world regions: the USA, the UK, Western World and the Rest of the World (2008–2015).

| Region | | <i>NEJM</i> | <i>The Lancet</i> | <i>JAMA</i> | <i>The BMJ</i> | Cites in four medical journals | | |
|-----------------------------|--------------|-------------|-------------------|-------------|----------------|--------------------------------|---------|--------|
| Newspaper (country) | Abbreviation | Cites | Cites | Cites | Cites | Total | Monthly | Weekly |
| (USA) | | | | | | | 11.7 | 2.7 |
| The New York Times | NYT | 786 | 359 | 537 | 263 | 1945 | 20.3 | 4.7 |
| USA Today | USATod | 228 | 61 | 219 | 48 | 556 | 5.8 | 1.3 |
| Washington Post | Washin | 336 | 134 | 246 | 143 | 859 | 8.9 | 2.1 |
| (UK) | | | | | | | 13.9 | 3.2 |
| Daily Telegraph | Telegr | 93 | 470 | 80 | 840 | 1483 | 15.4 | 3.6 |
| The Times | Times | 108 | 431 | 89 | 637 | 1265 | 13.2 | 3.0 |
| The Guardian | Guard | 114 | 503 | 58 | 585 | 1260 | 13.1 | 3.0 |
| (Western World) | | | | | | | 4.7 | 1.1 |
| Die Welt (DE) | Welt | 74 | 159 | 41 | 89 | 363 | 3.8 | 0.9 |
| Der Tagesspiegel (DE) | Tages | 109 | 166 | 63 | 89 | 427 | 4.4 | 1.0 |
| Le Figaro (FR) | Figaro | 158 | 176 | 64 | 86 | 484 | 5.0 | 1.2 |
| Le Monde (FR) | Monde | 111 | 222 | 43 | 100 | 476 | 5.0 | 1.1 |
| Corriere de la Sera (IT) * | Corrie | 143 | 247 | 60 | 137 | 587 | 7.0 | 1.6 |
| La Stampa (IT) | Stampa | 60 | 73 | 17 | 40 | 190 | 2.0 | 0.5 |
| El País (ES) | Pais | 88 | 163 | 34 | 80 | 365 | 3.8 | 0.9 |
| El Mundo (ES) | Mundo | 134 | 138 | 90 | 75 | 437 | 4.6 | 1.0 |
| The Australian (AT) | Austra | 91 | 218 | 102 | 256 | 667 | 6.9 | 1.6 |
| Toronto Star (CA) | Toront | 135 | 179 | 96 | 129 | 539 | 5.6 | 1.3 |
| The New Zealand Herald (NZ) | NZH | 71 | 143 | 38 | 139 | 391 | 4.1 | 0.9 |
| (Rest of the World) | | | | | | | 1.1 | 0.3 |
| La Nación (AR) | Nacion | 16 | 20 | 3 | 9 | 48 | 0.5 | 0.1 |
| O Globo (BR) | Globo | 20 | 18 | 10 | 20 | 68 | 0.7 | 0.2 |
| Jerusalem Post (IL) | Jerusa | 38 | 51 | 13 | 61 | 163 | 1.7 | 0.4 |
| El Universal (MX) | Univer | 5 | 11 | 2 | 9 | 27 | 0.3 | 0.1 |
| The Star (ZA) | Star | 30 | 122 | 17 | 49 | 218 | 2.3 | 0.5 |

*Data available from 27 January 2009. DE, Germany; FR, France, IT, Italy; ES, Spain; AT, Australia; CA, Canada; NZ, New Zealand; AR, Argentina; BR, Brazil; IL, Israel; MX, Mexico; ZA, South Africa.

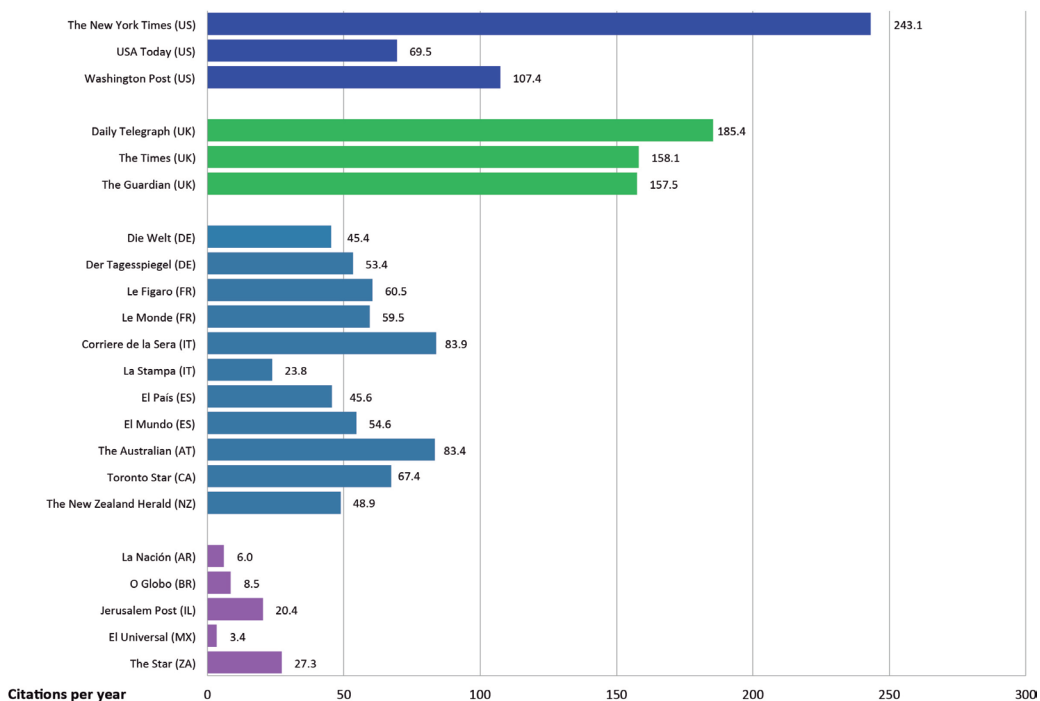


Figure 1 Citations per year of *NEJM*, *The Lancet*, *JAMA* and *The BMJ* in 22 newspapers in 14 countries and 4 world regions: the USA, the UK, Western World (Germany, DE; France, FR; Italy, IT; Spain, ES; Australia, AT; Canada, CA; New Zealand, NZ) and the Rest of the World (Argentina, AR; Brazil, BR; Israel, IL; Mexico, MX; South Africa, ZA) (2008–2015).

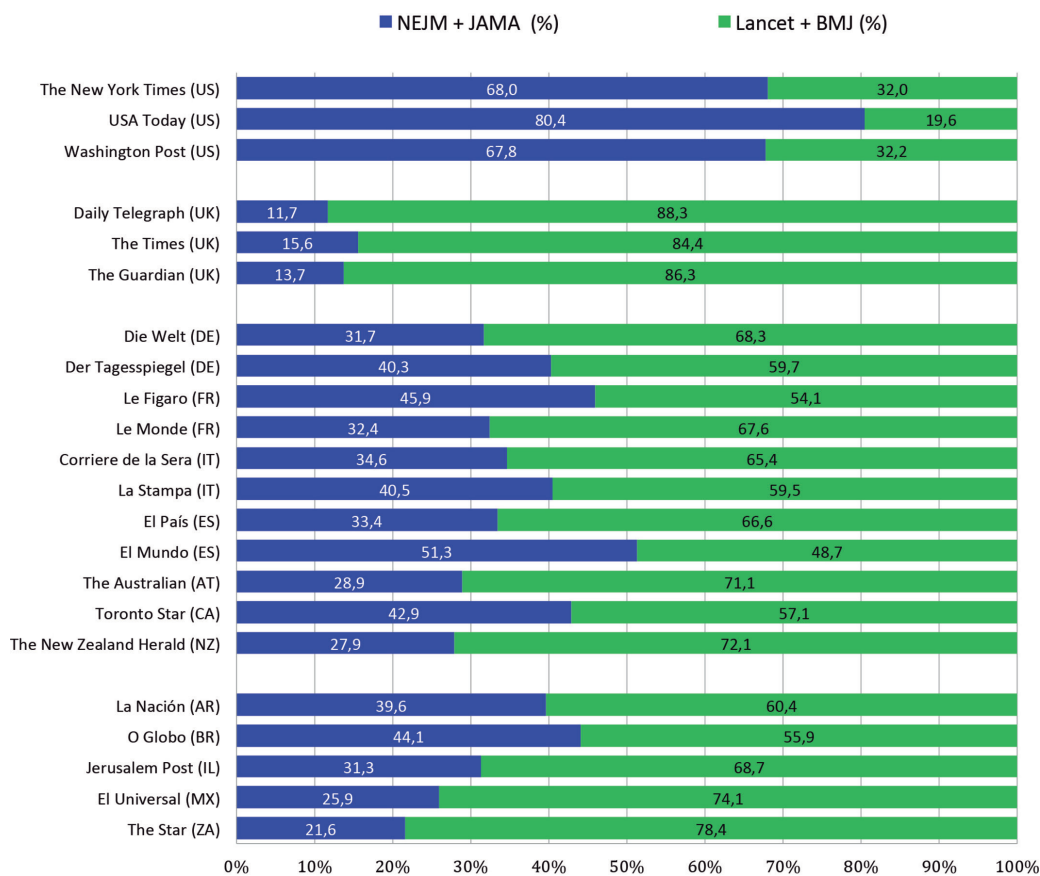


Figure 2 Citations (%) of American journals (*NEJM* and *JAMA*) vs British journals (*The Lancet* and *The BMJ*) in 22 newspapers in 14 countries: the USA, the UK, Western World (Germany, DE; France, FR; Italy, IT; Spain, ES; Australia, AT; Canada, CA; New Zealand, NZ) and the Rest of the World (Argentina, AR; Brazil, BR; Israel, IL; Mexico, MX; South Africa, ZA) (2008–2015).

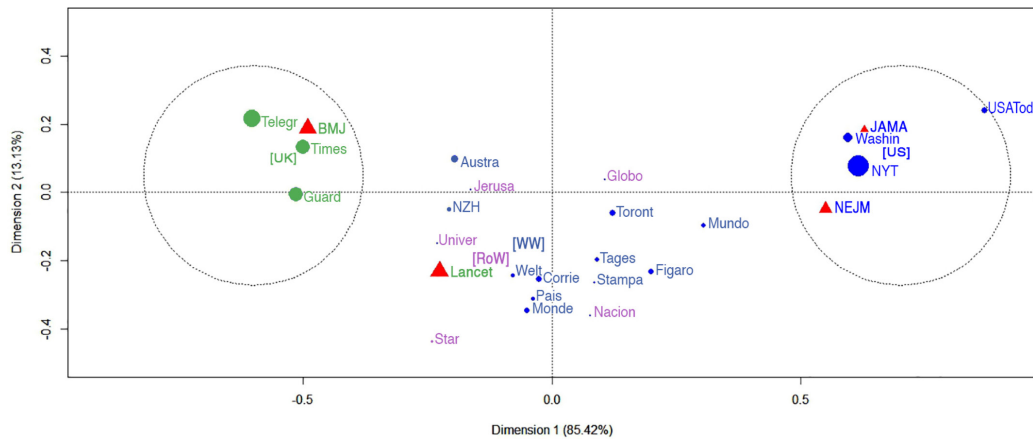


Figure 3 Correspondence analysis plot of citations of *NEJM*, *The Lancet*, *JAMA* and *The BMJ* in 22 newspapers of 14 countries and 4 world regions: the USA, the UK, Western World and the Rest of the World (2008–2015). The closer the journals, newspapers and regions are, the higher the number of citations that correlate to them. Dimension 1, labelled as the national dimension, retains 85.42% of the full information contained in the four original variables while the vertical dimension 2 retains only 13.13% of the original variability and has no specific label. (journals: as used in table 1). WW, Western World; RoW, Rest of the World.

indicate that newspaper nationality seems to influence the medical journals used as information sources. The British lay press seems to be more domestic-oriented than its American counterpart.

In seeking explanations for this domestic preference, the first to consider is that newspapers tend to pay more attention to journals of their own nationality because their papers are probably more newsworthy. But newsworthiness is not a good predictor of which events get into a newspaper¹¹; it is only one of many factors that influence press coverage, such as the availability of press releases or the prestige of the journal. Another factor to consider is the nationality of the authors who publish in the four analysed journals. As Sumathipala *et al*⁸ showed, there are clear differences among the nationalities of authors who publish original articles in these journals: of the 1074 original articles published in the four journals in 1 year, 340 (31.7%) were written by American authors, 292 (27.2%) by British, 332 (30.9%) by authors from the Western World region and 110 (10.2%) by authors from the Rest of the World region. These American authors published their original articles mostly in *JAMA* (173 out of 340, 50.9%) and *NEJM* (107 out of 340, 31.5%), and to a lesser extent in *The Lancet* (38 out of 340, 11.2%) and *The BMJ* (22 out of 340, 6.5%). In contrast, these British authors published their original articles mostly in *The BMJ* (216 out of 292, 74.0%) and *The Lancet* (66 out of 292, 22.6%), and to a lesser extent in *NEJM* (6 out of 292, 2.1%) and *JAMA* (4 out of 292, 1.4%). The authors from the Western World region published mainly in *The Lancet* (136 out of 332, 41.0%) and to a lesser extent in *NEJM* (78 out of 332, 23.5%), *The BMJ* (76 out of 332, 22.9%) and *JAMA* (42 out of 332, 12.7%). Among the authors from the Rest of the World region, this preference for *The Lancet* is even more pronounced (67 out of 110, 60.9%), with a smaller participation in *NEJM* (27 out of 110, 24.5%), *The BMJ* (8 out of 110, 7.3%) and *JAMA* (8 out of 110, 7.3%).

We found a positive relationship between the percentage of authors of original articles from each region of the world who publish in *NEJM*, *The Lancet*, *JAMA* and *The BMJ* (provided by Sumathipala *et al*⁸) and the citations that these journals have in the lay press in those countries (provided by our research). Focusing on the original articles makes sense, because these are precisely the articles that are most echoed in the lay press.¹² Correspondence analysis showed that journals belonging to a national medical society (*BMJ* and *JAMA*)—which are the ones publishing the highest proportion of original articles by authors from their respective countries—were the most polarised in the national dimension. In part, this national polarisation is due to the authors' decisions on which magazines to send their original articles; but it also depends on whether the editorial policy of the journal is more or less open to international authors. In general, it is assumed that newspapers tend to deal more with news that is closer to home, whereas scientific journals tend to be more international because science itself is global and international. Of course, not all journals have the same editorial policy, and it is perfectly legitimate to prioritise national research. Editors must decide where to go and how. It has been shown previously that it is possible to measure the internationalisation of published scientific research.⁸ Now, we show that it is also feasible to quantify the internationalisation of the media impact of scientific journals.

The selection of 22 international newspapers is relatively large, and although it is not representative of the enormous diversity of the lay press around the world, it includes some of the most relevant international newspapers. Despite its limitations,¹³ the citation analysis of academic papers is deeply ingrained in the scientific community. The analysis of press citations of scientific journals also has its limitations, because the mere mention of a journal does not provide any information about the

characteristics and sense of the citation, nor about the quality of the journalistic text.

This study is limited in scope, but offers a glimpse of the possibilities of press citation analysis on a larger scale. This type of analysis can serve as a starting point for studying the media impact of scientific publications, its correspondence with scientific impact and its association with the issue of press releases. The citation analysis could help us assess the journalistic impact and popularity of scientific publications, and better understand the characteristics of medical journalism.

In addition, the coordinates between -1 and 1 in the first dimension of the correspondence analysis are interpreted as weights and allow calculating new ones for updated data. New lists of citations could involve calculating coordinates for new (or updated) medical journals or newspapers. The very existence of a national factor in science communication needs to be further monitored and analysed.

Contributors GC designed the study and collected the data, with inputs from EC and RR. RR performed the correspondence analysis. GC, EC and RR analysed the data and interpreted the findings. All the authors wrote and approved the final manuscript. GC is the guarantor.

Competing interests All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work. RR and EC belong to MiRoR (Methods in Research on Research), which has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 676207. EC is partially supported by grants MTM2015-64465-C2-1-R (MINECO/FEDER) from the Ministerio de Economía y Competitividad (Spain), and 2014 SGR 464 from the Departament d'Economia i Coneixement de la Generalitat de Catalunya.

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