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Students' satisfaction and perceived impact on knowledge, attitudes and skills after a 2-day course in scientific writing: a prospective longitudinal study in Spain

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ABSTRACT

Objectives This study aimed to determine students' satisfaction with a 2-day course on scientific writing in health sciences and to assess their perceptions of the long-term impact on their knowledge, attitudes and skills.

Setting 27 iterations of a 2-day course on writing and publishing scientific articles in health sciences.

Participants 741 students attending the 27 courses.

Design Prospective longitudinal study.

Primary and secondary outcome measures Immediately after each course, students completed a first questionnaire, rating their satisfaction with different aspects of the classroom sessions on a Likert scale (0–5). Approximately 2 years after the course, students completed a follow-up questionnaire, using a Likert scale (0–4) to rate their knowledge, skills and attitudes in relation to scientific writing before and after attending the course.

Results 741 students (70% women) participated in the 27 iterations of the course; 568 (76.8%) completed the first questionnaire and 182 (24.6%) completed the follow-up questionnaire. The first questionnaire reflected high overall satisfaction (mean score, 4.6). In the second questionnaire, students reported that the course had improved their knowledge (mean improvement: 1.6; 95% CI 1.6 to 1.7), attitudes (mean improvement: 1.3; 95% CI 1.2 to 1.4) and skills (mean improvement: 1.4; 95% CI 1.3 to 1.4) related to writing and publishing scientific papers. Most respondents (n=145, 79.7%) had participated in drafting a scientific paper after the course; in this subgroup, all the specific writing skills assessed in the second questionnaire significantly improved.

Conclusions Students were satisfied with the format and the contents of the course, and those who responded to the follow-up survey considered that the course had improved their knowledge, attitudes and skills in relation to scientific writing and publishing. Courses are particularly important in countries without strong traditions in scientific publication.

Strengths and limitations of this study

- The study analysed 10 years' experience including 27 iterations of a 2-day course completed by >700 health science researchers.
- This is the first systematic evaluation of students' satisfaction and improvements in knowledge, skills and attitudes acquired of such a course in Spain.
- The study measures the perceived gains rather than objectively assessed gains.
- The response rate to the follow-up questionnaire was low.
- Selection bias could have led to overestimation of positive results in the follow-up survey: the more satisfied students or those with more writing successes to report, may have been more likely to participate.

INTRODUCTION

Publications are the measurable results of scientific activity. However, most health science researchers, especially in non-English speaking countries, receive little training in scientific writing.[1] Writing is challenging for researchers, especially for newcomers, who also need publications to advance their careers.[2]

Most researchers are expected to acquire the skills to write scientific papers without formal training, through 'learning by doing'.[3] Inadequate training in scientific writing can make postgraduate students and established researchers reluctant to write.[4] In recent decades, the number of courses and workshops on scientific writing have increased, but the effectiveness of these endeavours remains to be determined.[5]

Given the lack of undergraduate courses on scientific writing in Spain, in 2003, we designed and launched a 2-day course on writing and publishing scientific articles for researchers in the health sciences in the early stages of their careers.[6] This study aimed to determine students' satisfaction with this

Box Programme of the course.

First day

- Introduction to the course
- Writing styles
  - Scientific style and other styles.
  - Characteristics of scientific writing style.
  - Types of texts in scientific publications.
  - Starting to write: sentences and paragraphs.
  - Exercise: scientific writing styles.
  - Exercise: writing of paragraphs.
- The original article: introduction
  - Definition and general characteristics of the original article.
  - Structure of the original article.
  - The title: the article's business card.
  - Exercise: good and bad titles.
- The abstract of the original article
  - The abstract: essential information.
  - Types of abstracts (structured and non-structured) and contents.
  - Keywords and the Medical Subject Headings.
  - Exercise: editing of an abstract.
- The core of the original article (I)
  - The Introduction, Methods, Results and Discussion format.
  - The introduction: the background and study's aim.
  - The methods: what have we done?
  - Exercise: writing an Introduction.
- The core of the original article (II)
  - The results: what have we found?
  - Principles for text and data presentation.
  - The balance between text, tables and figures.
  - Exercise: building a table.
- The core of the original article (III)
  - The discussion: what does our results mean?
  - Structure of the discussion section.
  - The conclusions.
  - Exercise: analysis of a discussion.
- The bibliography and additional sections of the original article
  - Use of bibliography and formats.
  - Acknowledgements.
  - Funding.
  - Competing interests.

Second day

- How to publish an article
  - Exercise: where do I submit it?
  - Choosing the adequate journal.
  - The target audience, language and open access.
  - The bibliographic impact factor.
- Preparing the article for submission
  - The cover letter.
  - Final check.
  - Online submission.
  - Exercise: writing of a cover letter.
- The editorial process
  - The peer review process.
  - Standard phases of the editorial process.
  - Editorial decision criteria.
  - Answering peer review.
- Ethical aspects of scientific publication
  - Authorship: the International Committee of Medical Journal Editors criteria.
  - Repetitive publication.
  - Competing interests.
  - Other ethical aspects for authors, editors and publishers.
- Comprehensive exercise with a manuscript

course and their perceptions regarding its long-term impact on their knowledge, attitudes and skills.

METHODS

The following sections describe the course, the questionnaire administered in the classroom to evaluate students' immediate satisfaction with the course, and the follow-up questionnaire sent to participants to evaluate their perceptions of the impact of the course.

Course characteristics

We designed an intensive 2-day classroom course for Spanish-speaking undergraduate or postgraduate degrees in health sciences to cover the basic skills involved in scientific writing based on classic books about scientific writing.[3 7] The main objectives of the course were to provide basic advice about scientific writing, to present the structure and contents of standard scientific articles and to explain the editorial and peer review processes for health science journals. The course imparted this knowledge over 15 hours, combining lectures with individual and group exercises based on real examples. The syllabus for the first day (8 hours) covered scientific writing style, scientific publishing formats and the structure and contents of the original article; the syllabus for the second day (7 hours) covered ethical principles in scientific publishing, selecting a target journal, preparing manuscripts for submission and the editorial and peer review processes. The main topics are detailed in box, the full programme of the course is available at http://www.esteve.org/en/rc-programa (in Spanish) and most of the contents are included in a book used for reference in the course.[8] The Esteve Foundation (www.esteve.org) offered the course to institutions throughout Spain. The course targets health science researchers in training or in the initial stages of their careers (eg, undergraduate, postgraduate students, postdoctoral fellows, medical residents etc), since most undergraduate and postgraduate curricula in the health sciences in Spain did not include formal training in scientific writing. Two lecturers (AMG and EF) and the promoter (FB) developed all the contents. The lecturers are professors of epidemiology and public health and have recognised experience as authors, reviewers and editors in national and international journals. During the course, both lecturers are present and actively participate in all the sessions. While one explains a topic, the other stimulates the audience with questions or suggestions, making the teaching more dynamic and participative. The number of students in

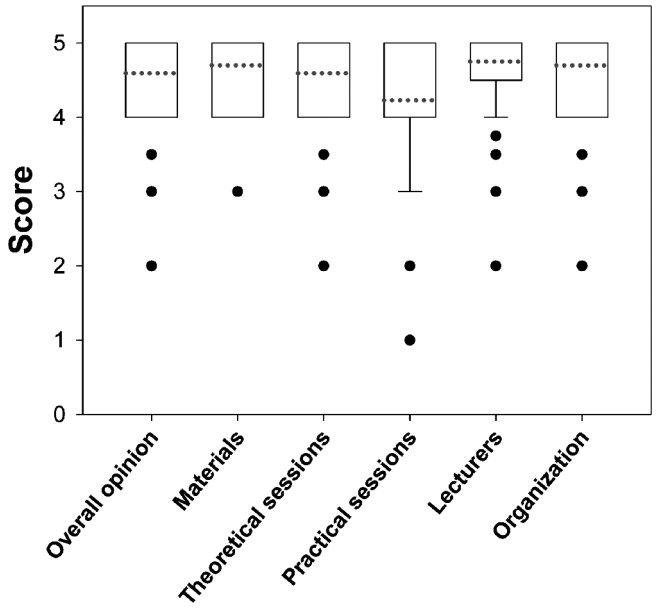

Figure 1 Results of the first questionnaire: students' (n=569) satisfaction with different aspects of classroom sessions in the 27 iterations of the scientific writing course in Spain, 2004–2013. Boxes represent IQRs. Solid lines represent medians, and dotted lines represent means. For all six variables, except "Practical sessions", the median coincides with the upper line of the box. The whiskers represent the 90th and 10th percentiles and the dots represent outliers (each dot represents at least one response).

each edition ranged between 17 and 40.[6] After a pilot edition during the Minorca Public Health Summer School in 2003, the first edition took place in Valencia in January 2004 and the most recent (44th edition) took place in Bilbao in December 2017. The present study includes data from 741 students participating in the 27 iterations held between 2004 and 2013. The course has been accredited (no 09/013214-MD) by the Catalan Council for Continuing Education in the Health Professions with the approval of the National Health System's Committee on Continuing Education under Spain's Ministry of Health.

First satisfaction questionnaire

We administered a satisfaction questionnaire at the end of each edition of the course. Each student anonymously rated items on a Likert scale (0–5) presented on printed form. The items queried students about their satisfaction with the course overall, materials, contents of the lectures, contents of the practical exercises, lecturers and organisational aspects. The questionnaire is available at http://www.esteve.org/en/rc-encuesta. We used the same questionnaire without changes in the 27 iterations of the course.

Follow-up questionnaire

We designed a follow-up questionnaire (available at http://www.esteve.org/en/rc-encuesta-diferido) to collect sociodemographic data and to assess students' perception of the effect of attending the course on their knowledge (5 items), attitudes (3 items), opinions (3 items) and skills (16 items: 3 general skills and 13 specific skills) with regard to scientific writing. The follow-up questionnaire also reassessed students' overall satisfaction with the course through a new question: 'Would you recommend this course to a colleague?'. Respondents rated all items on a Likert scale (0–4). To analyse the impact of the course on specific skills, we restricted the analysis to students who had collaborated in publishing a scientific article after doing the course. We emailed the follow-up questionnaire to the first 174 students (29.3% responded) in 2006 and to the subsequent 91 students (27.5% responded) in 2007. In 2013, we emailed the remaining 475 students, asking them to fill out the questionnaire online (22.3% responded).

Table 1 Characteristics of the students who answered the follow-up questionnaire about the course on scientific writing (27 iterations in Spain, 2004–2013)

	Total	Students who went on to collaborate in preparing a paper for publication	P value
Trainees, n	182	145	
Age, mean (SD) (years)	39.1 (9.4)	38.8 (9.6)	0.849*
Gender, n (%)			
Women	131 (72.0)	103 (71.0)	0.902†
Men	51 (28.0)	42 (29.0)	
Field of degree, n (%)			
Medicine	66 (36.3)	56 (38.4)	0.981†
Pharmacy	21 (11.5)	17 (11.6)	
Biology	20 (11.0)	15 (10.3)	
Others	75 (41.2)	58 (39.7)	
Main type of research, n (%)			
Clinical research	41 (22.5)	37 (25.3)	0.036†
Basic research	95 (52.2)	89 (61.0)	
Others	46 (25.3)	20 (13.7)	

*Student's t-test.
†χ^2 test.

Statistical analyses

We computed means, medians, ranges, SD, 95% CI and IQRs for the responses to each item in the questionnaire. To compare the characteristics of the subgroup of students in whom the specific writing skills were analysed with those of the entire group of respondents to the second questionnaire, we used [please, use the Greek symbol] ^{2} and Student's t-test. To compare the responses on the items in the follow-up questionnaire asking about students' perceptions of their knowledge,

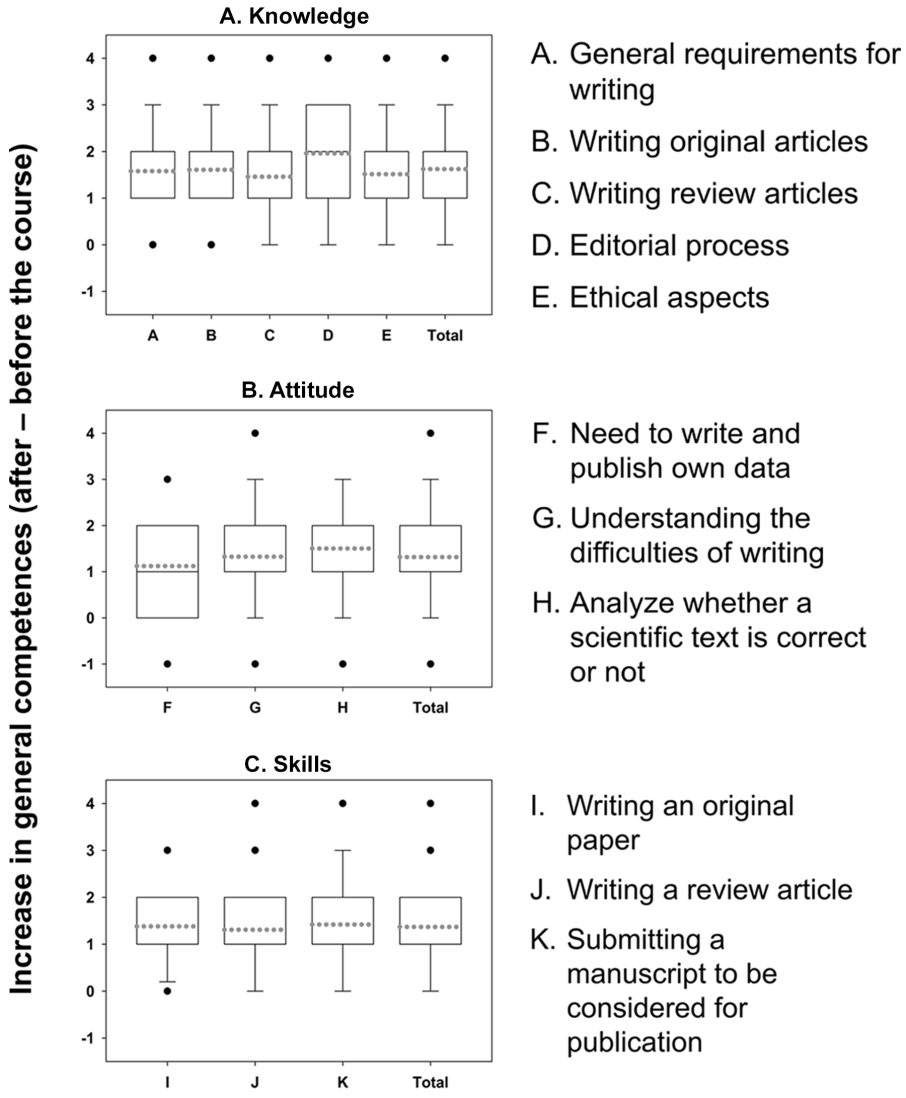

Figure 2 Perceived change in overall competence among students (n=182) who completed the follow-up questionnaire about the scientific writing course (27 iterations in Spain, 2004–2013). The increase in general competence was calculated for each item from individual scores; individual scores were calculated by subtracting the rating on the item asking about competence before and after attending the seminar. Significant gains were observed for all competencies (P<0.001; Wilcoxon signed-rank test). Boxes represent IQRs. Solid lines represent medians and dotted lines represent means. For variables A and B, the median coincides with the upper line of the box, and for variables C, E, G, H, I, J and K the median coincides with the bottom line. The whiskers represent the 90th and 10th percentiles and the dots represent extreme values.

skills and attitudes before and after the course, we used the Wilcoxon non-parametric test for paired samples (after-before comparisons). The distribution of the scores (including the predifference and postdifference in scores) is presented using traditional box plots. We used SigmaPlot V.11.0 (Systat Software, Chicago, Illinois, USA) for data processing and statistical analysis.

RESULTS

A total of 741 students (70% women) attended one of the 27 iterations of the course. The response rate to the first questionnaire was 76.8% (n=569). Overall, they rated the experience as very positive (mean 4.6, SD 0.6, of a maximum 5). Students' ratings of satisfaction with the course handouts, theoretical sessions, teachers and overall organisation were above 4.5 (figure 1); only satisfaction with the practical sessions was rated below 4.5 (mean 4.2, SD 0.8).

In the follow-up questionnaire, we obtained a total of 182 responses from 741 students (24.6% response rate). Table 1 summarises the general characteristics of these students (age, 39.1 years; 131 (72%) women) who responded to the follow-up questionnaire and of the subgroup who went on to collaborate in the publication of a scientific paper (n=145, 79.7% of the students who responded to the follow-up questionnaire). In the overall group, students had degrees in medicine (36.3%), pharmacy (11.5%), biology (11.0%) or other related fields such as nursing, psychology, biochemistry, biotechnology or statistics (41.2%); slightly more than half (52.2%) were

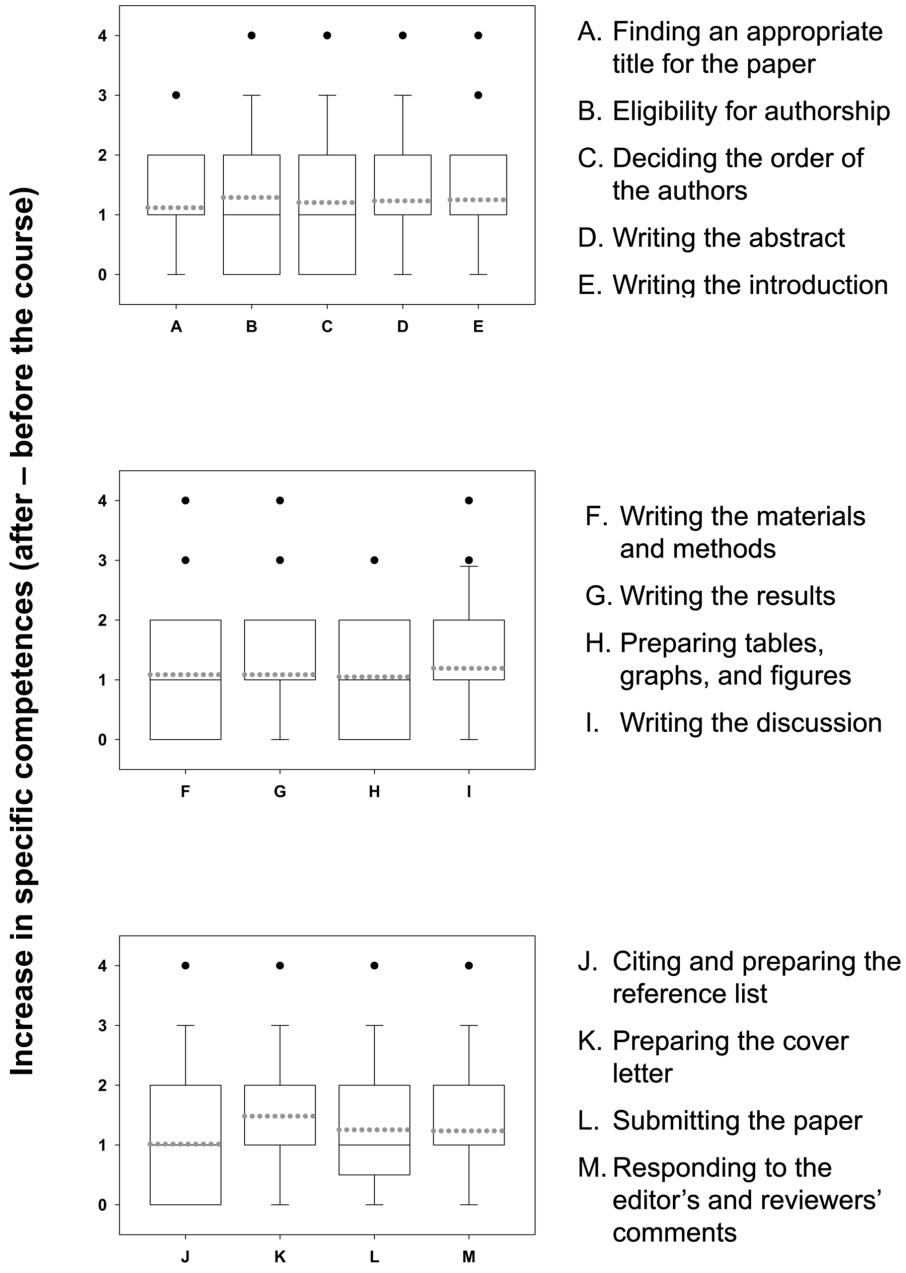

Figure 3 Changes in specific writing skills in students who went on to publish after the scientific writing course (n=145) (27 iterations in Spain, 2004–2013). The increase in specific writing skills was calculated for each item from individual scores; individual scores were calculated by subtracting the rating on the item asking about competence after attending the seminar from the rating on the item asking about competence before attending the seminar. Significant gains were observed for all general competences (P<0.001; Wilcoxon signed-rank test). Boxes represent IQRs. Solid lines represent medians and dotted lines represent means. For variables A, D, E, G, I and K, the median coincides with the bottom line of the box. The whiskers represent the 90th and 10th percentiles and the dots represent outliers.

involved in basic research. Students in the subgroup were similar to the entire group of respondents to the follow-up questionnaire in terms of age, gender and undergraduate training, but not in the type of research in which they were mainly involved.

The mean scores for all the items that assessed students' perceptions of their knowledge, skills and attitudes after the course were higher than those for their perceptions of these dimensions before the course (figure 2). Overall increases in scores for knowledge (mean 1.6; 95% CI 1.6 to 1.7), attitudes (mean 1.3; 95% CI 1.2 to 1.4) and skills (mean 1.4; 95% CI 1.3 to 1.4) after the course were significant (P<0.001). Among the items about knowledge (figure 2A), we observed the greatest improvement (2 points) in the understanding of the editorial process. All but five assessments (by four students) yielded higher postcourse scores regarding attitudes toward publishing (figure 2B). Students also indicated the need for training in scientific writing at both the undergraduate (mean score 3.1; 95% CI 2.9 to 3.3, of a maximum 4) and

postgraduate level (mean score 3.9; 95% CI 3.8 to 4.0). The mean score on the question asking about students' overall degree of satisfaction with the course was 3.8 (SD 0.4).

Figure 3 shows the change in perceptions of specific writing skills before and after the course in the subgroup of students who went on to collaborate in the publication of scientific paper. Statistically significant improvements were observed for all the skills (P<0.001; Wilcoxon signed-rank test). Average improvements ranged between 1.0 (95% CI 0.8 to 1.2) points for citing and writing references and 1.5 (95% CI 1.3 to 1.7) for preparing cover letters, with improvements in the remaining skills lying between these values: determining eligibility for authorship (1.3; 95% CI 1.1 to 1.5), writing introductions (1.3; 95% CI 1.1 to 1.5), writing abstracts (1.2; 95% CI 1.0 to 1.4), writing discussions (1.2; 95% CI 1.0 to 1.4) and responding to editors' and reviewers' comments (1.2; 95% CI 1.0 to 1.4).

DISCUSSION

This study analysed 10 years of experience that included 27 iterations of a 2-day course on how to write scientific articles. The course was completed by >700 health science researchers. The two surveys showed high satisfaction with the 2 day format and the contents of the course. Moreover, the second survey showed that students considered that the course had improved their overall knowledge, attitudes and skills as well as some specific writing skills. Importantly, students expressed the need for this type of training at both the undergraduate and postgraduate levels.

Our results are similar to those of other published experiences, most of which were included in two systematic reviews[5 9] that evaluated different outcomes. Like other authors,[10] we analysed students' satisfaction with the course. Most published accounts report experiences in English-speaking countries (USA, Australia and New Zealand).[5] Galipeau *et al* systematic review[5] included 12 studies focused on writing for publication; most of these had shortcomings like small samples, low validity or biases, so the authors concluded that there are important gaps in our knowledge of how to improve scientific writing.

Jawaid *et al*[11] reported an experience from Pakistan (language of course not stated), with 120 attendees who participated in a 3-month course based on four interactive workshops. Through a preworkshop and postworkshop questionnaire comprising 14 questions, the authors concluded their course improved attendees' knowledge and skills related to writing. One study from the USA[12] not included in Galipeau *et al* systematic review[5] assessed improvements in writing after a 60–90 min case report writing workshop. In a 3-year period, 214 students (mainly clinicians and educators) attended the workshops, and pre-evaluation and postevaluation found a significant improvement in self-rated writing competence and in the perceived probability of submitting a case report. In another study from the USA, Guydish *et al*[13] assessed the impact of a scientific writing seminar aiming to encourage manuscript writing and dissemination of addiction research. Over a 14-year period, a total of 113 postdoctoral students in 14 cohorts completed the 6 month seminar. After the course, between 75% and 100% of the students from each cohort submitted papers and between 60% and 100% of these were published. The authors concluded that writing seminars may be useful among early-stage investigators.

Regardless of whether scientific writing courses yield positive or negative results, evaluations of their effectiveness have seldom been published.[5 9] We consider these activities to be educational interventions, and as such they should have valid study designs under the principles of implementation research,[14] which seeks to understand and work within real world conditions, rather than try to control for these conditions or to remove their influence as causal effects, as is the case in experimental trials.

Some limitations of our study must be considered. First of all, the satisfaction questionnaire used has not had a formal validation, and the study measures perceived gains rather than objectively assessed gains. Second, while the response rate in the initial satisfaction baseline survey was robust (nearly 77%), it was low for the follow-up survey, and it decreased in the successive waves from 29% to 27% and 22%. This might reflect difficulties in reaching participants who were in training when they did the course, making them more likely to have changed jobs and professional email addresses. A likely explanation of the low response rate is that students who responded were likely to be those who got the most out of the workshop or had best outcomes to report. Selection bias can lead to overestimation of of either positive or negative results in satisfaction surveys. Another limitation is the lack of a control group, which can clarify interpretation of changes in competence in evaluations of interventions. Further studies should ensure follow-up at a fixed time not very long (1 or 2 years) after the course and baseline survey; the ideal time would be long enough to detect the changes supposedly due to the intervention but short enough to minimise attrition and recall bias. Furthermore, the positive effects we observed could be partly due to students' postcourse participation in other activities to improve scientific writing. The follow-up questionnaire did not collect information about such activities. However, we collected information on the impact of the course on collaboration in the writing of papers, as in other studies.[13 15–17]

Finally, some strengths of our study merit attention. This is the first regularly held course on scientific writing in Spain, currently with 40 iterations in 15 years and >1000 participants to date, and the course is still running. To our knowledge, this is also the first report of a systematic evaluation of students' satisfaction and improvements in knowledge, skills and attitudes acquired through a course of these characteristics in Spain. Although simultaneous assessment of prior and posterior knowledge and skills after the course could be considered a weakness in terms

of causal inference, it may actually be a strength since the students are more aware and provide more coherent information about the items evaluated and the changes suffered.

In conclusion, the format and contents of the course satisfied the students' needs, and participants who responded to the follow-up survey reported improvement in their skills related to scientific writing and publishing. Participants strongly agreed that health professionals need training in scientific writing during the course of their undergraduate and/or postgraduate studies. Academic institutions, at least in countries with a less robust tradition of publishing, should provide training on scientific writing to improve the reporting of research results.

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Contributors EF, AMG and FB conceived and designed the study. All the authors designed the questionnaires. EF and AMG designed the analysis strategy; ES and FB analysed the data and all the authors contributed to its interpretation. EF and FB wrote the first draft of the manuscript; all authors contributed substantially to subsequent versions of the manuscript and all authors approved the final version.

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Competing interests EF and AMG received fees as lecturers for conducting these courses, but did not receive any fee for the design, analysis or writing of this paper. ES and FB are employees of the Esteve Foundation, a private non-profit foundation under Spanish Law. ES and FB have participated in the courses and the preparation of this paper as part of their paid work.

Patient consent Not required.

Ethics approval Participants provided informed consent to participate in the study (oral consent for the first satisfaction questionnaire and written consent for the follow-up questionnaire). As the surveys were conducted as part of the routine evaluation of the course, as approved by the Council for Continuing Education, no further ethics approval was required.

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Data sharing statement A full data set of results is available from the corresponding author.

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