

## ORIGINAL PAPER ΕΡΕΥΝΗΤΙΚΗ ΕΡΓΑΣΙΑ

# The knowledge of medical students about publication ethics

**OBJECTIVE** Global literature reflects a growing concern over research misconduct, which has been referred to as a “disease” of modern science. Although intent to deceive is the central aspect of publication misconduct, some cases involving novices might derive from simple ignorance or limited knowledge. This study investigated the level of knowledge regarding the rules and ethics of scientific writing among undergraduate and postgraduate medical students. **METHOD** A survey was conducted among undergraduate and postgraduate medical students (n=136) by means of a closed questionnaire consisting of 9 questions, 5 of which pertained to students’ views on current publication ethics. A scoring system based on the answers was developed to evaluate the level of knowledge of scientific publishing (minimum 5 – maximum 25). **RESULTS** The mean score of the respondents was 16.9±2.2 and limited knowledge was noted, specifically concerning redundant publications. Only 16% of the respondents already had publication experience and only 18.5% had been taught about the relevant topics. No significant difference in score was found between undergraduate and postgraduate students nor between those with and those without publications, but those who had been taught about relevant topics had a significantly higher mean score than those who had no relevant teaching (p=0.01). **CONCLUSIONS** The knowledge of medical students on publication ethics was relatively good, but limited awareness was noted in certain areas. Education on publication ethics is recommended as part of the medical school course, affording this issue the weight it deserves.

Publishing papers is the main method for communicating knowledge and promoting scientific advancement. The publishing system has been built on trust that all the dynamically interacting groups involved (co-authors, peer-reviewers, editors, publishers) remain honest, following the rules and ethics of scientific integrity. Unfortunately, this is not always the case, as a variety of factors may push authors towards misconduct. These factors include the ease of fabrication, financial issues and, of course, the concept of “publish or perish”. Academic promotion and even the salary scale are largely based on the number of publications, traditionally with less concern for their quality.<sup>1,2</sup> In addition, the current evaluation system, with its various indices (impact factor, h-index, citations) increases the pressure to publish even further.

Global literature reflects the growing concern over research misconduct, which has been referred to as a “silent epidemic” of modern science.<sup>3</sup> In two surveys investigating the prevalence of research falsification, one third of the

scientists questioned admitted a variety of questionable research practices,<sup>4</sup> and 21% had discovered erroneous data in published manuscripts they had co-authored, 4% of them noting “fudged” or fraudulent data.<sup>5</sup> While intent to deceive is the central aspect of misconduct, some cases might derive from misconception or simple ignorance, notably when novices to academia are involved. In order to investigate the level of knowledge regarding the rules and ethics of scientific writing, a survey was conducted among the students in two Greek medical schools.

## MATERIAL AND METHOD

The study was conducted in December 2015 using a closed anonymous questionnaire. A convenience sampling technique was employed to select students from two northern Greek medical schools, the Aristotle University of Thessaloniki and the Democritus University of Thrace. The questionnaires were distributed to a total of 136 students; 91 sixth-year students of both universities and 45 postgraduate students of two different master’s degree (MS) courses in Democritus University.

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Γνώσεις φοιτητών Ιατρικής  
σχετικά με τους κανόνες ηθικής/  
δεοντολογίας των δημοσιεύσεων

Περίληψη στο τέλος του άρθρου

## Key words

Authorship disputes  
Duplicate publication  
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The initial version of the questionnaire was pretested in a pilot study with a target size of 5, following which necessary changes were made to establish the final version. The questionnaire consists of 9 questions pertaining to personal data and to the students' view on current publication ethics. The three initial questions investigated the level of studies of the respondents, their publication background and their exposure to relevant formal instruction on topics concerning publication ethics. All but one of the core survey questions (no 4–8) were presented as statements measured on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). A scoring system of the answers of questions no 4–8 was developed to evaluate the students' overall knowledge on the subject of scientific publishing. Responses to each of these questions scored 1–5, giving a total individual score ranging from 5 (poor knowledge) to 25 (best knowledge). The ethical matters explored in the questionnaire include honorary authorship, duplicate publication, salami-publication, the later effects of misconduct on one's career and co-author liability (tab. 1). Question no 9 introduced a ranking of five prominent types of misconduct, comprising duplicate publication, data falsification, unintentional error (*bona fide*), plagiarism and gift authorship.

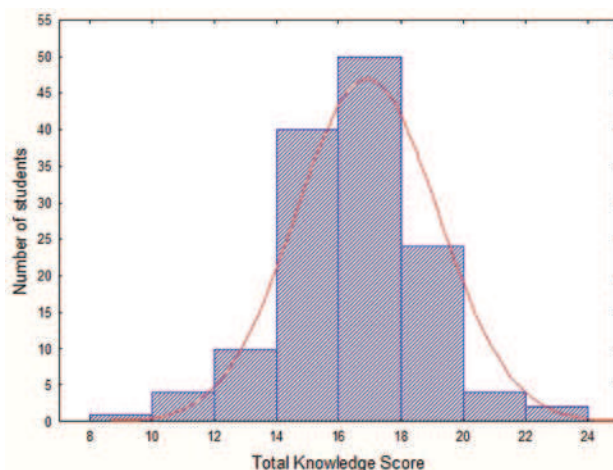
Statistical analysis included t-test or Chi-square test where appropriate and relations between groups were determined with ANOVA. The data were expressed as mean±standard deviation (SD) and  $p < 0.05$  was considered significant. The statistical software STATISTICA 7.0 (Statsoft, Oklahoma, USA) was used.

**Table 1.** The questionnaire on publication ethics for medical students. Ticked answers represent 5 points (best knowledge).

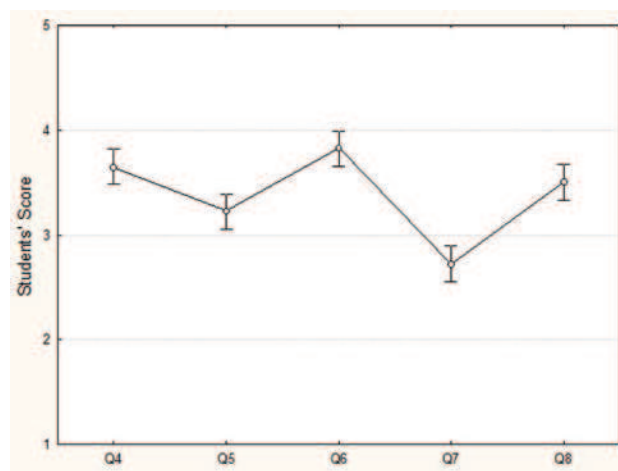
1. Are you an undergraduate or a postgraduate student?  
UNDER  POST
2. Do you have previous publication(s) in peer-reviewed journals?  
YES  NO
3. Have you ever been taught a subject relevant to publications' ethics and rules? YES  NO
4. A violation of publications' rules will affect the career of the involved author(s). Strongly agree , agree , neither agree or disagree , disagree , strongly disagree
5. Is it acceptable to split the results of a study and publish them separately? Strongly disagree , disagree , neither agree or disagree , agree , strongly agree
6. Is it necessary to include the head of the department as covering author, without him having substantially contributed to the study? Strongly disagree , disagree , neither agree or disagree , agree , strongly agree
7. Is it acceptable to publish the results of a study in two different journals? Strongly disagree , disagree , neither agree or disagree , agree , strongly agree
8. In case of disclosure of publication misconduct, all co-authors are responsible. Strongly agree , agree , neither agree or disagree , disagree , strongly disagree
9. How would you rank the following publication misconducts based on severity? (1=less severe, 5=most severe). Duplicate publication , data falsification , honest error , plagiarism , gift authorship

## RESULTS

All the respondents completed the questionnaire (136 in total, 45 postgraduates). Only 16% (22/136) reported having previous publication experience in peer-reviewed journals and only 18.5% (25/135) had been taught about publication ethics in an elective course. The average total score of the respondents was  $16.9 \pm 2.2$ , ranging from 10 to 24 (fig. 1). Statistically significant differences were observed between the scores on individual questions (ANOVA  $p < 0.01$ ), with the lowest (worst) values of  $3.2 \pm 0.9$  and  $2.7 \pm 1.02$  being given in response to the questions no 5 and no 7, respectively, concerning "salami-sliced" and duplicate publications (fig. 2). No statistical difference was found in the scores between undergraduate and postgradu-



**Figure 1.** Histogram of the frequencies of the students' total scores on the publication ethics questionnaire (n=136).



**Figure 2.** Average students' score in each of the core questions on the publication ethics questionnaire, Q4–Q8 (ANOVA). A lower score is noticed in questions Q5 and Q7 related to redundant publications.

ate students ( $p=0.81$ ) or between those with and without publications ( $p=0.92$ ). Statistically significant difference in scores was demonstrated between those who had received teaching in relevant topics and those who had not ( $17.9\pm 2.2$  vs  $16.6\pm 2.2$ ,  $p=0.01$ ) (fig. 3). The vast majority of the respondents (105/131, 80%) considered falsification of data to be the most severe form of misconduct in scientific writing, plagiarism was considered second in severity, while gift authorship and "salami" publication were considered mild violations of publishing ethics, set last in the ranking.

## DISCUSSION

All violations of scientific publishing contribute to society's scepticism about the reliability of scientific achievements and affect subsequent research, leading to false conclusions. Not all types of scientific misconduct are equally severe, however, and "bona fide" mistakes also occur. The spectrum of scientific misconduct is broad, ranging from major types, such as plagiarism, falsification and even fabrication of data, to minor types, such as redundant publications, deception over authorship or failure to declare conflict of interest.<sup>6,7</sup>

This study focused on less serious cases of misconduct that are common and tend to be underestimated, even though they may have significant implications for the author(s).<sup>8</sup>

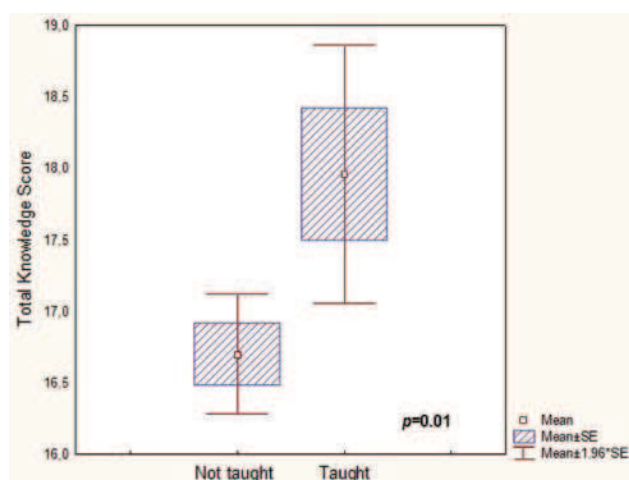
Regarding redundant publications, one study estimated the prevalence of duplicates in all research fields to be one in 2,000 papers between 1980 and 2007, clinical medicine

being the field with the highest absolute number of duplicates.<sup>9</sup> Integrity in authorship is an additional point of concern. Scientists included as authors without having substantially contributed to the work (honorary/gift authors) or others who get no authorship credit in spite of their substantial contribution (ghost authors) were detected in 21% of published articles in major medical journals.<sup>10</sup> The best means to eliminate such events is to understand their "pathogenesis" and then apply the appropriate preventive measures, as in all medical fields.

The overall mean score obtained by the students (16.9 out of a maximum of 25) suggests relatively good knowledge of the rules and ethics regulating scientific publishing. Lower scores pertained to knowledge-oriented questions concerning redundant and duplicate publications, as opposed to the higher scores recorded on questions strongly related to moral reasoning (effects of misconduct on career, gift authorship and co-author liability). When a similar study used more specific questions to assess the baseline knowledge of students on plagiarism, a remarkable lack of knowledge was demonstrated. A total of 423 all-year medical students participated in the study and their average score was 4.9 (out of 10), showing no improvement among senior students. As a result of these findings a formal course was then introduced as a necessity.<sup>11</sup>

An increasing number of medical student authored articles have been published since 1980, and the trend appears to be continuing;<sup>12</sup> nevertheless, according to the findings of this study, already having publications did not appear to exert a statistically significant effect on the students' scores regarding publication ethics. Research involvement is connected with building up critical thinking, but the students' engagements in publication appeared to be mostly *curriculum vitae* driven.<sup>13</sup> This opportunistic approach might deprive students of a wider perspective on publishing, including consideration of ethical concerns. In this context, it appears that the mentorship of senior peers alone cannot ensure consistent ethical behavior among students.

While already having publications does not imply a better level of knowledge on publishing ethics, student attendance of relevant elective courses proved to have a statistically significant effect on their knowledge, to the advantage of the attendees. Brkic and colleagues also showed a significantly higher level of student awareness after a short lecture on plagiarism, confirming the notion that early-stage education on scientific misconduct can be a potent preventive measure.<sup>14</sup> There is evidence that broader understanding is associated with lower levels of



**Figure 3.** Box and whisker plot of students' total scores on the publication ethics questionnaire: Those taught and those not taught relevant subject (t-test).

fraudulent behavior, although it is expected that different types of misconduct will continue to evolve in today's high-tech era.<sup>15,16</sup> Advice and warnings not to violate publication ethics have proven ineffective, in contrast to an interactive seminar which reduced cases of plagiarism.<sup>17</sup> It appears that depending on students' morality is not sufficient, and specific education is essential to mitigate misconduct in academic writing.

The answer to those setting the question "can professionalism in academic writing be taught?" is probably yes, but what is undeniable is that it must be learned.<sup>18</sup> Since a broader understanding has been associated with lower levels of fraudulent behavior, it is emphatically recommended that formal education on publication ethics should be included in the medical school curriculum, affording this issue the weight it deserves.

## ΠΕΡΙΛΗΨΗ

### Γνώσεις φοιτητών Ιατρικής σχετικά με τους κανόνες ηθικής/δεοντολογίας των δημοσιεύσεων

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**ΣΚΟΠΟΣ** Στη διεθνή βιβλιογραφία παρουσιάζεται αυξημένο ενδιαφέρον για τις παραβάσεις των κανόνων και της δεοντολογίας στις επιστημονικές δημοσιεύσεις, οι οποίες αποτελούν «ασθένεια» της σύγχρονης επιστήμης. Παρ'όλο που η πρόθεση εξαπάτησης συνιστά την κύρια αιτία των παραβάσεων, σε ορισμένες περιπτώσεις, στις οποίες εμπλέκονται συγγραφείς δίχως εμπειρία, είναι δυνατόν να διαδραματίζουν ρόλο η περιορισμένη γνώση ή και η άγνοια. Η τελευταία άποψη διερευνήθηκε σε ομάδα φοιτητών. **ΥΛΙΚΟ-ΜΕΘΟΔΟΣ** Για τη διερεύνηση του επιπέδου γνώσης σχετικά με τους κανόνες ηθικής και δεοντολογίας στις ιατρικές δημοσιεύσεις εκπονήθηκε μια δημοσκοπική έρευνα σε προπτυχιακούς και σε μεταπτυχιακούς φοιτητές Ιατρικής (n=136) και δόθηκε ένα κλειστό ερωτηματολόγιο αποτελούμενο από 9 ερωτήσεις σχετικές με την άποψη των φοιτητών για τους ισχύοντες κανόνες στις ιατρικές δημοσιεύσεις. Ένα βαθμολογικό σύστημα βασίστηκε στις απαντήσεις για την αξιολόγηση των γνώσεων των φοιτητών (ελάχιστος βαθμός 5 – μέγιστος βαθμός 25). **ΑΠΟΤΕΛΕΣΜΑΤΑ** Η βαθμολογία των απαντήσεων ήταν 16,9±2,2 (μέση±σταθερή απόκλιση [SD]) και διαπιστώθηκε περιορισμένη γνώση, ειδικά στις «περιττές» δημοσιεύσεις. Μεταξύ των φοιτητών, ποσοστό μόνο 16% είχαν προηγούμενη εμπειρία δημοσιεύσεων και μόνο 18,5% είχαν διδαχθεί προηγουμένως σχετικά θέματα. Δεν υπήρξε σημαντική διαφορά στη βαθμολογία μεταξύ προπτυχιακών και μεταπτυχιακών φοιτητών ή εκείνων που είχαν δημοσιεύσει με εκείνους οι οποίοι δεν είχαν δημοσιεύσει. Ωστόσο, διαπιστώθηκε στατιστικά σημαντική αύξηση στη βαθμολογία εκείνων που είχαν διδαχθεί προηγουμένως σχετικά θέματα έναντι εκείνων οι οποίοι δεν είχαν διδαχθεί (p=0,01). **ΣΥΜΠΕΡΑΣΜΑΤΑ** Η γνώση των φοιτητών όσον αφορά στη δεοντολογία των ιατρικών δημοσιεύσεων ήταν σχετικά ικανοποιητική, ενώ περιορισμένη γνώση διαπιστώθηκε σε ειδικά θέματα. Συνιστάται κατάλληλη εκπαίδευση, ώστε η δεοντολογία και οι κανόνες των ιατρικών δημοσιεύσεων να τύχουν της δέουσας εκτίμησης.

**Λέξεις ευρητηρίου:** Δεοντολογία δημοσιεύσεων, Δημοσκοπική έρευνα, Διαφωνίες για τη συγγραφική ιδιότητα, Διπλή δημοσίευση, Λογοκλοπή

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