

Original article

How much do Romanian medical students know about research ethics? A survey

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Raw data are available on reasonable requests.

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Octavian Andronic, Alexandra Bolocan, Dan Nicolae Păduraru ✉, Daniel Ion, Florentina Mușat

3rd Department of General Surgery of University Emergency Hospital, Bucharest and Carol Davila University of Medicine and Pharmacy, Bucharest

dan.paduraru.nicolae@gmail.com

O.A.: orcid.org/0000-0002-9053-0018

A.B.: orcid.org/0000-0003-2880-6922

D.N.P.: orcid.org/0000-0001-9527-7333

D.I.: orcid.org/0000-0001-7349-2497

F.M.: orcid.org/0000-0003-2575-8646



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Abstract

Background: Although scientific research in Romania has continued to expand over the past 20 years, it is unclear how prepared the country's students are to be involved in research and to publish the results of their work.

Objectives: To assess Romanian medical students' level of knowledge about research integrity and research ethics.

Methods: A cross-sectional survey of 187 medical students (of which 70% were women) from Carol Davila University of Medicine and Pharmacy, Bucharest, Romania, was performed between September 2017 and June 2018. The survey consisted of self-evaluation with respect to three aspects, namely knowledge of research in general, that of research integrity, and that of publication integrity. The self-evaluation was followed by a set of 17 questions that tested the respondent's knowledge.

Results: On average, the proportion of correct answers was 34% (range, 12%–65%). Whereas those who had assigned low grades to themselves (a score below 5) fared poorly (fewer correct answers) in the test that followed, those who rated themselves highly (a score of 5 or higher) did not fare as well as they were expected to. The majority of respondents (83%) were willing to learn more about research integrity through courses, workshops, training programmes, etc.

Conclusion: The respondents showed a low level of knowledge related to both research integrity and current standards of reporting scientific research. This lacuna demonstrates the need to train students at the beginning of their academic life because more and more of them, both undergraduate and postgraduate, are likely to be involved in scientific research.

Keywords:

Dissemination of scientific research, ethics courses, medical students, publishing integrity, research integrity, research misconduct

Introduction

Research integrity is based on four fundamental principles: honesty, accountability, reliability, and respect.¹ Any scientific approach must be based on these four principles and that involving medical research even more so, because any approach that compromises integrity in that domain can have particularly serious consequences.²

The integrity of a scientific publication derives from the general principles stated above and ensures not only the correctness of data but also honesty in presenting data and in deriving conclusions based on that data. In addition to the more serious misconduct that violates ethics, we are all aware of fabrication, falsification, and plagiarism³ in scientific publication—pitfalls that can result in unacceptable practices.

Scientific research in Romania has continued to expand over the past 20 years: the number of articles published by Romanian authors and indexed in international databases has increased tenfold.⁴ Given that rapid increase, it is becoming imperative to educate students on the principles of responsible research. The need to involve medical students in writing scientific articles has been justified often enough, and students who have published papers not only find jobs more easily compared to those who have not but are also appreciated more by their employers.⁵ Career success is also independently associated with involvement in research even at undergraduate level.⁶ Medical students who had undertaken extracurricular research went on to become physicians who published up to four times as many papers as their peers did who had not undertaken such research.⁷ And even students who are not interested in an academic career benefit from developing scientific writing skills and gain a deeper understanding of the importance of evidence-based medical con-

cepts and their impact on day-to-day clinical practice.⁸ However, it is unclear how prepared Romanian students are to be involved in research and to publish the results of their work. There is also insufficient data to make informed decisions on the aspects that need to be taught as part of courses on academic writing and research ethics. The potential pitfalls that young researchers face need to be understood and addressed.

It was against this background that the present research sought to assess Romanian medical students' level of knowledge on research integrity.

Methods

Study sample

The research was based on data collected during a survey of medical students from the Carol Davila University of Medicine and Pharmacy, Bucharest, Romania, between September 2017 and June 2018.

Test of knowledge of research and publication integrity

The test of knowledge of research and publication integrity comprised a set of 25 questions (Supplement 1) grouped into four sections.

Section 1 comprised three questions on self-evaluation of the level of knowledge, one question each on the knowledge of research in general, knowledge of research integrity, and knowledge of publishing integrity. The answers were to be a score, on a scale from 1 to 10, with 1 indicating the lowest level of knowledge and 10 indicating the highest, which meant that the total score for all the three questions was in the range of 3 to 30.

Section 2 was to test how much the respondents knew about research integrity and comprised 11 questions, of which 8 were MCQs (multiple-choice questions), which required the respondents to choose the correct answers from a choice of answers provided, and 3 re-

quired only one correct answer; thus the total score was in the range of 0 to 11.

Section 3 was to test how much the respondents knew about publication integrity and comprised 6 questions, of which 3 were MCQs and 3 were of the other type mentioned above; thus the total score was in the range of 0 to 6.

The questions from sections 2 and 3 were based on the European Code of Conduct for Research Integrity (last updated in Berlin in 2017),³ the Helsinki Declaration (last updated in Fortaleza, Brazil, in 2013),² and the Singapore Statement on Research Integrity (2011).¹

Section 4 included five questions to ascertain the respondents' interest in future training on the above topics, to be answered 'Yes' or 'No', each with 2 options.

Procedure

The respondents completed the questionnaire online. To enable the questionnaire to be distributed through social networks, it was converted into a digital format using Google Forms. The questionnaire was shared through institutional e-mails to all students of the Carol Davila University of Medicine and Pharmacy, and the web page was kept open from 20 September 2017 to 20 June 2018. A remainder was e-mailed about a month after the initial email. All the questions were mandatory.

Statistical analysis

The responses were entered into a spreadsheet (Microsoft Excel) for analysis. A correct answer represented the selection of the correct option on the single choice questions and the selection of all the correct options on the MCQs. For the sections designed to evaluate the respondent's level of knowledge (sections 2 and 3), the combined maximum possible score was 17 and the minimum was 0. The score of each respondent was transformed on a scale from 0 to 100.

The differences between groups were tested using the Mann–Whitney test for non-normally distributed data.

Ethics

At the beginning of the questionnaire, the respondents were informed of the study's details, offered the possibility of withdrawing from the study at any point, and asked to confirm their formal consent to participate in the study by ticking the appropriate box on the web page. The responses were completely anonymous—we collected no personal data except age and sex.

Results

Of the 1908 students who were invited to participate, 187 did—a response rate of about 10%.

Data on age, sex, and prior involvement in research (including writing papers) are summarized in Table 1. A little over two-thirds (70.5%) of the respondents were women, and 156 (83.4%) declared that they had no prior involvement in research, including writing of scientific papers. The mean age of the respondents was 23 years, with a maximum of 25 and a minimum of 21.

Table 1. Profile of participants (n = 187)

Variable	Category	N (%)
Sex	Men	55 (29.5)
	Women	132 (70.5)
Age	Median	23
	Mean	23
	Minimum	21
	Maximum	25
Research involvement	Yes	31 (16.6)
	No	156 (83.4)

The average combined score for the respondents' knowledge of research integrity was 28.9% and ranged from 9% to 73%; the corresponding values for publishing integrity were 43.3% and 15.3%–67% (Table 2).

Table 2. Level of participants' knowledge of research and publication integrity

Integrity	Mean \pm SD	Median (25–75 percentile)	Range	Normality
Research	28.9% \pm 18.5%	18.2% (18%–45%)	9%–73%	$P < 0.001$
Publishing	43.3% \pm 15.4%	50% (33%–50%)	15.3%–67%	$P < 0.001$

The respondents who declared that had been involved in research earlier ($n = 31$, or 16%) obtained an overall median score of 35.3% (29.4%–41.2%) whereas the corresponding values for those any prior research experience ($n = 156$, or 83.4%) were 29.4% and 23.5%–41.2%). The two groups showed no statistically significant differences ($p = 0.018$).

Differences between groups in their level of knowledge of research and publishing integrity are presented in Table 3.

Table 3. Differences in levels of knowledge of research and publishing integrity between sexes and between those with research experience and those without research experience

Variable	Median (25–75 percentile)	P value
Knowledge of research integrity		
Gender		
Male ($n = 55$)	18% (18%–45%)	0.109
Female ($n = 132$)	18% (18%–27%)	
Research experience		
Yes ($n = 31$)	36% (18%–36%)	0.209
No ($n = 156$)	18% (18%–45%)	
Knowledge of publishing integrity		
Gender		
Male ($n = 55$)	33% (16%–50%)	<0.001
Female ($n = 132$)	50% (33%–50%)	
Prior research experience		
Yes ($n = 31$)	50% (50%–50%)	0.284
No ($n = 156$)	50% (33%–50%)	

The average score for knowledge of both research integrity and publishing integrity was higher for women than that for men (Table 3).

When asked how often they read about research integrity, 88 (47%) said never, 50 (26.7%) said less than once a month, 37 (19.8%) said once a month, 6 (3.2%) said once a week, and 6 (3.2%) said every day. However, the differences in the level of knowledge between these categories were not statistically significant ($p > 0.05$ in each case).

Level of knowledge about research integrity

The question in research integrity section that received the maximum number of correct answers was “At which stage of research should the risk for subjects be assessed?” (Q. 4; 126, or 67.4%, correct answers), followed by “How is conflict of interest defined?” (Q. 9; 99, or 53%, correct answers). The question that received the fewest correct answers was “How should researchers share their findings?” (Q. 8; 6, or 3.2%, correct answers), followed by “Which of the following aspects regarding research should be communicated to potential subjects?” (Q. 5; 12, or 6.4%, correct answers). When asked about sharing research findings, 36% of the respondents said that researchers should share their findings openly, 17% said promptly, and 10% said as soon as possible. When asked about what should be communicated to potential subjects, 96% said potential risks; 77% said potential discomfort; 69%, aims; 66%, methods; and 56%, anticipated benefits. Only 10% of the respondents believed that the source of funding should be disclosed; 16% said that information about the researchers should be disclosed; and 36% maintained that any possible conflicts of interest should also be disclosed.

Falsification of data was recognized as a form of research misconduct by 82% of the respondents; fabrication, by 59%; and plagiarism, by 56%.

Level of knowledge about publishing integrity

The question in publishing integrity section (Table 3) that received the maximum number of correct answers was “Who is responsible for content of publication?” (Q. 1; 137, or 73.3% correct answers), followed by “Are negative results valid for publication?” (Q. 3; 162, or 86.6%, correct answers) and “Are post-publication corrections possible?” (Q. 2; 132, or 70.6%, correct answers). The question that received the fewest correct answers was “Which are criteria to determine authorship of a paper?” (Q.4; 24, or 12.8%, correct answers), followed by “Which are considered unethical practices regarding academic publishing?” (Q. 6; 26, or 13.9%, correct answers) and “Which actions, regarding academic publishing, are not considered wrong?” (Q. 5; 6, or 3.2%, correct answers). When asked whether it is ethical to cite selectively to promote the authors’ findings or to please journal editors, 87% of the respondents said that the practice was unethical; 49% believed that self-citation to boost one’s research metrics was wrong; and only 27% considered that inflating the number of references was wrong.

Self-evaluation of the level of knowledge on research and publication

None of the respondents awarded themselves very high scores either for their knowledge of research integrity or of publishing integrity (9 points and 10 points, respectively; Table 3). A quarter of the respondents gave themselves 5 points for their knowledge of research and about the same proportion (23%) gave themselves 7 points (Figure 1). As to knowledge of research integrity, 17% each gave themselves only 1 point or 2 points and 23% gave themselves 3 points. As to knowledge of publishing integrity, 38% respondents gave themselves 3 points.

However, the proportion of correct answers varied a great deal even among those who had given themselves the same score in self-evaluation (Spearman’s $\rho = 0.454$, $p < 0.001$). And although respondents who had awarded themselves low scores (lower than 5) in self-evaluation performed poorly when tested, getting only a small proportion of the answers right, those who had awarded themselves high scores (5 or higher) did not perform as well as was expected based on their self-evaluation.

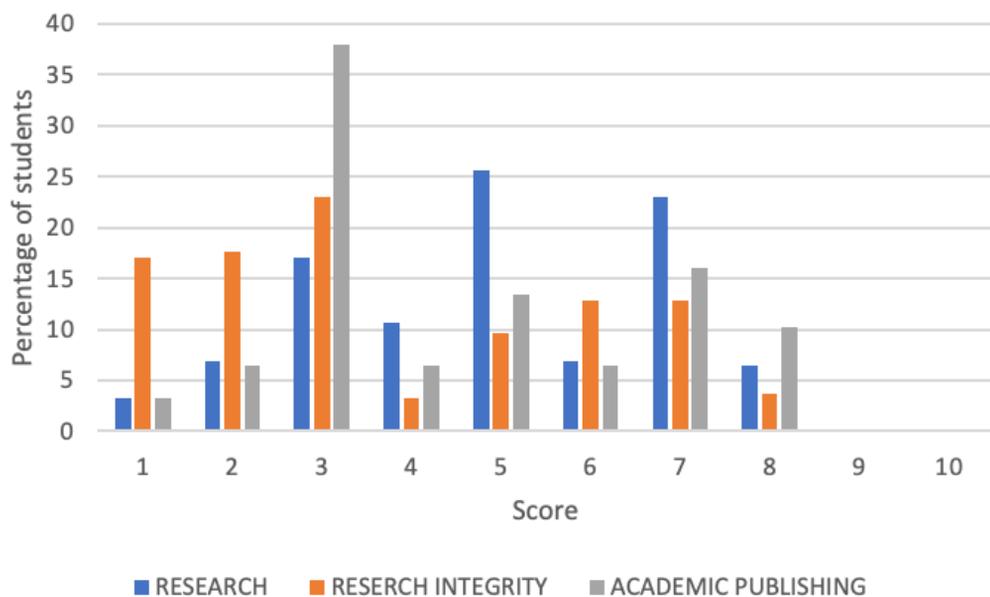


Figure 1. Self-evaluation (on a scale from 1 to 10) by respondents of their knowledge of research and publishing integrity

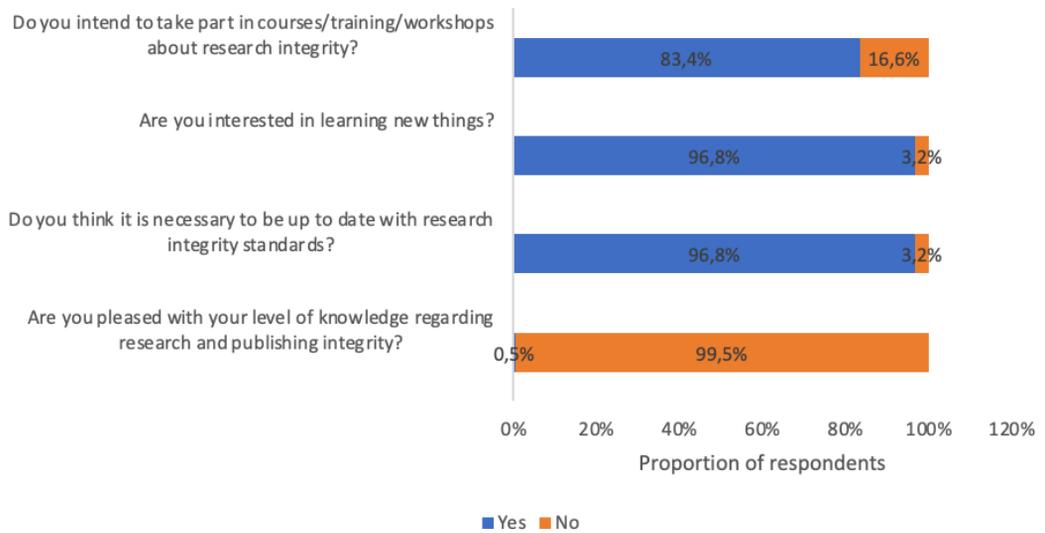


Figure 2. Willingness of respondents to learn more about integrity

A little more than half of the respondents (52%) stated that they had read about research integrity at least once; however, their performance was similar to that of others who said they read about research integrity less frequently ($p > 0.1$).

Finally, a majority of respondents ($n = 156$, or 83.4%) were willing to learn more about integrity and almost all believed that it is necessary to be up to date with current standards of research integrity. Almost no one was satisfied with their existing level of knowledge of research and publishing integrity (Figure 2).

Discussion

This study helps to understand how young researchers tend to approach the conduct of research, collection of scientific data, and the eventual publication of the findings of research. The data from the completed questionnaires showed a low level of knowledge among Romanian medical students of both research integrity and current standards of reporting scientific research and publication.

The low level of knowledge is understandable given that all the respondents were students with little to no prior training on research integrity and publishing standards. Under-

graduate students do not have a mandatory course in ethics in their curriculum. However, such a course becomes necessary as more and more undergraduate students become involved in research as part of their education, starting as early as in the first year of college. Training students in publication ethics should not be neglected, especially because most of the undergraduate programmes require them to submit a thesis based on original research (theoretical or experimental). Research and publication ethics should not be restricted to career researchers or graduate students. Educational programmes need to address a broader audience starting with college students. One survey of biomedical researchers from Switzerland concluded that integrity principles should be taught to children beginning with primary school and the instruction continued throughout the entire career.⁹ The study further affirmed that it is mainly early education – not courses taught at the university level – that ensures that principles of integrity are imbibed and then practised in professional lives later.

In the section on research integrity of our questionnaire, Q. 1, which was related to common-sense ethical practices (What are

the principles of good research practices? Possible answers: Reliability, Honesty, Respect, or Accountability) elicited only 26% correct answers. In that case, if following the most basic principles of ethics during research work is not intrinsically linked with one's lifetime education, training during college years should nevertheless be provided.

Some studies report significantly greater awareness of research integrity following ethics courses on part of the attending academics.⁹⁻¹¹ The effect of attending classes on research integrity was evaluated through a questionnaire completed before and after the course, and the comparison showed greater understanding of plagiarism, false authorship, and fabrication and falsification of data after the course.¹⁰ We believe that although principles of research ethics are available on the websites of many universities, courses can have a greater impact on making the principles more widely known and understood by the target audience.

For example, the principles of research integrity are available on Carol Davila University's website in a section titled 'Other useful definitions' (<https://umfcd.ro/cercetare-si-dezvoltare/comisia-de-etica-a-cercetarii/norme-etice/>), which defines a series of terms related to research. However, a majority of the definitions are vaguely explained, which makes it difficult to extract practical and objective information that can help in answering some of the questions included in our questionnaire. We believe that the document needs to be elaborated and updated and should offer concrete examples of research misconduct and its consequences. We also believe that the document deserves a more prominent spot on the website and its importance needs to be emphasized.

In our study, only 16% of the students claimed to have been involved in at least one research

project; in other studies, not only was the proportion higher but the participants had also published at least one research paper. Here are a few examples: 75% in Stanford University School of Medicine and 66% in the Duke University School of Medicine (both in the United States);¹¹ 50% in Norwegian medical schools;¹² 16% in a medical school in Riyadh, Saudi Arabia;¹³ 15% in medical schools from the United Kingdom;¹⁴ and 13% in medical schools in Pakistan.¹⁵

Falsification, plagiarism, and data fabrication were not considered equally as major forms of misconduct. Falsification was considered by the majority as unethical, consistent with an earlier report,¹⁶ whereas only a small percentage of students considered plagiarism and data fabrication as major forms of research misconduct. The difference was probably due to the general belief that the sheer number of research papers listed in a curriculum vitae is more important than the quality of those papers. More often than we care to admit, quality is sacrificed for speed and quantity when it comes to publishing research. For a medical student who lacks any knowledge of collecting, analysing, and interpreting data or of writing a research paper, fabrication and plagiarism could be seen as easier ways to overcome the difficulties. Also, students may believe that the responsibility for the content of a paper falls on the shoulder of their supervisors, who have more or less guided the students throughout the process. In other words, students with poor knowledge of how research should be performed and lacking any understanding of the principles of research integrity, pressed by the necessity of embellishing their curriculum vitae, may resort to plagiarism and data fabrication—as reported in one study conducted in Pakistan in which less than half (45%) of the medical students considered plagiarism to be wrong or unethical.¹⁷ The study claimed that the

students lacked any understanding of what plagiarism means and its consequences, and another study, involving students from a German medical school, reported that the students faced similar difficulties in distinguishing between examples of different types and degrees of plagiarism.¹⁸

The question related to the criteria that determine authorship of a paper was another one that elicited only a few correct answers, an observation consistent with that of an earlier and similar study.¹⁵ In both the studies, a majority of students, 72% in the present study and 77% in the earlier study, considered 'substantial contributions to the conception or design of the work or the acquisition, analysis or interpretation of data for the work' as the main criterion for being an author but overlooked two other criteria, namely 'drafting the work or revising it critically for important intellectual content' and 'final approval of the version to be published'.

One of the major limitations of the present study is that the chosen sample may not be representative of all students in Romania: our sample comprised only medical students and that too from only one centre, and was also heavily skewed in favour of women.

The respondents showed only a low level of knowledge of both research integrity and publication integrity; however, a majority of them were keen to acquire that knowledge. Instead of leaving it to the student's common sense to decide what constitutes research misconduct, it is desirable to train them in these aspects from the beginning of their academic life.

On the basis of the answers to the questions posed in the survey, we can formulate a series of recommendations to improve the level of knowledge of scientific research, research

integrity, and publication integrity of Romanian students and academics. One of the most important recommendations would be to develop training programmes on research integrity and make them mandatory for all those involved in the development of scientific programmes.

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