

# Research Integrity Practices from the Perspective of Early-Career Researchers

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**Abstract** Unavailability of published data and studies focused on young researchers in Europe and research integrity issues reveals that clear understanding and stance on this subject within European area is lacking. Our study provides information on attitudes and experiences of European researchers at early career stages (doctoral and postdoctoral level), based on a limited sample of respondents ( $n = 27$ ). The study provides both quantitative and qualitative results for the examined issues. The data suggest that awareness and interest of the younger researchers surveyed in research integrity issues is high, however, it is often based on self-initiatives, with many of the respondents not having adequate training or any possibility to obtain it. Our attitude survey conducted within the European Council of Doctoral Candidates and Junior Researchers indicates that only 22 % of respondents had an opportunity to obtain relevant training (significantly less than in a study conducted in the U.S.), and that only one third believed that institutions and supervisors regularly paid attention to it. Further, we noted certain differences between disciplines. The study also reveals that many younger researchers felt they faced problems due to the misconduct of their senior colleagues and the existing institutional culture. The results of the study indicate a need for better prevention mechanisms, training and raising awareness activities. Preferably, junior researchers should be given an active role in shaping the integrity culture. It should be noted that the presented results should be considered in the context of the limitations stemming from the small-scale survey. This paper encourages further research activities on research integrity practices to provide stronger evidence on the attitudes and experiences of young researchers in Europe and other parts of the world.

**Keywords** Research integrity · Responsible conduct of research (RCR) · Responsible research and innovation · Early-career researchers · Doctoral training

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## Introduction

The importance of scientific integrity and the responsible conduct of all actors involved in the research system has been widely recognized and discussed. All researchers, regardless of their professional experience, position or responsibility within an institution are equally expected to respect professional standards and ethical principles. However, an increasing number of cases reporting research misconduct indicates that discrepancies between expectations and practices do exist (Dorey 2010; Nowotny and Exner 2013; Jaffer and Cameron 2006). Those cases decrease public confidence in science, questioning the conduct, achievements and responsibility of the entire research community (Brounéus et al. 2014; Franzen et al. 2007). The cases of misconduct where the main actors are younger researchers or students usually draw even greater attention from the research community (Grant 2010; Miller 2010), as they additionally emphasize questions related to training and responsibility within institutions. The need for more extensive research aimed at this focus group is evident, given the increasing number of PhD students, and, subsequently, the likelihood of misconduct (Mitchell and Carroll 2008), and the potential impact such occurrence may have on the current and future science enterprise. The mentioned research would generate valuable data that would enable and encourage evidence-based policy decisions and open new avenues of research exploring and highlighting issues specifically relevant for researchers at early stages of their careers.

Considering the profile of doctoral and junior researchers in terms of research integrity issues, a number of features can be identified to explain the need for increased attention on this focus group:

- *level of experience*—in conducting research, presenting results and interacting within and beyond the research community, which is generally lower than for other research staff and which introduces themes related to mentoring and training
- *level of knowledge*—related to professional and ethical standards and rules (or their perception), which under certain circumstances could be related to the level of experience
- *career level*—being at the early stages of a research career, often without stable positions, contracts or grants, likely to be more frequently exposed to pressures related to career advancement and the achievement of scientific references needed to support their professional growth and stability
- *dependent status (or lack of independence)*—highlighting relations with their supervisors, senior staff and other faculty
- *high mobility rates*—(cross-national, institutional, sectoral and disciplinary), usually higher than for senior staff, exposes them to the influence of different research integrity practices, perceptions or cultural influences
- *special status of doctoral candidates*—they are considered to be both researchers and students, which additionally emphasizes training practices (or lack thereof)

- *future impact*—higher and longer impact influencing future of research; possibility for long-term benefits, shaping future integrity culture and influencing responsible research practice for new generations of researchers

A literature review reveals that the number of scientific studies focused specifically on PhD students and junior researchers in the context of research integrity issues is scarce and that they may not cover many potentially relevant aspects. However, it should be noted that the studies published on the subject are typically focused on one or more features indicated above.

The provision of adequate training is probably the most frequently explored and discussed topic in different contexts (Kalichman 2007; Steneck 2013). The relationship between supervisors and post-graduate students, as well as the role of mentors, supervisors and advisors in shaping integrity culture has been frequently discussed (Anderson et al. 2007; Bird 2001; Wright et al. 2008). Considering responsibility in ensuring RCR training for PhD students and fostering scientific integrity, Titus and Ballou (2014) highlight the role of institutions. Also, cases based on the Ombudsman's practice indicate the problems in mentoring young scientists and the appropriate recognition of their work (Beisiegel 2010).

There are several U.S.-based studies of surveys conducted at different levels and involving both faculty and students. They represent valuable sources of information on research integrity practices, perceptions and other issues relevant for postgraduate students and junior researchers (Langlais 2006a; Martinson et al. 2005). With respect to the European experience, there are two studies: a survey conducted among postgraduate students at medical faculties in Sweden (Nilstun et al. 2010) and a study on publication ethics which included PhD students of health science faculties in Ankara, Turkey (Arda 2012). However, we could not identify any studies or surveys conducted among doctoral and postdoctoral researchers at the European level.

The importance of evidence-based research for policy making and the unification of European research and education practices is widely recognized and encouraged. The existing studies cover a range of issues relevant for younger researchers, including mobility, training, supervision and various career aspects (Ateş et al. 2011; IDEA 2010). However, a clear understanding and stance on research integrity issues related to early career researchers in Europe is lacking, including the awareness, perceptions, training of young researchers, the problems they face, the role of institutions and supervisors, and potential disciplinary differences. These results could be valuable as support in building common standards and improving training practices within European Research and Higher Education Areas (ERA and EHEA).

A need for further evidence on research integrity and for prevention of research misconduct as the ultimate goal has also been recognized by the European Science Foundation in a report that took the form of a European Code of Conduct for Research Integrity (ESF 2010). The report stressed the importance of scholarly research as a tool for better understanding misconduct and improper research practices and encouraged such studies on both policy issues and scientific behavior.

It recommended occasional surveys of awareness in samples of students, scientists and scientific administrators and checks on the availability of mentoring programmes. The mechanisms for prevention, education and awareness are recognized to be a core requirement for embedding principles of good research practice and integrity into research culture.

The purpose of this study is to: (1) examine various issues related to research integrity and young researchers in Europe; (2) reduce the gaps resulting from the lack of relevant data and analysis on the subject; (3) bring attention to some specific experiences and needs of young researchers; and (4) serve as a starting point for new, focused, large-scale research, which would ultimately lead to the development of suitable training programs and strategic thinking at institutional, national or regional levels.

In this context we present the results of a survey on research integrity based on a small sample of respondents that was conducted within the European Council of Doctoral Candidates and Junior Researchers (Eurodoc). The purpose of the survey was to screen the situation related to doctoral candidates and junior researchers and to identify and shed more light on the issues that are important from their perspective, including awareness, perceptions, potential problems and need for training. The survey has been designed, conducted and analysed by a member of the association (author of the study), who has actively participated in international networking activities on research integrity (Krstić 2015).<sup>1</sup> The paper presents and discusses the findings of this small-scale attitude survey, highlights the limitations stemming from the limited sample of respondents and indicates a need for further research activities.

## Study Method

The survey was distributed through Eurodoc's internal mailing list (consultation list) which includes members involved in managing, consultative or representative activities of the association: board and secretariat members, national delegates (representatives of national member associations) and observers. The list included doctoral candidates and junior researchers with different disciplinary orientations. The questionnaire was prepared in English and it included an explanation of the purpose of the survey, the basic concepts related to the subject (research integrity), and the procedure that would be used to conduct the survey. Special attention was given to design and explain the method which would be used to protect the privacy and confidentiality of respondents and their answers. The procedure guaranteed that individual responses (sent directly to the author of the study) and personal data that may reveal identities or relate respondents to their answers would not be published or disclosed to third parties.

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<sup>1</sup> The publication (Krstić 2015) discusses the contribution of professional networks to research integrity and ethics. The survey presented in this paper was mentioned only in the context of a better understanding of the matter (related to professional networks), but it was announced that the fuller presentation of the survey results was forthcoming in a new paper. This paper presents the results announced in the cited publication.

The answers were provided on a voluntary basis. The number of the survey respondents was 27, which provided a good coverage of different disciplines, geographical areas and career levels. There were respondents from 21 different countries, 15 from the fields of science and engineering and 12 from the fields of social sciences, humanities and arts. The sample included 18 doctoral, 7 post-doctoral and 2 pre-doctoral (preparation for PhD) researchers. Additionally, 2 other responses were provided which could not be included in the survey analysis.

The survey was designed in a manner to provide both quantitative and qualitative results. For every question with multiple-choice answers there was an option to add a comment in an open-ended format. At the end of the survey each respondent was given an opportunity to include a general comment on the survey itself or on the relevant subject. The results were presented both in quantitative (number of answers or calculation of percentages) and qualitative form (analysis of open-ended comments).

It is not possible to provide accurate information on the percentage of members of the relevant mailing list who responded to the survey given that this dynamic list may have included delegates from previous years who were no longer active within the association. However, taking into consideration the activity of members as the basis for comparison, it can be considered that the number of respondents represented 57 % of the number of members who actively participated in the work of the consultation list (with at least one activity) for the relevant period (July 2010–January 2011).

The survey questions were designed in a way to illuminate issues important from the perspective of young researchers and not to investigate the possible existence or level of their misconduct.

## **Findings**

Although the survey had a screening character, to facilitate interpretation of the results, the responses are presented in both quantitative and qualitative ways. The disciplinary differences are presented for the questions where they were noted and found relevant. Despite the European dimension of the survey, it should be understood that the presented findings are relevant for the described sample and not for all doctoral candidates and junior researchers in Europe.

### **Awareness**

The terminology related to research integrity (in the context of both good and bad scientific practice) was provided and explained in the introduction to the survey. However, one of the goals was to examine whether researchers had been familiar with the relevant terminology and its real meaning prior to the survey. In addition, we tried to understand the level of their awareness (based on their own perceptions), as well as the sources from which they learned about it.

The quantitative results generally indicated good awareness, with only 11 % of respondents indicating that they did not have an opportunity to learn about research

integrity. However, 37 % considered that they were only partially aware of the issue.

Those who indicated that they had the opportunity to learn (including partially) were asked to indicate the sources of learning. They were offered a list of six options with the possibility to provide multiple answers (Table 1). The results presented in Table 1 indicate that most frequently they had the possibility to learn from their institutions, the Internet or colleagues. However, it is interesting to notice that all respondents who indicated their institutions as the only source of learning believed that their knowledge was only partial. Several respondents commented that they only had an opportunity to hear and not to learn about the matter. Limited understanding of the subject was also apparent from other comments.

It is interesting to note that respondents doing research in science and engineering had the opportunity to learn about research integrity from wider a variety of sources than those in social sciences, humanities and arts. They also used the Internet more often for such purposes (see Table 1).

### Training and Discussions

Several questions in the survey explored issues that can be related to the training of young researchers. These included: the possibility to obtain training (from any source), to discuss issues with supervisors or otherwise within their institutions, as well as their motivation to learn about the matter.

To the question whether the issues related to research integrity, including science misconduct, plagiarism or responsible research conduct were often discussed in their institutions, only one-third responded positively. Based on the comments provided it can be inferred that they were discussed mainly in the context of plagiarism, scientific fraud or other cases of misconduct which took place at the group or global level. One respondent explained their position with the following comment: “They are discussed only if a ‘mistake’ occurs. But not ‘prevention’ discussions”.

To the question exploring possibilities for training for early-career researchers, only 22 % of respondents confirmed that they had the opportunity to obtain training (formal or informal) on the above-mentioned issues or generally on good scientific practice. Among them there were a few comments indicating good scientific practices in their institutions. Additionally, a PhD researcher who did not have the opportunity to receive such training, indicated that a course on research ethics is

**Table 1** Sources of learning (multiple answers possible)

	Institutions	Sci journals	Internet	Colleagues	Seminars	Other
All respondents (n = 27)	12	4	11	9	1	1
Science and engineering (n = 15)	8	3	9	5	1	0
Soc. sciences, humanities and arts (n = 12)	4	1	2	4	0	1

now mandatory at their department, which was not available when they started their studies.

The following question examined the role of supervisors in providing training, i.e. whether they often paid attention to the issue and discussed it with doctoral and post-doctoral researchers. 37 % of respondents found that their supervisors regularly paid attention to the mentioned issues and 29 % found that they rarely did. This means that one-third of surveyed researchers felt that their supervisors did not pay any attention to the RCR.

An encouraging result of the survey is the finding related to the high interest in learning. In particular, 63 % of respondents expressed a clear motivation for training or learning more about the relevant issues. Additionally, 15 % of the respondents were uncertain. By cross-checking the results on interest in training with answers to the question on awareness, we found that all respondents who did not express interest in training (22 %) had the opportunity to learn about research integrity issues earlier. A comparison of the answers to interest in learning with those about the possibility to obtain training reveals another interesting correlation. The majority of respondents who indicated that they had an opportunity to obtain training also expressed their interest in further learning about relevant issues (only one of six persons who had training was not interested in learning more).

#### Perceptions on Reasons for Misconduct

The aim of this survey was not to explore the personal involvement of respondents in bad scientific practices, therefore it did not include questions that could provide information on the level and types of potential misconduct. Instead, the survey included a question exploring their perception of reasons for misconduct. They were asked to allocate a certain number of points (according to the perceived level of importance) to each item on the provided list which according to their opinion could be a reason for misconduct or related inappropriate research practice. The offered reasons represented a balance between options regarding the personality of researchers, their awareness and circumstances:

1. Lack of awareness, knowledge, understanding
2. Lack of appropriate training
3. Work overload (not enough time for conducting experiments or similar)
4. High publishing demands
5. Insufficient time to complete PhD or potential problems with funding
6. It is 'funny' to fake results
7. Research misconduct does not depend on circumstances, but only on the personality of those who practice it
8. Other (please indicate)

Respondents were asked to allocate 0 for reasons that they found not important, 1 for important and 2 for very important.

The results, presented in Table 2, indicate that the most respondents believed that misconduct did not depend on circumstances, but on the personality of those who practice it. This option was followed closely by another two items on the list: high publishing demands and lack of awareness, knowledge and understanding.

Further analysis of the answers reveals certain discrepancies in perceptions between respondents with different disciplinary orientations. Table 3 presents results classified according to the disciplinary orientations in two groups: (1) science and engineering and (2) social sciences, humanities and arts. The results presented for both groups include the sum of allocated points and the number of respondents (expressed in percentages) who allocated relevant number of points (0, 1 or 2) to different options signifying reasons for misconduct. The numbers of respondents (answers) are shown in percentages, in order to provide better comparison between different groups of research fields (sums of points cannot be directly compared due to different number of respondents).

While both groups found that the type of personality was a very important factor which may determine someone's tendency toward misconduct, respondents working in the fields of science and engineering considered a high publishing demand to be the highest threat that may compromise responsible scientific behavior. Results presented in Table 3 show that 60 % of researchers in these fields found it very important, with the highest overall number of points.

Alternately, the respondents in the field of social sciences, humanities and arts felt less pressured by high publishing demands. According to their perception, a lack of awareness, knowledge and understanding is the second most important reason after the character of researchers that may lead to misconduct. This finding can be related to the qualitative information provided by the survey, which indicates their diminished opportunities to obtain training or discuss the matter. Many respondents from both groups of research fields expressed their opinions that researchers in social sciences and humanities had less opportunity to learn about the subject,

**Table 2** Perceived importance of different reasons for misconduct (results for all respondents)

Option <sup>a</sup>	Number of answers for each option and level of importance, n = 27			Sum of allocated points (according to the level of importance) for different options
	0 (not important)	1 (important)	2 (very important)	
1	3	15	9	33
2	6	14	7	28
3	11	10	6	22
4	5	10	12	34
5	12	10	5	20
6	27	0	0	0
7	4	11	12	35

<sup>a</sup> Number of options corresponds to the options presented in the text above: (1) lack of awareness, knowledge, understanding; (2) lack of appropriate training; (3) overload by work (not time for conducting experiments or similar); (4) high publishing demands; (5) too short time to complete PhD or potential problems with funding; (6) it is 'funny' to fake results; (7) research misconduct does not depend on circumstances, but only on the personality of those who practice it



**Table 3** Perceived importance of different reasons for misconduct—differences in perception between respondents with different disciplinary orientations

Option <sup>a</sup>	Science and engineering, n = 15		Social sciences, humanities and arts, n = 12					
	Sum of allocated points	Percentages of answers indicating different levels of importance (%)		Sum of allocated points	Percentages of answers indicating different levels of importance (%)			
		0 <sup>b</sup>	1 <sup>c</sup>		2 <sup>d</sup>	0 <sup>b</sup>	1 <sup>c</sup>	2 <sup>d</sup>
1	17	13	60	27	16	8	50	42
2	16	13	67	20	12	33	33	33
3	13	40	33	27	9	42	42	17
4	22	13	27	60	12	25	50	25
5	12	40	40	20	8	50	33	17
6	0	100	0	0	0	100	0	0
7	18	20	40	40	17	8	42	50

<sup>a</sup> Number of options corresponds to the options presented in the text above: (1) lack of awareness, knowledge, understanding; (2) lack of appropriate training; (3) overload by work (not time for conducting experiments or similar); (4) high publishing demands; (5) too short time to complete PhD or potential problems with fundings; (6) it is “funny” to fake results; (7) research misconduct does not depend on circumstances, but only on the personality of those who practice it

<sup>b</sup> Not important

<sup>c</sup> Important

<sup>d</sup> Very important

receive training and discuss it with their supervisors than researchers in science and engineering.

### Inconveniences and Vulnerability

Bearing in mind the specific situation of doctoral candidates and junior researchers within their institutions and their dependence on supervisors and senior staff, a set of questions was designed to explore the potential problems they may face and the possible vulnerability resulting from this specific status.

Our findings indicate that 30 % of respondents believed they had experienced some sort of inconvenience due to the misconduct of their senior colleagues or somebody from their professional environment, and an additional 11 % suspected that this was the case. Although explanations and details on personal cases were not provided by all respondents who experienced or suspected that they had experienced inconvenience, according to the available comments it can be noted that the most frequent problem was associated with an inappropriate attribution of authorship. Young researchers indicated cases where they were completely deprived of authorship on publications resulting from their research results. Other examples included plagiarism, issues related to grant or project applications, as well as unacceptable practices of supervisors.

The survey suggests that the majority of respondents (56 %) were concerned that reporting misconduct in their research environments may negatively influence their PhD, careers or otherwise create problems for them. Additionally, 29 % of respondents were uncertain and only 15 % did not have such concerns.

It is interesting that half of the respondents were not sure whether they had suitable mechanisms to protect themselves from inconvenient situations, while one-third thought that they had such mechanisms. However, the explanations provided in optional comment fields reveal certain levels of dissatisfaction or distrust in such mechanisms. The reasons noted include an institutional or community culture in which solidarity between senior colleagues either prevents such mechanisms or otherwise punishes young researchers and students for reporting misconduct and for daring to ask for the protection of their rights and interests. Several comments indicated that such vulnerability was higher at lower levels of study or research. This posed particular problems for those respondents who were engaged in research activities at the undergraduate level.

The final question in this group examined whether respondents had the opportunity to discover misconduct, discrepancies in results or experiments through the scientific literature (e.g. trying to reproduce experimental results). If they had, an additional question followed about whether they knew what to do in such a situation, whether they had taken any action or perhaps felt confused. One-third of respondents provided positive answers or indicated that they knew somebody from their environment who had a similar experience. However, none of them could take any action. Their experience could be described by two typical scenarios. In one of them it was not possible to reproduce experiments under equal circumstances. The young researcher who discovered this could not take any action, as according to the prevailing opinion, research is published on the basis of “what is working” and not

“what is not working”. They were of the opinion that publishing discrepancies in conducting relevant experiments would expose them to a lot of criticism and long-lasting negative effects. The other scenario was where the same experiments, using the same techniques, instruments and materials produced almost opposite results. The junior researcher could not take any action, as it was found inappropriate to question the research (including a series of publications) done by a senior researcher.

## Discussion

We are not aware of any comparable data sets or qualitative research conducted at the European level which can provide information and understanding of the research integrity issues related to researchers at early career stages regarding their awareness, perceptions, training, the role of their institutions and supervisors, problems, as well as disciplinary differences. Similar types of data and studies stemming from associations of young researchers from other parts of the world were not available either. Due to this data gap, we found it appropriate to compare and discuss some of our findings in the context of the available results of surveys conducted at university or disciplinary levels in different parts of the world.

Our findings suggest that the perceived awareness and interest of the surveyed young researchers related to research integrity is high, but often based on self-initiatives, as many of them do not have suitable training or any possibility to receive training and knowledge on the subject within their institutions.

We found that their opportunity to obtain relevant training (from any source) was significantly lower than the opportunity of postgraduate students in the available analysis conducted in the U.S. While our survey suggests 78 % of respondents did not have the possibility to receive any training, the survey conducted at Old Dominion University (ODU) in the U.S. indicates that only 27 % of postgraduate students stated that they did not receive training on RCR (Langlais 2006b).

There is another noted discrepancy related to the interest in training between these two groups (high interest in our sample and high resistance to mandatory training in the ODU sample). This can be a consequence of two factors. The first one is related to the lack of training for respondents in our sample, so they felt an increased need to learn about the issue. The second reason may be the fact that we explored general interest in training and not specifically in mandatory training, as was the case with the ODU survey.

Another interesting finding in our survey is that a majority of respondents who indicated that they had obtained training also expressed an interest to learn more about relevant issues. This finding may lead to the conclusion that their training was inadequate or insufficient. However, this can also mean that the training they received has raised their awareness, and encouraged critical thinking and motivation to acquire broader and deeper knowledge on the subject.

A survey conducted in the U.S. at Western Michigan University shows that 70 % of graduate students indicated that they had not had any discussion with faculty in

the prior year about the topic of scientific misconduct.<sup>2</sup> Although the questions in the two studies were not designed in the same way, our study yielded similar results, indicating that research integrity had been discussed often only in one-third of institutions. While the results in the two studies can be considered to be similar (both being based on the perception of young researchers), the differences are notable when our results are compared with the findings of a survey based on faculty reports. In the study conducted among U.S. faculty investigating supervisors' activities, 88.6 % of respondents reported that they had discussed good research practices with their doctoral student graduates (Titus and Ballou 2014). In our survey 66 % of early-career researchers answered that their supervisors paid attention to research integrity (37 % regularly and 29 % rarely). However, this difference does not necessarily mean that the supervisors of our respondents paid less attention to research integrity than their U.S.-based colleagues. This may rather indicate a discrepancy in the perceptions between supervisors and students on what is provided and what is received. Other studies also reported different perceptions between faculty and students at the same institution with respect to the training provided in several RCR topics (Langlais 2006b).

Several studies explored the responsibility of different actors (institution, supervisors) in providing RCR training and the different roles of supervisors. The results illustrated a lack of clarity on who is responsible for critical aspects of doctoral students training (Titus and Ballou 2014). Also, the multiple roles of supervisors were discussed, emphasizing that they should serve both as mentors and exemplars (Gray and Jordan 2012). Our survey did not explore opinions on whose responsibility the RCR training should be, neither on what the role of supervisors should be. However, from explanations provided to different questions it is possible to infer that the role of supervisor is considered to be vital for fostering responsible research practices among young researchers. It was particularly emphasized in the case of "external" doctoral candidates.<sup>3</sup> Supervisors were frequently mentioned, both in the context of good and bad practices. In cases explaining good practices it is clear that they served both as mentors and as role models. Other cases describing unsuitable or bad practices often were related to the failure of the mentoring role or the irresponsible behavior of supervisors. However, in institutions where other mechanisms to support RCR were available, there was a higher awareness of responsibilities of other parties. In one of the best examples of good practice in our survey, aside from the important role of supervisors, there was a mention of the contribution of institution, colleagues, thesis committees, professional clubs, and organized activities such as workshops and courses.

The comparison of the survey results with the findings of the survey conducted among doctoral students of medical faculties in Sweden reveals a discrepancy in the opportunities to learn about responsible research or misconduct (Nilstun et al.

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<sup>2</sup> The data is found in the presentation "Ethics for the Next Generation", presented by P. Langlais at the 16th Annual Teaching Renewal Conference, University of Missouri at Columbia in 2006. An unpublished report "Teaching Research Ethics: An Institutional Change Model" from Western Michigan University (Hartmann and Mullins 2003) was indicated as the data source.

<sup>3</sup> An option that exists in some European countries—a PhD candidate working outside the university, often in a non-academic sector.

2010). While our survey indicates that 89 % of respondents had the opportunity to learn or hear about research integrity, the Swedish study shows that less than one-third of doctoral students had heard about scientific dishonesty in the last 12 months. The time limitation of 12 months in the Swedish survey could be one of the reasons for the discrepancy. However, it is more likely that the reason for the high awareness of researchers in our survey is related to the composition of the group and the activities of their members. In particular, Eurodoc members are often involved in many non-curricula activities, have better networking capacities and are usually better informed of many science policy issues. It is quite possible that awareness of the subject among the general population of younger researchers in Europe is lower than in our sample. In this context, attention should be given to the role different languages in Europe may have on the understanding of the subject given that some European languages may not have equivalent expressions or translation for the term ‘research integrity’. Differences in the definition of ‘scientific misconduct’, not only between countries, but also between research institutions have also been observed (Salwén 2014), (on which occasion the definition of the Swedish Research Council was criticized). Certain comments in our survey indicated that some respondents were more accustomed to the terminology in their native languages. Other respondents expressed interest to learn about the issue in their local environments. This difference in languages did not have significant effects within the association where the working language is English, also keeping in mind that the explanation of the matter was provided in the introduction to the survey. However, a precise and meaningful translation of the terminology to other languages could contribute to a better understanding of research integrity.

One result of potential concern in this survey is that doctoral candidates and junior researchers often felt that they were exposed to inconveniences due to the misconduct of senior colleagues. Unfortunately, this practice is neither new nor specific to the geographic area covered in the study. Research conducted in the U.S. two decades ago presented similar findings—that 44 % of doctoral students had exposure to misconduct or misbehavior and that 53 % of surveyed students felt vulnerable at the prospect of reporting a faculty member (Swazey et al. 1993). In a survey conducted within the American Physical Society (APS) 39 % of junior respondents revealed that they had observed or had personal knowledge of ethical violations while they were graduate students or post-docs (Kirby and Houle 2004). The report also noted some typical examples of unethical treatment of subordinates by the senior staff (“abuse” and “exploitation” as frequently described by graduate students). The inappropriate recognition of young scientists, graduate students and post-docs for their work in terms of authorship was also the subject of cases reported on the basis of a German “Ombudsman” experience (Beisiegel 2010). Different cases of the theft of student’s work and problems that young researchers faced due to misconduct or the unfair behavior of their supervisors and senior colleagues have also been described in other articles (Mitchell and Carroll 2008; Wagena 2005). Similar to the experience reported in our survey, a study presented a case where junior researchers could not take any action when a senior colleague with an established reputation in the field substantially plagiarized their work (Street et al. 2010).

It is possible that this specific situation of young researchers, including a limited opportunity to receive training and discuss relevant issues, was the reason that motivated many respondents to express their appreciation for the survey and encourage further work as well as report the findings. It is worth noting that following this survey two workshops have been organized by the association—one on research integrity, the first at the European level organized by and for doctoral candidates and junior researchers, and another on ethics in research organized for a broader audience (Krstić 2015).

The specific situation of young researchers and the importance of research integrity for the entire science enterprise and future knowledge economies requires much more action in Europe and world-wide. First, we recommend the development of mechanisms aimed at the prevention of scientific misconduct. Activities that promote good scientific practice, develop an institutional culture of responsible conduct and raise awareness should become an inherent part of all research institutions and professional societies. Suitable policy frameworks and mechanisms for their implementation are also needed. Alongside the development of high-quality training programmes suitable for early-career researchers it is crucial to foster ethical behavior and enhance the mentoring role of supervisors.

This study also indicates a need for more evidence-based research in Europe on the issues related to research integrity. Large-scale surveys exploring practices and needs could provide valuable comparable data to support policy decisions and encourage the development of suitable tailor-made training programmes.

Activities oriented toward researchers at early stages of their careers have the highest prospects of providing long-term benefits to society and developing research systems acknowledging principles of responsible research and innovation.

## Limitations

The main limitation of this study is that the survey is based on a small sample of respondents ( $n = 27$ ). *Therefore, the results should be considered in the context of this limitation and cannot be considered representative for all young researchers in Europe.* While the survey provided interesting information on attitudes and experiences of young researchers, the number of surveyed researchers was insufficient to allow a thorough quantitative analysis of disciplinary or geographical differences. Information on the potential differences could help improve an understanding of the situations of junior researchers across Europe and facilitate the development of adequate training programmes and policy measures.

In addition to the quantitative presentation of the results, this survey also included a qualitative dimension which provided potentially valuable information that can improve an understanding of the range of attitudes and experiences of young researchers. Bearing in mind that published studies focused on qualitative research methods are often based on even smaller samples (for example in Street et al. (2010)  $n = 17$ ), we believe that the pool of 27 respondents should not be considered insufficient for this type of information.

Another limitation may be related to the self-reporting character of some questions in the survey. However, this factor probably did not have a significant influence on the results, given that the survey did not examine misconduct of respondents, but only perceptions, possibilities (related to learning and training) and possible inconveniences.

The optional character of the comments can be considered both an advantage and a limitation (to an extent). It provided valuable qualitative information for every question and on the whole subject, while not putting pressure on respondents to comment on the issues they did not feel comfortable to speak about. Also, due to the optional character of the comments, this study cannot provide a full explanation for all the answers or situations that respondents have experienced.

A similar discussion applies to the mailed aspect of the survey. While it is generally considered to be a limitation, in this particular case it provided an advantage, as it was possible to contact respondents and clarify certain statements, if necessary. Besides, as noted, the survey did not investigate misconduct of respondents and all answers were provided on a voluntary basis. We believe that the mailed survey provided an advantage in this specific case due to the circumstances related to the small sample of respondents and a high level of confidentiality and trust. Otherwise, web-based surveys are recommended.

## Conclusion

The results presented in this small-scale study suggest that it is crucial that all parties in the research system pay more attention to the issues and subjects connecting research integrity and researchers at early stages of their careers. There should be more efforts in training young scientists and protecting them from the effects of misconduct. They should be given better opportunities to access awareness activities and discuss relevant matters—with peers and also with supervisors. Complementary activities beyond their institutional environments would be particularly useful, where they could discuss problems they face and propose better practices without fear of consequences. Targeted specialized surveys can also help raise awareness. Finally, more research is needed in Europe to provide evidence to support policy decisions, encourage the development of suitable training programmes and respond to the challenges associated with the internationalization of higher education and research institutions, and global research cooperation.

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