Promoting Integrity as an Integral Dimension of Excellence in Research

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A multinational survey on research misconduct and integrity: a workfloor perspective

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Summary

To date, most of the public and academic attention on scientific misconduct and integrity is based on an assumption that misconduct is carried out by individual researchers, the "bad apples". There has been less recognition that also social and organizational structures may influence how researchers conduct their research. This latter perspective is often referred to as the "bad barrel" approach.

Our objective is to analyze the relations between workplace factors and research misconduct and integrity. To do this, we collected survey data (n=1126) for eight European Universities in seven European countries and covered all academic positions and major science fields. We mainly present descriptive results in this report, but we have also done multivariate analysis of the associations between research misconduct and organizational variables and demographics.

Our main findings suggest that a systematic focus on researchers' well-being, work environment, identity-building, and open discussions on research misconduct and integrity can prevent scientific misconduct and foster integrity.

1 Introduction

To date, most of the public and academic attention on scientific misconduct and integrity is based on an assumption that misconduct is carried out by individual researchers with varying degrees of integrity, acting opportunistically in their own self-interest. Such an individual perspective is often broadly referred to as the "bad apple" approach, drawing on the assumptions that by removing the bad apples the problem will be solved. This perspective is also evident in how the media and other discussions in the public treat scientific accomplishments, where notions of individual culprits and the "academic superstar" are common.

An element that is strikingly underemphasized in these assumptions and discussions is the acknowledgment of researchers as organizational actors, that is, influenced by their organizational context. Rather than emphasizing individual misbehaviors, focus is broadened to include the social and organizational structures that influence how researchers conduct their research. Such a perspective is generally referred to as the "bad barrel" approach, suggesting a focus on the surrounding systems and structures rather than only on the individual culprits.

In this report, we focus on the latter "bad barrel" perspective. Our objective is to analyze the relations between workplace factors and research misconduct and integrity. Workplace factors include organizational culture, monitoring and sanctions, information and training, and managerial focus.

In so doing, we complement the existing body of literature that has focused on the antecedents and drivers of misconduct and integrity with a survey involving a larger sample size (n=1126). Studies using survey data have mainly had small sample sizes (n= ca. 200) in addition to have focusing on USA and the hard sciences (1, 2). By having a larger sample size, we are able to study the demographic and organizational sub-group influences on research misconduct and integrity in greater detail. To the best of our knowledge, we are the first to sample eight institutions in seven European countries and to cover all academic positions and major science fields in one survey.

The survey highlights the following questions from the work-floor:

1. How do researchers perceive the prevalence of misconduct?
2. What is the knowledge about integrity policies in research organisations?
3. How are whistleblowing systems perceived by researchers?
4. How do researchers perceive their work environment?
5. To what extent do researchers experience tensions between different evaluations of research misconduct?
6. How do researchers believe that research misconduct should be prevented?

2 About scientific misconduct and integrity

2.1 Key concepts

There is no European or international agreed-upon definition of scientific misconduct and many authors and institutions hesitate to give one. The European Science Foundation (ESF) and the ALLEA (All European Academies), which have been central in developing a European approach to misconduct (see The European Code of Conduct for Research Integrity), avoid giving a definition, but list the many 'disguises' of misconduct: fabrication, falsification, plagiarism (FFP), failure to meet clear ethical and legal requirements, improper dealing with infringements, and minor misdemeanors (3).

However, definitions exist, and one example is the definition by the US National Science Foundation: '(a) Research misconduct means fabrication, falsification, or plagiarism in proposing or performing research funded by NSF, reviewing research proposals submitted to NSF, or in reporting research results funded by NSF' (NSF Regulation 45 CFR 689)1. It is clear that research misconduct requires an intention or gross negligence: '(b) Research misconduct does not include honest error or differences of opinion' (ibid.).

Less severe cases of scientific misconduct, for example dropping and withholding data, "data fishing", falsification of bio-sketch or personal references, non-disclosure of conflicts of interests, claimed undeserved authorship or denied authorship to contributors, are often called "Questionable Research practices" (QRP). However, for such cases there are no internationally agreed definitions or agreement on ways to express a question to tap one item, how many items to be included on the list of QRPs, or a summary QRP score. In this report, we focus on both FFP and QRP.

Likewise, there are several approaches to research integrity. Science Europe (p. 3) states that research integrity is usually understood as 'the performance of research to the highest standards of professionalism and rigour, in an ethically robust manner' (4). However, many actors instead outline principles of research integrity, rather than definitions. In a statement from December 1st 2015, The Council of Europe agree with principles for research integrity expressed in the European Code of Conduct: honesty, reliability, objectivity, impartiality and independence, open communication, duty of care, fairness, and responsibility for future science generations (Council of the European Union, 2015, 14201/15, article 7)2.

[1] https://www.nsf.gov/oig/_pdf/cfr/45-CFR-689.pdf
[2] http://data.consilium.europa.eu/doc/document/ST-14201-2015-INIT/en/pdf

2.2 Prior literature

There are several approaches to explaining research misconduct. David Goodstein (5) lists three risk factors that he claims often characterize instances of scientific misconduct. One is career pressure, that is, the increase of competition for funding and for tenure. Another is "knowing the answer", that is, the researcher thinks he or she knows the results of the study if it were to be carried out properly, but decides to avoid the trouble of doing it properly. A third is the perceived difficulty of reproducing the research.

In addition to these risk factors, there has been some research on the causes implied in misconduct. Davis et al. (6) studied the closed cases registered in the files of the US Office of Research Integrity (ORI). They identified the following causes: (1) personal and professional stressors, (2) organizational climate, (3) job insecurities, (4) rationalizations A, (5) personal inhibitions, (6) rationalizations B and, (7) personality factors.

There is a vast literature on individual variation in wrongdoing; although, according to Andreoli and Lefkowitz (7), much of this literature is inconclusive. With regard to age one would think that moral development increases with age, but here the research seems to be inconclusive; some find a link, others not. When it comes to gender, the literature is more coherent that there are no significant gender differences (8). In a recent study, the hypothesis that male gender or individual publication rates and problematic image duplication as a form of data fabrication and falsification was positively related was not supported (9). Younger age, being an early career scientist, gender and fixed job position was not independent factors in a multivariate study of medical scientists (10). In other words, regarding demographic explanations, there does not seem to exist any significant differences.

One meta-analysis found that survey methodology was important in explaining the variation in the share of scientific misconduct reported in various studies. It was for example found that self-report surveys (vs. non-self), surveys using the words "falsification" and "fabrication" (vs. generic/indirect questions) and mailed surveys (vs. handed out) yielded lower shares of fabrication and falsification (1). After controlling for these factors, scientific misconduct was reported more frequently among medical/pharmaceutical researchers (vs. other disciplines). In a meta-analysis of surveys on plagiarism, the same type of survey methodological factors were important (2). However, another major conclusion of this latter study was that non-self-reports of plagiarism is higher than for data fabrication and falsification (2).

As to work organizational explanations, a lower position in the organizational hierarchy seems to be correlated with misconduct. However, there is no relationship between number of years in a business (tenure). Satisfaction with work is negatively correlated with misconduct (7). In a recent paper, multivariate analyses support that early career researchers (+) and researchers based in countries with cash-based publication incentives (+), peer-control, measured as

number of authors and countries (-), and researchers in countries with national misconduct policies (-) were associated with image duplication (9). Perceived pressure to publish has been reported to be independently and strongly related with misconduct among Flemish medical scientists after controlling for demographics (10).

These explanations point in large part to national, institutional and organisational factors; however, several of the prior studies do not go into depth on these. We believe that a richer understanding of such factors are both of academic and practical interests, and in our survey, we therefore explore such factors in more detail from a workplace perspective.

2.3 A workplace perspective

In this survey, we focus on the influence of the workplace, i.e. on the organizational conditions for research misconduct. Organizations involve groups of people who have a particular purpose – and research organizations, which is our main focus, involves generally researches and managers. Researchers are professionals in the sense that they have much discretion over their work, but they are also influenced by management systems and by the workplaces in which they work. This is our main assumption, and the one we aim to unpack in this study.

Our workplace perspective involves some key themes, which have been included in the survey. A first overall theme is the work environment, which involves both the immediate environment (e.g., the institute) and the more extended environment such as the faculty or university.

Herein, some factors are hypothesized to impact the likelihood of research misconduct. First, the nature of the work environment such as the pressure to publish, the availability of academic positions, the severity of penalties and the chances of getting caught. A high publication pressure, high competition for positions, low penalties and low chances of getting caught will be positively related to misconduct. Second, the work satisfaction of the researchers and to what they identifies with the organization. The more satisfied researchers are with their work and the work environment, and the more the researchers identify with their work-place, the less likely they are to be involved in misconduct. Third, understandings and knowledge of the relevant national and local research policies regarding what are legitimate and illegitimate research practices. The more knowledge, the less likely researchers are to be involved in misconduct.

A second overall theme is measures for prevention. First, we expect that increased monitoring will be negatively associated with misconduct, for instance through organizational systems for transparency of the conducted research. Second, we expect that leadership will play a positive role in the sense that leader follow-up and interest in issues of misconduct and integrity will be negatively related to misconduct. Third, we expect that increased information about policies and regulation will be negatively related to misconduct. Finally, we expect that fostering a

culture of openness about what misconduct is and how it can be prevented will be negatively associated with instances of misconduct.

3 Data and methods

3.1 Survey design

We have used a web-based cross-sectional survey (Questback) to collect our data (see the survey scheme in the appendix). The survey consists of 46 closed-choice likert-type items, multiple answer questions and some open-ended questions in 9 sections. Based on our workplace perspective, these were:

1. Organizational policies on misconduct and integrity
2. Whistleblowing mechanisms and attitudes
3. Work environment features
4. Perceptions of tensions and risks associated with misconduct
5. Compromise of scientific quality
6. Perceptions of integrity measures
7. Non-self-admission of falsification, fabrication and plagiarization (FFP) and "Questionable research practices" (QRP)
8. 12 Open ended questions on first-hand knowledge of research misconduct, adopted from the validated and revised Scientific Misconduct Questionnaire (SMQ-R) (11, 12). The results for the 194 respondents will not be not reported here, but will be published in a peer-review journal article.
9. Background questions

The survey questions were worked out in the consortium and a draft questionnaire was tested in order to increase validity and relevance of the questionnaire. The questions partly come from prior literature (4, 11-14, 17) and partly from the consortium. The organizational questions come from a literature review on the organizational aspects (see PRINTEGER Deliverable D II.6, WP II, Task II. 6). The PRINTEGER consortium discussed the format of the prevalence questions, and because of methodological and ethical concerns in the consortium, only non-self-reporting was included in the questionnaire.

The survey was approved by all top leaders at the eight partner institutions and the relevant research ethics or data protection authorities in the PRINTEGER partner countries before it was launched.

The respondents were informed about the aim of the survey and anonymity issues twice. First in the e-mail text with the Questback-link and then on the first page of the survey (see appendix).

Moreover, the respondents were asked (in Question 1) whether they consented to participate or not. The survey terminated for those who wanted to opt out at this stage.

3.2 Data collection procedure and period

We have recruited respondents at the eight PRINTEGER-partner institutions. The OsloMet-team (Oslo Metropolitan University, former HiOA), the responsible institution for the survey, first sent an e-mail with information about the survey and the Questback-link to all partner institutions. This e-mail was then sent to the top leaders who subsequently forward the information about the survey and the link to the Questback to the target population.

We contact, cooperated and got commitment from high-level executives at the PRINTEGER partner institutions early. We encouraged them to talk with their employees that the survey were coming, to talk about the (importance of the) topic of survey and how important answering was to get a high response rate. The data collection period took place from 7th of March to 1st of August 2017. After the survey was launched, three reminders to participate were sent to the researchers' at all eight institutions.

3.3 Target population

The target population for the survey was the academic research staff and not the technical and administratively employed staff. The academic research staff was defined as:

1. Professors or equivalent
2. Associate/Assistant Professor/Senior Researcher/Lecturer or equivalent
3. Teacher
4. Post-doc
5. PhD-student/Researcher or teaching assistant
6. Technical and administrative research staff (Research coordinators or laboratory personnel)

The total population across the eight institutions was 20,815. Only one of the institutions (Bristol) was not able to reach the PhD-students.

3.4 The sample

The gross survey sample consists of 1211 respondents. However, n=85 respondents (7.01% of the gross sample) were for two reasons lost for analysis giving us a net survey sample of 1126. The first and main reason (n=79) was not consenting to participate in the survey (Q1 in the survey). This occurred after initially being positive to the survey by opening the link to the Questback. The second and minor reason for loss of respondents was leaving all questions unanswered after either consenting to participate (n=3) or not answering the question to participate in the survey (n= 3).

Among 44 respondents (3.63% of gross sample) who did not answer the question on whether to consent to participate, 41 respondents answered the questions in rest of the survey and are therefore included in the net sample. In the gross sample, 1088 respondents (89.84%) answered yes to participate, but 3 respondents did not answer any of the questions in the rest of the survey (n = 1085, 89.59%) and 41 respondents (3.39%) in the gross sample failed to answer on the consent question, but answered the rest of the survey questions anyway, totaling 92.98%. In the net sample 1085 respondents (96.36%) consented to participate and 41 (3.64%) left this question unanswered.

Rather than using statistical techniques to address missing values (including imputation, likelihood, and weighting approaches), we have just coded missing data as "missing".

3.5 Response rates and response bias

The gross number of survey respondents is 1 211 with a response rate of 5.8%, while the net number of respondents is 1 126 with a response rate of 5.4 %. The response rate is extremely low, but is above the standard response rate of ca. 4% in market surveys. Research on "extremely" low response rates (4%) shows that most results are not necessarily suffering from serious non-response bias, suggesting that also survey data with very low response rates have scientific value (15).

Unfortunately, we do not know the characteristics of those who did not consent to participate and therefore opted out of the survey after the first question (6.5% of the gross sample). We therefore cannot assess whether these persons, who initially were positive towards participation by opening the Questback-link, in any way were different from those who participated. However, the OsloMet -team asked each institution to produce and deliver data on their population by age, gender, current academic position and academic field in order to calculate whether the net sample suffers from a non-response bias.

Two problems arose in the calculations of the population by the four background characteristics:

First, the local coding systems across the institutions are not the same. The academic positions in the survey, for example, does not completely fit the academic systems in each country. In the Dutch system, for example, different function descriptions for teaching and research exist parallel to each other. A separate function of lecturer, without any research tasks, hardly exist. Further, some of the universities (e.g. Leiden and Radboud) have coded academic field the same for all working at the same faculty (e.g. of social sciences), while for others (e.g. OsloMet), we have coded academic field using available individual-level information disregarding faculty affiliation. Some uncertainties also pertain to coding population background characteristics within the institutions. At OsloMet, for example, we have coded a substantial number of the

population as teachers (29.3%), but none of the respondents considered themselves teachers in the survey.

Second, certain population data were not available for all eight institutions. VUB was not able to produce data on the population broken down by academic field of the employees' highest degree; VUB is therefore not part of the calculations of the response rate and composition of the sample and the population by academic field (of highest degree). Bonn was only able to deliver data broken down by professors and "other scientific staff"; Bonn is therefore not part of the calculations of the response rates and non-response on academic positions.

The net response rates were higher for females, increased somewhat by age, and varied considerably between the institutions (Table 1). OsloMet, Leiden and Trento had the highest response rates. Among the academic positions, professors, associate professors and TA research staff had the highest response rates, post-docs the lowest. Among the scientific disciplines, social and behavioral scientists had clearly the highest response rates, while the other disciplines were at or below the average for the total sample. The variation in the net response rates also explains why some groups are under- or overrepresented in the sample compared with the population.

Table 1. Net response rates and composition of the population and the sample

	Net response rates (%)	Composition of sample (%)	Composition of population (%)	Difference sample and population
Gender*				
Males	4.7	47.8	53.6	-5.8
Females	5.9	52.2	46.4	+5.8
Age-groups**				
20-29	4.5	20.8	24.6	-3.7
30-39	5.0	30.5	32.7	-2.2
40-49	6.0	21.2	18.8	+2.5
50-59	5.6	16.2	15.4	+0.7
60+	7.0	11.3	8.6	+2.7
Employed at***				
OsloMet	15.5	22.0	7.0	+15.0
Leiden	9.2	32.6	17.4	+15.2
Trento	7.0	10.8	7.6	+3.2
Radboud	4.3	12.0	13.8	-1.8
VUB	3.7	9.2	12.1	-2.9
Tartu	2.3	6.7	14.4	-7.7
Bristol	2.1	5.9	14.0	-8.2
Bonn	0.3	0.9	13.7	-12.8
Academic position#				
Professors	9.0	18.1	12.2	5.9
Associate professors	7.7	36.4	28.7	7.7
Teachers	1.4	1.3	5.7	-4.4
Post-docs	2.9	10.6	22.5	-11.9
PhD-students	6.4	30.1	28.5	1.6
TA research staff etc.	8.6	3.4	2.4	1.0
Academic field$				
Engineering	5.1	5.0	5.3	-0.3
Language, info, comm.	3.6	3.8	5.7	-1.9
Law, arts, humanities	4.6	17.1	20.1	-3.0
Medical/life sciences	4.6	23.6	27.7	-4.1
Natural sciences	3.8	17.3	24.7	-7.3
Social and behavioral	10.7	33.2	16.6	16.6

* Excluding gender not given (n=36) and “other” (n=3).
** Excluding age not given (n=18).
*** Excluding those who did not answer (n=19) or answered “other”/do not wish to answer where they were employed (n=82).
# VUB is not part of these calculations, as we were not able to get population-level data broken down by academic positions at this university.
$ Bonn were only able to deliver data broken down by professors and “other scientific staff”; Bonn is therefore not part of these calculations.

Weights may be used to correct no-response biases in the presentation of the percentages, means and the distributions, but is generally not recommended in analysis of associations between variables (e.g. in regression models). A problem with weights is that one might correct some biases in the sample but unweight others. The lack of a uniform coding system across the institutions and also certain uncertainties on coding even within the universities (e.g. on academic positions and field), also cast some doubt on whether one would actually use correct weights based on the estimated non-response bias. We have therefore not used weights.

4 Results

4.1 Background characteristics

Table 1 in the "data and methods" section presented the distributions of the sample by age, gender, academic position, science background and institution. Here we review the distributions on other demographics as well as some work related questions from the "background characteristics" section of the survey.

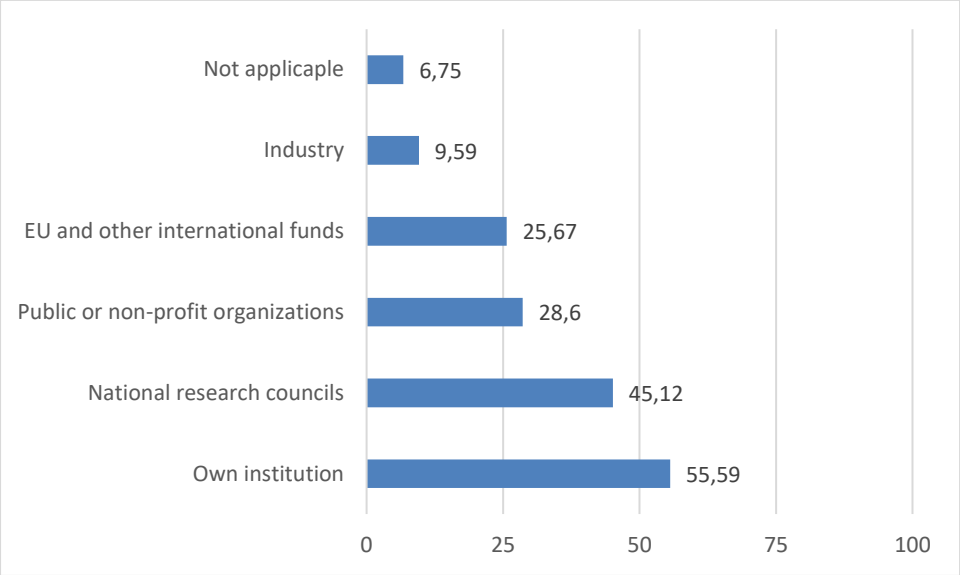
The highest academic degree of most of the respondents was doctoral degree (62.5%), followed by master's (33.5%) and bachelors or other degrees (1.7%) (2.3% did not answer this question).

Half of the respondents have a temporary position (49.6%). Table 1 showed that 40.7% were PhD-students and Post-docs. This shows that temporary positions are very common in the university sector and that this is not only due to PhD- and Post-doc positions.

One in four has a manager or leadership role and six out of ten (61.3%) belong to any association for researchers. Around a third of the sample have been active in research for 5 years or less, another third have been active researchers for 6-15 years, while the last third have been active researchers for 16 years or more.

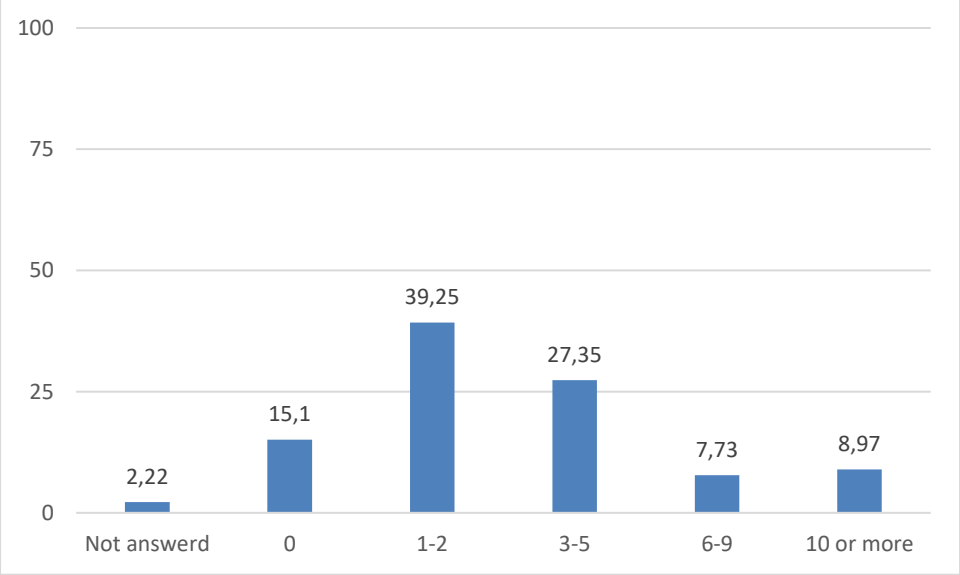
The researchers get funding from a variety of sources (Figure 1). Most get their funding from their own institution, followed by National research councils. One in four get funding from the EU and other international funds, and less than one in ten get funding to do research from industry.

Figure 1. Where do you get your research funding? (in %) (several answers possible).



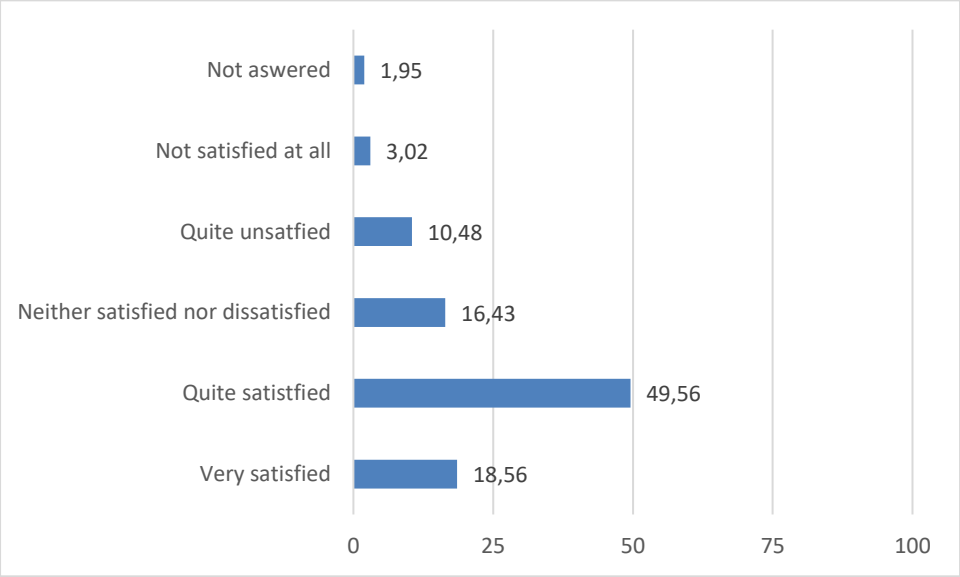
We also asked about how many peer-reviewed papers the respondents had published in the last year. While 15% have not written a peer-reviewed paper in the last year, it is most common to write 1-2 papers, followed by 3-5 articles per year (Figure 2).

Figure 2. How many academic (peer-reviewed) publications (including co-authored papers) have you authored over the last year? (in %)



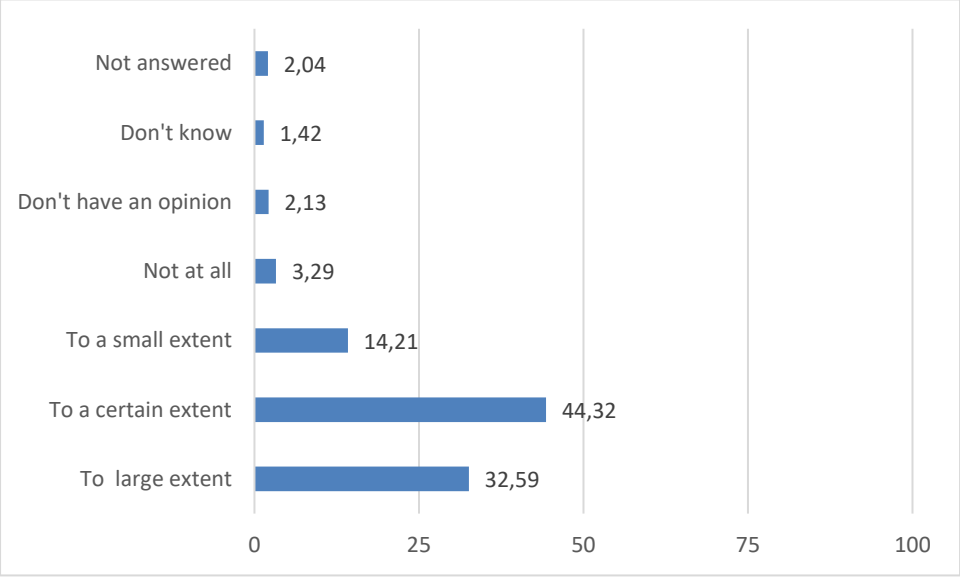
We have asked the respondents about work satisfaction and work-identity. Figure 3 shows that 68.1% are quite or very satisfied at work. Only 13.5% are quite unsatisfied or not satisfied at all with their current work situation.

Figure 3. How satisfied are you with your current work situation (i.e. your well-being at work)?



Our question on work identity shows that a large majority, three out of four (76.9%), identifies to a certain or large extent with the professional culture of their department (Figure 4).

Figure 4. To what extent do you identify with the professional culture and values of your department? (in %)



Almost half of the sample (48.85%) have not attended or held any lectures, workshops, or conferences on research ethics in the past year. However, almost half (44.05%) did so 1-5 times. Very few did so 6-10 (2.49%) or 11 or more times (2.58%).

4.2 Prevalence of research misconduct

In this part of the survey, we asked three questions and we were interested in examining the personal experience with research misconduct.

The first question is tapping "Non-self-admission" of FFPs and QRPs. We did not ask questions on "self-admission", i.e. "did you do any FFPs or QRPs?" We asked the question "Have you known about or justifiably suspected that any of the colleagues in your faculty during the last 12 months has"….done any of the following FFPs or QRPs (Table 2). Like other surveys asking about colleagues' behavior, we have not been able to correct for a possible inflation of the prevalence of misconduct due to more than one respondent reporting the same incident (but see one exception in (16)).

The non-self-admission rates for the FFPs are very low and in the range of 1-3%. The share who do not know or are uncertain are 11-12% for the FFPs. The finding that the non-self-admission rates for plagiarism (3.37%) in our survey is higher than for fabrication (1.78%) and falsification (1.87%) is on par with the conclusion in a meta-analysis on the topic (2).

The non-self-admissions for the various QRPs tend to be higher than for the FFPs with the highest share for the eight items at 24%. Several other studies also have also showed that misconduct that are considered less serious tend to be reported in higher shares (1, 2). Three exceptions to higher shares are "Falsified biosketch, resume, reference list", "Not disclosed a conflict of interest" and "Been pressured by a study sponsor or contractor to engage in unethical research conduct or skewed presentation of research": These shares are at 2-5%, that is at the level of the FFPs.

The share who do not know or are uncertain are also higher for the QRPs than for the FFPs, with the former shares being at 18-27% and the latter at 11-12%.

Table 2 Have you known about or justifiably suspected that any of the colleagues in your faculty during the last 12 months has… (in %).

	Yes	No	Not answered/ do not want to answer	Uncertain/ do not know	Not applicable
FFP					
Fabricated data	1.78	80.99	2.85	10.75	3.64
Plagiarized data	3.37	79.22	3.10	11.81	2.49
Falsified data	1.87	79.22	3.47	12.26	3.20
QRPs					
Falsified biosketch, resume, reference list	3.20	72.74	2.84	17.58	3.64
Deliberately withheld data from the research community to gain personal or institutional advantage	5.42	66.25	3.10	21.94	3.29
Selectively dropped data from “outlier” cases without transparent explanation	7.64	60.57	3.28	24.25	4.26
Tried out a variety of different methods of analysis until one is found that yields a result that is statistically significant	17.67	47.6	3.02	27.18	4.53
Not disclosed a conflict of interest	4.71	68.38	3.10	21.14	2.66
Denied authorship to contributors	12.79	62.26	3.46	19.27	2.22
Claimed undeserved authorship	23.62	49.82	4.00	20.60	1.95
Been pressured by a study sponsor or contractor to engage in unethical research conduct or skewed presentation of research	2.22	73.53	3.02	18.47	2.75

In Table 3, we present the results from prior meta-studies on the topic. When comparing our estimates in table 6 with the non-self-admissions of FFP and QRP from prior studies, we see that our figures are curiously low. In fact, our non-self-admission figures are more in line with those for self-admissions.

Table 3. Self-admission and non-self-admissions for FFP and QRP in meta-studies (in % and 95% CI)

Admission	Falsification and Fabrication*	Plagiarism*	QRP**
Self-admission	1.97% (0.86-4.45)	1.7% (1.2-2.4)	9.54% (5.15-13.94) Max: 33.7%
Non-self-admission	14.12% (9.91-19.72)	29.6% (17.4-45.5)	28.53% (18.85-38.2) Max: 72%

Sources: Fanelli 2009: Pupovac and Fanelli 2015

* Pooled weighted means

** Crude unweighted means

There are several possible reasons why our FFP and QRP estimates are so low compared to prior studies, and most of them are probably due to differences in survey methodology. First, our respondents were primed about the aims, data-protection, ethical and anonymity issues both in the e-mail text with the web-link and on the first page of the survey (see Appendix). Most other (web) surveys present these issues only once. Although we do not know the identities of those who were initially positive to the survey but opted out after the first question by not consenting to participate (6.5% of the gross sample), we believe that they might have had more knowledge about cases of research misconduct than those who participated.

Second, we cannot rule out that our sample is special by recruiting the sample from the eight institutions participating in the PRINTEGER project. For example, several have ethics departments. Could it be that the PRINTEGER partner institutions have a stronger focus on research integrity and value integrity policies more than other European institutions? Alternatively, should not this focus rather be a marker for knowing more about this topic and thus a higher willingness to report?

Third, our window (last 12 months) for measuring non-self-admission of FFP and QRPs are the same as in several other studies (11-14), but shorter than in most of the studies included in the meta-analyses (1, 2) – several of them asked their respondents to recall any colleague who had ever committed at least one of the FFPs or QRPs. A prevalence estimated from a life-time-perspective would of course be higher than a prevalence based on the last 12 months.

Fourth, surveys using generic/indirect question (avoid using word Plagiarism, Falsification, Plagiarization) rather than asking directly about FFP had significantly higher rates of non-self-

reporting of FFP (1, 2). We asked the generic question “Have you known about or justifiably suspected….” rather than “Have any of your colleagues engaged in the following activities…” , but we did not avoid mentioning the FFP words directly.

Fifth, we are studying European institutions, all academic positions and science disciplines while prior studies have focused on the USA, fewer academic positions and mainly the pharmaceutical, clinical, medical and life sciences. A pooled meta-analysis of self-reports and non-self-reports of fabrication and falsification found higher estimates for the medical/pharmaceutical sciences than for other sciences (1).

4.2.1 Modelling the associations between FFP/QRP and demographics/work environment

The prevalence of FFP are so low in our study that it is difficult to make meaningful sub-analyzes on the items separately. The differences by any of the demographic questions (32-46, see appendix) or organizational variables (Questions 2, 5, 9-12, see appendix) were not significant in bi- or multivariate models because of the few events (results not shown). However, if we define FFP as having answered “yes” to at least one of the three types of severe misconduct, we get a somewhat higher prevalence (average is 5%), and some of the demographic and quite a few of the organizational variables are significant in bi-variate models (Table 4), but not in multivariate models (results not shown). In the bi-variate models, work-identity and well-being is associated with lower prevalence, while researchers at “other” institution had higher prevalence. Of the organizational variables, high penalties and high risk of being caught for research misconduct, as well as strong focus and shared understanding of research conduct is associated with a lower prevalence of FFP. On the other hand, pressure to commercialize results or outcomes of research, economic incentives, strong hierarchy, afraid that someone will steal their ideas and no written policies at the university level, are associated with higher FFP prevalence.

Table 4. Statistically significant (5% level) bi-variate associations between non-self-reporting of at least one of the FFPs and organizational variables and demographics

Organizational variables	**Demographics**
Prevalence of at least one of the FFPs is 5.2 % on average	
Decreased risk: High penalties High risk of getting caught Open discussions and strong focus on research integrity (managers) Understanding of rules and procedures (researchers) Support of rules and procedures (management) **Increased risk:** Pressure to commercialize results Economic incentives (acquisition, publishing) Strong hierarchy Afraid someone will steal your ideas No written policies (university)	**Decreased risk:** Work-identity Well-being **Increased risk:** Institution («other»)

For QRPs, we do not study the association between each item and demographics and organizational variables. The QRPs might have been defined somewhat differently in our study compared to prior studies. In the meta-analysis by Fanelli (1), examples such as “dropping data points based on a gut feeling”, and “changing the design, methodology or results of a study in response to pressures from a funding source” are mentioned among several others. These two items are covered by our survey (see Table 2). However, results in Fanelli’s study were not given per QRP item so we could not make any direct comparisons with our study.

In the same way as for FFP, we therefore studied an alternative QRP outcome defined as having answered yes to at least one of the following seven items (average is 37%): 1. Selective dropping of data. 2. Tried out various methods to get significant effects. 3 Selective reporting of variables. 4. Falsification of bio-sketch or personal references. 5. Non-disclosure of conflicts of interests. 6. Claimed undeserved authorship or 7. Denied authorship to contributors.

We first analyzed to what extent there was a significant bi-variate association (at 5% level) between QRP and demographics and organizational variables. The organizational variables that were significantly related to QRP, were basically the same as those that were significantly related to FFP (Table 5). While no written policies at university level increased the risk for FFPs, it was no written policies at department level that increased the risk for QRPs. As for FFP, work-identity and well-being is also negatively associated with QRP. Researchers belonging to language/information/communication, Law/arts/humanities (30%), and natural sciences (26%) had lower risks of QRP than researchers did in social science (40%). On the other hand, number of publications, being female (at 41.3% vs. 33.3% for males), four of the institutions incl. “other” institution (at ca. 50% vs. the institution with the lowest prevalence at 27%), medical- and life science (50%) and post-doc (at 48.3% vs. 35.4% for PhD-students) were significantly related to increased QRP risks.

Table 5. Statistically significant (5% level) bi-variate associations between non-self-reporting of at least one of seven QRP items and organizational variables and demographics

Organizational variables	**Demographics**
The prevalence of at least one of seven QRP items is 36.8% on average	
Decreased risk: High penalties and high risk of getting caught High understanding/support of rules and procedures (researchers, management) High expectations for research integrity from management Strong focus on integrity (managers) Expectations of rules and procedures (researchers, management) Open discussions Shared understanding on misconduct and integrity **Increased risk:** Pressure (to publish, get external funding) Economic incentives (funding, publish, commercialize) Strong hierarchy Afraid someone will steal your ideas No written policies (department) Time and workload pressure	**Decreased risk:** Work-identity Well-being Language/information/communication, Law/arts/humanities Natural sciences **Increased risk:** Number of publications Females Four institutions incl. “other” Medical-life sciences Post-doc

Our bi-variate findings that FFP and QRP is negatively related with work satisfactions is in accordance with prior literature (7). We have found that early career researchers/post-docs, cash-based publication incentives and pressure to publish/commercialize results are positively related with both FFP and QRP, while misconduct policies were negatively related with misconduct. These findings are thus in correspondence with prior literature (9, 10).

In a multivariate analysis, controlling for the demographics in Table 5 (right column), all variables remained statistically significant expect for the effect of well-being, language/information/communication sciences and post-doc (results not shown). 3

A meta-analyses for fabrication and falsification also found higher estimates among clinical, medical and pharmaceutical research (1) (this prior study did not do such sub-analysis for QRP), but this is the first time to our knowledge that any have documented lower non-self QRP rates for law/arts/humanities and the natural sciences. These results give support to the idea that our figures are somewhat lower due to the fact that a large share of our sample covers other disciplines than the medical and life sciences.

In a recent study, the hypothesis that male gender or individual publication rates and problematic image duplication as a form of data fabrication and falsification was positively related was not supported (9). However, we found that non-self-reports of QRP was positively and independently related with number of publications and with female gender, even after controls for other demographic factors. As in other research, we have not found significant effects of age or years active in research.

There is a substantial variation in this measure of scientific misconduct across the eight included European institutions. These differences remained after controlling for observable demographics, work satisfaction and work-identity. This means that there is a statistically significant effect that can be contributed to the institutions. This could be explained by two factors. First, our demographic control variables may not be crisp enough or there might be omitted controls. Second, there might be some national or organizational differences that are picked up by university. However, because the consortium have agreed not to reveal the identities of the universities with higher QRP and FFP, it is difficult to speculate further on what national or organizational factors that might be at play and to what extent there are plausible explanations for the university differences.

As in all research based on a cross-sectional survey data, it is not possible to make any causal inferences. A reason why the biomedical, clinical and medical sciences have higher non-self-reports might be that so much status and money is involved. However, it could also be that respondents in the medical profession is more aware of these concerns and are more likely to report it (1).

[3] Organizational variables are highly correlated and explain large part of the variation in QRP. To avoid multicollinearity and high standard errors all variables cannot be included in the same model. We have therefore not done separate multivariate models on the organizational variables or combined the organizational variables in a full model with the demographic variables.

4.3 Unethical pressure

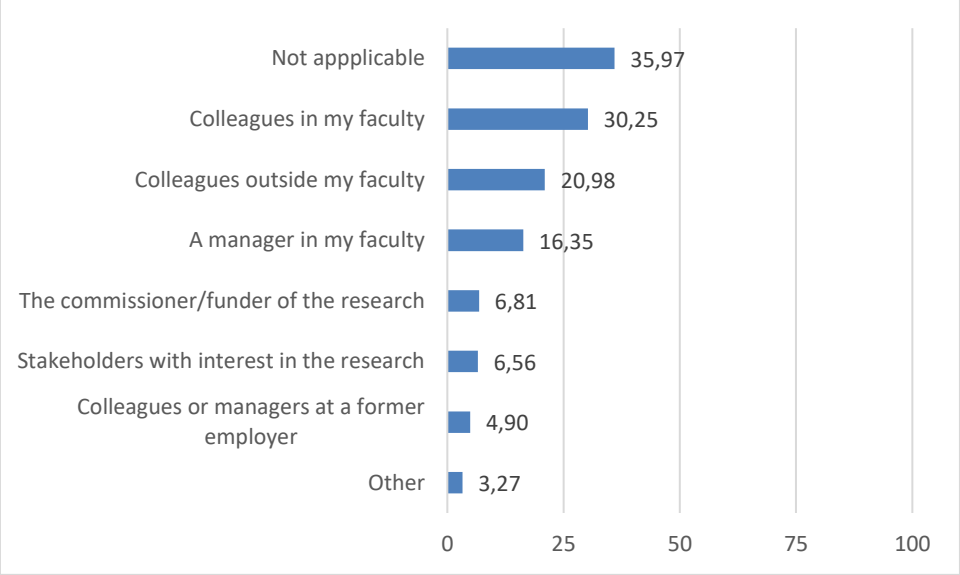
Table 6, shows that 16.3% of the respondents have been exposed to unethical pressure regarding ordering/inclusion of authors. Less than 5% have been experiencing such pressure during various phases of the research process.

Table 6. Have you during the last 12 months been exposed to unethical pressure concerning….(in %)

	Yes	No	Uncertain/ do not know	Do not want to answer/not answered	Not applicable
Ordering/inclusion of authors	16.25	71.31	6.04	3.38	3.02
Design/method	2.31	88.63	3.55	2.76	2.75
Analysis of data	3.46	86.23	4.00	3.02	3.29
Presentation of results	4.97	84.64	4.26	3.29	2.84

Finally, the sources of the unethical pressure are mainly internal or external colleagues or internal managers (Figure 5).

Figure 5. If you answered 'yes' to having been exposed to unethical pressure; please indicate the sources of the pressure (several answers possible):



4.4 Organizational policies

In this section of the survey, we asked four questions about the institution's policies for raising awareness of research misconduct and integrity.

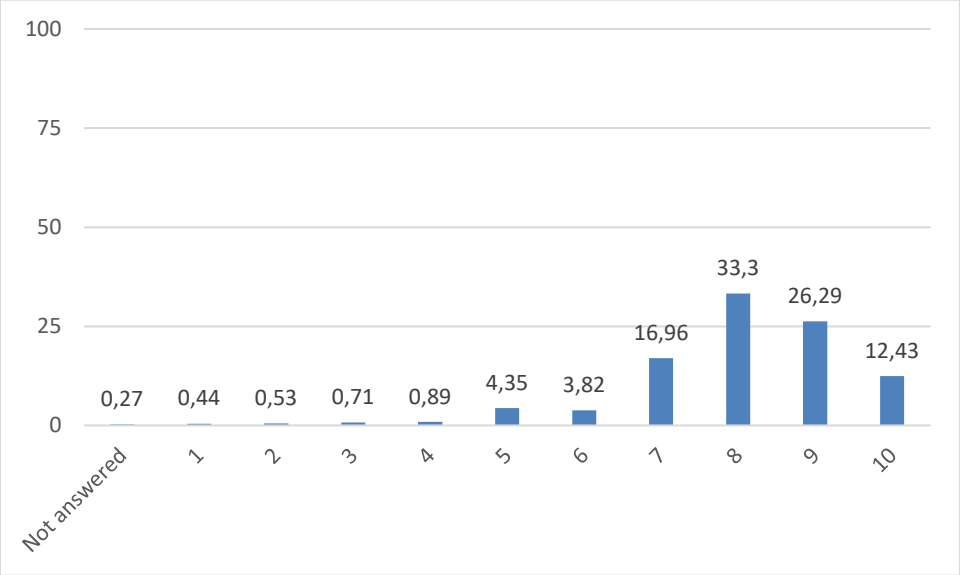
The awareness of written policies about research misconduct and integrity increases with the respondents' position within the university hierarchy (Table 7). Only two in ten answers affirmative on this question at the department level while six in ten does the same at the University level. At the same time, the share who do not know whether such policies exist are decreasing as you go from the department level to the university level. The share who do not know is surprisingly high disregarding university hierarchy.

Table 7. Does your research institution have a written policy about research misconduct and integrity at the following levels? (in %)

	Yes	No	I don't know	Not answered
My department	21.31	22.65	51.69	4.35
My faculty	37.12	9.24	49.11	4.53
My university	61.46	2.04	33.75	2.75

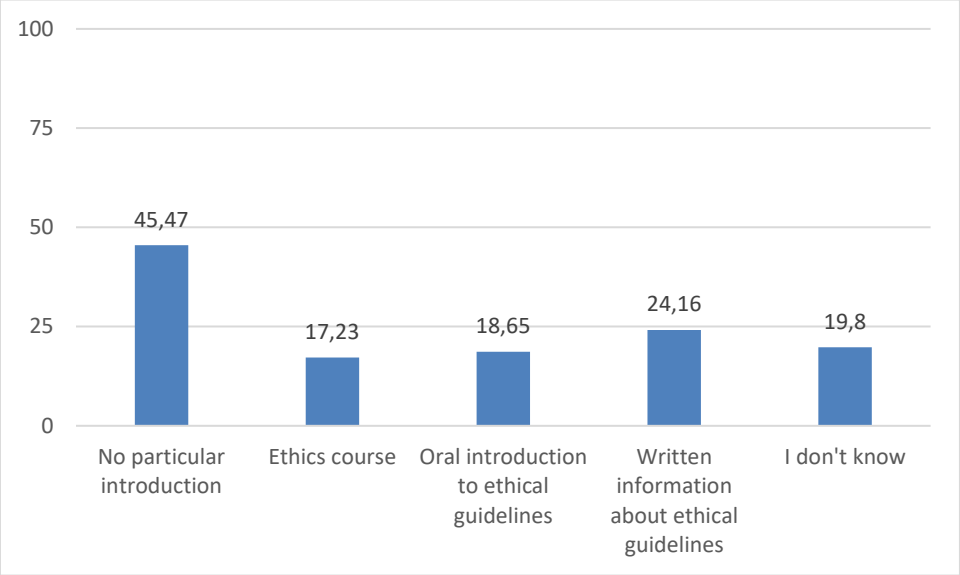
On a scale from 1 to 10 with 1 being "very unsure" and 10 being "very sure", the respondents seems very confident in their understanding of research misconduct with an average score of 8.0 (Figure 6).

Figure 6. How confident are you in your understanding of research misconduct? (in %)



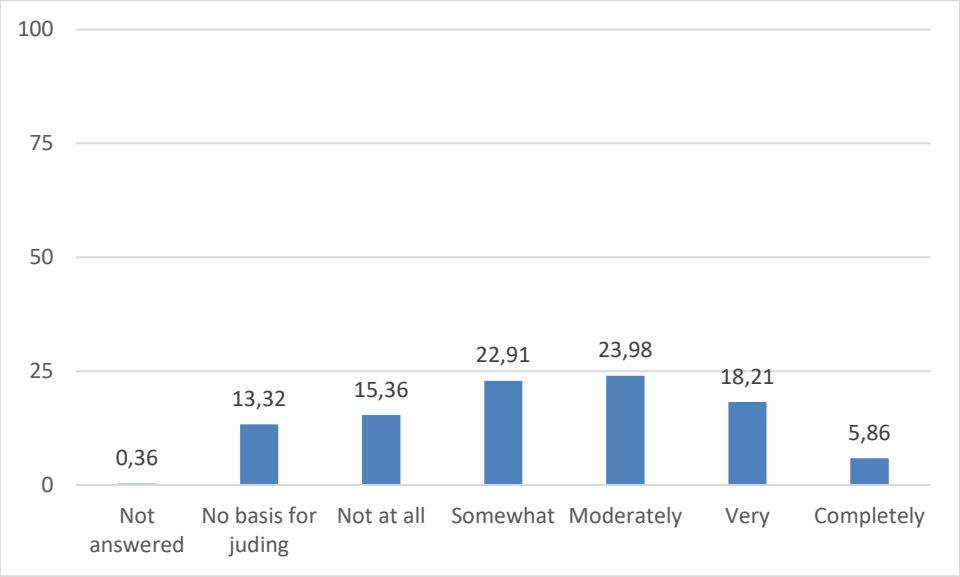
We asked how new employees are introduced to research integrity at the respondents' own department (Figure 7). Two-thirds of the researchers do not know or claim that there are no particular introduction (65.27%). Around two in ten claim that a course or oral/written information about research ethics is given.

Figure 7. How are new employees introduced to research integrity in your department? (Several answers possible) (in %) (3 respondents did not answer each of these sub questions)



Only one in four (24.07%) thinks that their department managers communicate high (very/completely) expectations for research integrity (Figure 8).

Figure 8. How consistently do managers in your department communicate high expectations for research integrity?

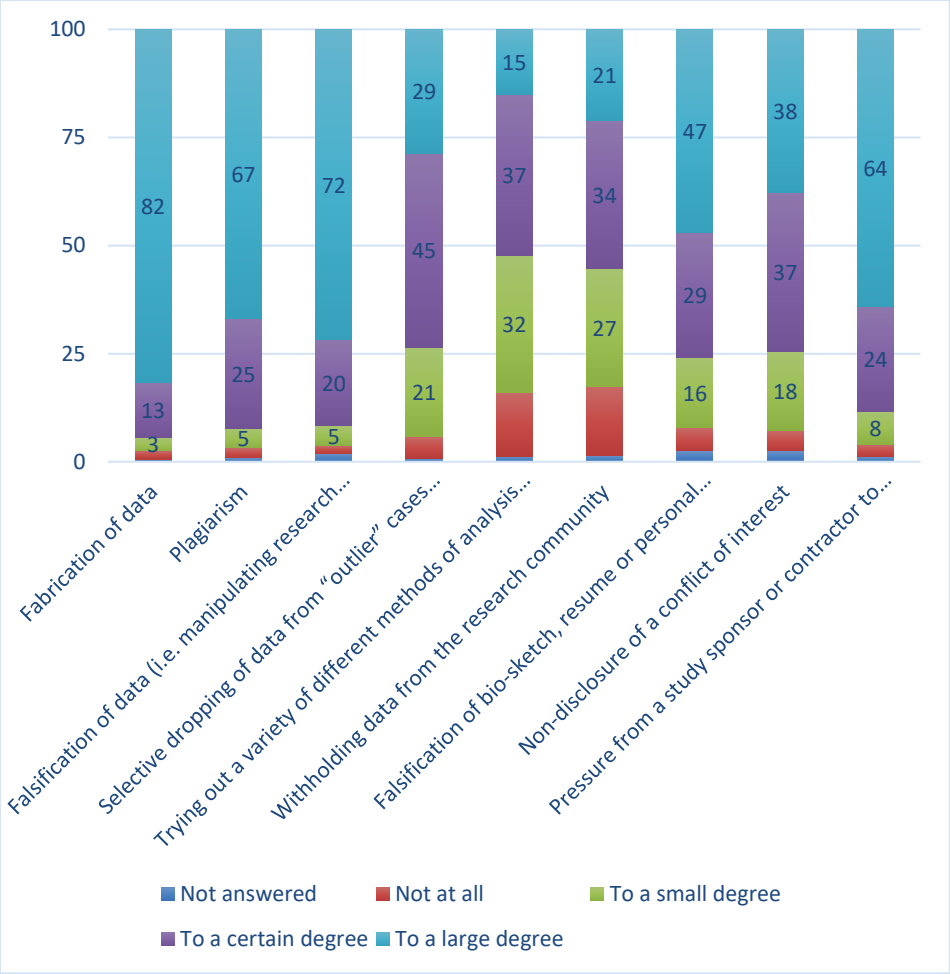


4.5 Whistleblowing

In this section, we were interested in mapping the mechanisms for and attitudes towards whistleblowing when it comes to research misconduct.

We asked three questions. The first was “to what degree would you feel responsible to report internally or externally the suspected misconduct if you witnessed any of the following” (see Figure 9). The share that “to a large degree” is willing to report on instances of severe misconduct, the FFPs, is clearly higher than those who “to a large degree” are willingness to report instances of QRPs. We also see that the respondents “to a large degree” are willing to blow the whistle if they were “pressured by a study sponsor or contractor to engage in unethical research conduct or skewed presentation of research”.

Figure 9. To what degree would you feel responsible to report internally or externally the suspected misconduct if you witnessed any of the following (in %) (for full length of the sub-questions, see appendix)



In the second question, we asked for the respondents' opinion on three statements about whistleblowing (Figure 10). The share agreeing "to a large degree" is surprisingly low on all statements. In fact, the largest shares, going from the left to the right in Figure 9, are respectively "not at all" (routines for whistleblowing), "to a small degree" (protection as a whistleblower) and "certain degree" (faculty takes whistleblowing seriously and act accordingly).

Figure 10. Do you agree with the following statements about whistleblowing?

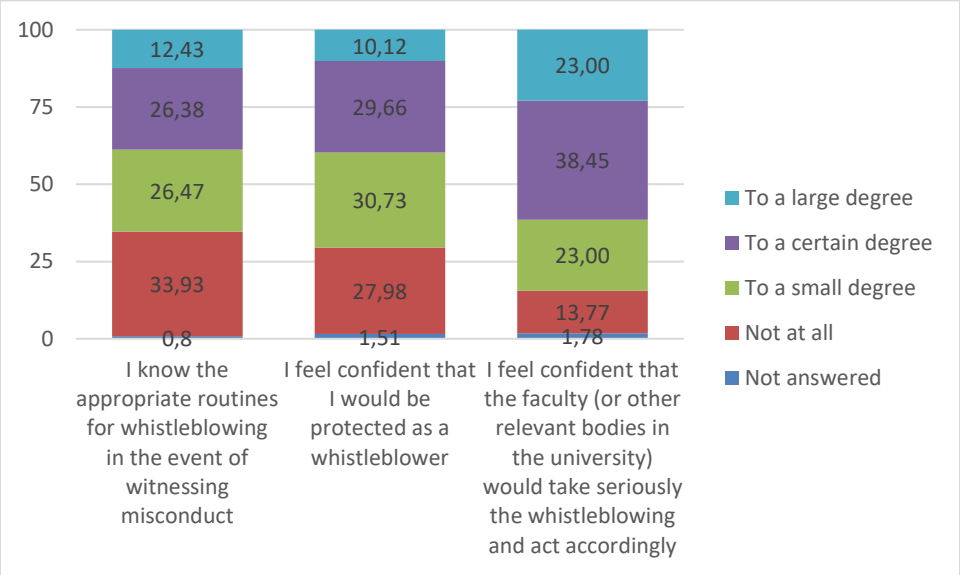
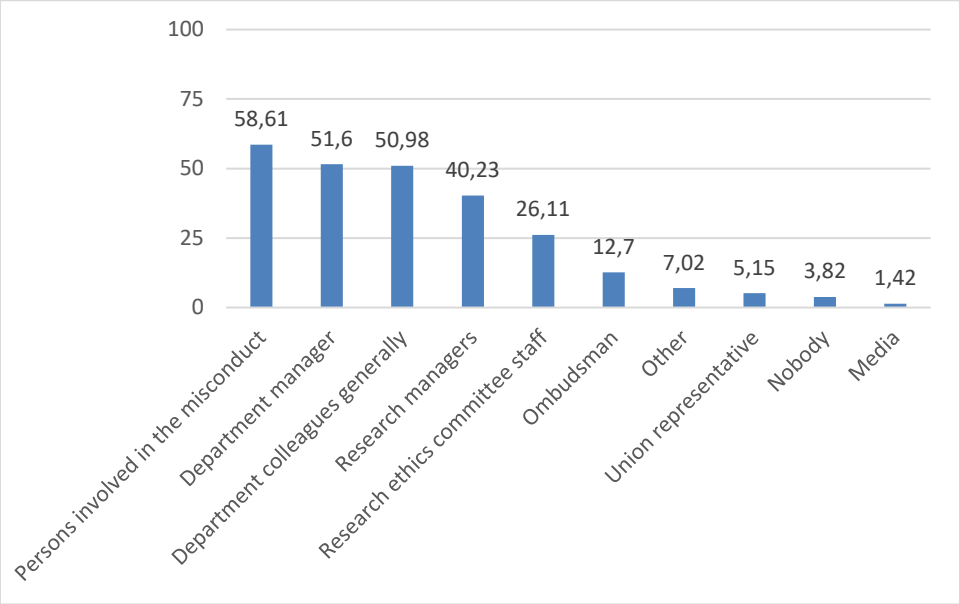


Figure 11 shows that the most common persons with whom the respondent researchers would discuss alleged scientific misconduct are the involved persons themselves, department/research managers and colleagues. Somewhat surprisingly perhaps, fewer would discuss suspected cases with research ethics committee staff, ombudsman or a union representative. Almost no one would contact the media to discuss such cases.

Figure 11. If you witnessed or heard about suspected misconduct, with whom would you discuss this? (Several answers possible) (in %) (10 respondents did not answer each of these sub questions)



4.6 Work environment

In this section of the survey, we were interested in how the researchers perceive aspects of their own work environment and how this might be relevant for the understanding of research misconduct and integrity.

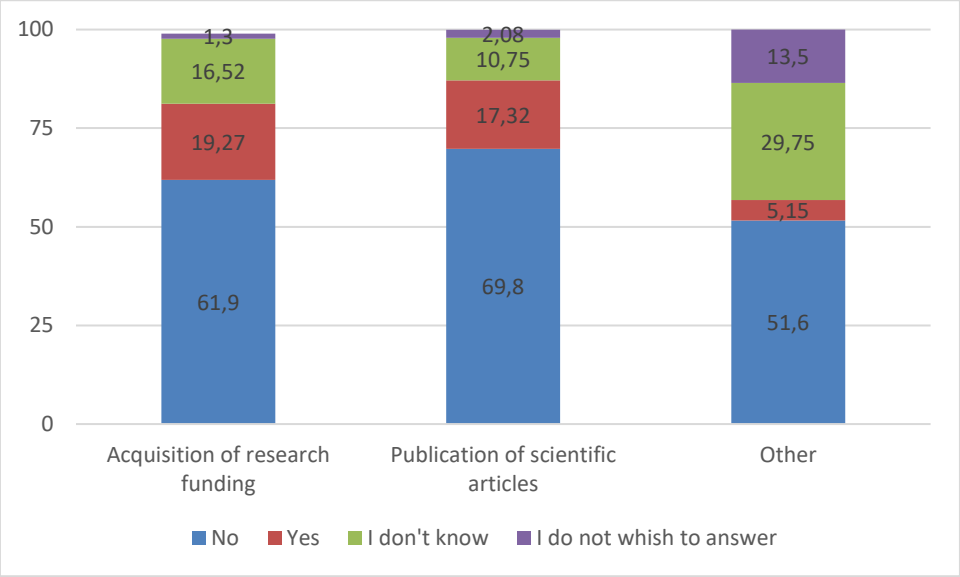
Four questions were asked. The first was to what degree the respondents agree/disagree with various statements about their own departments' work environment. The scale ranges from very low to very high. Table 8 shows that the largest share of the respondents rate the availability of academic positions as low to medium, difficulty of obtaining tenure as high to very high, and the pressure to obtain funding and to publish as high to very high. On questions whether penalties are severe for misconduct or whether the chances of being caught when doing research misconduct are high or low, the highest shares answer "don't know" followed by "medium/average". Finally, own/researchers'/managements' understanding and support of rules and procedures related to research misconduct are generally rated as medium to high. However, the respondents rate their own understanding and support on these issues as higher than for their colleagues and the management.

Table 8. In your immediate work environment, how would you rate the following? (in %) (the two highest shares within each question are bolded)

	Not answered	I don't know	Very low	Low	Medium/ average	High	Very high
Availability of academic positions	1.15	4.97	18.47	**32.50**	**31.62**	8.17	3.11
Difficulty in obtaining tenure	1.78	10.30	6.48	11.01	22.56	**22.65**	**25.22**
Pressure on researchers to obtain external funding	1.51	4.35	1.42	6.22	19.18	**29.57**	**37.74**
Pressure on researchers to publish	1.51	2.84	1.15	2.22	19.18	**34.72**	**38.37**
Severity of penalties for research misconduct	1.33	**41.39**	4.88	11.55	**17.41**	15.28	8.17
Chances of getting caught for research misconduct if it occurs	1.51	**27.80**	6.04	19.8	**26.20**	13.23	5.42
Understanding of rules and procedures related to research misconduct:							
Researchers'	1.42	12.34	3.29	11.55	**33.66**	**27.71**	10.04
Management	1.51	18.56	3.11	10.57	**27.26**	**28.24**	10.75
My own	1.51	2.93	1.51	8.61	**30.11**	**35.70**	19.63
Support of rules and procedures related to research misconduct:							
Researchers'	1.78	18.03	1.87	8.61	**27.18**	**28.69**	13.85
Management	2.13	22.11	2.93	10.21	**23.27**	**25.13**	14.21
My own	1.69	9.95	1.42	4.53	19.89	**34.72**	**27.80**

The second work environment question was whether direct economic incentives were in place for acquisition of funding, publishing or other activities. Figure 12 shows that a little less than two in ten are economically awarded if successful in grant writing and publishing.

Figure 12. In your department are there direct economic incentives (other than career advancement) for you individually related to…. (in %).



The third work environment question was "to what degree do you agree/disagree with the following statements about the work environment in your department? In Table 9, we have grouped the twelve statements into two bundles. The first five are tapping competitive departmental culture and pressure, while the last seven are tapping open and shared departmental culture.

Starting with the questions on competitive culture and pressure, it is evident that the researchers feel that individual performances are more valued than collective ones and that there is a high time and work pressure (these two questions have the highest average scores). There is a tendency among the respondents to disagree on the statements on pressure towards commercializing research results and checking own performance indicators.

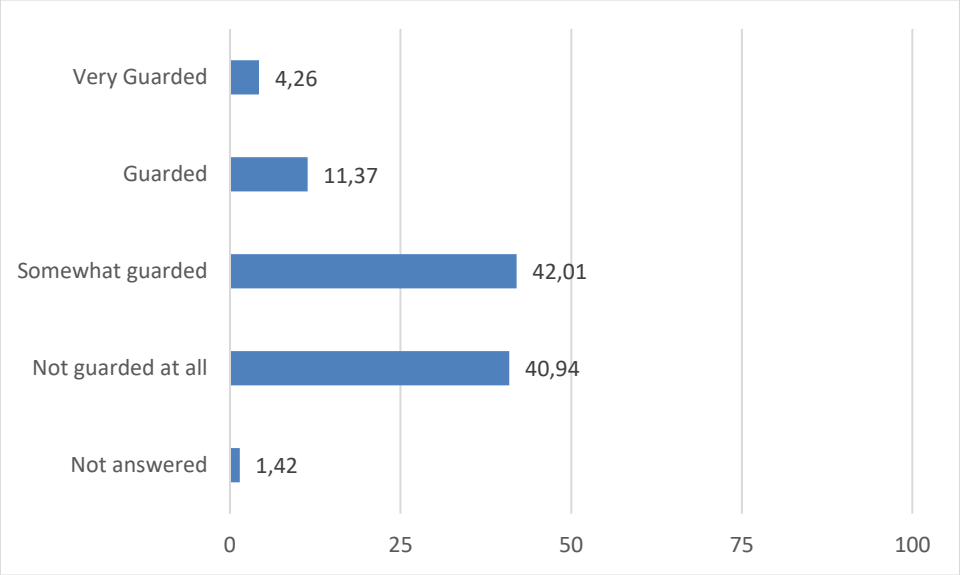
The questions on open and shared departmental culture show that the respondents tend to disagree that they conduct most research alone (score of 2.96) and that they tend to agree that colleagues and managers easily can monitor the respondents' research (score of 3.31). Further, the researchers tend to agree that there is a shared understanding of what is good research conduct, but at the same time (score of 3.55), they tend to disagree that the culture is supportive of openly resolving ethical concerns or research errors (score of 2.33).

Table 9. To what degree do you agree/disagree with the following statements about the work environment in your department? In % and average of the Likert-scale ranging from 1 (Strongly disagree) to 5 (Strongly agree).

	Not answered	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	Average (range 1-5)
Competitive culture and pressure							
In my department there is a high level of pressure to commercialize results or outcomes of research	1.60	25.93	32.86	25.13	11.55	2.93	2.32
I frequently assess my own performance (for instance my H index. Research Gate score etc.) compared to that of my peers	1.42	23.89	27.18	23.36	19.72	4.44	2.53
In my department there is a strong hierarchy between senior and junior researchers	1.42	10.92	36.77	25.13	18.83	6.93	2.74
The work culture at my department is oriented more towards individual performances than towards collective performances	0.98	2.84	16.61	28.86	35.26	15.45	3.44
In my department there is a high level of time and workload pressure regarding research activities	1.24	2.13	9.86	28.06	42.45	16.25	3.62
Openness and shared culture							
The culture of my department is supportive of openly resolving ethical concerns or research errors	1.33	5.24	11.90	36.23	35.88	9.41	2.33
I conduct most of my research alone rather than in collaboration with colleagues	1.33	12.08	30.55	17.94	25.40	12.7	2.96
In my department there is a culture for open discussion about research misconduct and integrity	1.87	8.35	19.18	37.83	27.09	5.68	3.03
My department managers' focus on research integrity is strong	1.51	5.86	15.01	36.68	30.82	10.12	3.25
I have an active role in academic networks, associations or societies outside my own department	1.60	10.30	18.29	19.36	36.86	13.59	3.26
It is easy for my colleagues and managers to monitor and assess my research	1.33	4.44	20.07	23.36	42.54	8.26	3.31
There is a shared understanding of what is good research conduct in my department	2.13	3.73	9.41	26.38	46.18	12.17	3.55

The fourth work environment question was “In your department, how guarded are people in their communications with each other out of concern that someone else will ‘‘steal’’ their ideas?”. Figure 13 shows that 15.6% is stating that they are guarded or very guarded that someone will steal their research ideas.

Figure 13. In your department, how guarded are people in their communications with each other out of concern that someone else will ‘‘steal’’ their ideas?



4.7 Tensions and risk

In this part of the survey, we asked six questions and were interested in what the respondents perceive as risks related to research misconduct.

In Figure 14, we present the results for the question “If you work in projects or take part in academic networks with scientists from other institutions, countries or fields, do you experience conflicting standards regarding proper research conduct?” Results show that “seldom” is the most common answer followed by “sometimes”. Very few experienced conflicting standards “often”.

Figure 14. If you work in projects or take part in academic networks with scientists from other institutions, countries or fields, do you experience conflicting standards regarding proper research conduct?

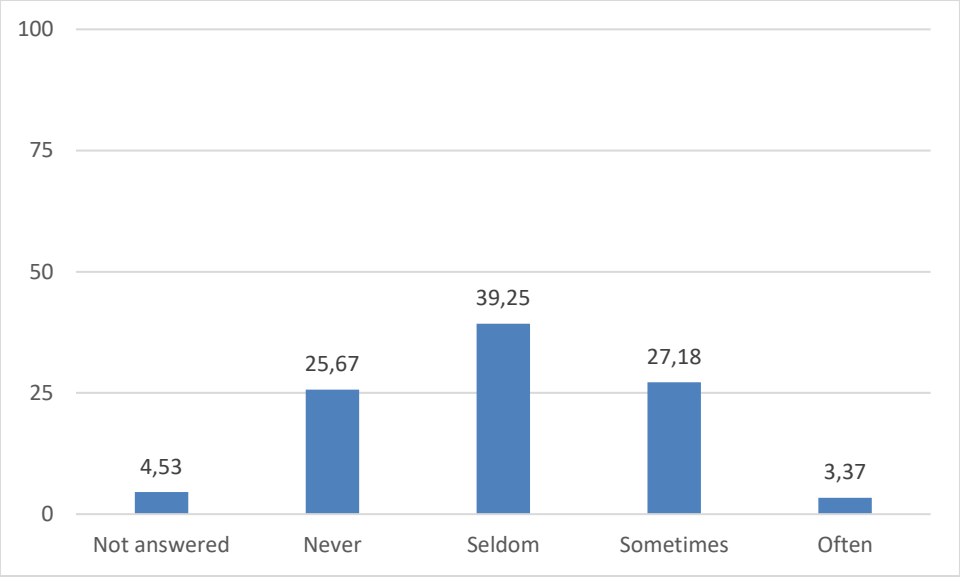


Figure 15 shows that quite few of the respondents “sometimes” or “often” feel tension between academic loyalty of rigorous work and loyalty to the subjects of research, co-workers or department managers. However, almost one in four have experienced such tension with funding bodies.

Figure 15. Do you experience a tension between loyalty to academic values of rigorous research and loyalty to…. (in %).

The results in Figure 16 shows that our respondents tend to disagree more with the claim that "research misconduct is a minor problem" the further away the perspective is from their own work-floor. In other words, the view seems to be that "it is not us, but the others who are doing scientific misconduct". This is also clearly shown when average scores are calculated, where 1 is "Strongly disagree" and 5 is "Agree strongly": The scores are 3.78 at "my own faculty", 3.38 "in my own field of research", and 2.57 at "in research in general". This phenomenon, that people tend to see themselves as better than others, is sometimes referred to as the "Muhammad Ali effect" (1).

Figure 16. I perceive research misconduct to be a minor problem… (in %)

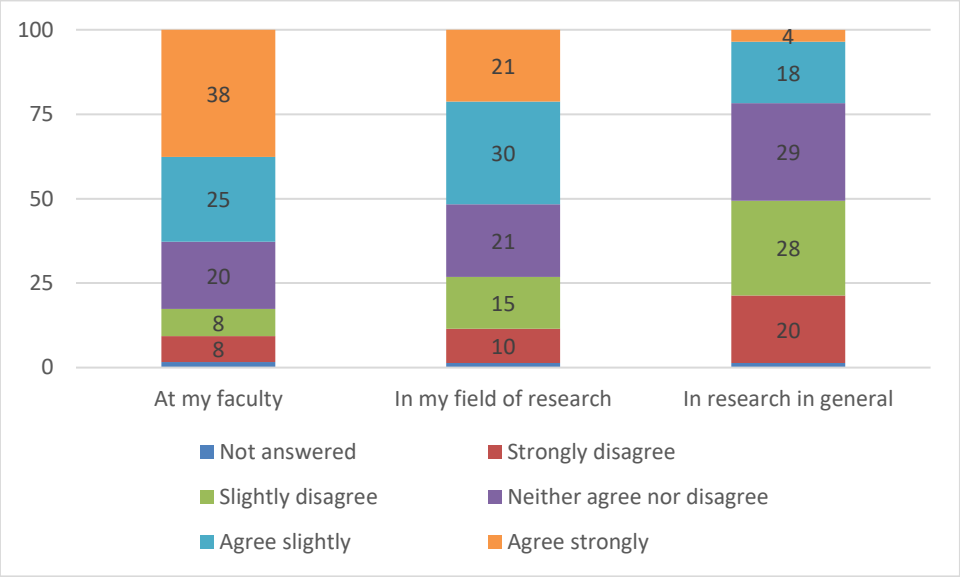
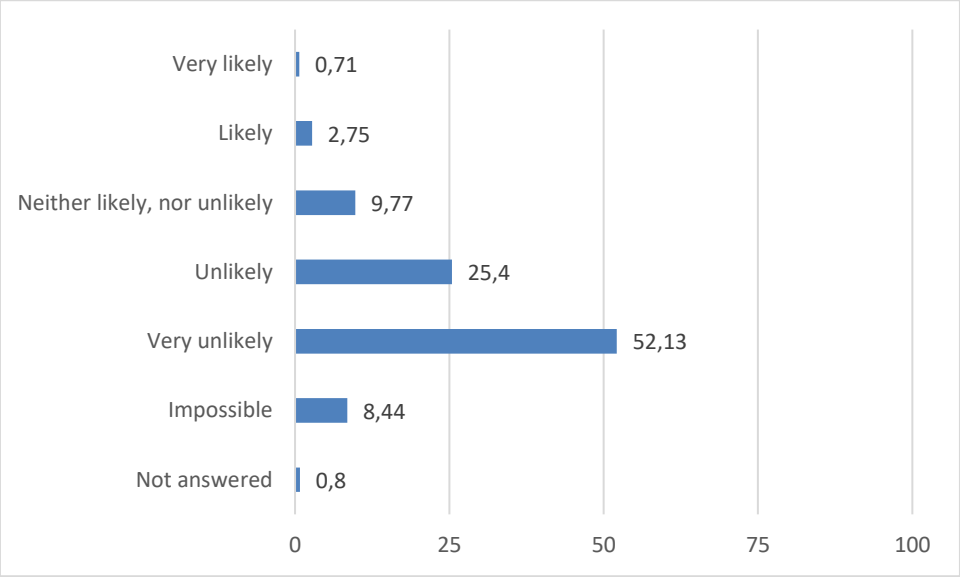


Figure 17. “How do you rate the risk that you might be personally implicated in research misconduct or questionable research practices?” (in %).



The final question in this section was “how do you rate the risk that you might be personally implicated in research misconduct or questionable research practices?” (Figure 17). Not surprisingly, very few, only 3.5%, admitted that it was (very) likely that they themselves would be personally involved in such matters.

4.8 Research quality

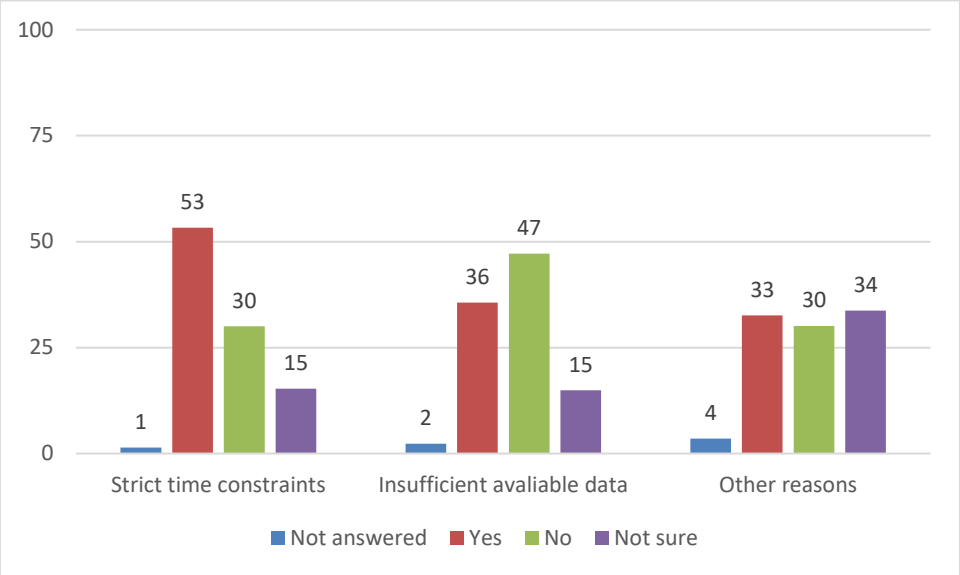
Compromised research quality may in some situations be a question of research integrity and we were therefore also interested in factors that may affect quality. In this section of the survey, we asked seven questions.

The first question was “Have any of the funders of research projects you have been involved in ever unduly interfered in your work?” Here, 6.5% answered “yes”, 88.8% “no” and 4.7% did not (whish) answer.

In our second question in this section, we asked whether the respondents “believed that the quality of their research varied depending on the funding source”. On this question, 60.1% replied no, 19.5% yes, 17.1% “I don’t know” and 3.2% “did not (wish to) answer”.

We also wondered whether “the quality of the research suffer due to time constraints, insufficient availability of data or other reasons” (Figure 18). More than half claims that their research quality suffer due to time constraints. Close to four out of ten also felt that their research quality suffered from insufficient available data.

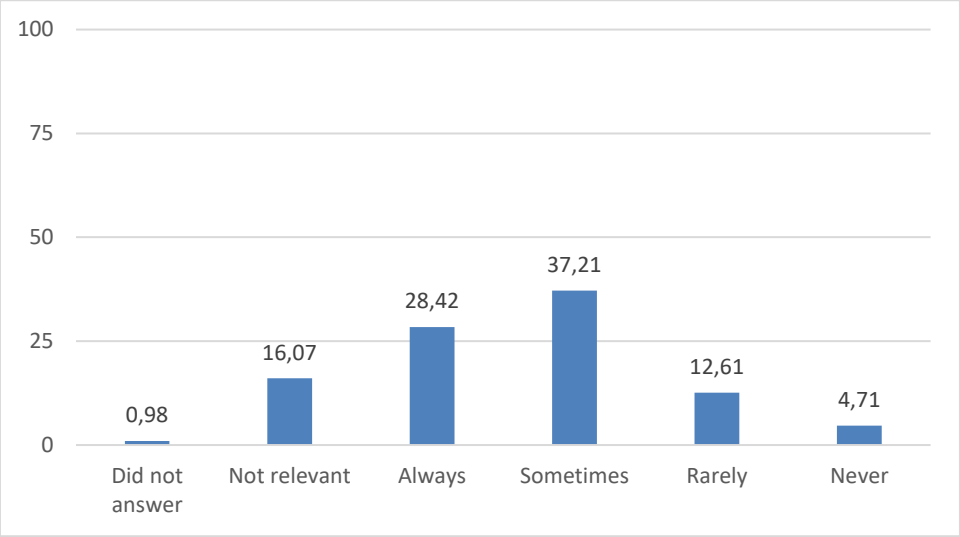
Figure 18. Does the quality of your research suffer due to…(in %)



We asked the question “Do you believe that you have a better chance of getting your research published if you draw stricter conclusions and avoid mentioning uncertainties in the abstract/conclusion of your study (but rather in a limitations section)?” Here, 39.7% answered “yes”, 36.0% “no”, 23.3% did not know and 1,1% left the question unanswered.

The final question in this section was “Do you attempt to publish findings also when they are negative or inconclusive in respect to a specific research question?” (Figure 19). Here, almost two-thirds (65.6%) always or sometimes attempt to publish negative or inconclusive results.

Figure 19. Do you attempt to publish findings also when they are negative or inconclusive in respect to a specific research question?



4.9 Integrity measures

In this part of the survey, we were interested in how the researchers perceive potential integrity measures. Results from ten statements follow in Table 10. It would be safe to say that the researchers are not great fans of more external monitoring or internal monitoring by managers. However, if the monitoring takes place within the research communities themselves, the researchers are more convinced that this measure would be useful to strengthen research integrity and/or reduce the risk of misconduct. The respondents are more or less “normally distributed” in their view on more sanctions with the mean at “neither disagree nor agree”. This means that equal shares are for and against this type of measure.

Further, the respondents seem to be rather positive towards change of performance criteria and more focus on research integrity. It seems to support a notion that the researchers would appreciate more “slow science” and more focus on research integrity at the cost of research misconduct.

Finally, the respondents are rather positive towards information and training in order to strengthen research integrity and/or reduce the risk of misconduct. However, conventional training, reflection groups and information seem to be the favorite rather than online training.

Table 10. In order to strengthen research integrity and/or reduce the risk of misconduct, to what degree do you agree that the following measures are useful (in % and average score with minimum 1, strongly disagree, and with maximum 5, strongly agree)

	Not answered	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	Average (Range 1-5)
Monitoring and sanctions							
Increased monitoring externally (for instance by research funding organisations)	2.13	11.01	25.67	29.22	26.29	5.68	2.90
Increased monitoring internally (by managers)	2.13	11.81	23.36	27.35	30.28	5.06	2.93
Increased monitoring internally (by peers)	2.49	5.24	14.48	20.52	46.36	10.92	3.44
Increased severity of sanctions	2.40	6.75	23.53	37.83	21.67	7.82	3.00
Focus on integrity and change of reward criteria							
Managerial emphasis and attention to research integrity	2.40	3.55	8.53	20.52	47.78	17.23	3.68
Change of performance criteria and rewards	2.66	2.22	7.28	27.98	36.41	23.45	3.74
Information and training							
Online training tools	2.13	7.02	17.94	31.44	30.55	10.92	3.21
Conventional training and education in research ethics	2.40	2.93	7.73	22.74	47.78	16.43	3.69
Ethical reflection groups and open dialogue	2.22	2.49	7.73	16.16	48.40	23.00	3.84
Information on ethical guidelines	2.22	1.60	6.22	15.63	50.44	23.89	3.91

5 Conclusions

The PRINTEGER survey has provided an important contribution to the work in the project and will inform the concluding recommendations in the project. It also makes a substantial contribution to the state-of-the-art on quantitative research on research integrity.

Our survey has several strengths. First, compared to most other surveys on the topic, our sample size is generally much larger. Second, to the best of our knowledge, we are the first to sample eight institutions in seven European countries and to cover all academic positions and major science fields in one survey. The survey also has some limitations. First, as in all research based on cross-sectional survey data, it is not possible to make any causal inferences. Second, the response rate is extremely low, but is above the standard response rate of approximately 4% in market surveys. Research on "extremely" low response rates (≤ 4%) shows that results do not necessarily suffer from serious non-response bias, suggesting that also survey data with very low response rates have scientific value (15).

As in prior research (2), we find that FFP is less prevalent than QRP. This is so whether single items of misconduct or composite measures are considered. While only 5% of our respondents have known about or justifiably suspected that any of his/her colleagues over the past year have done at least one of the FFPs, the same is true for 37% for one of the seven considered QRP items.

Our results have shown a work-floor perspective is useful to highlight the more meso-level systemic mechanisms that might impact on the likelihood of misconduct. This perspective thus adds to an individual perspective taken in prior studies and provides a broader understanding of misconduct and how to prevent it.

Taking the strengths and limitations of our data into account, our interpretation of the results is that the following activities have the potential to prevent scientific misconduct:

- Systematic focus on researchers' well-being, i.e. cultivating a positive work environment

- Identity-building, i.e. cultivating researchers' association with the goals and values of the organization

- Building down hierarchies, i.e. less structural differences between junior and senior researchers

- Facilitating open discussions about what research misconduct is and how it can be avoided in the future

- Transparently dealing with ethical concerns and possible research errors

- Increased monitoring of research conduct and processes by peers and management

- Strong focus on and prioritization of research integrity by managers at the universities

- Providing researchers and managers with knowledge about rules and procedures related to research misconduct

- Developing whistleblowing procedures, including knowledge about whistleblowing channels and protection of whistleblowers

- Increased buffering by managers of the institutional pressures to publish that researchers face, e.g., change of performance criteria

- Increasing the severity of penalties of research misconduct

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Appendix

E-mail text with link to survey

On the day of launching the survey on 7th of March 2017, the following instructions were sent to the eight partner institutions:

"*Dear all!*

Good news! We have now received ethics approval and approvals from all top leaders at the 8 partner institutions. This means that we are now ready to launch the survey.

The survey is to be sent out by each of the partner universities. It is thus important that you send an e-mail to your organisational contact person for the survey (rector or the person he/she has delegated this task to) and ask them to include the heading and the text below in the e-mail.

It is important for methodological reasons that the respondents at each of the partner universities receive the survey at approximately the same time. Hence, please send the e-mail to your to your organisational contact person for the survey as soon as possible (and kindly ask them to do the same when sending out the survey!).

The following e-mail heading and text should be used. You may add a couple of sentences in your national languages if you deem this appropriate.

Heading: Invitation to participate in the PRINTEGER survey on Research Misconduct and Integrity

In email body:

This survey is carried out as part of the PRINTEGER project (www.printeger.eu), funded by the European Union's Horizon 2020 framework program, and distributed in eight European higher education institutions. PRINTEGER's mission is to enhance research integrity by promoting a research culture in which integrity is part of what it means to do excellent research. To promote such a culture, an improved governance of integrity and responsible research has to be informed by practice: the daily operation of researchers and the tensions of a complex research system. With this survey we aim to gain a better understanding of the perceptions, behaviour and attitudes of research professionals, and we therefore hope you can spare approximately 20 minutes of your time to help us, by filling in this survey.

We kindly ask that you fill out the survey as soon as possible.

If you have questions about the survey or about the project, please do not hesitate to contact the PRINTEGER partner in your country http://printeger.eu/consortium/, the partner responsible for the survey (eric.breit@afi.hioa.no) or the project coordinator (H.Zwart@science.ru.nl).

Thank you for filling out the survey!

The survey can be accessed through the following link:

https://response.questback.com/arbeidsforskningsinstituttet/v5q8wyqzf4»

PRINTEGER survey scheme