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## **Knowledge and perception about research integrity and misconduct: A survey among young scientists attending a school on methodology, ethics and integrity in biomedical research**

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The scientific community is facing a so-called “replication crisis” that seriously tarnishes the reputation of scientists, as well as the credibility of research institutions, and public confidence in science, especially in biomedical research where collective and individual health and well being are directly involved. Irreproducibility of findings may be attributable not only to scientific misconduct including fabrication, falsification and plagiarism (FFP), but also and above all to questionable research practices (QRP). Among the factors which may induce researchers, in particular young scientists, to FFP and QRP, factors related to individual researchers (such as pressure of competition for external funding, need for publications, need for recognition, lack of knowledge/preparation about the realities/stresses of a scientific career etc.), as well as the evolving nature of science and the research enterprise (e.g., the negative aspects of fragmentation, isolation and specialisation, the lack of awareness of the rules and standards of proper scientific conduct, etc.) do stand out (OECD, 2007).

In Italy, there are no guidelines for ensuring proper research conduct, and studies on scientific misconduct are disappointingly lacking. The University of Insubria is a small size university in northern Italy organized in 7 departments with over 700 staff and 10,000 students, offering study programmes in law, economics, business administration, engineering, information and communication technologies. The main focus area is however biomedicine, with courses in medicine and surgery, dentistry, more than 24 post-degree medical schools of specialization and 3 different PhD programs in biomedical sciences. In order to promote knowledge about proper research practices among young researchers, an “Insubria School on Methodology, Ethics and Integrity in Biomedical Research” has been established. During the 2018 edition, participants were invited to take part into a survey conducted by means of a well-established Scientific Misconduct Questionnaire (SMQ, Broome et al., 2005). The aim was to assess their perceptions and attitudes towards research integrity and misconduct, as well as to determine factors related to their research environment, which may contribute to misconduct in research. The association between perceptions of scientific misconduct and commitment of questionable research was measured as well.

A total of 65 young scientists mainly females (56.9%) and PhD students (43.1%), completed the questionnaire. Most of them were working in an academic institution (53.8%), and were directly involved in research (81.5%) since (mean±SD) 3.0±2.9 years. They published 5.1±7.7 papers and have already attended a lecture, workshops or conference on ethics before (55.4%).

With reference to their immediate work environment, study respondents rated as low or very low the severity of penalties for scientific misconduct (33.9%), the chances of getting caught for scientific misconduct if it occurs (44.6%), researchers’ understanding of rules



and procedures related to scientific misconduct (38.4%), their own understanding of rules and procedures related to scientific misconduct (33.9%), researchers support of rules and procedures related to scientific misconduct (38.5%), and the effectiveness of institution's rules and procedures for reducing scientific misconduct (32.4%).

With reference to their workplace, 24.7% of respondents were aware about an investigator involved in scientific misconduct during the last five years. The commonest sources from which they became aware of the instances of scientific misconduct were from other researchers (36.4%), and less commonly from the institution's ethics committee (4.5%) and from study monitor (0.0%).

When asked about how frequently they believed that specific types of misconduct and questionable practices occur in their workplace, respondents rated as from seldom to frequent occurrences of disagreements about authorship (52.3%), selective dropping of data from outlier cases (46.2%), plagiarism (37%), data falsification (33.8%), falsification of biosketch, resume, references list (29.3%), and pressure from study sponsor (21.5%), intentional protocol violation related to subject enrolment (20%), intentional protocol violations related to procedures (20%). A few participants admitted to having been involved seldom or occasionally in disagreements about authorship (21.5%), selective dropping of data from outlier cases (18.4%), intentional protocol violations related to procedures (10.8%), plagiarism (6.1%), falsifying data (4.6%), intentional protocol violations related to subject enrolment (4.6%), pressure from study sponsor to engage in unethical practices (4.6%) and falsification of biosketch, resume, references list (1.5%).

69.2% of respondents were concerned about scientific misconduct. The majority (73.8%) however believed that the responsibilities for scientific integrity of a study lies with the principal investigator only, and only some participants (10.8%) acknowledged they were uncomfortable talking with researchers about ethical behaviour. Nearly all (93.8%) agreed about the need for training on standards of research ethics. 81.5% of young scientists disagreed with the view that dishonesty and misrepresentation of data is common in society and doesn't really hurt anybody.

Among factors contributing to scientific misconduct, respondents indicated need for publications (95.6%), pressure for external funding (93.9%), conflict of interest (90.7%) and need for recognition (84.7%), and unclear definition of what constitutes misconduct (84.6%).

As a whole, results of the survey suggest that young scientists perceive misconduct and questionable research practices as frequent in their workplace, producing a sense of concern and a need for training. Caution is however required when interpreting this finding since it is rather a daunting task to estimate the real frequency of FFP and QRP among researchers, and even if these were to be detected, it is hard to prove them (Fanelli, 2009). In any case, there is still a great need for avoiding QRP and spreading scientific misconduct awareness in order to reach scientists and researchers at all career levels. Prevention of scientific misconduct and training in research methodology will primarily result in more scope for both scientific and personal achievement, as well as will also meet ethical and social obligations and responsibilities (Cosentino and Picozzi, 2013). Research integrity must be ensured by research institutions which should consider introducing specific courses on scientific misconduct and ethics in order to have prepared students and PhDs. An important

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remark is that, together with undergraduate and PhD students, Professors and Researchers should be educated about research integrity and methodology. Furthermore, academic institutions should also help in establishing integrity assessment procedures, in order to verify adherence to academic integrity and ethical principles, and, if need be, intervene.

Keywords: research misconduct, research integrity, training, survey, young scientists, Italy.

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