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Factors Associated with Research Wrongdoing in Nigeria

Omokhoa A. Adeleye and

University of Benin Teaching Hospital

Clement A. Adebamowo

West African Bioethics Program

Abstract

Concerns about research wrongdoing in biomedical research are growing in developing countries, where research ethics training and research regulatory systems are just emerging. In a first-time study in Africa, medical/dental researchers ($N = 132$) in two states in Nigeria were interviewed on a wide range of research wrongdoings and potential predictors. Using multivariate logistic regression, significant predictors of research wrongdoing were identified. Some 22.0% admitted to at least one of fabrication, falsification, and plagiarism, the predictors of which were knowledge gaps in research ethics and pressure to publish enough papers for promotion. Acknowledging inadequate knowledge of research ethics was a predictor of admitting a wrongdoing. Systems that support ethical research, including skilled training and funding, are recommended.

Keywords

research misconduct; research wrongdoing; Nigeria

RESEARCH MISCONDUCT AND OTHER UNACCEPTABLE acts in research remain major sources of concern in modern biomedical research. These concerns have grown in recent times as the rewards from research have increased, and significant amounts of medical research and clinical trials have moved to developing countries where the regulatory environment is less rigorous.

Some of several recent instances of research wrongdoing illustrate the seriousness of the problem. In 2006, the Seoul National University announced, after an investigation, that Woo Suk Hwang's research publications on cloned human embryos were fabricated (Cyranski, 2007). In the same year, Jon Sudbø admitted to fabricating data on 900 fictitious patients. Worse still, most of his more than 30 publications were found to have arisen from fabrication and falsification (Odling-Smee, 2007).

Research misconduct is commonly understood to include FFP—falsification (altering research processes, or recording or reporting wrong results), fabrication (inventing and recording or reporting results), and plagiarism (taking the words, ideas, or data of others or self and reporting them without giving due credit). However, recent trends have necessitated a broader definition of the term. The U.S. White House National Science and Technology Council (Office of Science and Technology Policy) defines research misconduct as “fabrication, falsification, or plagiarism in proposing, performing or reviewing research, or in reporting research results.” Other wrongdoings (e.g., stealing, intimidation, and discrimination) are left to be tackled through other official regulatory mechanisms (Office of

Science and Technology Policy, 2000). The Wellcome Trust's (2005) definition includes, in addition to FFP, deliberate, dangerous, or negligent deviations from standard research practices, failure to follow established protocol such that it occasions harm, concealment of other researchers' misconduct, and damage to another's research property. It excludes honest error and unskilled research. Research wrongdoing—a term that is becoming more widely used in the research ethics literature—encompasses all unacceptable acts in research, including FFP (DuBois, Kraus, & Vasher, 2012; Keith-Spiegel, Sieber, & Koocher, 2010).

Cases of research wrongdoing are often unreported (Fanelli, 2009; Jessen et al., 2007; Katavic, 2010). Nevertheless, a few surveys offer some insight into the prevalence of research wrongdoing. A pilot study of some U.S.-based clinical and biomedical research trainees showed that 15.1% of them admitted to past personal misconduct (Kalichman & Friedman, 1992). In one of the first empirical studies published in this field in this century, 5.7% of newly appointed (not necessarily newly qualified) medical consultants in the United Kingdom admitted past personal research misconduct (Geggie, 2001). A large survey of publicly funded researchers in the United States showed that 33% of the respondents said that they had engaged in at least one of the top ten misbehaviors in their study in the preceding three years (Martinson, Anderson, & De Vries, 2005). While there are differences in the designs and specific variables used in these surveys, it remains important that they set out to measure the occurrence of research wrongdoing directly from researchers.

However, little is known about research wrongdoing admission rates in developing countries. Attention was recently drawn to knowledge gaps about the integrity of research conduct in Latin America at a bioethics meeting in the United States (Heitman & Litewka, 2012a). Little is known about Africa in the literature on research wrongdoing. While the United States has experienced eras in research ethics development, including one in the 1980s when policy makers were most concerned with defining and investigating research misconduct (Steneck & Bulger, 2007), developing countries, especially in Africa, have given little attention to this challenge.

We therefore embarked on this study to measure the prevalence of research wrongdoing and its associated factors among health researchers in Nigeria. This is the first study of a wide range of research wrongdoings along with their associated factors in Africa. It is expected that the findings will add to the justification for the promotion of training and practice regarding ethical regulation of research, with particular attention to research integrity, in Nigeria and the rest of Africa. The findings would also add to the body of evidence that research wrongdoing is a challenge to the research and ethics enterprise, irrespective of location or level of technological development.

Method

The study was conducted in three medical and dental schools located in two adjoining states in southern Nigeria that routinely share material and human resources for research and training, thus approximating a research community. Data was collected in January and February 2009 into a database for research ethics studies on researchers in these schools. Structured training and formal research ethics regulatory systems are mostly in their early formative stages in these institutions and the rest of Nigeria.

Study Design and Participants

The study population consisted of lecturers and consultants/attendants in the institutions. To compute sample size, we estimated that the prevalence was 48% based on an estimated prevalence of 15% above the 33% in the Martinson et al. (2005) study. We set the power

of the study at 90% and computed a minimum sample size of 109. All researchers in the institutions were eligible participants.

Ethical Issues

The institutions' names are blinded because of the sensitive nature of the data collected and the potential for dignitary harm. The ethics and research committee of one of the institutions provided ethical clearance for the study in all of the institutions in line with national regulations. Each institution provided approved access to their staff, and voluntary informed consent was obtained from each participant. In order to improve confidentiality and enable a high response rate, responses did not contain any respondent identifier, and the questionnaires were self-administered outside the direct view of persons involved in the study. Only the principal investigator may answer questions arising from the questionnaire administration by personal contact or phone call.

Data Management

The questionnaire had a section on respondents' sociodemographic characteristics, followed by a list of wrongdoings from which the respondents were requested to identify the ones they had ever committed. The wrongdoings in the list were adapted from those employed by Martinson et al. (2005) and from the Council of Science Editors' definition of research misconduct (Council of Science Editors, 2008). Respondents were also required to identify factors that they perceived as barriers to their ethical conduct of research. Such factors included self-assessed inadequate knowledge of research ethics and of research methods, inadequate resources (funds, facilities, and time) for research, negative influences from peers and seniors (mockery by colleagues because of one's efforts to conduct research ethically and unwholesome example of unethical research by senior colleagues), and pressure to urgently publish papers. Respondents were also asked to identify criteria for ethical research in a list drawn from Nigeria's National Code of Health Research Ethics (Federal Ministry of Health [FMOH]/National Health Research Ethics Committee of Nigeria [NHREC], 2007, see Appendix), which incorporates similar criteria in the ethics literature (Emanuel, Wendler, & Grady, 2000; Emanuel et al., 2004). The code is a legal instrument regulating the ethical review and conduct of health research in Nigeria (Adebamowo et al., 2007), and the knowledge of the aforementioned criteria in the code is the subject of a more detailed study (Adeleye & Ogundiran, in press). For the research wrongdoings, perceived barriers, and the criteria, respondents were required to respond by selecting "yes" if they agreed with the option and "no" if they did not. The responses were used to compute frequencies and percentages which, in turn, were used for further analyses. Data were entered and analyzed via Stata/SE 10.0® for Windows. Univariate analyses with Fisher's exact probability test were initially done for associations between wrongdoings (all acts combined, FFP, and the top three among the others) and independent variables. The independent variables included the barriers to ethical conduct of research, inability to correctly identify all of the criteria for ethical research in the national code, age, sex, and rank. Using multivariate logistic regression, further analyses to eliminate possible confounders in the associations were done. The regression involved the development of an initial model in which those independent variables with $p \leq 0.2$ in the univariate analyses were included as covariates. Final models were arrived at by a backward elimination procedure. Throughout, $p < 0.05$ and 95% confidence interval estimates of odds ratios that excluded 1.00 were considered statistically significant.

Results

Of the total of 167 eligible researchers, 132 consented to the study and completed the questionnaire, giving a response rate of 79.0%. The participants' mean (SD) age was 44.9

(7.9) years. Most respondents fell into the age group of 40–49 years [62 (47.0%)], were males [107 (81.1%)], and had the rank of Lecturer I [63 (47.7%)].

Of the total of 132 participants, 72 (54.6%) admitted at least one research wrongdoing. Overall, the most frequently admitted wrongdoing was inadequate record keeping—39 (29.5%). Some 29 (22.0%) respondents admitted to at least one of FFP. The most frequently admitted among FFP was fabrication, 19 (14.4%), followed by falsification, 13 (9.8%), and plagiarism, 6 (4.5%). Other wrongdoings admitted included the use of inappropriate or inadequate research design, 18 (13.6%); unauthorized use of confidential information, such as the use of data on patients who consented to clinical care but not to research, 15 (11.4%); publishing the same data or results in more than one publication, 7 (5.3%); failing to present data that contradict one's own research, 5 (3.8%); having relationships with research students or research participants that may be interpreted as questionable, 2 (1.5%); and manipulating the methodology or results of a study in response to pressure from a funding source, 1 (0.8%).

Table 1 shows the distribution of wrongdoings by the factors shown to be significant in either univariate or multivariate analysis. The final multivariate logistic regression models and the respective effect measures are presented. Of the respondents who acknowledged inadequate knowledge of research ethics, 64.9% (37/57) admitted at least one wrongdoing compared to 46.7% (35/75) of those who did not acknowledge inadequate knowledge of research ethics ($p = 0.04$; OR = 2.18, 95% CI = 1.06–4.52). Similarly, of the respondents who were unable to correctly identify all of the listed criteria for ethical research, 62.7% (52/83) admitted at least one wrongdoing compared to 40.8% (20/49) of those who were able to correctly identify all the criteria ($p = 0.02$; OR = 2.50, 95% CI 1.20–5.24).

Compared to 10.0% (6/60) of lecturers in the higher cadres, 31.9% (23/72) of those below the rank of senior lecturer admitted at least one of FFP ($p < 0.01$; OR = 5.69, 95% CI = 1.92–16.88). Of the respondents who perceived ethics as hampering urgency to publish papers for promotion, 41.7% (10/24) admitted at least one of FFP compared to 17.6% (19/108) of those who did not have this perception ($p = 0.01$; OR = 4.40, 95% CI = 1.44–13.46). Compared to 6.1% (3/49) of respondents who correctly identified all of the listed criteria for ethical research, 31.3% (26/83) of those who could not correctly identify them admitted at least one of FFP ($p < 0.01$; OR = 9.59, 95% CI = 2.46–37.41).

Some 29.2% (7/24) of respondents who perceived ethics as hampering timeliness of publications compared to 11.1% (12/108) without this perception admitted to fabrication ($p = 0.03$; OR = 3.29, 95% CI = 1.14–9.56).

Some 22.8% (13/57) of those who acknowledged knowledge gap in research ethics compared to 6.7% (5/75) who did not acknowledge the knowledge gap admitted using inappropriate research designs ($p = 0.03$; OR = 3.51, 95% CI = 1.11–11.17).

Mockery by colleagues at efforts towards ethical research was associated with falsification ($p = 0.04$), plagiarism ($p < 0.01$), inadequate record keeping ($p = 0.04$), and inappropriate research design ($p < 0.01$), but the very wide confidence intervals of these associations imply poor precision.

Discussion

This study is the first in Africa to cover a relatively wide range of wrongdoings in health research along with factors associated with them. The major findings indicate that research wrongdoing is an important problem in the health research community studied, casting doubts on the integrity of researchers and the validity of their research. Similar concerns

have been expressed by research ethicists in other countries (National Academy of Sciences, National Academy of Engineering, Institute of Medicine, 2009; Steneck, 2005, 2007). The main factors associated with the acts are largely related to inadequate knowledge and mentorship for ethical conduct of research in the research community studied. The findings also demonstrate that, as attested to by others (Green, 2011; Vlassov & Grooves, 2010, 2011), research wrongdoing is widespread among health researchers, irrespective of place, culture, and length of experience in formal ethical conduct of research.

There are limitations to attempts to compare different proportions of health researchers who had committed research wrongdoing in different places and time. The number and types of specific variables measured often differ as do respondents' lengths of experience and specific roles in research (e.g., whether they directly interact with human participants or are engaged in only data management). Procedures for data collection in a survey (e.g., how confidentiality was built in) may also determine the validity of responses as may the length of periods under consideration for the wrongdoings. Situational and psychosocial factors may affect respondents' perceived risk of admission of wrongdoing, willingness to admit wrongdoing, and truthfulness of responses.

The proportion of researchers admitting research wrongdoing in this study is high compared to findings from studies in the United States and United Kingdom, which showed 15.1% of biomedical trainees (Kalichman & Friedman, 1992) and 5.7% of medical consultants (Geggie, 2001) admitted past personal research misconduct respectively. The proportion in this study may also be compared to a pooled value of up to 33.7% representing admission rate of questionable research practices (other than falsification and fabrication) in a Web-based meta-analysis (Fanelli, 2009).

Our findings were similar to those of a U.S. survey by Martinson et al. (2005) that, however, covered a three-year period. A similar proportion of respondents (this study versus Martinson et al.'s) reported inadequate record keeping (29.5%/27.5%); publishing the same data or results in two or more publications (5.3%/4.7%); failing to present data that contradict one's own research (3.8%/6.0%); and having relationships with research students or research participants that may be interpreted as questionable (1.5%/1.4%). However, the admission rate for plagiarism was higher in this study (4.5%) than that of Martinson et al. (1.4%). In their review of the literature on international perspectives on plagiarism, Heitman and Litewka (2012b) note that trainees from developing countries have a higher risk of committing plagiarism than their U.S. peers. It is uncertain whether the same can be said of lecturers and researchers in developing countries. What appears to be the major susceptibility factor among the researchers in this study is the weakness of formal ethical regulatory and mentorship systems. Similarly, the findings of unauthorized use of confidential information for research purposes (12.1%/1.7%) were quite dissimilar. The much higher proportion in this study was probably related to the lack of adequate checks and safeguards on access to patients' information. In developed countries, patients' records are better protected against unauthorized access even by facility staff. For example, the Health Insurance Portability and Accountability Act of 1996 in the United States protects patients' and health clients' data from access and use especially by health insurance firms and healthcare providers, except following authorization by the patients or clients or designated individuals or institutions (Coughlin, 2006; HIPAA, 1996; Nosowsky & Giordano, 2006). Such legislation is lacking in many developing countries including Nigeria. Conversely, the manipulation of the methodology or results of a study in response to pressure from a funding source was more frequent in the U.S. study (15.5%) than this study (0.8%). This may be due to the relative rarity of extramural research funding in Nigeria.

Considering all of the listed wrongdoings as a whole, two factors emerged in the final model as explanatory variables—self-judged inadequate knowledge of research ethics and the inability to correctly identify all of the listed criteria for ethical research. Both factors appear to converge as deficiency in the knowledge of research ethics. This underscores the need for improved training and mentorship in research ethics to support ethical conduct of research. While research wrongdoing is inconsistent with virtuous character, it appears reasonable to view the respondents' admission of inadequate knowledge as "virtuous". This disposition could imply willingness to learn or change and may be a veritable opportunity for effective interventions through improved trainings delivered by suitably skilled trainers in research ethics.

Inadequate record keeping appears to be a widespread wrongdoing, topping the list of wrongdoings in this study and the Martinson et al. study (see above). Inadequate record keeping may be related to the researcher's inexperience, limited resources (such as not having enough funds to hire and train competent research assistants or purchase required resources), not enough time allocated to research, and being unable to determine the type of record that should be kept. This wrongdoing is often mildly called a questionable research practice. De Vries, Anderson, and Martinson (2006) classify it as "normal misbehavior", but note, from their study, that it is often implicated in cases of FFP. Inadequate record keeping may impede research inquiries and investigations of misconduct (Schreier, Wilson, & Resnik, 2006). Health researchers and research institutions must always bear in mind that they are responsible for the adequate keeping of research records as highlighted in the U.S. Public Health Service Policies on Research Misconduct (Department of Health and Human Services, 2005).

The association of lower ranks of researchers with at least one of FFP calls for concern because it potentially threatens the future of research. This situation may be due to poor mentoring. The challenge for the local research community would be to provide research and ethics mentorship to early-career researchers.

The number of scientific articles authored by a researcher is the major criterion for the promotion of researchers in many parts of the world. It is therefore not surprising that some researchers feel an urgent need to publish and may commit research wrongdoing in order to quickly reach the required publication threshold for promotion. Thus, publication pressure sufficient to regard ethics as time-wasting has been associated, in this study, with at least one of FFP, particularly fabrication. Publication pressures from different sources have been similarly identified in the literature as reasons for research wrongdoing (Fanelli, 2010; Irish Council of Bioethics, 2010; Sherin, 2010; Meško & Oberkal, 2011; National Academy of Sciences, National Academy of Engineering, Institute of Medicine, 2009). The situation poses a challenge to researchers to respond to pressures by improving on efficiency rather than compromise ethics.

Discouragement by the unwholesome example of unethical research by senior colleagues constitutes negative influence, which, in this study, was associated with unauthorized use of confidential information. These findings may reflect an important but probably understudied type of negative influence as a determinant of research wrongdoing. One major concern about this is that it besmears the respect deserved by senior researchers and harms expectations from them in their roles as mentors in the research ethics enterprise.

The poor precision in the associations between some wrongdoings and mockery by colleagues because of efforts to conduct research ethically allows for only limited remarks. It must be noted, at least, that it is strange and worrisome, especially as a factor apparently associated with falsification, plagiarism, inadequate record keeping, and inappropriate

research design. The strangeness may be viewed against the fact that, conversely, naming and shaming are often recommended appropriate responses to those who commit research wrongdoing, particularly plagiarism (Chalmers, 2006; Schüklenk, 2007). The association suggests that the affected researchers lacked the courage to sustain ethical conduct of research most likely because an environment that supports ethical conduct of research is lacking.

Inappropriate research design compromises scientific validity (Council for International Organizations of Medical Sciences, 2002; FMOH/NHREC, 2007) and may enable conclusions beyond what research data warrant. When in a position to do so, health researchers ought to act against their colleagues' incorrect use of research data. Doing otherwise, as was the case with some respondents in this study, is considered unethical. In Heitman et al.'s (2005) review of Martinson et al.'s study, they indicated that when senior researchers overlook the research wrongdoings of junior researchers, the latter may be learning to do likewise, thus potentially breeding a dangerously unethical culture.

Despite the important findings in this study, it has some limitations. First, the list of wrongdoings was not exhaustive as it represents only those commonly identified in current literature. The cross-sectional design of the study makes it impossible to ascertain temporality in the associations—it was not possible to determine that the explanatory variables preceded the outcome variables. Recall bias and denial with respect to the admission of wrongdoing should also be considered in interpreting the results. Denials could have occurred due to the indignity associated with research wrongdoing or its admission. Some of the effect estimates were unstable due to small sample size.

Best Practices

Our study shows that research wrongdoing is a challenge in the population studied. The findings lend themselves to important best practice considerations. Biomedical researchers, institutions engaged in research and relevant policy formulating, and implementing agencies of the Nigerian government need to collaborate to establish and create opportunities for systems that support ethical research. In Nigeria, the National Health Research Ethics Committee can play advisory and supervisory roles in managing a national response to this challenge.

One intervention that deserves consideration is adequate research funding. In Nigeria, biomedical researchers fund their research mostly from their low personal incomes. Thus, they are often unable to afford needed research equipment and to employ research assistants, let alone earn some remuneration from research. This appears to create a setting for unwholesome practices such as weak research designs, inadequate data collection and record keeping, and FFP. Best practice response to support ethical research should therefore include adequate and accountable funding of research from private and public sources.

Systems to support ethical research should also include improved administrative regulation of research to ensure compliance with local and international standards. This should cover all stages of research from conception until well after publication. Administrative interventions should include setting up agencies that formulate policies on responsible conduct of research and research wrongdoing as exemplified by the U.S. Office of Science and Technology Policy.

Institutional structures should be set up to promote and make provision for detecting, reporting, and investigating suspected and known wrongdoings in an arrangement that protects the informant. Guidelines for appropriate response to suspected wrongdoing (Keith-Spiegel, Sieber, & Koocher, 2010) and plagiarism detection software and services (Garner,

2011) have been developed and recommended for use. Detection of research wrongdoing is necessary in order to frustrate the intentions of offenders, penalize them, and eventually deter intending offenders. To guide researchers and research institutions, Schreier et al. (2006) recommend best practices regarding record keeping—legibility, accuracy, completeness, and orderliness of records, and recording procedures in a manner that makes them reproducible. It may also be necessary to review promotion criteria for lecturers to give less weight to required numbers of publications in order to reduce the publication pressure associated with research wrongdoing. As fewer researchers engage in wrongdoing and ethical conduct of research gets promoted, mockery of the ethical will hopefully be replaced by naming and shaming of the unethical.

Research Agenda

Further studies on research wrongdoing in other parts of Nigeria and Africa are desirable in order to have a better understanding of the situation in the country and the continent respectively. Larger sample sizes than what was used in this study would be required in order to have sufficient observations for categories of variables so that more stable estimates of effect sizes can be obtained. The list of wrongdoings used in this study needs to be expanded as more practices become better understood as research wrongdoings. More explanatory variables should also be explored for significance. Using qualitative methods, each wrongdoing and explanatory variable can be studied in more details to gain a better understanding of their nature and associations. Given the sensitiveness in collecting data on research wrongdoing and the indignity associated with its admission, studies requiring self-report should be designed and conducted with careful consideration for confidentiality. Data on all-time acts of research wrongdoing, as was obtained in this study, provide a general pattern of the problem. But there is added value in specifying a short period for all participants, say three years, as was done by Martinson et al. (2005); this would allow for more reliable recall. Specification of period and number of wrongdoings will permit computation of rates of wrongdoing.

Educational Implications

Training in research ethics with emphasis on responsible conduct of research is urgently required. Several useful educational resources on responsible conduct of research, including curricula and reference materials, have been developed (see, e.g., Fischer & Zigmond, 2011; Heitman & Bulger, 2005; Irish Council for Bioethics, 2010; National Academy of Sciences, National Academy of Engineering, Institute of Medicine, 2009; Silverman et al., 2010), and may be used in the development of local training materials. Fischer and Zigmond (2011) recommended some problem-based stepwise educational approaches that involve challenging trainees to be more imaginative and creative. Mentoring by senior researchers would be useful if the mentors are knowledgeable, skilled, and exemplary. In line with Heitman's allusion, neither training in objective observations nor rigorous compliance with procedures is sufficient in assuring scientific integrity (Heitman, 2002). It seems that health researchers still need to motivate themselves to conduct research from the standpoint of personal and group integrity. That way, a structured and stronger research ethics culture would hopefully emerge in Nigeria and in similar environments.

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Appendix: Criteria for Ethical Research as Presented to the Study Participants

1. The research must have social or scientific value; improvement in well-being of participants or the population they represent or increase in scientific knowledge.
2. The research must have scientific validity, such as unbiased measurements and analysis.
3. There must be fair selection of participants in the research; the vulnerable should not be targeted for risky research and the socially advantaged should not be favored for beneficial research.
4. The research must include valid attempts to minimize risks and maximize health benefits.
5. The research must undergo independent review by persons unaffiliated with it.
6. Informed consent is essential to ethical research; information is given to the proposed participants who voluntarily decide whether or not to enroll and continue to participate.
7. There must be respect for potential and enrolled participants; they are allowed to withdraw at any time and their confidentiality is protected.
8. Nothing must be done to undermine the trust that is at the heart of researcher-participant relationships.
9. The interests of participants, researchers, sponsors, and communities must be protected.
10. The research must be conducted in accordance with international standards to further assure highest ethical and scientific standards.

Authors' Biographical Sketches

Omokhoa Adeleye is a Senior Lecturer and Acting Head, Department of Community Health, School of Medicine, University of Benin, Benin City, Nigeria. His teaching and research interests include bioethics, health education, epidemiology, and research methods. He conceived and designed this study, and analyzed and interpreted the data. He also prepared the manuscript.

Clement Adebamowo is Director of Office of Strategic Information, Research and Training, Institute of Human Virology, Nigeria; and an Associate Professor of Epidemiology, University of Maryland, Baltimore. His research interests are noncommunicable diseases epidemiology and AIDS-associated malignancies. He provided substantial technical and material inputs at every stage and to every part of this study.

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TABLE 1

Factors Associated with Research Wrongdoing: Final Models in Multivariate Logistic Regression (N = 132).

Wrongdoing	Associated factors		Admitted wrongdoing		Multivariate logistic regression	
			Yes (%)	No (%)	<i>p</i>	Odds ratio (95% CI)
At least one of all listed wrongdoings	Self-assessment of one's knowledge of research ethics as being inadequate	Yes	37 (64.9)	20 (35.1)	0.04	2.18 (1.06—4.52)
		No	35 (46.7)	40 (53.3)		
	Inability to correctly identify all listed criteria for ethical research	Yes	52 (62.7)	31 (37.3)	0.02	2.50 (1.20—5.24)
		No	20 (40.8)	29 (59.2)		
At least one of FFP	Ranks below senior lecturer	Yes	23 (31.9)	49 (68.1)	< 0.01	5.69 (1.92—16.88)
		No	6 (10.0)	54 (90.0)		
	Urgency about publishing enough papers for promotion such that attention to ethics is seen as a source of delay	Yes	10 (41.7)	14 (58.3)	0.01	4.40 (1.44—13.46)
		No	19 (17.6)	89 (82.4)		
	Inability to correctly identify all listed criteria for ethical research	Yes	26 (31.3)	57 (68.7)	< 0.01	9.59 (2.46—37.41)
		No	3 (6.1)	46 (93.9)		
	Self-assessment of one's knowledge of research methods as being inadequate	Yes	18 (31.0)	40 (69.0)	<i>a</i>	
		No	11 (14.9)	63 (85.1)		
	Mockery by colleagues because of one's efforts to conduct research ethically	Yes	4 (80.0)	1 (20.0)	<i>a</i>	
		No	25 (19.7)	102 (80.3)		
Fabrication	Urgency about publishing enough papers for promotion such that attention to ethics is seen as a source of delay	Yes	7 (29.2)	17 (70.8)	0.03	3.29 (1.14—9.56)
		No	12 (11.1)	96 (88.9)		
	Inability to correctly identify all listed criteria for ethical research	Yes	18 (21.7)	65 (78.3)	<i>a</i>	
		No	1 (2.0)	48 (98.0)		
Falsification	Mockery by colleagues because of one's efforts to conduct research ethically	Yes	2 (40.0)	3 (60.0)	0.04	7.03 (1.06—46.68)
		No	11 (8.7)	116 (91.3)		
Plagiarism	Mockery by colleagues because of one's efforts to conduct research ethically	Yes	3 (60.0)	2 (40.0)	< 0.01	62.00 (7.41—518.76)
		No	3 (2.4)	124 (97.6)		
Inadequate record keeping	Mockery by colleagues because of one's efforts to conduct research ethically	Yes	4 (80.0)	1 (20.0)	0.04	10.51 (1.14—97.35)
		No	35 (27.6)	92 (72.4)		
	Sex (male)	Male	36 (33.6)	71 (66.4)	<i>a</i>	
		Female	3 (12.0)	22 (88.0)		
Using inappropriate research design	Self-assessment of one's knowledge of research ethics as being inadequate	Yes	13 (22.8)	44 (77.2)	0.03	3.51 (1.11—11.17)
		No	5 (6.7)	70 (93.3)		
	Mockery by colleagues because of one's efforts to conduct research ethically	Yes	4 (80.0)	1 (20.0)	0.01	25.00 (2.44—255.60)
		No	14 (11.0)	113 (89.0)		
	Urgency about publishing enough papers for promotion such that attention to ethics is seen as a source of delay	Yes	7 (29.2)	17 (70.8)	<i>a</i>	
		No	11 (10.2)	97 (89.8)		
	Self-assessment of one's knowledge of research methods as being inadequate	Yes	12 (20.7)	46 (79.3)	<i>a</i>	
		No	6 (8.1)	68 (91.9)		
UUCI ^b	Discouragement by the unwholesome example of unethical research by senior colleagues	Yes	5 (38.5)	8 (61.5)	< 0.01	6.81 (1.87—24.78)
		No	10 (8.4)	109 (91.6)		

^aStatistically significant in univariate analysis but not sustained in multivariate logistic regression

^bUnauthorized use of confidential information, such as the use of data on patients that consented to clinical care but not to research