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A Cross-Sectional Survey Study to Assess Prevalence and Attitudes Regarding Research Misconduct among Investigators in the Middle East

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Abstract Recent studies from Western countries indicate significant levels of questionable research practices, but similar data from low and middle-income countries are limited. Our aims were to assess the prevalence of and attitudes regarding research misconduct among researchers in several universities in the Middle East and to identify factors that might account for our findings. We distributed an anonymous questionnaire to a convenience sample of

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investigators at several universities in Egypt, Lebanon, and Bahrain. Participants were asked to a) self-report their extent of research misconducts, as well as their knowledge of colleagues engaging in similar research misconducts and b) provide their extent of agreement with certain attitudes about research misconduct. We used descriptive, bivariate, and multivariate logistic regression statistics to analyze the data. Data from 278 participants showed a high prevalence of misconduct, as 59.4% of our respondents self-reported to committing at least one misbehaviors and 74.5% reported having knowledge of any misbehaviors among any of their colleagues. The most common type of self-report misconduct was "circumventing research ethics regulations" (50.5%) followed by "fabrication and falsification" (28.6%). A significant predictor of misconduct included a lack of "prior ethics training". Scientific misconduct represents a significant issue in several universities in the Middle East. The demonstration that a lack of "prior ethics training" was a significant predictor of misconduct should lead to educational initiatives in research integrity. Further studies are needed to confirm whether our results can be generalized to other universities in the Middle East.

Keywords Research ethics · Research misconduct · Responsible conduct in research · Middle East

Introduction

During the past few decades, studies documenting the extent of research misconduct have led to concerns regarding the integrity of investigators and the credibility of their research (Nussenzveig and Zukanovich Funchal 2008; Trikalinos et al. 2008). The Office of Research Integrity defines research misconduct as "fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results (The Office of Research Integrity 2016). Other definitions are broader and include types of wrongdoings, such as intentional research protocol violations, falsification of a resume, inappropriate assigning of authorship, and not declaring a conflict of interest (Broome et al. 2005; Buzzelli 1993).

Data regarding the prevalence of research misconduct mostly comes from Western countries. In a survey involving early- and mid-career scientists, Martinson and colleagues surveyed investigators regarding their self-report on a broad range of sanctionable behaviors and demonstrated that the percentages of respondents who said they had engaged in falsification and plagiarism were 0.3% and 1.4%, respectively. The frequencies for other misbehaviors were above 5%; for example, "inappropriately assigning authorship credit" was 10.0% and "dropping observations or data points from analyses based on a gut feeling" was 15.3% (Martinson et al. 2005).

Fanelli conducted a meta-analysis of 18 studies involving surveys documenting the occurrence of research misconduct (15 from the U.S., 3 from the U.K, 1 from Australia, and 2 multinational). Between 0.3% and 4.9% admitted to having fabricated or falsified research

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data; meta-analysis yielded a pooled weighted average of 1.97% of scientists who admitted to have fabricated, falsified or modified data or results at least once; up to 33.7% admitted to other "questionable research practices"; the crude unweighted mean for these behaviors was 9.54%. In surveys inquiring about personal knowledge of a colleague who fabricated or falsified research data, between 5.2% and 33.3% of respondents replied affirmatively, whereas between 6.2% and 72% of respondents had knowledge of various "questionable research practices" committed by their colleagues (Fanelli 2009).

Similar studies showing the extent of questionable research practices in non-Western countries have recently been performed, but are few in number. A questionnaire-based study from India determined the extent of occurrence of misconduct in publications amongst biomedical researchers. Of the 155 respondents, 65.1% reported the offering of gift authorship; 56.7% had knowledge of an individual who altered or fabricated data; and 53.5% observed plagiarism (Dhingra and Mishra 2014). A study from Nigeria revealed that 68.9% of investigators admitted to at least one of eight listed forms of scientific misconduct (P. Okonta and Rossouw 2013). In a follow-up report, these authors from Nigeria showed that more than half of the respondents were aware of a colleague who had committed misconduct defined as "non-adherence to rules, regulations, guidelines and commonly accepted professional codes or norms" (P. I. Okonta and Rossouw 2014).

The aims of this study were to obtain data regarding the prevalence of scientific misconduct in the Middle East; explore potential contributing factors to research misconduct; and to determine investigators' attitudes regarding certain aspects of responsible conduct in research.

Methods

Study Design Cross-sectional questionnaire.

Questionnaire We developed a structured questionnaire consisting of the following sections: 1) respondents' demographic characteristics, including prior research experience and previous ethics training; 2) respondents' self-report of research misconducts, as well as their knowledge (either by their direct observation or having had other evidence) of colleagues engaging in similar research misconduct practices; and 3) extent of agreement with certain attitudes about responsible conduct in research.

We adapted a list of research misconduct practices from those used in several studies performed by Martinson and his colleagues (Martinson et al. 2005, 2006). Specifically, these authors conducted six focus groups consisting of scientists from top tier universities who gave their opinions regarding which research misconducts and questionable research practices were of greatest concern to them. From our adapted list of misbehaviors, we constructed the following research misconduct composites: a) circumventing research ethics regulations; b) fabrication and falsification; c) plagiarism; d) authorship misconduct; e) conflict of interest; and f) other research misconduct practices (Table 2 lists the specific misbehaviors for each of these composites).

Target Population We surveyed the following groups: 1) undergraduate students and individuals working in research positions (e.g., research assistants and technicians); 2) Individuals with Masters and PhDs degrees and post-doctoral students; and 3) academic faculty. We targeted individuals in these groups at the following institutions in the Middle East: Cairo

University, the American University in Cairo (AUC) and Suez Canal University in Egypt; Royal College of Surgeons in Ireland (RCSI) Medical University of Bahrain; and Ain Wazein Hospital in Lebanon. The universities were selected on the basis of availability of a local researcher to coordinate the distribution of the questionnaire and enhance awareness of the study.

Questionnaire Distribution

We conducted this study from February 2015 to September 2015. We distributed the questionnaire to a convenient sample by a) sending a web link on SurveyMonkey® via a recruitment email; and b) distributing by "hand" to investigators at Cairo University. All questionnaires were returned anonymously. The language of the survey was in English.

Sample Size Determination

We calculated an estimated sample size of about 340 participants based on a margin of error of 5%, a confidence level of 95%, and a combined population size of approximately 3000 investigators in the targeted universities.

Data Analysis

For questions regarding self-reporting of misconduct and knowledge of misconduct of colleagues, respondents were asked how often each type of misconduct occurred by choosing either "Never", "Once or twice" or "Three or more". These responses were transformed into dichotomous responses: "never" and "one or more times".

We calculated the prevalence of self-reported and knowledge of colleagues' misconducts separately for each item and categorized into one of the six research misconduct composites described previously. Additionally, for each misconduct composite, we computed, for self-report and for knowledge of colleagues' misconduct, the aggregate frequencies at which at least one of the research misconducts for that composite was reported.

Data were extracted from SurveyMonkey and the paper questionnaires and entered into SPSS statistical software. We used descriptive analysis to report the frequencies of the demographics. We used bivariate analysis (Chi-Square) to investigate the association between the misconduct composite aggregates and the following independent factors: gender, prior ethics training, location of university where a graduate degree was obtained (western or non-western), and academic position (faculty; master's, PhDs, and postgraduates; and "other" (undergraduates, research assistants, and technicians)). The association between the mean age of respondents and misbehaviors was tested using an independent sample t-test.

Multivariate analysis models were built for each of the misconduct composite categories. Independent variables found to be significant at the level of $p \leq 0.10$ in the bivariate analysis were entered in the logistic regression model. Purposeful selection of variables in logistic regression modeling that uses more traditional levels such as 0.05 can miss identifying variables known to be important (Bursac et al. 2008). Covariates in the final multivariate analysis were considered significant at a p level of ≤ 0.05. We also calculated Odds Ratio and confidence intervals.

For questions regarding "attitudes", we used a Likert-scale consisting of: strongly agree, agree, neutral, disagree, and strongly disagree. We collapsed the responses of "strongly agree" and "agree" into one category and collapsed the responses of "disagree" and "strongly disagree" into another category. We present the descriptive analysis of the category ("agree" and "strongly disagree") responses.

Ethics

Informed Consent: Questionnaires were accompanied by a cover letter that described a) the purpose of the study ("This study aims to assess investigators' attitudes regarding responsible conduct in research as well as the self-report of research misbehaviors and personal knowledge of misbehaviors of their colleagues in various institutions in the Middle East/North Africa region") and b) the voluntary nature of participation. Informed consent to participate in the study was implied when respondents either returned the paper-based survey or when they electronically clicked on the "finish button" on the Surveymonkey website.

Confidentiality: Due to the sensitivity of the data and to enhance accurate reporting, questionnaires were collected anonymously.

Ethics Review: We obtained ethical approval from the research ethics committees at each of the institutions from where we recruited participants.

Conflicts of Interest: The authors declare that they have no conflicts of interest.

Results

We obtained surveys from 348 participants of whom 278 answered questions beyond the demographics section. Of these respondents, 212 were from universities in Egypt, 33 attended RCSI in Bahrain, and 33 were from Ain Wazein Hospital in Lebanon. Table 1 shows the demographic data. Ages ranged between 18 to 73 years; mean age of 34.2 years, SD ± 11.9 years and median of 31.0 years (data not shown). More than 60% of participants were females (60.4%); the majority was of Egyptian nationality (72.7%). More than a third (44.6%) represented academic faculty (Lecturers: 14.7%; Assistant Professors: 7.2%; Associate Professors: 4.6%; and Full Professors: 8.3%), 34.6% had either earned their Masters/PhDs or were post-doctoral students, and 20.8% represented undergraduates, research assistants and technicians, which is henceforth designated as the "other" category. Of those who had obtained a graduate degree ($n = 236$), 78.8% received their degree from a university in the Middle East or North Africa, whereas 17.8% obtained their degree from a Western university. More than half of the respondents indicated they had received ethics training (56.8%) and more than 80% reported previous experience in research (83.3%). For questions related to self-reporting of research misconduct, we analyzed only the responses of those with research experience ($n = 224$). For questions regarding attitudes toward issues in research misconduct, we analyzed the responses from all participants ($n = 278$) regardless of any prior research experience.

Prevalence of Self-Report and Knowledge of Colleagues' Research Misbehaviors

Table 2 shows the frequencies of self-report and knowledge of colleagues' research misbehaviors for each specific item. Each of these misbehaviors are categorized in one of the misconduct composite. Regarding the composite of Circumventing Research Ethics

Table 1 Participants' demographics (n = 278)

Characteristic		n (%)
Gender	Male	108 (38.8)
	Female	168 (60.4)
	Did Not Respond	2 (0.7)
Nationality	Egyptian	202 (72.7)
	Lebanese	31 (11.2)
	Bahraini	8 (2.9)
	Other Middle East and North African countries	5 (1.9)
	Western countries	28 (10.0)
	Miscellaneous	4 (1.5)
Academic Position	Faculty	122 (44.6)
	Masters, PhD, and Postdoctoral	94 (34.6)
	Other (Undergraduates, Research Assistants & Technicians)	62 (20.8)
University location where graduate degree was obtained (n = 236)	Middle East or North Africa	202 (78.8)
	European Union, United Kingdom, US, Canada, Australia	42 (17.8)
	Other Country	8 (3.4)
Received prior ethics training?	Yes	158 (56.8)
	No	120 (43.2)
Prior research experience?	Yes	224 (83.3)
	No	54 (16.7)
If yes, type of research performed? (check all that apply)	Human Subject	136 (48.9)
	Animal	43 (15.5)
	Human Biological Samples	25 (9.0)
	Laboratory	64 (23.0)

Regulations, 18.0%, 17.1%, and 11.5% self-reported "one or more times" instances of conducting research without prior approval from a research ethics committee, not obtaining proper informed consent from participants, and the use of confidential information without proper authorization; respectively. The frequencies at which respondents stated they had knowledge of their colleagues' misbehaviors for this misconduct composite were 26.3%, 34.9%, and 18.7%; respectively.

Regarding "fabrication and falsification", 9.7% self-reported instances of "fabrication" and 18.9% and 22.1% self-reported instances of "falsification": dropping "outliers" and selecting only data that supported the hypothesis; respectively. Frequencies of having knowledge of these research misconduct practices among their colleagues were higher and ranged between 23.4% and 37.4%.

Frequencies of respondents' self-reported acts of three different types of plagiarism ranged between 3.7% and 8.8%, whereas knowledge of similar acts among their colleagues were three times higher. Respondents self-reported that 18.4% had granted authorship to someone who had not contributed substantively to a manuscript and 5.1% self-reported the denial of authorship when it was appropriate to do so. Knowledge of colleagues committing the same practices was higher; (37.8% and 19.8%; respectively). Prevalence of self-reporting of conflicts of interests was 3.2%; whereas the knowledge of such practices among colleagues was almost three times higher (9.7%).

Regarding research practices shown in the "Other" misconduct composite, the percentages of respondents who said they committed "one or more times" the practices of ignoring aspects

Table 2 Frequencies of respondents' self-report of misbehaviors and knowledge of colleagues' misbehaviors grouped within defined misconduct composites; (self-report = 224*; knowledge of colleagues behaviors = 278**)

Misconduct composite and associated misbehaviors	Self-report n (% of Total) One or more times	Knowledge of colleagues n (% of Total) One or more times
Circumventing research ethics regulations		
Conducting research involving human subjects without prior approval from a Research Ethics committee	39 (18.0)	73 (26.3)
Not obtaining proper informed consent from participants	37 (17.1)	97 (34.9)
Use of confidential information about research subjects without their authorization	25 (11.5)	52 (18.7)
Ignoring aspects of animal-subjects research requirements such as care, feeding, etc.	13 (6.0)	37 (13.3)
Fabrication and falsification		
Making up research data (fabrication)	21 (9.7)	72 (25.9)
Changing research data without mentioning it.	21 (9.7)	65 (23.4)
Dropping "outliers" without mentioning it	41 (18.9)	90 (32.4)
Selecting only those data that support your hypothesis	48 (22.1)	104 (37.4)
Plagiarism		
Publishing results that belong to someone else	14 (6.5)	55 (19.8)
Using someone else's words or ideas without giving proper credit	19 (8.8)	92 (33.1)
Submitting a manuscript to a journal that you already published in another Journal	8 (3.7)	32 (11.5)
Authorship misconduct		
Giving authorship to someone who has not made a substantive contribution	40 (18.4)	105 (37.8)
Denying authorship credit to someone who has made a substantive contribution	11 (5.1)	55 (19.8)
Allowing your name to be put on papers to which you have made little contribution	18 (8.3)	N/A
Conflict of interest		
Aware of a conflict of but failed to disclose it	7 (3.2)	27 (9.7)
Compromising the rigor of a study's design or methodology in response to pressure from a commercial or not-for-profit funding source	8 (3.7)	28 (10.1)
Inappropriately altering or suppressing research results in response to pressure from a commercial or not-for-profit funding source	7 (3.2)	24 (8.6)
Other research practices		
Ignoring aspects of materials-handling research requirements such as biosafety, radioactive materials, etc.	33 (15.2)	63 (22.7)
Providing an inappropriately negative or positive letter of recommendation	11 (5.1)	46 (16.5)
Cutting corners because one was in a hurry to complete a project	35 (16.1)	78 (28.1)

*respondents with research experience;

**respondents with and without research experience

of proper material handling, providing inappropriate recommendation letters, and "cutting corners" were 15.2%, 5.1% and 16.1%; respectively; while knowledge of these practices among colleagues were 22.3%, 15.2% and 26.8%; respectively.

Table 3 shows the aggregate frequencies (reported for at least one of the misconduct for that composite) of self-report and knowledge of colleagues" research misbehaviors for each of the misconduct composites. The misconduct composite in which at least one of the misbehaviors was noted was "circumventing research ethics regulations" (50.5%) followed by "fabrication and falsification" (28.6%); a misbehavior representing a "conflict of interest" was the least self-reported misconduct composite (5.8%). Knowledge of "fabrication or falsification committed at least once by a colleague was the most frequent type of misconducted composite (49.6%), followed by "circumventing research ethics regulations" (46.4%) and "authorship misconduct" (40.6%). Having knowledge of a colleague's "conflict of interest" was the least reported misconduct composite (16.5%). On a whole, 59.4% admitted to having committed at least one misconduct behavior from any of the composites and 74.5% reported having knowledge of a colleague's misconduct from any of the composite.

Table 4 shows the association between each of the self-report misconduct composites and the following independent factors: a) prior ethics training, b) region where the post-graduate degree was obtained (Middle East/North Africa vs Western); c) academic position; and d) gender. For the misconduct composites regarding "circumventing research ethics regulations" and "fabrication and falsification", the aggregate frequencies for those who had "prior ethics training" was significantly less than those without prior ethics training ($p = 0.021$ and $p = 0.001$, respectively). For the "any misconduct" composite, the aggregate frequencies for respondents with "prior ethics training" was significantly less compared with those without prior ethics training ($p < 0.003$).

For the misconduct composites regarding "circumventing research ethics regulations" and "fabrication and falsification", respondents who held a degree from a western university self-reported these misconducts that were significantly less than those who obtained a degree from a university in the Middle East/North Africa ($p = 0.008$ and $p = 0.001$, respectively). For the "any misconduct" composite, respondents with a Western university degree self-reported a misconduct that was significantly less than those who graduated from a non-Western university ($p = 0.01$).

For the misconduct composited regarding "other research practices", respondents who held an academic position at the faculty level reported having committed a misconduct that was significantly less than those who were "masters/PhD or postdoctoral" students ($p < 0.001$). There were no statistically significant associations between gender and any of the misconduct composites.

Table 3 Self-report and knowledge of colleagues' misconduct for each composite

Misconduct composite	Self-report of misbehaviors Total n = 224 n (% of Total) At least one misconduct	Knowledge of colleagues' misbehaviors Total n = 278 n (% of Total) At least one misconduct
Circumventing research ethics regulations	112 (50.0)	129 (46.4)
Fabrication and falsification	64 (28.6)	138 (49.6)
Plagiarism	26 (11.6)	99 (35.6)
Authorship misconduct	46 (20.5)	113 (40.6)
Conflict of interest	13 (5.8)	46 (16.5)
Other research practices	51 (22.8)	102 (36.7)
Any misconduct within any composite	133 (59.4)	207 (74.5)

Table 4 Association between self-report within each misconduct composite and prior ethics training, region where degree obtained, academic position, and gender (n = 224)

Misconduct composite	Prior ethics training n (%)			Region where degree obtained n (%)			Academic position n (%)			Gender n (%)		
	Yes (n = 131)	No (n = 93)	P-value	Middle East/ North Africa (n = 185)	Western (n = 39)	P-value	Master/PhD/ Postdoc/ and Other (n = 109)	Faculty (n = 115)	P-value	Male (n = 89)	Female (n = 134)	P-value
Circumventing research ethics regulations	57 (43.5)	55 (59.1)	0.021	100 (54.1)	12 (30.8)	0.008	61 (56.0)	51 (44.3)	0.262	44 (49.4)	67 (50.0)	0.847
Fabrication and falsification	23 (17.6)	41 (44.1)	0.000	61 (33.0)	3 (7.7)	0.001	37 (33.9)	27 (23.5)	0.083	31 (34.8)	33 (24.6)	0.099
Plagiarism	11 (8.4)	15 (16.1)	0.075	25 (13.5)	1 (2.6)	0.052	17 (15.6)	9 (7.8)	0.070	9 (10.1)	17 (12.7)	0.557
Authorship misconduct	22 (16.8)	24 (25.8)	0.100	41 (22.2)	5 (12.8)	0.189	21 (19.3)	25 (21.7)	0.647	17 (19.1)	29 (21.6)	0.646
Conflict of interest	7 (5.3)	6 (6.5)	0.727	12 (6.5)	1 (2.6)	0.341	9 (8.3)	4 (3.5)	0.126	2 (2.2)	11 (8.2)	0.063
Other research practices	25 (19.1)	26 (28.0)	0.119	44 (28.8)	7 (17.9)	0.430	35 (32.1)	16 (13.9)	0.001	18 (20.2)	32 (23.9)	0.521
Any misconduct	67 (51.1)	66 (71.0)	0.003	117 (63.2)	16 (41.0)	0.010	70 (64.2)	63 (54.8)	0.151	55 (61.8)	77 (57.5)	0.519

Table 5 shows that when evaluated as a continuous variable, age was shown to be statistically associated with several misconduct composites: "circumventing research ethics regulations", "fabrication and falsification" and "any misconduct". In general, respondents who reported misconducts were younger than those who did not report misconduct ($p < 0.01$ for all three composite categories).

Table 6 shows the multivariate logistic regression analysis and respective effect measures for factors found to be significant at $p \leq 0.10$ on the bivariate analysis and hence, entered in the logistic regression model. Having "prior ethics training" was shown to be a statistically significant independent factor for not having committed a misbehavior for the following misconduct composites: "circumventing research ethics regulations" ($p = 0.016$) and "fabrication and falsification" ($p < 0.000$). Obtaining a degree from a Western University was shown to be a statistically significant independent factor for not self-reporting a misbehavior in the "fabrication and falsification" misconduct composite ($p = 0.016$). Younger "age" was shown to be a statistically significant independent factor for the "circumventing research ethics regulations" composite ($p = 0.001$). Finally, having had "prior ethics training" and younger "age" were shown to be statistically significant independent factors for having not committed "any misconduct" ($p = 0.002$ for both).

Attitudes Regarding Certain Issues in Research Misconduct

Table 7 shows the frequencies with which respondents "strongly agree/agree" with certain issues in responsible conduct in research. The table also show the responses stratified based on "prior ethics training", "prior research experience" and "academic position". Almost three-quarters of the respondents (73.8%) expressed concerns about the "amount of misconduct that occurs"; more than half (52.8%) agreed that "dishonesty and misrepresentation of data" are common; and 69.0% agreed that there are pressures to publish to gain promotion, which represents a major reason for research misconduct. Finally, 87.1% agreed that investigators should report instances of research misconduct and 87.5% agreed that investigators should declare conflicts of interest to the appropriate authorities.

Those with "prior ethics training" were significantly more likely to agree with the "concern regarding the amount of misconduct" compared with individuals without ethics training (79.7% vs. 65.7%, $p < 0.005$) and were also more likely to be "aware of regulations that govern research" (84.6% vs. 50.5%; $p < 0.0001$). There were also significant associations between "prior research experience" and the attitude that "investigators should declare their conflicts of interest" as well as significant associations between academic position of "faculty" and the attitudes that "dishonesty and misrepresentation of data are common" and the attitude that "investigators should report instances of research misconduct".

Discussion

Our study represents the first extensive study reporting on the prevalence of research misconduct among investigators at different institutions in the Middle East. Similar to other studies performed in Western countries and in LMICs, our data indicate that scientific misconduct represents a significant issue that needs to be addressed. Specifically, our data showed that 59.4% of the respondents self-reported having committed at least one instance of research misconduct. This frequency is slightly higher than that reported by Fanelli in a systematic

Table 5 Association between average age and self-report within each misconduct composite (n = 224)

	Circumventing research ethics regulations at least one misconduct		Fabrication and falsification at 4 least one misconduct		Plagiarism at least one misconduct		Authorship misconduct at least one misconduct		Conflict of interest at least one misconduct		Other research practices at least one misconduct		Any misconduct at least one misconduct	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Average age of participant	34.4	40.4**	34.5	38.6**	33.5	37.9	37.8	36.1	32.2	37.7	32.9	38.7**	35.1	40.7**

**p ≤ 0.10, *$p \leq .05$

Table 6 Multi-variate analysis logistic regression model

Misconduct composite	Constant	Age		Female		Prior ethics training		Degree obtained from Western School		Faculty position	
	Exp (B)	OR	P-value	OR	P-value	OR	P-value	OR	P-value	OR	P-value
Circumventing research ethics regulation	8.26	0.96	0.001	–	–	0.49	0.016	0.62	0.235	–	–
Fabrication and falsification	3.387	0.98	0.351	0.48	0.027	0.27	0.000	0.20	0.016	0.709	0.434
Plagiarism	0.308	–	–	–	–	0.47	0.084	0.23	0.156	0.48	0.098
Authorship	0.384	–	–	–	–	0.58	0.102	–	–	–	–
Conflict of interest	0.023	–	–	3.89	0.082	–	–	–	–	–	–
Other research practices	1.074	0.97	0.197	–	–	–	–	–	–	0.52	0.156
Any research misconduct	13.109	0.96	0.002	–	–	0.38	0.002	0.66	0.295	–	–

review of studies mainly from the US and UK, where up to 33.7% admitted to have committed "other questionable practices" (Fanelli 2009). Our result is similar to the overall frequencies of 69% and 54.6% observed in two studies involving Nigerian researchers (P. Okonta and Rossouw 2013; Adeleye and Adebamowo 2012).

Comparing frequencies of misconduct between different studies is challenging, as methodologies and the types and definitions of research misbehaviors might differ between the studies. With this caveat, the frequency of self-reported acts involved with a specific set of research misconducts (i.e., "falsification and fabrication") in our study was 9.7% for falsification and ranged between 9.7% and 22.1% for different acts of fabrication. These results are higher than what have been reported in other studies from western countries; for example, Fanelli showed that between 0.3% and 4.9% of scientists admitted to having fabricated or falsified research data (Fanelli 2009) and Geggie documented that 2.1% of medical consultants in the U.K. admitted to modifying research or experimental results to improve the outcome (Geggie 2001). However, our results regarding falsification and fabrication are similar to those reported in a study involving researchers in Nigeria, where the self-reported frequencies for falsification and fabrication were 27.5% and 29.8%; respectively (P. Okonta and Rossouw 2013).

Regarding plagiarism, 8.8% of our respondents reported having committed this behavior, which is also higher than the 1.4% reported by Martinson and colleagues in their study involving scientists in the United States, but similar to results reported in studies involving non-western countries. For example, in the Nigerian study by Okonta and Rossouw, the frequency at which investigators reported having committed plagiarism was 9.2% and in another study involving Nigerian researchers, (Adeleye and Adebamowo 2012), the self-reported frequency for plagiarism was 4.5%. In a qualitative study involving 35 international students from West Africa, China, and Asia, Bamford and Sergiou (2005) observed that 18 out of the 35 respondents admitted that they had plagiarized from other sources. Using a repository of documents from Physics, Mathematics, and Computer Science, Citron and Ginsparg showed that the practice of reusing text of one article in another is more common in some countries than others. The authors, who consider such a practice as being close to scientific plagiarism, attributed these practices to "differences in academic

Table 7 Attitudes regarding certain issues in responsible in conduct in research; percentages of respondents who answered "strongly agree/agree" (n = 248)

Question	Total n (%)	Ethics training n (%)		Research experience n (%)		Academic position n (%)		
		With ethics training (n = 143)	Without ethics training (n = 105)	With research (n = 204)	Without Research (n = 44)	Other (n = 47)	Masters, PhD, Postdocs (n = 84)	Faculty (n = 114)
I'm concerned about the amount of misconduct that occurs.	183 (73.8)	114 (79.7)*	69 (65.7)	150 (73.5)	33 (75.0)	31 (66.0)	67 (77.0)	85 (74.6)
Dishonesty and misrepresentation of data are common.	131 (52.8)	71 (49.7)	60 (57.1)	106 (52.0)	25 (56.8)	25 (53.2)	37 (42.5)	69 (60.5)*
Investigators should report instances of research misconduct.	216 (87.1)	123 (86.0)	93 (88.6)	180 (88.2)	36 (81.8)	36 (76.6)	75 (86.2)	105 (92.1)*
The pressures to publish to gain promotion is a major reason why investigators engage in research misconduct.	171 (69.0)	94 (65.7)	77 (73.3)	144 (70.6)	27 (61.4)	31 (66.0)	58 (66.7)	82 (71.9)
Investigators should declare conflicts of interest to the appropriate officials.	217 (87.5)	128 (89.5)	89 (84.8)	183 (89.7)*	34 (77.3)	37 (78.7)	76 (87.4)	104 (91.2)
I am aware of regulations that govern research involving humans, animals, or laboratory practices.	174 (70.2)	121 (84.6)$^{+}$	53 (50.5)	146 (71.6)	28 (63.6)	33 (70.2)	62 (71.3)	79 (69.3)

*$p \leq 0.05$, **$p \leq .01$, $^{+}$ $p \leq .0001$

infrastructure and mentoring, or incentives that emphasize quantity of publications over quality." (Citron and Ginsparg 2015). These authors also showed that researchers from Western countries engaged in this practice of of reusing text less often than investigators from Eastern Europe, Russia, China, Southeast Asia, and the Middle East. Using data from the Citron and Ginsparg study, Bohannon produced a map of the countries reported by those authors (Bohannon 2014).

Regarding authorship misconduct, our data showed that 5.1% of respondents admitted to having denied appropriate authorship and 18.4% granted authorship to non-deserving individuals. Corresponding frequencies reported for behavior of colleagues regarding similar acts of authorship misconduct were 19.2% and 37.9%; respectively. These results are similar to estimates reported involving Western and Nigerian researchers; specifically, "inappropriately assigning authorship credit" was reported as 10% in a United States survey (Martinson et al. 2005) and "authorship disagreements" was 36.4% among Nigerian researchers (P. Okonta and Rossouw 2013).

In our study, reported behaviors involving acts of research misconduct among colleagues ranged between 25 and 35%, which were approximately 1.5 to 3 times higher than what respondents reported for themselves. In Fanelli's systematic review and meta-analysis of survey data, frequencies regarding the behaviors of colleagues were 14.12% for falsification and up to 72% for other questionable research practices (Fanelli 2009).

Of the factors we investigated that might account for self-reported research misbehaviors, a lack of "prior ethics training" proved to be significant for the misconduct composites representing "circumventing research ethics regulations" and "fabrication and falsification"; this factor was also significant self-reported "any" research misbehavior from any of the misconduct composites. These results emphasize that training in ethics might enhance investigators' awareness and understanding of the issues surrounding research integrity. That said, other studies have yielded variable results regarding the potential impact of ethics education on research misconduct. For example, Okonta and Rossouw failed to find any association between scientific misconduct and having had education in ethics (P. I. Okonta and Rossouw 2014). In contrast, Adeleye and Adebamowo found that 'self-assessment of one's knowledge of research ethics as being inadequate" was associated with at least one of type of research misconduct (Adeleye and Adebamowo 2012). A study involving graduate students at a US university demonstrated that students who had taken an ethics course scored significantly higher on questions regarding human research practices compared with students who had not taken an ethics course; however, other types of research practices demonstrated no significant association with ethics education (Mundt 2008). Other studies investigating the potential influence of ethics education have yielded conflicting results (Brown and Kalichman 1998; Eastwood et al. 1996; Kalichman and Freidman 1992).

We also showed that having obtained a degree from a Western university was significantly associated with a lower prevalence of "fabrication and falsification" on multivariate analysis. Social scientists have theorized that disparities in research misconduct may very well be due to societies placing a differential emphasis on socially desirable ends as well as differences in the legitimate means of achieving such ends (Merton 1938). Consideration of cultural explanations of scientific misconduct should not serve as an "indictment of the transgressor's culture" that is operating under a different set of specialized scientific norms (Davis 2003).

An additional factor to explain for the differences in frequencies regarding misconduct between Western countries and LMICs can be attributed to the strength of the regulatory systems that provided oversight of research misconduct, which might be weaker in LMICs compared with those in West (Heitman and Litewka 2011). Such regulatory systems exist at the national and institutional levels. Furthermore, an organization's structures, processes, and

policies can be determinative of the moral behaviors and decision making of its leaders and staff (Silverman 2000). Flawed oversight mechanisms and poor modeling can lead to difficulties in building a moral community (Bruhn 2009). Indeed, less than half of the respondents in our study agreed that there are appropriate mechanisms in place to report misconduct at their institution. In the study by Okonta, 60% of the researchers rated the effectiveness of their institution's rules and procedures for reducing scientific misconduct as low. In contrast, in a survey of research coordinators in the US, the effectiveness of their institutions' rules and procedures for reducing scientific misconduct was rated as being high (Pryor et al. 2007).

The pressure to "publish or perish" might represent another factor that might be explanatory for research misconduct. When asked about behavioral influences on scientific misconduct, a high proportion of Nigerian investigators mentioned the "pressure for tenure" (89.1%) and the "need for publications (100%) (P. Okonta and Rossouw 2013). Descriptively, we showed that 69.0% of the respondents agreed with the perspective that "pressures to publish to gain promotion" is a major reason why investigators engage in research misconduct". The pressure emanating to "publish or perish" might not explain the differences observed in research misconduct between western countries compared with LMICs, as this alleged causality for misconduct is common to investigators throughout the world.

There are several methodological limitations to our findings. First, accuracy of self-reporting on research misconduct might be biased by the effect of social expectations of morality leading to underreporting of misconduct. Recall bias and denial could also lead to falsely lower frequencies of self-report. In contrast, results regarding behaviors of colleagues might be falsely high, as different respondents might report on the same colleagues. Another limitation involves using a convenience sampling technique resulting in a non-probability sample of researchers, thus limiting the extent to which our findings can be generalized to what occurs in other universities. Generalizability might also have been limited by our sample consisting of more than 70% investigators residing in Egyptian universities. Furthermore, our small sample of investigators who obtained a degree from a Western university might challenge our result that this factor was significant for the difference we observed between this group and those holding a degree in a Middle East/North African university in the "fabrication and falsification" misconduct composite. However, notwithstanding the small sample size, there are advantages of comparing data from different groups (i.e., western and eastern universities) within the same study. Indeed, there are methodological and definitional challenges when comparing data between different studies. For example, different studies will use different sets of research misbehaviors in their surveys and will define a type of research misbehavior differently. Finally, our use of a quantitative method limited our ability to explore explanatory mechanisms of influences for research misconduct. As such, we recommend the use of qualitative studies (i.e., interviews and focus groups) to further explore the explanatory factors of our findings. Future studies should also further determine the potential impact of ethics courses that focus on responsible conduct in research.

While waiting for more definitive studies, we recommend training in the responsible conduct of research for investigators to enhance their awareness of international norms of research conduct. For the last decade, formal instruction in the responsible conduct of research has been required for all trainees supported by Public Health Service training grants in the U.S. We also encourage institutions to examine how their structures and processes can further enhance organization moral behavior regarding responsible conduct in research. Finally, we endorse further understanding of how

various non-Western cultures approach scientific research so that certain instances of cultural differences are not misinterpreted as misconduct (Davis 2003).

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References

Adeleye, O. A., & Adebamowo, C. A. (2012). Factors associated with research wrongdoing in Nigeria. *Journal of Empirical Research on Human Research Ethics, 7*(5), 15–24. https://doi.org/10.1525/jer.2012.7.5.15.

Bamford, J., & Sergiou, K. (2005). International students and plagiarism: an analysis of the reasons for plagiarism among nternational foundation students. *Investigations in University Teaching and Learning, 2*(2), 17–22.

Bohannon, J. (2014). Study of massive preprint archive hints at the geography of plagiarism. Science. Retrievalbe at: http://news.sciencemag.org/scientific-community/2014/2012/study-massive-preprint-archivehints-geography-plagiarism.

Broome, M. E., Pryor, E., Habermann, B., Pulley, L., & Kincaid, H. (2005). The scientific misconduct questionnaire–revised (SMQ-R): validation and psychometric testing. *Accountability in Research, 12*(4), 263–280. https://doi.org/10.1080/08989620500440253.

Brown, S., & Kalichman, M. (1998). Effects of training in the responsible conduct of research: a survey of graduate students in experimental sciences. *Science and Engineering Ethics, 4*, 487–498.

Bruhn, J. G. (2009). The functionality of gray area ethics in organizations. *Journal of Business Ethics, 89*, 205.

Bursac, Z., Gauss, C. H., Williams, D. K., & Hosmer, D. W. (2008). Purposeful selection of variables in logistic regression. *Source Code for Biology and Medicine, 3*, 17. https://doi.org/10.1186/1751-0473-3-17.

Buzzelli, D. E. (1993). The definition of misconduct in science: a view from NSF. *Science, 259*(5095), 584–585 647-588.

Citron, D. T., & Ginsparg, P. (2015). Patterns of text reuse in scientific corpus. *Proceedings of the National Academy of the Sceinces, 112*(1), 25–30.

Davis, M. S. (2003). The role of culture in research misconduct. *Accountability in Research, 10*(3), 189–201. https://doi.org/10.1080/714906092.

Dhingra, D., & Mishra, D. (2014). Publication misconduct among medical professionals in India. *Indian Journal of Medical Ethics, 11*(2), 104–107.

Eastwood, S., Derish, P., Leash, E., et al. (1996). Ethical issues in biomedical research: perceptions and practices of postdoctoral research fellow responding to a survey. *Science Eng Ethics, 2*, 89–114.

Fanelli, D. (2009). How many scientists fabricate and falsify research? A systematic review and meta-analysis of survey data. *PLoSOne, 4*, 1–11.

Geggie, D. (2001). A survey of newly appointed consultants' attitudes towards research fraud. *Journal of Medical Ethics, 27*(5), 344–346.

Heitman, E., & Litewka, S. (2011). International perspectives on plagiarism and considerations for teaching international trainees. *Urologic Oncology, 29*(1), 104–108. https://doi.org/10.1016/j.urolonc.2010.09.014.

Kalichman, M. W., & Freidman, P. J. (1992). A pilot study of bomedical trainees' perceptions concerning research ethics. *Academic Medicine, 67*, 769–775.

Martinson, B. C., Anderson, M. S., & de Vries, R. (2005). Scientists behaving badly. *Nature, 435*, 737–748.

Martinson, B. C., Anderson, M. S., Crain, A. L., & de Vries, R. (2006). Scientists' perceptions of organizational justice and self-reported misbehaviors. *Journal of Empirical Research on Human Research Ethics, 1*(1), 51–66. https://doi.org/10.1525/jer.2006.1.1.51.

Merton, R. K. (1938). Social structure and anomie. *American Sociological Review, 3*, 672–682.

Mundt, L. A. (2008). Perceptions of scientific misconduct among graduate allied health students relative to ethics education and gender. *Journal of Allied Health, 37*(4), 221–224.

Nussenzveig, P. A., & Zukanovich Funchal, R. (2008). Integrity: misconduct by a few damages credibility for many. *Nature, 454*(7204), 574; author reply 575. https://doi.org/10.1038/454574c.

Okonta, P., & Rossouw, T. (2013). Prevalence of scientific misconduct among a group of researchers in Nigeria. *Developing World Bioethics, 13*(3), 149–157. https://doi.org/10.1111/j.1471-8847.2012.00339.x.

Okonta, P. I., & Rossouw, T. (2014). Misconduct in research: a descriptive survey of attitudes, perceptions and associated factors in a developing country. *BMC Medical Ethics, 15*, 15.

Pryor, E. R., Habermann, B., & Broome, M. E. (2007). Scientific misconduct from the perspective of research coordinators: a national survey. *Journal of Medical Ethics, 33*(6), 365–369.

Silverman, H. J. (2000). Organizational ethics in health care organizations: proactively managing the ethical climate to ensure organizational integrity. *HEC Forum, 12*, 202–215.

The Office of Research Integrity (2016). Definition of Research Misconduct. Retrievable at: https://ori.hhs.gov/definition-misconduct.

Trikalinos, N. A., Evangelou, E., & Ioannidis, J. P. (2008). Falsified papers in high-impact journals were slow to retract and indistinguishable from nonfraudulent papers. *Journal of Clinical Epidemiology, 61*(5), 464–470.