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Bioethical Issues in Biostatistical Consulting (BIBC): Findings from a U.S. National Pilot Study

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Primary Subject Heading:	Ethics
Secondary Subject Heading:	Research methods, Public health, Medical education and training
Keywords:	ETHICS (see Medical Ethics), MEDICAL ETHICS, PUBLIC HEALTH, STATISTICS & RESEARCH METHODS

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3 1 Bioethical Issues in Biostatistical Consulting (BIBC):
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6 2 Findings from a U.S. National Pilot Study
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58 **KEYWORDS:** Medical Ethics, Research Ethics, Public Health, Biostatistics
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Abstract

OBJECTIVES: The overall purposes of this first U.S. national pilot study were: 1) to test the feasibility of online administration of the Bioethical Issues in Biostatistical Consulting (BIBC) Questionnaire to a random sample of American Statistical Association members; 2) to determine the prevalence and relative severity of a broad array of bioethical violations requests that are presented to biostatisticians by investigators seeking biostatistical consultations; and 3) to establish the sample size needed for a full-size Phase II Study.

METHODS:

Design: Cross-sectional survey as approved and endorsed by the American Statistical Association (ASA).

Participants: administered to a randomly drawn sample of 112 professional biostatisticians who were ASA members.

Primary and Secondary Outcome Measures: The 18 bioethical violations were first ranked by Perceived Severity scores, then categorized into three Perceived Severity subcategories in order to identify seven 'top tier concern violations' and seven '2nd tier concern violations'.

RESULTS: Methodologically, this Phase I Pilot Study demonstrated that the BIBC Questionnaire, as administered online to a random sample of ASA members, served to identify bioethical violations that occurred during biostatistical consultations, and provided data needed to establish the sample size needed for a full-scale Phase II study. The #1 top tier concern was 'remove or alter some data records in order to better support the research hypothesis'. The #2 top tier concern was 'interpret the statistical findings based on expectation, not based on actual results'. In total, 14 of the 18 BIBC Questionnaire items, as judged by a combination of 'severity of violation' and 'frequency of

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3 49 occurrence over past 5 years' were rated by biostatisticians as 'top tier' or '2nd tier' bioethical
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5 50 concerns.
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8 51 **CONCLUSION:** This pilot study gives clear evidence that researchers make requests of their
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10 52 biostatistical consultants that are not only rated as severe violations, but further that these requests
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12 53 occur quite frequently. **Word Count: 300**
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18 55 **Article Summary: Strengths and Limitations of this study**

20 56 Strengths: - 1st study to quantify bioethics violations in biostatistical consulting

22 57 - verified that the BIBC Questionnaire detected differences in
23
24 58 frequency and severity of bioethical violations

26 59 - established sample size needed for full-sized study

28 60 - established feasibility of recruitment and data collection methods

30 61 Limitations: - small sample size of pilot study

32 62 - limited capability to conduct analysis of co-factors
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40 64 **Data Statement:**

42 65 "Technical appendix, statistical code, and dataset available from Dr. Min Qi Wang,

44 66 Department of Statistics, University of Maryland School of Public Health via his email:

46 67 mqw@umd.edu
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53 69 **Introduction**

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55 70 This pilot study is the first U.S. national survey to quantitatively identify a wide array of
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3 71 bioethical violations that arise between scientific investigators and their biostatistical consultants,
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5 72 a collaborative research consultation that underpins virtually all scientific studies. This study
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8 73 quantifies, for the first time, the frequency of requests for 'inappropriate data manipulation or
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10 74 practices' by investigators via consultations with biostatisticians on a national level. While this
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12 75 phenomenon has been known to exist, the extent to which it exists has simply not been
13
14 76 adequately studied.¹⁻⁷ Two previous studies were identified that attempted to quantify aspects of
15
16 77 bioethical violations in research and suggested violations levels were 'of concern,' but each of
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18 78 these two studies asked only 10 questions which directly addressed specific violations and each
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20 79 survey only achieved a low response rate, one 31%, one 37%.⁸⁻¹¹

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25 80 The overall purposes of this pilot study, conducted in collaboration with the American
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27 81 Statistical Association (ASA), were three-fold: 1) to administratively pilot test the research
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29 82 methods proposed for use in a full-scale study using the newly developed Bioethical Issues in
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31 83 Biostatistical Consulting (BIBC) Questionnaire as administered to a random sample of U.S.
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33 84 biostatisticians; 2) to establish, for the first time, the prevalence and relative severity of a broad
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35 85 array of bioethical violations requests that are presented to biostatisticians by investigators
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37 86 seeking biostatistical consultations; and, 3) to gain estimates of the prevalence and relative
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39 87 severity of those bioethical violations to permit the planning and conducting of a full-scale,
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41 88 Phase II study.
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48 **Methods**

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51 91 This Phase I pilot national survey used a validated, pretested 18-item Bioethical Issues in
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53 92 Biostatistical Consulting (BIBC) Questionnaire as previously developed within an NIH/NIDCR
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55 93 Oral Health Disparities Center (U54 DE14257) in collaboration with the National Center for
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3 94 Bioethics for Research and Health Care at Tuskegee University.¹² In this Phase I pilot study, the
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5 95 18-item BIBC Questionnaire was administered to a randomly drawn sample of 112 professional
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8 96 biostatisticians who were members of the American Statistical Association, as drawn from their
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11 97 national membership list.

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13 98 Each questionnaire item represents a different bioethical violation event. Specifically,
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15 99 the 18-items ask what bioethical violations the respondent has personally and directly been
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17 100 asked to do during their bioethical consultations over the past five years. Respondents were
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19
20 101 asked to make provide two assessments for each of the 18 items: 1) the total number of times
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22 102 they had been asked to do that specific bioethical violation over the past five years (using a 5-
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24 103 point ordinal scale: 0, 1, 2-4, 5-9, and 10+); and, 2) their own professional opinion on the
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26 104 ‘bioethical violation severity’ of that specific bioethical violation (using a 5-point ordinal scale
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28 105 ranging from least to most severe: 0-5).

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31 106 Of the approximately 18,000 total American Statistical Association (ASA) members,
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33 107 approximately 5,000 members who are categorized as “working statisticians” (frequently
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35 108 performing data management and data analysis, consulting to other researchers in data analysis
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37 109 and statistics) comprised the available sample pool. They met the following eligibility criteria: 1)
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39 110 self-identified on their ASA annual registration forms as specializing in biomedical research
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41 111 consulting activities; and, 2) have at least two years of experience as biostatisticians. Our goal
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43 112 for this pilot study was draw a sample of 112 and to achieve a high response rate (>70%) via the
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45 113 use of an endorsement by the American Statistical Association (ASA) and the use three specific
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47 114 incentives to participate: 1) a \$99 Amazon gift certificate for completing the estimated 30
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49 115 minute BIBC survey; 2) an web tool online data collection system that avoided the use of any
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51 116 personal identifier for the respondent; and finally for this novel line of inquiry in reporting of
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3 117 violations, 3) the use of the concept of 'requests made to biostatisticians' as its dependent variable
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6 118 (as opposed to the alternative high-risk dependent variable of 'actually committed violations') to
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8 119 ensure higher participation rates, as well as greater participant candor, in this first exploratory
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10 120 study.

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13 121 This pilot study was approved by the IRB at the University of Maryland School
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15 122 of Public Health and by the IRB at New York University.
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19 20 124 **Results**

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23 125 First, from an initial working list of 800 emails as provided by the American
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25 126 Statistical Association, a random selection process was used progressing in subsets of
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27 127 n=50 to obtain an n = 112 while avoiding an over-enrollment which would exceed
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30 128 budgetary limits for incentives for enrolled subjects. The final response rates for
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32 129 randomly drawn ASA members was 67%. The demographic data on the respondents
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34 130 revealed that respondents self-reported working as biostatisticians between 2-55 years
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37 131 (median number of years = 13), and 86.4% were employed full-time, 7.3% were self-
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39 132 employed, 2.7% part-time employed and 3.6% were retired. Of those currently
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41 133 working, 41.8% worked at a university (73.3% at a 1st tier research university and
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43 134 11.1% at a 2nd tier research university) while 58.2% were employed at non-university
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46 135 jobs.

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49 136 Table 1, on its left side, shows the 18 bioethical violations items from the BIBC
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51 137 Questionnaire in ranked order by percent of respondents rating the item as a '5' (most
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53 138 severe) in 'Perceived Severity', and then subcategorized into Severity Group I (the top 3
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55 139 most egregious violations), Severity Group II (the next 8 most egregious violations),
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3 140 and Severity Group III (the 7 least egregious violations). The bolded ‘q#’s’ –within
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5 141 Severity Groups I & II—are marked by a supra-numeral 1 (e.g. **q#2¹**) and indicate ‘top
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7 142 tier violations’ (i.e., have a ‘Perceived Severity’ score of 4-5 for at least 65% of the
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9 143 respondents AND a # of times asked in last 5 years’ of 1-10+ times for >20% of the
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11 144 respondents). There were 7 identified ‘top tier concern violations’.

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15 145 The unbolded ‘q#’s’ with a supra-numeral 2 (e.g., q#7²) –all these are within
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17 146 Severity Group III—are labeled as ‘2nd tier concern violations’ (i.e., have a ‘Perceived
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19 147 Severity’ score of 4-5 for at least 33-64% of the respondents AND a # of times asked in
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21 148 last 5 years’ of 1-10+ times for >20% of the respondents). There were also 7 identified
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23 149 ‘2nd tier concern violations.’
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29 151 **Discussion and Conclusions**

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32 152 Thus 14 of the 18 BIBC Questionnaire items, as judged by a combination of
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34 153 ‘severity of violation’ and ‘frequency of occurrence over past 5 years’ were rated by
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36 154 biostatisticians as ‘top tier’ or ‘2nd tier’ bioethical concerns, i.e., minimally having the
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38 155 characteristics of a ‘Perceived Severity’ score of 4-5 for at least 33% of the respondents
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40 156 AND having been ‘been asked during a biostatistical consultation’ over the past 5 years
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42 157 for at least 20% of the respondents.
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46 158 In addition, there are clear public health implications from the findings of this
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48 159 Phase I pilot study. First, the pilot U.S. national survey quantitatively identified a wide array of
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50 160 bioethical violations that arise between scientific investigators and their biostatistical consultants,
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52 161 giving clear evidence that researchers make requests of their biostatistical consultants that are not
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54 162 only rated as severe violations, and that these requests occur quite frequently. Second, these
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3 163 Phase I pilot findings provide strong evidence in support of future studies that will: 1) provide
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5 164 replication of these findings in a large sample of subjects, and 2) allow a more refined analysis of
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8 165 the findings by demographic variables.
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10 166 Following our successful completion of this Phase I pilot study, our research team
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12 167 submitted as Phase II grant that was funded by the ORI at the U.S. DHHS to conduct a follow-up
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14 168 Phase II full-sized study which currently is currently underway, again in collaboration with the
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16 169 American Statistical Association. The findings from that Phase II full-sized study will serve to
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18 170 guide the development of future educational bioethical training modules targeted at university-
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20 171 based clinical research training programs and their directors as well as to encourage and develop
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22 172 means for research universities and companies to improve their institutional environmental
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24 173 efforts regarding job and publication pressures to reduce the frequency of these bioethical
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26 174 violation requests.
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34 176 **Word Count: 1,280**
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37 178 **Each Author's Specific Contributions:**

38 179 MinQi Wang, PhD: led the research team in the writing of Phase I grant; designed the online
39 180 data collection system; conducted the data analysis; reviewed and approved the final draft of this
40 181 manuscript
41 182

42 183 Alice F. Yan, MD, PhD: contributed to the writing of the Phase I grant; administered and
43 184 managed the online data collection system; contributed to the data analysis; reviewed and
44 185 approved the final draft of this manuscript
45 186

46 187 Ralph V. Katz, DMD, MPH, PhD: initially conceived of the project and research design method;
47 188 contributed to the writing of this Phase I grant; wrote the first draft of this manuscript
48 189

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53 194

54 195 **Competing Interests Statement:**

55 196 The authors of this paper have read and understood the BMJ Group policy on
56 197 declaration of interests and declare that they have none.
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Table 1. Ranking of Bioethical Violations by 'Perceived Severity' and 'Number of Times Directly Asked to do it over the past 5 years': BIBC Phase I (n=112)

Findings for q#1-18 which asked biostatisticians "to estimate the number of times—during the past five years—that you, personally, have been DIRECTLY asked to do this".

	Perceived Severity score		# of times asked		
	'most severe' or 'high end'		over past 5 years		
	a '5'	'a 4 or 5'	never	1-9	10 ⁺
Severity Group I: Top 3 bioethical violations as ranked on 'Perceived Severity'					
q#10. Falsify the statistical significance to support a desired result	91%	92%	96%	3%	1%
q#9. Change data in order to achieve the desired outcome	85%	90%	96%	4%	-
q#2. ¹ Remove or alter some data records in order to better support the research hypothesis	70%	87%	64%	35%	1%
Severity Group II: next 8 ranked bioethical violations on 'Perceived Severity'					
q#8. ¹ Interpret the statistical findings based on expectation, not based on the actual results	44%	71%	69%	30%	1%
q#3. ¹ Not report the presence of key missing data that could bias the results	35%	77%	73%	25%	2%
q14. Did not fully describe the treatment under study since protocol wasn't exactly followed	33%	65%	83%	17%	-
q12. ¹ Ignored violations of assumptions since results may change from positive to negative	33%	69%	68%	29%	3%
q15. Not to mention interim analyses to avoid the problem of 'too much testing'	30%	64%	84%	15%	1%
q16. ¹ Report power based on a <i>post-hoc</i> calculation but make it appear as a <i>a priori</i> statement	30%	65%	73%	25%	2%
q18. ¹ Request not to properly adjust for multiple testing when ' <i>a priori</i> , originally planned secondary outcomes' get shifted to a ' <i>a posteriori</i> primary outcome status'	29%	66%	72%	27%	1%
q6. ¹ Modify a measurement scale in order to achieve some desired results rather than adhering to the original scale as validate	25%	65%	73%	26%	1%
Severity Group III: Lowest 7 bioethical violations as ranked on 'Perceived Severity'					
q7. ² Remove categories of a variable in order to report more favorable results	20%	60%	60%	40%	-
q11. ² Reporting results before data has been cleaned and validated	18%	49%	40%	51%	9%
q5. ² Conduct too many post-hoc tests but purposefully fail to adjust alpha levels in order to make results look more impressive than they really are	17%	61%	39%	48%	13%
q13. ² Did not discuss duration of follow-up since it wasn't consistent	16%	39%	74%	26%	-
q1. ² Stress only the significant findings	14%	45%	35%	55%	10%
q4. ² Not report the model statistics (including effect size in ANOVA or R ² in linear regression)					

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3	285	because it appeared too small to indicate any meaningful changes	12%	39%	66% 32% 2%
4					
5	286	q17. ² Fail to show plot since it didn't show as strong as effect as you would have hoped for	8%	33%	51% 45% 4%
6	287				
7					
8	288	¹ 1 st tier concern violations, i.e., Perceived Severity score of 4-5 for at least 65% of sample + "# of times asked in last 5 years" of 1-10+ times for			
9	289	least 20% of sample			
10	290	² 2 nd tier concern violations, i.e., Perceived Severity score of 4-5 for 33-64% of sample + "# of times asked in last 5 years" of 1-10+ times for at least			
11	291	of sample			
12					
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14	292				

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Identifying bioethical issues in biostatistical consulting: findings from a U.S. national pilot survey of biostatisticians

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Complete List of Authors:	Wang, Min; University of Maryland School of Public Health, Biostatistics Yan, Alice; University of Wisconsin-Milwaukee School of Public Health, Behavioral and Community Health Katz, Ralph; New York University College of Dentistry, Epidemiology & Health Promotion
Primary Subject Heading:	Ethics
Secondary Subject Heading:	Research methods, Public health, Medical education and training
Keywords:	ETHICS (see Medical Ethics), MEDICAL ETHICS, PUBLIC HEALTH, STATISTICS & RESEARCH METHODS

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19 8 Ralph V. Katz [Corresponding Author and 3rd listed author]
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44 19 Alice F. Yan, MD, PhD [Second Author]
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46 20 Email: yanf@uwm.edu
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48 21 Institution: Department of Behavioral and Community Health
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57 25 **KEYWORDS:** Medical Ethics, Research Ethics, Public Health, Biostatistics
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Abstract

OBJECTIVES: The overall purposes of this first U.S. national pilot study were to: 1) test the feasibility of online administration of the Bioethical Issues in Biostatistical Consulting (BIBC) Questionnaire to a random sample of American Statistical Association members; 2) determine the prevalence and relative severity of a broad array of bioethical violations requests that are presented to biostatisticians by investigators seeking biostatistical consultations; and 3) establish the sample size needed for a full-size Phase II Study.

METHODS:

Design: A descriptive survey as approved and endorsed by the American Statistical Association (ASA).

Participants: administered to a randomly drawn sample of 112 professional biostatisticians who were ASA members.

Primary and Secondary Outcome Measures: The 18 bioethical violations were first ranked by Perceived Severity scores, then categorized into three Perceived Severity subcategories in order to identify seven 'top tier concern violations' and seven '2nd tier concern violations'.

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45 66 **Data Statement:**

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47 67 "Technical appendix, statistical code, and dataset available from Dr. Min Qi Wang,
48
49 68 Department of Statistics, University of Maryland School of Public Health via his email:
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51 69 mqw@umd.edu
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71 Introduction

72 This pilot study is the first U.S. national survey to quantitatively identify a wide array of
73 bioethical violations that arise between scientific investigators and their biostatistical consultants,
74 a collaborative research consultation that underpins virtually all scientific studies. This
75 descriptive survey quantifies, for the first time, the frequency of requests for 'inappropriate data
76 manipulation or practices' by investigators via consultations with biostatisticians on a national
77 level. While this phenomenon has been known to exist, the extent to which it exists has simply
78 not been adequately studied, and this lack of research on bioethical research violations has been
79 lamented by several authors.¹⁻¹³

80 While six previous studies that attempted to quantify aspects of bioethical violations in
81 research have suggested violations levels were 'of concern', each study has major limitations that
82 preclude the drawing of firm and clear conclusions.^{1,2,6,9,11,12} One early study in 1993 only
83 reported on the rate of exposure of doctoral students to perceived misconduct,¹ while another
84 study of that era that evaluated 23 possible ethical research violations reported 10% of the
85 membership of three surveyed professional research societies had observed data falsification or
86 fabrication.² Two later studies targeted research coordinators and asked only a very limited
87 number of questions and achieved low response rates, one 31%, one 37%.^{5, 11, 12} A fifth study,
88 a survey seeking the opinion of scientific meeting program chairs from their annual international
89 research meeting, which focused only on scientific abstracts submitted to their annual meeting,
90 assessed 26 problematic research practices, achieved a response rate of 78% and reported that
91 30% had observed falsification of data and 54% had observed plagiarism one or more times.⁶
92 The sixth study, which sought to assess scientific fraud experienced by an international group of
93 biostatisticians, reported that 51% were aware of at least one fraudulent study but only achieved

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3 94 a response rate of 37%.⁹
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6 95 The overall purposes of this pilot study, conducted in collaboration with the American
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8 96 Statistical Association (ASA), were three-fold: 1) to administratively pilot test the research
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10 97 methods proposed for use in a full-scale study using the newly developed Bioethical Issues in
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12 98 Biostatistical Consulting (BIBC) Questionnaire as administered to a random sample of U.S.
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14 99 biostatisticians; 2) to establish, for the first time, the prevalence and relative severity of a broad
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16 100 array of bioethical violations requests that are presented to biostatisticians by investigators
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18 101 seeking biostatistical consultations; and, 3) to gain estimates of the prevalence and relative
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20 102 severity of those bioethical violations to permit the planning and conducting of a full-scale,
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22 103 Phase II study.
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29 105 **Methods**

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32 106 This Phase I pilot national survey used a validated, pretested 18-item Bioethical Issues in
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34 107 Biostatistical Consulting (BIBC) Questionnaire as previously developed within an NIH/NIDCR
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36 108 Oral Health Disparities Center (U54 DE14257) in collaboration with the National Center for
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38 109 Bioethics for Research and Health Care at Tuskegee University.¹³ In this Phase I pilot study, the
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40 110 18-item BIBC Questionnaire was administered to a randomly drawn sample of 112 professional
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42 111 biostatisticians who were members of the American Statistical Association, as drawn from their
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44 112 national membership list.
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48 113 Each questionnaire item represents a different bioethical violation event. Specifically,
49
50 114 the 18-items ask what bioethical violations the respondent has personally and directly been asked
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52 115 to do during their bioethical consultations over the past five years. Respondents were asked to
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54 116 make two assessments for each of the 18 items: 1) the total number of times they had been asked
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3 117 to do that specific bioethical violation over the past five years (using a 5-point ordinal scale: 0, 1,
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5 118 2-4, 5-9, and 10+); and, 2) their own professional opinion on the ‘bioethical violation severity’ of
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8 119 that specific bioethical violation (using a 5-point ordinal scale ranging from least to most severe:
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11 120 0-5).

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13 121 Of the approximately 18,000 total American Statistical Association (ASA) members,
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15 122 approximately 5,000 members who are categorized as “working statisticians” (frequently
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17 123 performing data management and data analysis, consulting to other researchers in data analysis
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20 124 and statistics) comprised the available sample pool. They met the following eligibility criteria: 1)
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22 125 self-identified on their ASA annual registration forms as specializing in biomedical research
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24 126 consulting activities; and, 2) have at least two years of experience as biostatisticians. Our goal
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27 127 for this pilot study was draw a sample of 112 and to achieve a high response rate (>70%) via the
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29 128 use of an endorsement by the American Statistical Association (ASA) and the use three specific
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32 129 incentives to participate: 1) a \$99 Amazon gift certificate for completing the estimated 30
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34 130 minute BIBC survey; 2) an web tool online data collection system that avoided the use of any
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36 131 personal identifier for the respondent; and finally for this novel line of inquiry in reporting of
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39 132 violations, 3) the use of the concept of 'requests made to biostatisticians' as its dependent variable
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41 133 (as opposed to the alternative high-risk dependent variable of 'actually committed violations') to
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44 134 ensure higher participation rates, as well as greater participant candor, in this first exploratory
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46 135 study. Data analysis for this initial pilot study consisted of descriptive analysis of the
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48 136 demographic variables, as well as for both the ‘perceived severity’ rankings and ‘frequency’
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51 137 rankings of the 18 listed possible bioethical violations.

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53 138 This pilot study was approved by the IRB at the University of Maryland School
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55 139 of Public Health and by the IRB at New York University as an Expedited Review
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3 140 category involving minimal risk for the subjects.
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7 8 142 **Results** 9

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11 143 First, from an initial working list of 800 emails as provided by the American
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13 144 Statistical Association, a random selection process was used progressing in subsets of
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15 145 n=50 to obtain an n = 112 while avoiding an over-enrollment which would exceed
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17 146 budgetary limits for incentives for enrolled subjects. The final response rates for
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19 147 randomly drawn ASA members was 67%. The demographic data on the respondents
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21 148 revealed that respondents self-reported working as biostatisticians between 2-55 years
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23 149 (median number of years = 13), and 86.4% were employed full-time, 7.3% were self-
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25 150 employed, 2.7% part-time employed with 3.6% not currently working. Of those
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27 151 currently working, 41.8% worked at a university (73.3% at a 1st tier research university
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29 152 and 11.1% at a 2nd tier research university) while 58.2% were employed at non-
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31 153 university jobs.
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37 154 Table 1, on its left side, shows the 18 bioethical violations items from the BIBC
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39 155 Questionnaire in ranked order by percent of respondents rating the item as a '5' (most
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41 156 severe) in 'Perceived Severity', and then subcategorized into Severity Group I (the top 3
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43 157 most egregious violations), Severity Group II (the next 8 most egregious violations),
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45 158 and Severity Group III (the 7 least egregious violations). The bolded 'q#'s' –within
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47 159 Severity Groups I & II—are marked by a supra-numeral 1 (e.g. **q#2¹**) and indicate 'top
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49 160 tier violations' (i.e., have a 'Perceived Severity' score of 4-5 for at least 65% of the
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51 161 respondents AND a # of times asked in last 5 years' of 1-10+ times for >20% of the
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53 162 respondents). There were 7 identified 'top tier concern violations'.
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3 163 The unbolded ‘q#’s’ with a supra-numeral 2 (e.g., q#7²) –all these are within
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5 164 Severity Group III—are labeled as ‘2nd tier concern violations’ (i.e., have a ‘Perceived
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8 165 Severity’ score of 4-5 for at least 33-64% of the respondents AND a # of times asked in
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10 166 last 5 years’ of 1-10+ times for >20% of the respondents). There were also 7 identified
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13 167 ‘2nd tier concern violations.

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15 168 Based upon these pilot study findings that the observed effect size of most of the
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17 169 variables in relation to the demographic factors were moderate (i.e., in the range of 0.3-04), our
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20 170 follow-up Phase II study will seek a sample of 400 ASA members which will have a statistical
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22 171 power above 80% while being able to detect a minimum of 10% difference of the dependent
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24 172 variable between demographic and environmental variables.
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30 174 **Discussion and Conclusions**

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33 175 Thus 14 of the 18 BIBC Questionnaire items, as judged by a combination of
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35 176 ‘severity of violation’ and ‘frequency of occurrence over past 5 years’ were rated by
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37 177 biostatisticians as ‘top tier’ or ‘2nd tier’ bioethical concerns, i.e., minimally having the
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39 178 characteristics of a ‘Perceived Severity’ score in the high range (i.e., a score of 4 or 5)
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41 179 for at least 33% of the respondents AND having been ‘been asked during a biostatistical
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44 180 consultation’ over the past 5 years for at least 20% of the respondents. Inevitably, if
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46 181 unfortunately, the limited sample size of this pilot study prevents detailed sub-analyses
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48 182 of the findings by demographic and work-environmental factors. Finally, given that
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50 183 these findings are from a pilot study designed to answer methodologic issues, any
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52 184 detailed comparisons of our bioethical violations findings with prior studies would be
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55 185 inappropriate; those comparisons must await the findings from our funded—and now
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3 186 underway—full-sized, Phase II study.
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5 187 Nevertheless, there are clear public health implications from the findings of this
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8 188 Phase I pilot study. First, the pilot U.S. national survey quantitatively identified a wide array of
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10 189 bioethical violations that arise between scientific investigators and their biostatistical consultants,
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13 190 giving clear evidence that researchers make requests of their biostatistical consultants that are not
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15 191 only rated as severe violations, and that these requests occur quite frequently. Second, these
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17 192 Phase I pilot findings provide strong evidence in support of future studies that will: 1) provide
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19 193 replication of these findings in a large sample of subjects, and 2) allow a more refined analysis of
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21 194 the findings by demographic variables.
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24 195 Following our successful completion of this Phase I pilot study, our research team
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26 196 submitted a Phase II grant that was funded by the Office of Research Integrity (ORI) at the U.S.
27
28 197 DHHS to conduct a follow-up Phase II full-sized study which currently is currently underway,
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30 198 again in collaboration with the American Statistical Association. The findings from that Phase
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32 199 II full-sized study will serve to more definitively describe both the frequency and severity of
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34 200 bioethical violations requested during biostatistical consultations, as well as guide the
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36 201 development of future educational bioethical training modules targeted at university-based
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38 202 clinical research training programs and their directors as well as to encourage and develop means
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40 203 for research universities and companies to improve their institutional environmental efforts
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42 204 regarding job and publication pressures to reduce the frequency of these bioethical violation
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44 205 requests.
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53 207 **Word Count: 1,662**
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56 209 **Each Author's Specific Contributions:**

57 210 MinQi Wang, PhD: led the research team in the writing of Phase I grant; designed the online
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3 211 data collection system; conducted the data analysis; reviewed and approved the final draft of this
4 212 manuscript

5 213
6 214 Alice F. Yan, MD, PhD: contributed to the writing of the Phase I grant; administered and
7 215 managed the online data collection system; contributed to the data analysis; reviewed and
8 216 approved the final draft of this manuscript

9 217
10 218 Ralph V. Katz, DMD, MPH, PhD: initially conceived of the project and research design method;
11 219 contributed to the writing of this Phase I grant; wrote the first draft of this manuscript; and,
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18 226

19 227 **Competing Interests Statement:**

20 228 The authors of this paper have read and understood the BMJ Group policy on
21 229 declaration of interests and declare that they have none.
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Table 1. Ranking of Bioethical Violations by 'Perceived Severity' and 'Number of Times Directly Asked to do it over the past 5 years': BIBC Phase I (n=112)

Findings for q#1-18 which asked biostatisticians "to estimate the number of times—during the past five years—that you, personally, have been DIRECTLY asked to do this".

	Perceived Severity score		# of times asked		
	'most severe' or 'high end'		over past 5 years		
	a '5'	'a 4 or 5'	never	1-9	10+
Severity Group I: Top 3 bioethical violations as ranked on 'Perceived Severity'					
q#10. Falsify the statistical significance to support a desired result	91%	92%	96%	3%	1%
q#9. Change data in order to achieve the desired outcome	85%	90%	96%	4%	-
q#2. ¹ Remove or alter some data records in order to better support the research hypothesis	70%	87%	64%	35%	1%
Severity Group II: next 8 ranked bioethical violations on 'Perceived Severity'					
q#8. ¹ Interpret the statistical findings based on expectation, not based on the actual results	44%	71%	69%	30%	1%
q#3. ¹ Not report the presence of key missing data that could bias the results	35%	77%	73%	25%	2%
q14. Did not fully describe the treatment under study since protocol wasn't exactly followed	33%	65%	83%	17%	-
q12. ¹ Ignored violations of assumptions since results may change from positive to negative	33%	69%	68%	29%	3%
q15. Not to mention interim analyses to avoid the problem of 'too much testing'	30%	64%	84%	15%	1%
q16. ¹ Report power based on a <i>post-hoc</i> calculation but make it appear as a <i>a priori</i> statement	30%	65%	73%	25%	2%
q18. ¹ Request not to properly adjust for multiple testing when ' <i>a priori</i> , originally planned secondary outcomes' get shifted to a ' <i>a posteriori</i> primary outcome status'	29%	66%	72%	27%	1%
q6. ¹ Modify a measurement scale in order to achieve some desired results rather than adhering to the original scale as validate	25%	65%	73%	26%	1%
Severity Group III: Lowest 7 bioethical violations as ranked on 'Perceived Severity'					
q7. ² Remove categories of a variable in order to report more favorable results	20%	60%	60%	40%	-
q11. ² Reporting results before data has been cleaned and validated	18%	49%	40%	51%	9%
q5. ² Conduct too many post-hoc tests but purposefully fail to adjust alpha levels in order to make results look more impressive than they really are	17%	61%	39%	48%	13%
q13. ² Did not discuss duration of follow-up since it wasn't consistent	16%	39%	74%	26%	-
q1. ² Stress only the significant findings	14%	45%	35%	55%	10%
q4. ² Not report the model statistics (including effect size in ANOVA or R ² in linear regression) because it appeared too small to indicate any meaningful changes	12%	39%	66%	32%	2%

345 q17.² Fail to show plot since it didn't show as strong as effect as you would have hoped for 8% 33% 51% 45% 4%

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347 ¹ 1st top tier concern violations, i.e., Perceived Severity score of 4-5 for at least 65% of sample + "# of times asked in last 5 years" of 1-10+ times for

348 least 20% of sample

349 ² 2nd tier concern violations, i.e., Perceived Severity score of 4-5 for 33-64% of sample + "# of times asked in last 5 years" of 1-10+ times for at least 20%

350 of sample

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