

BMJ Open

Disciplined doctors: does the sex of a doctor matter?

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2014-005405
Article Type:	Research
Date Submitted by the Author:	09-Apr-2014
Complete List of Authors:	Unwin, Emily; University College London, UCL Medical School Woolf, Katherine; University College London, UCL Medical School Wadlow, Clare; University College London, UCL Medical School Dacre, Jane; University College London, UCL Medical School
Primary Subject Heading:	Medical education and training
Secondary Subject Heading:	Health services research, Epidemiology
Keywords:	LAW (see Medical Law), MEDICAL EDUCATION & TRAINING, EPIDEMIOLOGY, GMC, Gender

SCHOLARONE™
Manuscripts

Title Page

Disciplined doctors: does the sex of a doctor matter?

Emily Unwin, Katherine Woolf, Clare Wadlow, Jane Dacre

Corresponding author:

Prof Jane Dacre, Director UCL Medical school
UCL Medical School, 74 Huntley Street. London, WC1E 6AU. UK
j.dacre@ucl.ac.uk
Tel: 020 7679 0894
Fax: 020 7679 0890

Dr Emily Unwin, PhD student
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Dr Katherine Woolf, Lecturer
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Dr Clare Wadlow, Clinical training fellow
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Key words:

Law, Medical education & training, epidemiology, GMC, gender

Word count:

4316

Abstract

Objectives: To examine the association between doctors' sex and receiving sanctions on their medical registration, whilst controlling for other potentially confounding variables.

Design: Cross-sectional study.

Setting: The General Medical Council's (GMC) List of Registered Medical Practitioners (LRMP) database of doctors practising in the United Kingdom (UK).

Population: All doctors on the GMC's LRMP on 29th May 2013. The database included all doctors who are or have been registered to practice medicine in the UK since October 2005. The exposure of interest was doctor's sex. Confounding variables included years since primary medical qualification, world region of primary medical qualification and specialty.

Outcome measures: Sanctions on a doctor's medical registration. Sanction types included warning, undertakings, conditions, suspension or erasure from the register. Binary logistic regression modelling, controlling for the confounders, described the association between doctor's sex and sanctions on a doctor's medical registration.

Results: Of the 329,542 doctors on the LRMP, 2,697 doctors (0.8%) had sanctions against their registration, 516 (19.1%) of whom were female. In the fully adjusted model, female doctors had nearly a third of the odds (OR 0.37, 95% CI: 0.33-0.41) of having sanctions compared to male doctors. There was evidence that the association varies with specialty, with female doctors who had specialised as GPs being the least likely to receive sanctions compared to their male colleagues.

Conclusions: Female doctors have reduced odds of receiving sanctions on their medical registration when compared to their male colleagues. This association remained after adjustment for the confounding factors. These results are representative of all doctors registered to practice in the UK. Further exploration of why doctors' sex may impact their professional performance is underway.

Article summary

Strengths and limitations of this study

- We used a large national database with no missing data, so the findings of the study apply to all doctors registered to practise in the UK.
- Receiving sanctions is a rare outcome and using a large dataset is crucial when examining rare outcomes.
- This is one of the first studies of this nature on UK data that adjusted for known confounders.
- The study was constrained by the variables collected and made available by the GMC. So we were unable to examine the effect of other potential confounding factors.
- The data available did not provide the reasons for why a sanction had been imposed, nor data on those granted voluntary erasure. A more detailed evaluation of the reasons for referral to the GMC may go towards explaining the sex difference observed.

Introduction

The number of complaints about doctors' fitness to practise received by the UK medical regulatory body, the General Medical Council (GMC), has been increasing since 2007¹. Following a triage and investigation process by the GMC the outcome of a case against a doctor can be closed, or can result in a sanction against the doctor's registration. The cost of this regulatory process, both in terms of financial cost of the actual complaints investigation procedure, but also in terms of the loss of the medical workforce during the process, can be significant. The level of stress that a doctor endures while undergoing a fitness to practise investigation was recently reported in the BMJ and highlights the impact the complaints investigation procedure can have on the mental well being of doctors².

One of the most significant changes in the medical profession has been the increase in the number of women entering this previously male dominated profession. The number of female medical students has been increasing since the mid-1960s with female medical students outnumbering male medical students since the mid-1990s³. It is predicted that female doctors will outnumber their male colleagues by 2017³. This change in the demographic profile of UK doctors has brought with it a heightened interest in how the increase of female doctors may impact the profession.

Examining and understanding the predictors of doctors receiving sanctions may aid the medical profession in identifying doctors whose performance might raise future concerns, in order to support these doctors and help prevent GMC referral. Research from the United States of America has suggested that male and female doctors differ in terms of risk of disciplinary action, with male doctors being at increased risk^{4,5,6,7,8}. However, the applicability of the findings from these American studies to the UK may be limited due to differences in both the medical and legal systems in these countries. In 2011 Wakeford explored the situation in the UK⁹. He examined the factors associated with severest outcomes of the GMC disciplinary procedures, suspension or erasure from the medical register. In agreement with the American studies, he demonstrated that female doctors were four times less likely to be disciplined when compared to male doctors. However, the interpretation of this finding is limited because the measure of effect for doctors' sex was not adjusted for potential confounders.

We aimed to examine the effect of doctors' sex on receiving sanctions against their medical registration, while adjusting for known confounding factors. This would allow

1
2
3 for a meaningful comparison of male and female doctors and their experience of
4 disciplinary action in the UK.
5
6

7 8 **Methods**

9 **Study design, setting and source of data**

10 We conducted a cross-sectional study using UK-wide data. The data were obtained
11 from the GMC. Under the Medical Act 1983 the GMC is required to keep up-to-date
12 registers of qualified doctors. The main register is the List of Registered Medical
13 Practitioners (LRMP). The LRMP is a list of all doctors registered to practise
14 medicine in the UK, and as such changes daily. The GMC provided us with a
15 snapshot of doctors registered on the LRMP on the 29th May 2013. The list included
16 doctors who have been registered with the GMC at any point in the period 20th
17 October 2005^a – 28th May 2013. The different categories of registration status
18 included: provisionally registered with a licence; provisionally registered without a
19 licence; registered with a licence; registered without a licence; suspended; not
20 registered – administrative reason; not registered – deceased; not registered –
21 erased after Fitness to Practise panel hearing; and not registered – having
22 relinquished registration. The database provided details of doctor's sex; the year,
23 country, and institutions of the doctor's primary medical qualification; date of entry on
24 the GP and/or Specialist registers (when they complete specialty training and qualify
25 as a specialist); and the doctor's current registration status, including whether they
26 currently had any sanctions on their medical registration (see below for details).
27
28
29
30
31
32
33
34
35
36
37

38 **Population**

39 All doctors who were listed on the LRMP on the 29th May 2013 were included.
40
41
42

43 **Primary outcome and exposure**

44 The outcome of interest was sanctions on a doctor's medical registration on the 29th
45 May 2013.
46

47 The types of sanctions included:

- 48
49 • **Warning:** issued when a doctor's performance has not been in keeping with
50 the principles set by the GMC for doctors, but a restriction on the doctor's
51 registration is not necessary. Warnings remain on the LRMP for a five year
52 period;
53
54
55

56
57 ^a The 20th October 2005 was the date when the GMC first began to publish full details of a doctor's
58 registration status on the LRMP online.
59
60

- **Undertakings:** an agreement between the GMC and the doctor about the doctor's future practice. The doctor must adhere to these undertakings to maintain their registration;
- **Conditions:** set out by the GMC and restrict a doctor's practice. The doctor must comply with these conditions to maintain their registration. Conditions can initially be imposed for a maximum of three years and then be renewed in periods of up to 36 months;
- **Suspension or erasure:** the doctor's licence is withdrawn by the GMC and they are no longer able to practise. Suspension from the register can last up to 12 months, but may be indefinite in certain circumstances.

A sanction can be imposed if a doctor's fitness to practise has been proved to be impaired. The impairment can result from misconduct; poor professional performance; physical or mental ill health; or a conviction or fitness to practise determination by another regulatory body either in the UK or overseas¹⁰. However it is recognised that the reason for impairment can cross more than one category (for example a doctor with a drug misuse problem could be classified as having mental ill health, yet the effects of the drug abuse could impact their professional performance). The duration of a sanction on a doctor's registration varies and it is possible for doctors to have more than one sanction against their registration and this typically represents the outcomes of different complaints. It was not possible to establish the date a sanction was imposed from the available data.

The outcome of interest was collapsed into a binary variable: doctors with sanctions against their registration; and doctors with no sanctions against their registration.

The exposure of interest was doctor's sex, as declared by the doctor to the GMC.

Selection of variables

The variables included in the study were selected before any statistical analysis. Data was available on the year of primary medical qualification (PMQ), country of PMQ and primary specialty, if on the Specialist or General Practitioner (GP) Registers. These variables were selected as a priori confounders based on findings from earlier research^{6,7,9,11}, which demonstrated that these factors may influence the risk of receiving sanctions.

Once the variables had been selected, we performed a variable reduction process, to reduce the number categories into meaningful categories. Once again, this was

1
2
3 performed before any statistical analysis. The variable 'year of PMQ' was converted
4 into 'number of years since qualification' by subtracting the year of PMQ from 2013
5
6^b. We then collapsed the variable into six categories. The first category '0-2 years'
7 represented Foundation Training, the second category '3-10 years' represented the
8 bulk of time a doctor would likely spend in Specialty Training. The subsequent
9 categories were divided into 10-year blocks. The variable 'country of PMQ' was
10 collapsed into three categories; 'UK', 'EEA' (European Economic Area) and
11 'International'. The list of countries included in the EEA category was obtained from
12 the European Union website¹² and included all countries that were members before
13 May 2013. The variable 'specialty' was divided into fourteen categories. Doctors
14 who were not present on either the Specialist Register or the GP Register were
15 categorised as having 'no specialty'. Doctors on both the Specialist Register and the
16 GP Register were recorded as having 'dual specialty' and doctors only on the GP
17 register were categorised as 'GP'. For doctors only registered on the Specialist
18 Register, their primary specialty was taken and recorded into one of eleven
19 categories. To categorise those doctors on the Specialist Register two researchers
20 (EU and CW) independently allocated each primary specialty to a specialty category.
21 Kappa statistic demonstrated a good level of agreement ($\kappa = 0.72$). Any
22 disagreements about specialty category allocation were resolved through discussion.
23
24
25
26
27
28
29
30
31
32

33 **Statistical methods**

34
35 We took a causal modelling analysis approach to analyse the data. We firstly
36 performed bivariate analyses to look for crude associations in the data, followed by
37 Mantel-Haenszel analyses, before going on to complete multivariate analyses using
38 binary logistic regression modelling. The initial logistic regression model included
39 only the exposure (sex) and outcome (sanctions) variables to provide a crude
40 measure of effect. The final logistic regression model was built to include all
41 potential confounder variables, while checking for multicollinearity. The final logistic
42 regression model enabled the calculation of an adjusted measure of effect. The final
43 model was assessed for the presence of effect modifiers following the findings from
44 the Mantel-Haenszel analyses.
45
46
47
48
49
50

51
52 Statistical analyses were conducted using the software Stata 12/SE.
53
54

55
56^b As mentioned above, a doctor could appear in the LRMP dataset if they had been removed from the
57 medical register. The actual date of those doctors being removed could lie anytime between 20th
58 October 2005 and 28th May 2013. However, as no actual removal dates were given for those doctors,
59 we used 2013 for all doctors.
60

We used the STROBE Statement¹³ to guide our study report.

Results

There were 329,542 doctors on the LRMP on the 29th May 2013, of whom 40.3% were female. Table 1 shows the distribution of variables by the sex of doctors. The median number of years since qualification was 19 years. The distribution of the number of years since a doctor had qualified was skewed to the right with the majority of the doctors qualifying 11-20 years ago (28.1%). The majority of the doctors had received their PMQ from a UK medical school (59.3%).

Approximately half of all the doctors were neither on the GP Register nor the Specialist Register (51.0%), of which the majority (58.0%) had received their PMQ greater than 10 years previously. Of those doctors who had specialised, General Practice was the most popular specialty (21.3%), followed by Medicine (6.6%). 0.5% of the doctors were on both the Specialist and GP Registers.

2697 (0.8%) doctors had sanctions against their registration on the 29th May 2013. There was a higher proportion of male doctors who had sanctions against their registration when compared to female doctors (1.1% of all male doctors compared with 0.4% of all female doctors, $\chi^2=505.4$, $P<0.001$). There was strong evidence for an association between receiving sanctions and the number of years since received PMQ, with doctors who qualified 31-40 years ago having the highest proportion of sanctions; world region of PMQ, with doctors who qualified outside the EEA with the highest proportion of doctors with sanctions; and specialty, with doctors on both the Specialist and GP Registers having the highest proportion of doctors with sanctions. These results are presented in Table 2.

Using bivariate analyses we compared female doctors to male doctors. There was a strong trend between sex of a doctor and the number of years since the doctor received their PMQ, with female doctors being more likely to have recently qualified and the proportion of female doctors reducing as the number of years since PMQ increased. We also found that female doctors were more likely to have qualified in the UK (65.5% of all female doctors compared to 55.0% of all male doctors) and male doctors were more likely to have qualified outside of the EEA (32.1% of all male doctors compared to 22.5% of all female doctors). Approximately equal proportions of male and female doctors qualified in the EEA (12.9% and 12.0% respectively). Both sexes were more likely to not to be registered in a specialty (GP or hospital), though there was a slightly higher proportion of women when compared to men who

1
2
3 were not on the Specialist or GP Registers. When examining those doctors who
4 were registered in a specialty, a higher proportion of female doctors were on the GP
5 Register compared to male doctors (24.3% of female doctors compared with 19.3%
6 of male doctors) and a higher proportion of male doctors were registered with a
7 hospital specialty (32.0% of male doctors compared with 20.1% of female doctors).
8
9 In summary, number of years since received PMQ, world region where PMQ was
10 received, and registered specialty were associated with both the outcome (sanctions)
11 and the exposure (sex of a doctor) and as such we considered these variables as
12 confounders.
13
14
15
16

17
18 The unadjusted odds ratio for having sanctions against a doctor's registration
19 comparing female doctors with male doctors was 0.35 (95% CI: 0.32-0.38),
20 suggesting that being a female doctor is protective of receiving sanctions.
21

22 Mantel-Haenszel analyses and tests of homogeneity were conducted to examine the
23 change in the strength of the association between sanctions and sex while controlling
24 for each of the confounders separately.
25

26 There was strong evidence that the true odds ratios were different between the
27 different specialty categories ($P=0.0002$), therefore specialty was considered as an
28 effect modifier when conducting multivariate analyses.
29
30
31

32
33 Table 3 represents the results from the binary logistic regression model built to adjust
34 for all the variables. After taking into account the number of years since PMQ, world
35 region where the doctor received their PMQ and specialty, female doctors had nearly
36 a third of the odds of having sanctions on their registration compared to male doctors
37 (OR 0.37, 95% CI: 0.33-0.41, $P<0.0001$).
38

39 All of the a priori confounders were felt to be confounders because the adjusted odds
40 ratio changed when each variable was added to the model. We found no evidence
41 of multicollinearity.
42

43 The Mantel-Haenszel analyses suggested that specialty may be an effect modifier,
44 we therefore performed a statistical test for effect modification by firstly collapsing the
45 specialty variable into four groups to increase the power of the test. Table 4
46 demonstrates that specialty was felt to be an important effect modifier with female
47 doctors being less likely to receive sanctions when compared to male doctors, but
48 the effect was greater for GPs than for those doctors with no specialty or practising a
49 hospital specialty.
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Upon discovering the strong evidence for an association between doctor's sex and
4 likelihood of receiving sanctions on a doctor's registration, we decided to further the
5 findings by performing post-hoc analyses to establish whether the type of sanction
6 imposed on a doctor's registration was associated with doctor's sex. All variables
7 were categorised to create binary variables to ensure there were sufficient cases in
8 each category of variable. The results displayed in Table 5 demonstrate that female
9 doctors have reduced odds of having each type of sanction imposed on their
10 registration when compared to their male colleagues. Female doctors had
11 approximately one third of the odds of receiving a warning, being suspended or
12 erased from the register and they had just over half the odds of receiving
13 undertakings or conditions on their registration compared to male doctors. The
14 Mantel-Haenszel analyses suggested that when examining the outcome 'warning'
15 specialty may be an effect modifier, and when examining the outcome 'erased' world
16 region where received PMQ may be an effect modifier, we therefore performed a
17 statistical test for effect modification. Specialty was demonstrated to be an important
18 effect modifier when examining the association between warning and sex, with
19 female specialists having approximately half the odds of receiving a warning
20 compared to male specialists, whereas for male and female doctors without a
21 specialty there was no strong evidence for a difference in the odds of receiving a
22 warning (see Table 6). World region where a doctor received their PMQ was also
23 shown to be an important effect modifier when examining the association between
24 erasure and sex. Female doctors who had received their PMQ in the UK had
25 approximately one fifth of the odds of being erased, whereas female doctors who
26 received their PMQ outside of the UK had approximately one third of the odds of
27 being erased when compared to their male colleagues (see Table 7).

42 Discussion

43 In our large cross-sectional study we found strong evidence that being female was
44 associated with a reduction in odds of receiving sanctions (OR 0.35, 95% CI: 0.32-
45 0.38) in the unadjusted model. Controlling for years since PMQ, world region where
46 received PMQ, and specialty did slightly increase this odds ratio (OR 0.37, 95% CI:
47 0.33-0.41, $P < 0.0001$), but there remained strong evidence for the association
48 between doctor's sex and receiving sanctions. There was evidence that the
49 association varied with specialty, with female GPs being the least likely to have
50 sanctions against their registration. Post hoc analyses demonstrated the association
51 between receiving a warning varied with specialty registration, with female specialists
52 having less than half the odds of receiving a warning when compared to their male
53
54
55
56
57
58
59
60

1
2
3 colleagues, but no real evidence for a difference between the sexes and receiving a
4 warning in doctors who had not yet specialised. Post hoc analyses also provided
5 evidence to show that the odds of being erased from the medical register varied
6 depending on where a doctor had received their PMQ, with female doctors who had
7 received their PMQ in the UK being the least likely to be erased from the medical
8 register.
9
10

11
12
13 To our knowledge this is the first study in the UK to examine the association between
14 doctor's sex and receiving sanctions against medical registration, while adjusting for
15 known confounders.
16
17

18 19 20 **Strengths and weaknesses of this study**

21 One of the major strengths of this study is that we used a large national database.
22 The advantage of using this dataset is two-fold; firstly, because a national database
23 was used the findings of the study apply to all doctors registered to practise in the
24 UK; secondly, receiving sanctions is a rare outcome and using a large dataset is
25 crucial when examining rare outcomes.
26
27

28 A further strength of this study is that it adjusted for known confounders. Previous
29 research on UK data did not adjust the measure of effect of sex for potential
30 confounders⁹.
31
32

33 Finally, a further advantage was the completeness of the dataset. The data is
34 collected by the GMC for inclusion on the LRMP, and not research purposes.
35 Doctors are required to provide the data to the GMC to be registered and as such
36 there is no missing data. However, the fact the data is not collected for research
37 purposes is also a limitation of the study. The study was constrained by the
38 variables collected and made available by the GMC. As such, we were only able to
39 explore the variables available and we were unable to examine the effect of other
40 potential confounding factors.
41
42

43 It could be argued that the reason for referral to the GMC could be a source of
44 residual confounding if systematic differences exist between the sexes. The GMC
45 may take action against a doctor's registration for a number of reasons; including
46 misconduct; poor performance; or physical or mental ill health. The data available
47 did not provide the reasons for why a sanction had been imposed, but a more
48 detailed evaluation of the reasons for referral to the GMC may go towards explaining
49 the sex difference observed.
50
51

52 A further limitation is that a doctor can apply for voluntary erasure from the LRMP
53 during an investigation process. Once again, this is a potential source of residual
54
55
56
57
58
59
60

1
2
3 confounding and it is possible that the sex of doctors who are subject to a complaints
4 investigation and apply for voluntary erasure differs to those doctors who complete
5 the investigative process and receive a sanction (however, it is important to note that
6 the GMC's decision to grant a request for voluntary erasure is based on the public
7 interest and the doctor's health and likelihood to return to practise¹⁴).
8
9

10 11 12 **Comparison with other studies**

13 Several studies have examined the association between doctors' sex and disciplinary
14 action, with the majority of these studies demonstrating that female doctors are less
15 likely to be subject to disciplinary action than male doctors^{4,5,6,7,8,9}. However, the
16 majority of these studies have been performed in the United States of America,
17 where the medical and legal systems differ to the UK and therefore we felt that their
18 findings may not be applicable to the UK population of doctors. To our knowledge,
19 one study has been performed in the UK using national data⁹, however when
20 examining the association between doctors' sex and disciplinary action this study did
21 not control for any potential confounders.
22
23

24 The findings of this study are in agreement with previous research that has shown
25 that older doctors⁷, doctors who qualified outside of the country in which they are
26 practising^{9,11} and doctors of certain specialties⁶ are more likely to be subjected to
27 disciplinary action from a medical regulatory board. It has also been demonstrated in
28 previous studies that female doctors are more likely to be have qualified more
29 recently than male doctors³, are more likely to have qualified in the country in which
30 they are practising¹⁵ and choose different specialties to male doctors¹⁶.
31
32

33 This study showed that the reason that male doctors receive more sanctions is not
34 because they qualified longer ago, nor because they are more likely to have qualified
35 outside the UK, despite both of those factors being associated with increased
36 likelihood of sanctions.
37
38

39 40 41 42 **Unanswered questions and future research**

43 This study has demonstrated that female doctors are less likely to receive sanctions
44 against their medical registration compared to male doctors, however it is not clear
45 why women are less likely to receive sanctions when compared to men. Exploring
46 the possible reasons for this sex difference in professional performance is required,
47 using a theoretical based approach. One theory suggested by some researchers is
48 that male and female doctors differ in communication style and hence the interaction
49 with patients and colleagues differed between the sexes, which could affect the risk
50
51
52
53
54
55
56
57
58
59
60

1
2
3 of being subject to a complaint^{17,18}. Future research could be performed to explore
4 this further.
5
6

7
8 We have also demonstrated that the effect of sex on likelihood to receive sanctions
9 varied by specialty, with female GPs being the least likely to receive sanctions. It
10 has been demonstrated by an observational study of primary care physicians in the
11 USA that female primary care physicians spend more time with their patients when
12 compared to their male colleagues and they engaged more in conversation,
13 displaying more positive-talk, partnership-building, question-asking and information-
14 giving¹⁹. These differences in communication style and time spent with patients may
15 go towards explaining the larger sex discrepancy observed in GPs, however future
16 research is required to explore these possible reasons further.
17
18
19
20
21

22
23 We have also shown that female specialists are much less likely than male
24 specialists to receive a warning, but the sex difference disappears for doctors who
25 have not yet specialised. The association between sex and the other types of
26 sanctions was not found to vary with specialty registration. Examining why receiving
27 warnings varies according to specialty registration, with a sex difference being
28 observed in specialists, merits being explored. Possibilities include that the threshold
29 for delivering a warning to a non-specialist is lower than for a specialist because it
30 may be more likely that a non-specialist is at an early stage of their career and
31 perhaps the medical regulatory body feel it is important to highlight that behaviour
32 which demonstrates a significant departure from the principles of Good Medical
33 Practice as set out by the GMC will be dealt with seriously and the warning may be
34 hoped to act as a deterrent for any future more serious demonstrations of departure
35 from the principles set out by the GMC.
36
37
38
39
40
41
42
43

44
45 Our results have demonstrated that female doctors who qualified in the UK are the
46 least likely to be erased from the medical register (the most severe sanction to be
47 imposed). Female doctors who qualified outside of the UK are less likely to be
48 erased from the medical register than their male colleagues who qualified outside of
49 the UK, but they are more likely to be erased than their female colleagues who
50 qualified in the UK. These results echo the findings of a cohort study conducted by
51 Humphrey et al.¹¹ who demonstrated that referrals to the GMC concerning doctors
52 who had received their PMQ outside of the UK was associated with the most severe
53 sanctions on their registration (suspension or erasure).
54
55
56
57
58
59
60

1
2
3 Our results also show that female doctors have approximately one third of the odds
4 of being erased or suspended, and just over half the odds of receiving undertakings
5 or conditions when compared to their male colleagues. These results suggest that,
6 with the exception of the sanction 'warning', the more severe the sanction
7 (suspension or erasure from the medical register) the more likely men will receive it.
8 Exploring the reasons for this sex difference in the severity of sanctions imposed
9 would be of interest. It is possible that male doctors' behaviour and actions warrant
10 the severest types of sanctions to be imposed, whereas female doctors' behaviour
11 and actions do not require such severe sanctions. Examining the reasons for why
12 doctors have received sanctions would go towards showing whether this is in fact the
13 case.
14
15
16
17
18
19

20
21 It should also be noted that this study was observational in design and as such
22 causality cannot be determined. It is possible that other factors, such as ethnicity,
23 may be confounding the association between doctors' sex and disciplinary action.
24 Research examining whether other potential confounders could explain the observed
25 association is required.
26
27
28
29

30 Further exploration of why doctors' sex may impact their professional performance is
31 needed to enable the profession to develop a better understanding of the factors
32 associated with impaired fitness to practise and crucially, how to better support those
33 doctors and ensure patient safety.
34
35
36
37

38 **Conclusion**

39 In this study we demonstrated that female doctors practising in the UK were less
40 likely to receive sanctions on their medical registration when compared with their
41 male colleagues. These findings remained after adjusting for known confounders.
42 Reasons for why this sex difference exists needs to be examined.
43
44
45
46

47 **Acknowledgements**

48 We acknowledge Una Lane for facilitating access to the data and for answering our
49 queries on the dataset. We acknowledge Andrew Ledgard for clarifying our queries
50 on the dataset.
51
52
53
54
55
56
57
58
59
60

Footnotes

Contributorship statement: EU conceived and designed the study with input from KW and JD. EU and CW categorised the data. EU analysed and interpreted the data with support from KW. EU drafted the manuscript and all authors participated in the revision process and have approved this submission for publication. EU is guarantor, had full access to all of the data in the study, and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding: No specific funding was obtained for this study. EU is a PhD student, and recipient of a UCL Impact studentship. None of the funders influenced the conduct of this research.

Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf. All authors declare no competing interests that may be relevant to the submitted work.

Ethical approval: The study is part of a research project that has received ethical approval from the UCL Research Ethics Committee.

Data sharing statement: No additional data available.

Transparency declaration: EU, as guarantor, affirms that this manuscript is an honest, accurate and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Copyright: The corresponding author has the right to grant on behalf of all authors and does grant on behalf of all authors, a worldwide licence to the Publishers and its licensees in perpetuity, in all forms, formats and media (whether known now or created in the future), to i) publish, reproduce, distribute, display and store the Contribution, ii) translate the Contribution into other languages, create adaptations, reprints, include within collections and create summaries, extracts and/or, abstracts of the Contribution, iii) create any other derivative work(s) based on the Contribution, iv) to exploit all subsidiary rights in the Contribution, v) the inclusion of electronic links from the Contribution to third party material where-ever it may be located; and, iv) licence any third party to do any or all of the above.

Table 1: Distribution of variables by sex of doctors.

Variable	Male N=196,814	Female N=132,728	Total N=329,542
Sanction imposed on registration			
No	194,633 (98.9%)	132,212 (99.6%)	326,845 (99.2%)
Yes	2,181 (1.1%)	516 (0.4%)	2,697 (0.8%)
No. of years since received PMQⁱ			
0-2 years	6,332 (3.2%)	8,830 (6.7%)	15,162 (4.6%)
3-10 years	28,548 (14.5%)	37,220 (28.0%)	65,768 (20.0%)
11-20 years	52,437 (26.6%)	40,023 (30.2%)	92,460 (28.1%)
21-30 years	39,146 (19.9%)	23,069 (17.4%)	62,215 (18.9%)
31-40 years	30,206 (15.4%)	12,136 (9.1%)	42,342 (12.9%)
≥41 years	40,145 (20.4%)	11,450 (8.6%)	51,595 (15.7%)
Region where received PMQ			
UK	108,323 (55.0%)	86,989 (65.5%)	195,312 (59.3%)
EEA ⁱⁱ	25,333 (12.9%)	15,880 (12.0%)	41,213 (12.5%)
International	63,158 (32.1%)	29,859 (22.5%)	93,017 (28.2%)
Specialty			
No Specialty	94,815 (48.2%)	73,309 (55.2%)	168,124 (51.0%)
Anaesthetics	8,710 (4.4%)	3,797 (2.9%)	12,507 (3.8%)
EM ⁱⁱⁱ	754 (0.4%)	209 (0.2%)	963 (0.3%)
GP ^{iv}	37,959 (19.3%)	32,264 (24.3%)	70,223 (21.3%)
Medicine	15,076 (7.7%)	6,775 (5.1%)	21,851 (6.6%)
O&G ^v	2,934 (1.5%)	1,966 (1.5%)	4,900 (1.5%)
Ophthalmology	2,508 (1.3%)	1,078 (0.8%)	3,586 (1.1%)
Paediatrics	3,906 (2.0%)	3,891 (2.9%)	7,797 (2.4%)
Pathology	5,589 (2.8%)	2,965 (2.2%)	8,554 (2.6%)
Psychiatry	5,494 (2.8%)	3,077 (2.3%)	8,571 (2.6%)
Radiology	172 (0.1%)	41 (0.03%)	213 (0.1%)
Surgery	16,452 (8.4%)	1,942 (1.5%)	18,394 (5.6%)
Other	1,330 (0.7%)	867 (0.7%)	2,197 (0.7%)
Dual Specialty	1,115 (0.6%)	547 (0.4%)	1,662 (0.5%)

ⁱPrimary Medical QualificationⁱⁱEuropean Economic AreaⁱⁱⁱEmergency Medicine^{iv}General Practice^vObstetrics & Gynaecology

Table 2: The distribution of sanctions for each variable and the association of individual factors with sanctions.

Variable	Total number of doctors	Sanctions (%)	p-value
Sex			<0.001
Male	196,814	1.1%	
Female	132,728	0.4%	
No. of years since received PMQⁱ			<0.001
0-2	15,162	0.1%	
3-10	65,768	0.6%	
11-20	92,460	0.8%	
21-30	62,215	1.1%	
31-40	42,342	1.4%	
≥41	51,595	0.7%	
Region where received PMQ			<0.001
UK	195,312	0.6%	
EEA ⁱⁱ	41,213	0.9%	
International	93,017	1.2%	
Specialty			<0.001
No Specialty	168,124	0.7%	
Anaesthetics	12,507	0.7%	
EM ⁱⁱⁱ	963	0.7%	
GP ^{iv}	70,223	1.2%	
Medicine	21,851	0.5%	
O&G ^v	4,900	1.2%	
Ophthalmology	3,586	0.5%	
Paediatrics	7,797	0.6%	
Pathology	8,554	0.6%	
Psychiatry	8,571	0.8%	
Radiology	213	0.5%	
Surgery	18,394	0.9%	
Other	2,197	0.3%	
Dual Specialty	1,662	1.4%	

ⁱPrimary Medical QualificationⁱⁱEuropean Economic AreaⁱⁱⁱEmergency Medicine^{iv}General Practice^vObstetrics & Gynaecology

Table 3: The adjusted odds ratio for having sanctions against registration for each variable compared to its baseline having adjusted for all other variables.

Variable	Adjusted OR ⁱ	95% CI ⁱⁱ	p-value
Sex of a doctor			
			<0.0001
Male	1		
Female	0.37	0.33-0.41	
No. of years since received PMQ			
			<0.0001
0-2	1		
3-10	3.42	2.20-5.32	
11-20	3.85	2.48-5.98	
21-30	5.66	3.63-8.81	
31-40	6.44	4.13-10.05	
≥41	3.12	1.20-4.87	
Region where received PMQ			
			<0.0001
UK	1		
EEA	1.33	1.17-1.50	
International	1.65	1.51-1.80	
Specialty			
			<0.0001
No Specialty	1		
Anaesthetics	0.65	0.52-0.82	
EM	0.66	0.31-1.39	
GP	1.43	1.29-1.58	
Medicine	0.49	0.40-0.60	
O&G	1.22	0.93-1.59	
Ophthalmology	0.53	0.33-0.83	
Paediatrics	0.64	0.47-0.88	
Pathology	0.65	0.50-0.86	
Psychiatry	0.81	0.63-1.04	
Radiology	0.47	0.07-3.38	
Surgery	0.78	0.66-0.93	
Other	0.36	0.17-0.77	
Dual Specialty	1.37	0.90-2.09	

ⁱ Odds Ratio

ⁱⁱ Confidence Interval

Table 4: Stratum-specific odds ratios for having sanctions imposed on registration if the doctor is female for each specialty divided into four categories.

Variable	Stratum-Specific OR ⁱ	95% CI ⁱⁱ	p-value
Specialty Category			
			<0.0001
No Specialty	0.43	0.38-0.49	
GP	0.26	0.22-0.31	
Hospital Specialty	0.44	0.36-0.56	
Dual Specialty	0.09	0.13-0.70	

ⁱ Odds Ratio

ⁱⁱ Confidence Interval

Table 5: The unadjusted and adjusted odds ratio for having each type of sanction against registration for a female doctor when compared to a male doctor.

Sanction type	Model 1		Model 2 ⁱ	
	Unadjusted OR ⁱⁱ	95% CI ⁱⁱⁱ	Adjusted OR ⁱⁱ	95% CI ⁱⁱⁱ
Warning	0.29	0.24-0.35	0.30	0.25-0.36
Undertakings	0.64	0.52-0.79	0.66	0.53-0.81
Conditions	0.48	0.39-0.59	0.54	0.44-0.67
Suspended	0.28	0.21-0.36	0.32	0.25-0.42
Erased	0.21	0.17-0.27	0.26	0.21-0.34

ⁱ Model adjusted for number of years since received PMQ, region where received PMQ and specialty

ⁱⁱ Odds Ratio

ⁱⁱⁱ Confidence Interval

Table 6: Stratum-specific odds ratios for having a warning imposed on registration if the doctor is female for each specialty divided into two categories.

Variable	Stratum-Specific OR ⁱ	95% CI ⁱⁱ	p-value
Specialty Category			0.0031
No Specialty	0.90	0.67-1.20	
On Specialist and/or GP Registers	0.48	0.35-0.65	

ⁱ Odds Ratio

ⁱⁱ Confidence Interval

Table 7: Stratum-specific odds ratios for being erased from the LRMP if the doctor is female for each region where received PMQ divided into two categories.

Variable	Stratum-Specific OR ⁱ	95% CI ⁱⁱ	p-value
Region where received PMQ Category			0.0301
EEA and/or International	0.32	0.24-0.44	
UK	0.18	0.11-0.28	

ⁱ Odds Ratio

ⁱⁱ Confidence Interval

References

1. General Medical Council. *The state of medical education and practice in the UK*. London: GMC; 2012.
2. Dyer C. GMC and vulnerable doctors: too blunt an instrument? *BMJ* 2013; 347: f6230.
3. Elston MA. *Women and medicine: the future*. London: Royal College of Physicians; 2009.
4. Cardarelli R & Licciardone, JC. Factors associated with high-severity disciplinary action by a state medical board: a Texas study of medical license revocation. *JAOA* 2006; 106(3): 153-156.
5. Clay SW & Conaster RR. Characteristics of physicians disciplined by the State Medical Board of Ohio. *JAOA* 2003; 103(2): 81-88.
6. Khaliq AA, Dimassi H, Huang CY, Narine L & Smego RA Jr. Disciplinary action against physicians: who is likely to get disciplined? *The American Journal of Medicine* 2005; 118(7): 773-777.
7. Kohatsu ND, Gould D, Ross LK & Fox PJ. Characteristics associated with physician discipline: a case-control study. *Archives of Internal Medicine* 2004; 164(6): 653-658.
8. Morrison J & Wickersham P. Physicians disciplined by a State Medical Board. *JAMA* 1998; 279: 1889-1893.
9. Wakeford R. Who gets struck off? *BMJ* 2011; 343: d7842.
10. General Medical Council. *A guide for doctors referred to the GMC*. http://www.gmc-uk.org/concerns/doctors_under_investigation/a_guide_for_referred_doctors.asp (accessed December 2013)
11. Humphrey C, Hickman S & Gulliford MC. Place of medical qualification and outcomes of UK General Medical Council "fitness to practise" process: cohort study. *BMJ* 2011; 342: d1817.
12. European Union. *Countries*. http://europa.eu/about-eu/countries/index_en.htm (accessed May 2013).
13. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC & Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for Reporting Observational Studies. *PLoS Med* 2007; 4(10): e296.
14. General Medical Council. *Guidance on making decisions on voluntary erasure applications*. GMC; 2013.
15. Lambert TW, Goldacre MJ & Parkhouse J. Doctors who qualified in the UK between 1974 and 1993: age, gender, nationality, marital status and family formation. *Medical Education* 1998; 32(5): 533-537.
16. Lambert TW, Goldacre MJ, Edwards C & Parkhouse J. Career preferences of doctors who qualified in the United Kingdom in 1993 compared with those doctors qualifying in 1974, 1977, 1980, and 1983. *BMJ* 1996; 313(7048): 19-24.
17. Taragin TI, Wilczek AP, Karns ME, Trout, R & Carson JL. Physician demographics and the risk of medical malpractice. *The American Journal of Medicine* 1992; 93(5): 537-542.
18. Firth-Cozens, J. Doctors with difficulties: why so few women? *Postgraduate Medical Journal* 2008; 84(992): 318-320.
19. Roter D, Lipkin M & Korsgaard A. Sex differences in patients' and physicians' communication during primary care medical visits. *Medical Care* 1991; 29(11): 1083-1093.

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Y
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Y
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Y
Objectives	3	State specific objectives, including any prespecified hypotheses	Y
Methods			
Study design	4	Present key elements of study design early in the paper	Y
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Y
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	Y
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Y
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Y
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	N/A
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Y
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Y
		(b) Describe any methods used to examine subgroups and interactions	Y
		(c) Explain how missing data were addressed	N/A
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Y
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	Y
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Y

		(b) Report category boundaries when continuous variables were categorized	Y
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Y
Discussion			
Key results	18	Summarise key results with reference to study objectives	Y
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Y
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Y
Generalisability	21	Discuss the generalisability (external validity) of the study results	Y
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Y

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

**Disciplined doctors: does the sex of a doctor matter?
A cross-sectional study examining the association between
a doctor's sex and receiving sanctions against their medical
registration.**

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2014-005405.R1
Article Type:	Research
Date Submitted by the Author:	17-Jun-2014
Complete List of Authors:	Unwin, Emily; University College London, UCL Medical School Woolf, Katherine; University College London, UCL Medical School Wadlow, Clare; University College London, UCL Medical School Dacre, Jane; University College London, UCL Medical School
Primary Subject Heading:	Medical education and training
Secondary Subject Heading:	Health services research, Epidemiology
Keywords:	LAW (see Medical Law), MEDICAL EDUCATION & TRAINING, EPIDEMIOLOGY, GMC, Gender

SCHOLARONE™
Manuscripts

Title Page

Disciplined doctors: does the sex of a doctor matter? A cross-sectional study examining the association between a doctor's sex and receiving sanctions against their medical registration.

Emily Unwin, Katherine Woolf, Clare Wadlow, Jane Dacre

Corresponding author:

Prof Jane Dacre, Director UCL Medical School
UCL Medical School, 74 Huntley Street. London, WC1E 6AU. UK
j.dacre@ucl.ac.uk
Tel: 020 7679 0894
Fax: 020 7679 0890

Dr Emily Unwin, PhD student
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Dr Katherine Woolf, Lecturer
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Dr Clare Wadlow, Clinical training fellow
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Key words:

Law, Medical education & training, epidemiology, GMC, gender

Word count:

4432

Abstract

Objectives: To examine the association between doctors' sex and receiving sanctions on their medical registration, whilst controlling for other potentially confounding variables.

Design: Cross-sectional study.

Setting: The General Medical Council's (GMC) List of Registered Medical Practitioners (LRMP) database of doctors practising in the United Kingdom (UK).

Population: All doctors on the GMC's LRMP on 29th May 2013. The database included all doctors who are or have been registered to practice medicine in the UK since October 2005. The exposure of interest was doctor's sex. Confounding variables included years since primary medical qualification, world region of primary medical qualification and specialty.

Outcome measures: Sanctions on a doctor's medical registration. Sanction types included warning, undertakings, conditions, suspension or erasure from the register. Binary logistic regression modelling, controlling for the confounders, described the association between doctor's sex and sanctions on a doctor's medical registration.

Results: Of the 329,542 doctors on the LRMP, 2,697 doctors (0.8%) had sanctions against their registration, 516 (19.1%) of whom were female. In the fully adjusted model, female doctors had nearly a third of the odds (OR 0.37, 95% CI: 0.33-0.41) of having sanctions compared to male doctors. There was evidence that the association varies with specialty, with female doctors who had specialised as General Practitioners (GPs) being the least likely to receive sanctions compared to their male colleagues (OR 0.26, 95% CI: 0.22-0.31).

Conclusions: Female doctors have reduced odds of receiving sanctions on their medical registration when compared to their male colleagues. This association remained after adjustment for the confounding factors. These results are representative of all doctors registered to practice in the UK. Further exploration of why doctors' sex may impact their professional performance is underway.

Article summary

Strengths and limitations of this study

- We used a large national database with no missing data, so the findings of the study apply to all doctors registered to practise in the UK.
- Receiving sanctions is a rare outcome and using a large dataset is crucial when examining rare outcomes.
- This is one of the first studies of this nature on UK data that adjusted for known confounders.
- The study was constrained by the variables collected and made available by the GMC. So we were unable to examine the effect of other potential confounding factors.
- The data available did not provide the reasons for why a sanction had been imposed, nor data on those granted voluntary erasure. A more detailed evaluation of the reasons for referral to the GMC may go towards explaining the sex difference observed.

Introduction

The number of complaints about doctors' fitness to practise received by the UK medical regulatory body, the General Medical Council (GMC), has been increasing since 2007¹. Following a triage and investigation process by the GMC the outcome of a case against a doctor can be closed, or can result in a sanction against the doctor's registration. The cost of this regulatory process, both in terms of financial cost of the actual complaints investigation procedure, but also in terms of the loss of the medical workforce during the process, can be significant. The level of stress that a doctor endures while undergoing a fitness to practise investigation was recently reported in the BMJ and highlights the impact the complaints investigation procedure can have on the mental well being of doctors².

One of the most significant changes in the medical profession has been the increase in the number of women entering this previously male dominated profession. The number of female medical students has been increasing since the mid-1960s with female medical students outnumbering male medical students since the mid-1990s³. It is predicted that female doctors will outnumber their male colleagues by 2017³. This change in the demographic profile of UK doctors has brought with it a heightened interest in how the increase of female doctors may impact the profession.

Examining and understanding the predictors of doctors receiving sanctions may aid the medical profession in identifying doctors whose performance might raise future concerns, in order to support these doctors and help prevent GMC referral. Research from Canada, the United States of America and Australia and New Zealand has suggested that male and female doctors differ in terms of risk of disciplinary action, with male doctors being at increased risk^{4,5,6,7,8,9,10}. However, the applicability of the findings from these studies to the UK may be limited due to differences in both the medical and legal systems in these countries. In 2011 Wakeford explored the situation in the UK¹¹. He examined the factors associated with severest outcomes of the GMC disciplinary procedures, suspension or erasure from the medical register. In agreement with these worldwide studies, he demonstrated that female doctors were four times less likely to be disciplined when compared to male doctors. However, the interpretation of this finding is limited because the measure of effect for doctors' sex was not adjusted for potential confounders.

1
2
3 We aimed to examine the effect of doctors' sex on receiving sanctions against their
4 medical registration, while adjusting for known confounding factors. This would allow
5 for a meaningful comparison of male and female doctors and their experience of
6 disciplinary action in the UK.
7
8
9

10 **Methods**

11 **Study design, setting and source of data**

12 We conducted a cross-sectional study using UK-wide data. The data and permission
13 to use the data for research purposes were obtained from the GMC. This study is
14 part of a research project that has received ethical approval from the UCL Research
15 Ethics Committee.
16
17

18 Under the Medical Act 1983 the GMC is required to keep up-to-date registers of
19 qualified doctors. The main register is the List of Registered Medical Practitioners
20 (LRMP). The LRMP is a list of all doctors registered to practise medicine in the UK,
21 and as such changes daily. It lists those doctors who are (or could) practise
22 medicine, as well as those doctors who have been suspended or erased. The GMC
23 provided us with a snapshot of doctors registered on the LRMP on the 29th May
24 2013. The list included all doctors who have been registered with the GMC (and
25 therefore eligible to actively practise medicine) at any point in the period 20th October
26 2005^a – 28th May 2013. The different categories of registration status included:
27 provisionally or fully registered; suspended; not registered – administrative reason, or
28 deceased, or having relinquished registration; and not registered – erased after
29 Fitness to Practise panel hearing. The database provided details of doctor's sex; the
30 year, country, and institutions of the doctor's primary medical qualification and the
31 doctor's current registration status, including whether they currently had any
32 sanctions on their medical registration (see below for details). It classified doctors as
33 General Practitioners (GPs) (on the GP register) and as hospital specialists (on the
34 Specialist register). Doctors who are neither on the GP or Specialist registers are
35 doctors who have not undertaken or completed speciality training.
36
37
38
39
40
41
42
43
44
45
46
47

48 **Population**

49 All doctors who were listed on the LRMP on the 29th May 2013 were included.
50
51

52 **Primary outcome and exposure**

53
54
55
56
57 ^a The 20th October 2005 was the date when the GMC first began to publish full details of a doctor's
58 registration status on the LRMP online.
59
60

1
2
3 The outcome of interest was sanctions on a doctor's medical registration on the 29th
4 May 2013.

5
6 The types of sanctions included:

- 7
8
- 9 • **Warning:** issued when a doctor's performance has not been in keeping with
10 the principles set by the GMC for doctors, but a restriction on the doctor's
11 registration is not necessary. Warnings remain on the LRMP for a five year
12 period;
 - 13 • **Undertakings:** an agreement between the GMC and the doctor about the
14 doctor's future practice. The doctor must adhere to these undertakings to
15 maintain their registration;
 - 16 • **Conditions:** set out by the GMC and restrict a doctor's practice. The doctor
17 must comply with these conditions to maintain their registration. Conditions
18 can initially be imposed for a maximum of three years and then be renewed in
19 periods of up to 36 months;
 - 20 • **Suspension or erasure:** the doctor's licence is withdrawn by the GMC and
21 they are no longer able to practise. Suspension from the register can last up
22 to 12 months, but may be indefinite in certain circumstances.
- 23
24
25
26
27
28

29 A sanction can be imposed if a doctor's fitness to practise has been proved to be
30 impaired. The impairment can result from misconduct; poor professional
31 performance; physical or mental ill health; or a conviction or fitness to practise
32 determination by another regulatory body either in the UK or overseas¹². However it
33 is recognised that the reason for impairment can cross more than one category (for
34 example a doctor with a drug misuse problem could be classified as having mental ill
35 health, yet the effects of the drug abuse could impact their professional
36 performance). The duration of a sanction on a doctor's registration varies and it is
37 possible for doctors to have more than one sanction against their registration and this
38 typically represents the outcomes of different complaints. It was not possible to
39 establish the date a sanction was imposed or the reason for why a sanction had
40 been imposed from the available data.

41
42
43
44
45
46
47
48

49 The outcome of interest was collapsed into a binary variable: doctors with sanctions
50 against their registration; and doctors with no sanctions against their registration.

51
52

53 The exposure of interest was doctor's sex, as declared by the doctor to the GMC.

54
55
56
57
58
59
60

Selection of variables

The variables included in the study were selected before any statistical analysis. Data was available on the year of primary medical qualification (PMQ), country of PMQ and primary specialty, if on the Specialist or General Practitioner (GP) Registers. These variables were selected as a priori confounders based on findings from earlier research^{7,8,11,13}, which demonstrated that these factors may influence the risk of receiving sanctions.

Once the variables had been selected, we performed a variable reduction process, to reduce the number categories into meaningful categories. Once again, this was performed before any statistical analysis. The variable 'year of PMQ' was converted into 'number of years since qualification' by subtracting the year of PMQ from 2013^b. We then collapsed the variable into six categories. The first category '0-2 years' represented Foundation Training, the second category '3-10 years' represented the bulk of time a doctor would likely spend in Specialty Training. The subsequent categories were divided into 10-year blocks. The variable 'country of PMQ' was collapsed into three categories; 'UK', 'EEA' (European Economic Area) and 'International'. The list of countries included in the EEA category was obtained from the European Union website¹⁴ and included all countries that were members before May 2013. The variable 'specialty' was divided into fourteen categories. Doctors who were not present on either the Specialist Register or the GP Register were categorised as having 'no specialty' and represented trainee and other non-specialist doctors. Doctors on both the Specialist Register and the GP Register were recorded as having 'dual specialty' and doctors only on the GP register were categorised as 'GP'. For doctors only registered on the Specialist Register, their primary specialty was taken and recorded into one of eleven categories. To categorise those doctors on the Specialist Register two researchers (EU and CW) independently allocated each primary specialty to a specialty category. Kappa statistic demonstrated a good level of agreement (kappa = 0.72). Any disagreements about specialty category allocation were resolved through discussion.

Statistical methods

We took a causal modelling analysis approach to analyse the data. We firstly performed bivariate analyses to look for crude associations in the data, followed by Mantel-Haenszel analyses, before going on to complete multivariate analyses using

^b As mentioned above, a doctor could appear in the LRMP dataset if they had been removed from the medical register. The actual date of those doctors being removed could lie anytime between 20th October 2005 and 28th May 2013. However, as no actual removal dates were given for those doctors, we used 2013 for all doctors.

1
2
3 binary logistic regression modelling. The initial logistic regression model included
4 only the exposure (sex) and outcome (sanctions) variables to provide a crude
5 measure of effect. The final logistic regression model was built to include all
6 potential confounder variables, while checking for multicollinearity. The final logistic
7 regression model enabled the calculation of an adjusted measure of effect. The final
8 regression model enabled the calculation of an adjusted measure of effect. The final
9 model was assessed for the presence of effect modifiers following the findings from
10 the Mantel-Haenszel analyses.
11
12

13
14
15 Statistical analyses were conducted using the software Stata 12/SE.
16

17
18 We used the STROBE Statement¹⁵ to guide our study report.
19

20 21 **Results**

22
23 There were 329,542 doctors on the LRMP on the 29th May 2013, of whom 40.3%
24 were female. Table 1 shows the distribution of variables by the sex of doctors. The
25 median number of years since qualification was 19 years. The distribution of the
26 number of years since a doctor had qualified was skewed to the right with the
27 majority of the doctors qualifying 11-20 years ago (28.1%). The majority of the
28 doctors had received their PMQ from a UK medical school (59.3%).
29

30
31 Approximately half of all the doctors were neither on the GP Register nor the
32 Specialist Register (51.0%), of which the majority (58.0%) had received their PMQ
33 greater than 10 years previously. It is interesting to note that half of the doctors
34 registered to practise medicine in the UK in this period were not registered specialists
35 (they were neither on the GP or Specialist registers) and the majority of these
36 doctors had qualified greater than ten years ago, suggesting that these doctors are
37 not trainee doctors, but doctors who have elected not to complete specialty training.
38 Of those doctors who had specialised, General Practice was the most popular
39 specialty (21.3%), followed by Medicine (6.6%). 0.5% of the doctors were on both
40 the Specialist and GP Registers.
41
42
43
44
45
46
47

48
49 2697 (0.8%) doctors had sanctions against their registration on the 29th May 2013.
50 There was a higher proportion of male doctors who had sanctions against their
51 registration when compared to female doctors (1.1% of all male doctors compared
52 with 0.4% of all female doctors, $X^2=505.4$, $P<0.001$). There was strong evidence for
53 an association between receiving sanctions and the number of years since received
54 PMQ, with doctors who qualified 31-40 years ago having the highest proportion of
55 sanctions; world region of PMQ, with doctors who qualified outside the EEA with the
56
57
58
59
60

1
2
3 highest proportion of doctors with sanctions; and specialty, with doctors on both the
4 Specialist and GP Registers having the highest proportion of doctors with sanctions.
5
6 These results are presented in Table 2.
7

8
9 Using bivariate analyses we compared female doctors to male doctors. There was a
10 strong trend between sex of a doctor and the number of years since the doctor
11 received their PMQ, with female doctors being more likely to have recently qualified
12 and the proportion of female doctors reducing as the number of years since PMQ
13 increased. We also found that female doctors were more likely to have qualified in
14 the UK (65.5% of all female doctors compared to 55.0% of all male doctors) and
15 male doctors were more likely to have qualified outside of the EEA (32.1% of all male
16 doctors compared to 22.5% of all female doctors). Approximately equal proportions
17 of male and female doctors qualified in the EEA (12.9% and 12.0% respectively).
18 Both sexes were more likely to be not registered in a specialty (GP or hospital),
19 though there was a slightly higher proportion of women when compared to men who
20 were not on the Specialist or GP Registers. When examining those doctors who
21 were registered in a specialty, a higher proportion of female doctors were on the GP
22 Register compared to male doctors (24.3% of female doctors compared with 19.3%
23 of male doctors) and a higher proportion of male doctors were registered with a
24 hospital specialty (32.0% of male doctors compared with 20.1% of female doctors).
25 In summary, number of years since received PMQ, world region where PMQ was
26 received, and registered specialty were associated with both the outcome (sanctions)
27 and the exposure (sex of a doctor) and as such we considered these variables as
28 confounders.
29
30
31
32
33
34
35
36
37
38
39

40
41 The unadjusted odds ratio for having sanctions against a doctor's registration
42 comparing female doctors with male doctors was 0.35 (95% CI: 0.32-0.38),
43 suggesting that being a female doctor is protective of receiving sanctions.
44

45 Mantel-Haenszel analyses and tests of homogeneity were conducted to examine the
46 change in the strength of the association between sanctions and sex while controlling
47 for each of the confounders separately.
48

49 There was strong evidence that the true odds ratios were different between the
50 different specialty categories ($P=0.0002$), therefore specialty was considered as an
51 effect modifier when conducting multivariate analyses.
52
53
54
55

56 Table 3 represents the results from the binary logistic regression model built to adjust
57 for all the variables. After taking into account the number of years since PMQ, world
58
59
60

1
2
3 region where the doctor received their PMQ and specialty, female doctors had nearly
4 a third of the odds of having sanctions on their registration compared to male doctors
5 (OR 0.37, 95% CI: 0.33-0.41, $P < 0.0001$).

6
7 All of the a priori confounders were felt to be confounders because the adjusted odds
8 ratio changed when each variable was added to the model. We found no evidence
9 of multicollinearity.

10
11 The Mantel-Haenszel analyses suggested that specialty may be an effect modifier,
12 we therefore performed a statistical test for effect modification by firstly collapsing the
13 specialty variable into four groups to increase the power of the test. Table 4
14 demonstrates that specialty was felt to be an important effect modifier with female
15 doctors being less likely to receive sanctions when compared to male doctors, but
16 the effect was greater for GPs than for those doctors with no specialty or practising a
17 hospital specialty.

23 24 **Discussion**

25
26 In our large cross-sectional study we found strong evidence that being female was
27 associated with a reduction in odds of receiving sanctions (OR 0.35, 95% CI: 0.32-
28 0.38) in the unadjusted model. Controlling for years since PMQ, world region where
29 received PMQ, and specialty did slightly increase this odds ratio (OR 0.37, 95% CI:
30 0.33-0.41, $P < 0.0001$), but there remained strong evidence for the association
31 between doctor's sex and receiving sanctions. There was evidence that the
32 association varied with specialty, with female GPs being the least likely to have
33 sanctions against their registration.

34
35 To our knowledge this is the first study in the UK to examine the association between
36 doctor's sex and receiving sanctions against medical registration, while adjusting for
37 known confounders. We believe that these known confounders have only been
38 adjusted for in one other study which was conducted in the USA⁸.

39 40 **Strengths and weaknesses of this study**

41
42 One of the major strengths of this study is that we used a large national database.
43 The advantage of using this dataset is two-fold; firstly, because a national database
44 was used the findings of the study apply to all doctors registered to practise in the
45 UK; secondly, receiving sanctions is a rare outcome and using a large dataset is
46 crucial when examining rare outcomes.

1
2
3 A further strength of this study is that it adjusted for known confounders, all these
4 confounders have only been adjusted for in one previous study, which was
5 conducted in California⁸. Previous research on UK data did not adjust the measure
6 of effect of sex for potential confounders¹¹.
7

8
9 Finally, a further advantage was the completeness of the dataset. The data is
10 collected by the GMC for inclusion on the LRMP, and not research purposes.
11 Doctors are required to provide the data to the GMC to be registered and as such
12 there is no missing data. However, the fact the data is not collected for research
13 purposes is also a limitation of the study. The study was constrained by the
14 variables collected and made available by the GMC. As such, we were only able to
15 explore the variables available and we were unable to examine the effect of other
16 potential confounding factors or explore the reasons for why a sanction had been
17 imposed.
18

19
20 It could be argued that the reason for referral to the GMC could be a source of
21 residual confounding if systematic differences exist between the sexes. The GMC
22 may take action against a doctor's registration for a number of reasons, which can be
23 broadly divided into three major categories; misconduct; poor professional
24 performance; or physical or mental ill health. The data available did not provide the
25 reasons or the category for why a sanction had been imposed, but a more detailed
26 evaluation of the reasons for referral to the GMC may go towards explaining the sex
27 difference observed. In their research, Alam et al.⁴ and Elkin et al.¹⁰, demonstrated
28 not only that male doctors were more likely to be subject to disciplinary action, but
29 that the main offense for which a doctor was being disciplined was sexual
30 misconduct. It is possible that male doctors are more likely to commit an offense
31 involving sexual misconduct than their female colleagues, which may go towards
32 explaining the sex difference seen in these populations. However, other studies in
33 this area did not find sexual misconduct to be the most common offense^{6,7,9}. As
34 such, exploring the offenses for which a doctor may receive disciplinary action in this
35 population may go towards explaining the sex difference observed and may help the
36 regulatory body and medical profession to introduce targeted interventions, such as
37 education programmes, to reduce the number of offenses.
38

39
40 A further source of residual confounding could be the route of referral. Doctors
41 practising in the UK can be referred to the GMC through five main routes; the public;
42 employers; doctors; the GMC; and the police¹⁶. It would be interesting to examine
43 whether the referral rate for each route demonstrates any sex differences, and if so,
44 exploring the reasons for this difference.
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 A further limitation is that a doctor can apply for voluntary erasure from the LRMP
4 during an investigation process. Once again, this is a potential source of residual
5 confounding and it is possible that the sex of doctors who are subject to a complaints
6 investigation and apply for voluntary erasure differs to those doctors who complete
7 the investigative process and receive a sanction (however, the GMC's decision to
8 grant a request for voluntary erasure is based on the public interest and the doctor's
9 health and likelihood to return to practise¹⁷). It is important to note that voluntary
10 erasure is requested by doctors for multiple reasons other than being involved in an
11 investigation process, including retiring permanently from practising medicine or
12 leaving the UK to work permanently abroad. To explore whether voluntary erasure
13 requests may explain the sex difference seen, the reason for why a voluntary erasure
14 request was submitted would first have to be ascertained. This information was not
15 available in the dataset used for this research, but could be requested and explored
16 in future studies.
17
18
19
20
21
22
23

24 It is also of interest to note that certain sanctions (erasure and some suspensions)
25 are permanent, whereas other sanctions are time limited. As such, the permanent
26 sanctions may be over represented because they will never be removed from a
27 doctor's registration. If male doctors are more likely to receive these permanent
28 sanctions, this could lead to male doctors being over represented when examining
29 the association between sex and sanctions, and may go towards explaining the sex
30 difference observed between doctors who had sanctions imposed against their
31 registration.
32
33
34
35
36
37
38
39

40 **Comparison with other studies**

41 Our main finding, that female doctors are less likely to be subject to disciplinary
42 action when compared to their male colleagues, mirrors the results of several studies
43 from across the world which have also examined the association between doctors'
44 sex and disciplinary action^{4,6,7,8,9,10,11}. However, the majority of these studies have
45 been performed in the United States of America^{6,7,8,9}, Canada⁴, Australia and New
46 Zealand¹⁰, where the medical and legal systems differ to the UK and therefore we felt
47 that their findings may not be applicable to the UK population of doctors. These
48 studies' main objective was not necessarily to explore the association between
49 doctors' sex and disciplinary action. Some of these studies were descriptive and
50 those studies that did control for confounders did not, albeit for one study⁸, control for
51 the same confounders we have selected. To our knowledge, one study has been
52 performed in the UK using national data¹¹, however when examining the association
53
54
55
56
57
58
59
60

1
2
3 between doctors' sex and disciplinary action this study did not control for any
4 potential confounders.

5
6 The findings of this study are in agreement with previous research that has shown
7 that older doctors⁸, doctors who qualified outside of the country in which they are
8 practising^{11,13} and doctors of certain specialties⁷ are more likely to be subjected to
9 disciplinary action from a medical regulatory board. It has also been demonstrated in
10 previous studies that female doctors are more likely to have qualified more
11 recently than male doctors³, are more likely to have qualified in the country in which
12 they are practising¹⁸ and choose different specialties to male doctors¹⁹.

13
14 This study showed that the reason that male doctors receive more sanctions is not
15 because they qualified longer ago, nor because they are more likely to have qualified
16 outside the UK, despite both of those factors being associated with increased
17 likelihood of sanctions.
18
19
20
21
22
23

24 **Unanswered questions and future research**

25
26 This study has demonstrated that female doctors are less likely to receive sanctions
27 against their medical registration compared to male doctors, however it is not clear
28 why women are less likely to receive sanctions when compared to men. Exploring
29 the possible reasons for this sex difference in professional performance is required,
30 using a theoretical based approach. One theory suggested by some researchers is
31 that male and female doctors differ in communication style and hence the interaction
32 with patients and colleagues differed between the sexes, which could affect the risk
33 of being subject to a complaint^{20,21}. Future research could be performed to explore
34 this further and examine whether communication styles differ between male and
35 female doctors, and also whether the communication styles of doctors who receive
36 sanctions differ from doctors who have never received sanctions.
37
38
39
40
41
42
43

44 We have also demonstrated that the effect of sex on likelihood to receive sanctions
45 varied by specialty, with female GPs being the least likely to receive sanctions. It
46 has been demonstrated by an observational study of primary care physicians in the
47 USA that female primary care physicians spend more time with their patients when
48 compared to their male colleagues and they engaged more in conversation,
49 displaying more positive-talk, partnership-building, question-asking and information-
50 giving²². These differences in communication style and time spent with patients may
51 go towards explaining the larger sex discrepancy observed in GPs, however future
52 research is required to explore these possible reasons further.
53
54
55
56
57
58
59
60

1
2
3 Our results show that doctors who had been qualified for longer were more likely to
4 receive sanctions, it is therefore reasonable to hypothesise that the risk of receiving a
5 sanction increases with exposure. Therefore doctors who work part-time or have
6 fewer patient encounters may be less likely to receive sanctions against their
7 registration. Previous studies have demonstrated that female consultants have fewer
8 patient episodes and are more likely to work part-time when compared to their male
9 colleagues^{23,24}, it is therefore reasonable to hypothesise that the sex difference
10 observed in disciplinary action may be partly explained by the difference in work
11 patterns between the sexes. This hypothesis merits being explored further by
12 examining whether those doctors who receive sanctions are more likely to work full-
13 time and have more patient encounters than those doctors who have never received
14 sanctions.

15
16
17
18
19
20
21
22
23 A further possible explanation for the sex difference observed is perhaps that male
24 and female doctors are viewed and treated differently by the public, the profession
25 and the regulatory body. It is possible that there is a higher threshold of tolerance for
26 female doctors. The GMC are twice as likely to receive a complaint about a male
27 doctor than a female doctor¹⁶. It is reasonable to assume that as a result male
28 doctors are more likely to receive sanctions against their medical registration.
29 Research examining the perception of male and female doctors would be warranted.

30
31
32
33
34
35 It should also be noted that this study was observational in design and as such
36 causality cannot be determined. It is possible that other factors, such as ethnicity,
37 may be confounding the association between doctors' sex and disciplinary action.
38 Research examining whether other potential confounders could explain the observed
39 association is required

40
41
42
43
44 The points discussed above highlight that the real interest of this research is not
45 about the outcome sanctions itself, but about trying to understand the differences
46 between male and female doctors that lead to the observed sex difference in
47 receiving sanctions. Investigations into why and how male and female medical
48 practises differ will in turn lead to being able to propose interventions to reduce not
49 only the number of doctors referred to the medical regulatory body, but also the
50 difference between the sexes of doctors who are referred. Further exploration of why
51 doctors' sex may impact their professional performance is needed to enable the
52 profession to develop a better understanding of the factors associated with impaired
53
54
55
56
57
58
59
60

1
2
3 fitness to practise and crucially, how to better support those doctors and ensure
4 patient safety.
5
6
7

8 9 **Conclusion**

10 In this study we demonstrated that female doctors practising in the UK were less
11 likely to receive sanctions on their medical registration when compared with their
12 male colleagues. These findings remained after adjusting for known confounders.
13
14 Reasons for why this sex difference exists needs to be examined.
15
16

17 18 **Acknowledgements**

19 We acknowledge Una Lane for facilitating access to the data and for answering our
20 queries on the dataset. We acknowledge Andrew Ledgard for clarifying our queries
21 on the dataset.
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Footnotes

Contributorship statement: EU conceived and designed the study with input from KW and JD. EU and CW categorised the data. EU analysed and interpreted the data with support from KW. EU drafted the manuscript and all authors participated in the revision process and have approved this submission for publication. EU is guarantor, had full access to all of the data in the study, and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding: No specific funding was obtained for this study. EU is a PhD student, and recipient of a UCL Impact studentship. None of the funders influenced the conduct of this research.

Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf. All authors declare no competing interests that may be relevant to the submitted work.

Ethical approval: The study is part of a research project that has received ethical approval from the UCL Research Ethics Committee.

Data sharing statement: No additional data available.

Transparency declaration: EU, as guarantor, affirms that this manuscript is an honest, accurate and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Copyright: The corresponding author has the right to grant on behalf of all authors and does grant on behalf of all authors, a worldwide licence to the Publishers and its licensees in perpetuity, in all forms, formats and media (whether known now or created in the future), to i) publish, reproduce, distribute, display and store the Contribution, ii) translate the Contribution into other languages, create adaptations, reprints, include within collections and create summaries, extracts and/or, abstracts of the Contribution, iii) create any other derivative work(s) based on the Contribution, iv) to exploit all subsidiary rights in the Contribution, v) the inclusion of electronic links from the Contribution to third party material where-ever it may be located; and, iv) licence any third party to do any or all of the above.

Table 1: Distribution of variables by sex of doctors.

Variable	Male N=196,814	Female N=132,728	Total N=329,542
Sanction imposed on registration			
No	194,633 (98.9%)	132,212 (99.6%)	326,845 (99.2%)
Yes	2,181 (1.1%)	516 (0.4%)	2,697 (0.8%)
No. of years since received PMQⁱ			
0-2 years	6,332 (3.2%)	8,830 (6.7%)	15,162 (4.6%)
3-10 years	28,548 (14.5%)	37,220 (28.0%)	65,768 (20.0%)
11-20 years	52,437 (26.6%)	40,023 (30.2%)	92,460 (28.1%)
21-30 years	39,146 (19.9%)	23,069 (17.4%)	62,215 (18.9%)
31-40 years	30,206 (15.4%)	12,136 (9.1%)	42,342 (12.9%)
≥41 years	40,145 (20.4%)	11,450 (8.6%)	51,595 (15.7%)
Region where received PMQ			
UK	108,323 (55.0%)	86,989 (65.5%)	195,312 (59.3%)
EEA ⁱⁱ	25,333 (12.9%)	15,880 (12.0%)	41,213 (12.5%)
International	63,158 (32.1%)	29,859 (22.5%)	93,017 (28.2%)
Specialty			
No Specialty	94,815 (48.2%)	73,309 (55.2%)	168,124 (51.0%)
Anaesthetics	8,710 (4.4%)	3,797 (2.9%)	12,507 (3.8%)
EM ⁱⁱⁱ	754 (0.4%)	209 (0.2%)	963 (0.3%)
GP ^{iv}	37,959 (19.3%)	32,264 (24.3%)	70,223 (21.3%)
Medicine	15,076 (7.7%)	6,775 (5.1%)	21,851 (6.6%)
O&G ^v	2,934 (1.5%)	1,966 (1.5%)	4,900 (1.5%)
Ophthalmology	2,508 (1.3%)	1,078 (0.8%)	3,586 (1.1%)
Paediatrics	3,906 (2.0%)	3,891 (2.9%)	7,797 (2.4%)
Pathology	5,589 (2.8%)	2,965 (2.2%)	8,554 (2.6%)
Psychiatry	5,494 (2.8%)	3,077 (2.3%)	8,571 (2.6%)
Radiology	172 (0.1%)	41 (0.03%)	213 (0.1%)
Surgery	16,452 (8.4%)	1,942 (1.5%)	18,394 (5.6%)
Other	1,330 (0.7%)	867 (0.7%)	2,197 (0.7%)
Dual Specialty	1,115 (0.6%)	547 (0.4%)	1,662 (0.5%)

ⁱPrimary Medical QualificationⁱⁱEuropean Economic AreaⁱⁱⁱEmergency Medicine^{iv}General Practice^vObstetrics & Gynaecology

Table 2: The distribution of sanctions for each variable and the association of individual factors with sanctions.

Variable	Total number of doctors	Sanctions (%)	p-value
Sex			<0.001
Male	196,814	1.1%	
Female	132,728	0.4%	
No. of years since received PMQⁱ			<0.001
0-2	15,162	0.1%	
3-10	65,768	0.6%	
11-20	92,460	0.8%	
21-30	62,215	1.1%	
31-40	42,342	1.4%	
≥41	51,595	0.7%	
Region where received PMQ			<0.001
UK	195,312	0.6%	
EEA ⁱⁱ	41,213	0.9%	
International	93,017	1.2%	
Specialty			<0.001
No Specialty	168,124	0.7%	
Anaesthetics	12,507	0.7%	
EM ⁱⁱⁱ	963	0.7%	
GP ^{iv}	70,223	1.2%	
Medicine	21,851	0.5%	
O&G ^v	4,900	1.2%	
Ophthalmology	3,586	0.5%	
Paediatrics	7,797	0.6%	
Pathology	8,554	0.6%	
Psychiatry	8,571	0.8%	
Radiology	213	0.5%	
Surgery	18,394	0.9%	
Other	2,197	0.3%	
Dual Specialty	1,662	1.4%	

ⁱPrimary Medical QualificationⁱⁱEuropean Economic AreaⁱⁱⁱEmergency Medicine^{iv}General Practice^vObstetrics & Gynaecology

Table 3: The adjusted odds ratio for having sanctions against registration for each variable compared to its baseline having adjusted for all other variables.

Variable	Adjusted OR ⁱ	95% CI ⁱⁱ	p-value
Sex of a doctor			
			<0.0001
Male	1		
Female	0.37	0.33-0.41	
No. of years since received PMQ			
			<0.0001
0-2	1		
3-10	3.42	2.20-5.32	
11-20	3.85	2.48-5.98	
21-30	5.66	3.63-8.81	
31-40	6.44	4.13-10.05	
≥41	3.12	1.20-4.87	
Region where received PMQ			
			<0.0001
UK	1		
EEA	1.33	1.17-1.50	
International	1.65	1.51-1.80	
Specialty			
			<0.0001
No Specialty	1		
Anaesthetics	0.65	0.52-0.82	
EM	0.66	0.31-1.39	
GP	1.43	1.29-1.58	
Medicine	0.49	0.40-0.60	
O&G	1.22	0.93-1.59	
Ophthalmology	0.53	0.33-0.83	
Paediatrics	0.64	0.47-0.88	
Pathology	0.65	0.50-0.86	
Psychiatry	0.81	0.63-1.04	
Radiology	0.47	0.07-3.38	
Surgery	0.78	0.66-0.93	
Other	0.36	0.17-0.77	
Dual Specialty	1.37	0.90-2.09	

ⁱ Odds Ratio

ⁱⁱ Confidence Interval

Table 4: Stratum-specific odds ratios for having sanctions imposed on registration if the doctor is female for each specialty divided into four categories.

Variable	Stratum-Specific OR ⁱ	95% CI ⁱⁱ	p-value
Specialty Category			
			<0.0001
No Specialty	0.43	0.38-0.49	
GP	0.26	0.22-0.31	
Hospital Specialty	0.44	0.36-0.56	
Dual Specialty	0.09	0.13-0.70	

ⁱ Odds Ratio

ⁱⁱ Confidence Interval

References

1. General Medical Council. *The state of medical education and practice in the UK*. London: GMC; 2012.
2. Dyer C. GMC and vulnerable doctors: too blunt an instrument? *BMJ* 2013; 347: f6230.
3. Elston MA. *Women and medicine: the future*. London: Royal College of Physicians; 2009.
4. Alam A, Klemensberg J, Griesman J et al. The characteristics of physicians disciplined by professional colleges in Canada. *Open Medicine* 2011; 5(4): e173-e174.
5. Cardarelli R & Licciardone, JC. Factors associated with high-severity disciplinary action by a state medical board: a Texas study of medical license revocation. *JAOA* 2006; 106(3): 153-156.
6. Clay SW & Conaster RR. Characteristics of physicians disciplined by the State Medical Board of Ohio. *JAOA* 2003; 103(2): 81-88.
7. Khaliq AA, Dimassi H, Huang CY, et al. Disciplinary action against physicians: who is likely to get disciplined? *The American Journal of Medicine* 2005; 118(7): 773-777.
8. Kohatsu ND, Gould D, Ross LK et al. Characteristics associated with physician discipline: a case-control study. *Archives of Internal Medicine* 2004; 164(6): 653-658.
9. Morrison J & Wickersham P. Physicians disciplined by a State Medical Board. *JAMA* 1998; 279: 1889-1893.
10. Elkin KJ, Spittal MJ, Elkin DJ et al. Doctors disciplined for professional misconduct in Australia and New Zealand, 2000-2009. *MJA* 2011; 194: 452-456.
11. Wakeford R. Who gets struck off? *BMJ* 2011; 343: d7842.
12. General Medical Council. *A guide for doctors referred to the GMC*. http://www.gmc-uk.org/concerns/doctors_under_investigation/a_guide_for_referred_doctors.asp (accessed December 2013)
13. Humphrey C, Hickman S & Gulliford MC. Place of medical qualification and outcomes of UK General Medical Council "fitness to practise" process: cohort study. *BMJ* 2011; 342: d1817.
14. European Union. *Countries*. http://europa.eu/about-eu/countries/index_en.htm (accessed May 2013).
15. Von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for Reporting Observational Studies. *PLoS Med* 2007; 4(10): e296.
16. General Medical Council. *The state of medical education and practice in the UK*. London: GMC; 2013.
17. General Medical Council. *Guidance on making decisions on voluntary erasure applications*. GMC; 2013.
18. Lambert TW, Goldacre MJ & Parkhouse J. Doctors who qualified in the UK between 1974 and 1993: age, gender, nationality, marital status and family formation. *Medical Education* 1998; 32(5): 533-537.
19. Lambert TW, Goldacre MJ, Edwards C, et al. Career preferences of doctors who qualified in the United Kingdom in 1993 compared with those doctors qualifying in 1974, 1977, 1980, and 1983. *BMJ* 1996; 313(7048): 19-24.
20. Taragin TI, Wilczek AP, Karns ME, et al. Physician demographics and the risk of medical malpractice. *The American Journal of Medicine* 1992; 93(5): 537-542.
21. Firth-Cozens, J. Doctors with difficulties: why so few women? *Postgraduate Medical Journal* 2008; 84(992): 318-320.
22. Roter D, Lipkin M & Korsgaard A. Sex differences in patients' and physicians' communication during primary care medical visits. *Medical Care* 1991; 29(11): 1083-1093.
23. Bloor K, Freemantle N & Maynard A. Gender and variation in activity rates of hospital consultants. *J R Soc Med* 2008; 101(1): 27-33.
24. Goldacre MJ, Lambert TW & Davidson JM. Loss of British-trained doctors from the medical workforce in Great Britain. *Med Educ* 2001; 35(4): 337-344.

Title Page

Disciplined doctors: does the sex of a doctor matter?

A cross-sectional study examining the association between a doctor's sex and receiving sanctions against their medical registration.

Formatted: Font: 12 pt

Emily Unwin, Katherine Woolf, Clare Wadlow, Jane Dacre

Corresponding author:

Prof Jane Dacre, Director UCL Medical School
UCL Medical School, 74 Huntley Street. London, WC1E 6AU. UK
j.dacre@ucl.ac.uk
Tel: 020 7679 0894
Fax: 020 7679 0890

Dr Emily Unwin, PhD student
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Dr Katherine Woolf, Lecturer
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Dr Clare Wadlow, Clinical training fellow
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Key words:

Law, Medical education & training, epidemiology, GMC, gender

Word count:

4432

Abstract

Objectives: To examine the association between doctors' sex and receiving sanctions on their medical registration, whilst controlling for other potentially confounding variables.

Design: Cross-sectional study.

Setting: The General Medical Council's (GMC) List of Registered Medical Practitioners (LRMP) database of doctors practising in the United Kingdom (UK).

Population: All doctors on the GMC's LRMP on 29th May 2013. The database included all doctors who are or have been registered to practice medicine in the UK since October 2005. The exposure of interest was doctor's sex. Confounding variables included years since primary medical qualification, world region of primary medical qualification and specialty.

Outcome measures: Sanctions on a doctor's medical registration. Sanction types included warning, undertakings, conditions, suspension or erasure from the register. Binary logistic regression modelling, controlling for the confounders, described the association between doctor's sex and sanctions on a doctor's medical registration.

Results: Of the 329,542 doctors on the LRMP, 2,697 doctors (0.8%) had sanctions against their registration, 516 (19.1%) of whom were female. In the fully adjusted model, female doctors had nearly a third of the odds (OR 0.37, 95% CI: 0.33-0.41) of having sanctions compared to male doctors. There was evidence that the association varies with specialty, with female doctors who had specialised as [General Practitioners \(GPs\)](#) being the least likely to receive sanctions compared to their male colleagues ([OR 0.26, 95% CI: 0.22-0.31](#)).

Conclusions: Female doctors have reduced odds of receiving sanctions on their medical registration when compared to their male colleagues. This association remained after adjustment for the confounding factors. These results are representative of all doctors registered to practice in the UK. Further exploration of why doctors' sex may impact their professional performance is underway.

Article summary

Strengths and limitations of this study

- We used a large national database with no missing data, so the findings of the study apply to all doctors registered to practise in the UK.
- Receiving sanctions is a rare outcome and using a large dataset is crucial when examining rare outcomes.
- This is one of the first studies of this nature on UK data that adjusted for known confounders.
- The study was constrained by the variables collected and made available by the GMC. So we were unable to examine the effect of other potential confounding factors.
- The data available did not provide the reasons for why a sanction had been imposed, nor data on those granted voluntary erasure. A more detailed evaluation of the reasons for referral to the GMC may go towards explaining the sex difference observed.

Introduction

The number of complaints about doctors' fitness to practise received by the UK medical regulatory body, the General Medical Council (GMC), has been increasing since 2007¹. Following a triage and investigation process by the GMC the outcome of a case against a doctor can be closed, or can result in a sanction against the doctor's registration. The cost of this regulatory process, both in terms of financial cost of the actual complaints investigation procedure, but also in terms of the loss of the medical workforce during the process, can be significant. The level of stress that a doctor endures while undergoing a fitness to practise investigation was recently reported in the BMJ and highlights the impact the complaints investigation procedure can have on the mental well being of doctors².

One of the most significant changes in the medical profession has been the increase in the number of women entering this previously male dominated profession. The number of female medical students has been increasing since the mid-1960s with female medical students outnumbering male medical students since the mid-1990s³. It is predicted that female doctors will outnumber their male colleagues by 2017³. This change in the demographic profile of UK doctors has brought with it a heightened interest in how the increase of female doctors may impact the profession.

Examining and understanding the predictors of doctors receiving sanctions may aid the medical profession in identifying doctors whose performance might raise future concerns, in order to support these doctors and help prevent GMC referral. Research from [Canada](#), the United States of America [and Australia and New Zealand](#) has suggested that male and female doctors differ in terms of risk of disciplinary action, with male doctors being at increased risk^{4,5,6,7,8,9,10}. However, the applicability of the findings from these ~~American~~ studies to the UK may be limited due to differences in both the medical and legal systems in these countries. In 2011 Wakeford explored the situation in the UK¹¹. He examined the factors associated with severest outcomes of the GMC disciplinary procedures, suspension or erasure from the medical register. In agreement with the ~~se worldwide-American~~ studies, he demonstrated that female doctors were four times less likely to be disciplined when compared to male doctors. However, the interpretation of this finding is limited because the measure of effect for doctors' sex was not adjusted for potential confounders.

1
2
3
4
5
6 We aimed to examine the effect of doctors' sex on receiving sanctions against their
7 medical registration, while adjusting for known confounding factors. This would allow
8 for a meaningful comparison of male and female doctors and their experience of
9 disciplinary action in the UK.
10

11 12 13 **Methods**

14 **Study design, setting and source of data**

15 We conducted a cross-sectional study using UK-wide data. The data [and permission](#)
16 [to use the data for research purposes](#) were obtained from the GMC. [This study is](#)
17 [part of a research project that has received ethical approval from the UCL Research](#)
18 [Ethics Committee.](#)
19

20 Under the Medical Act 1983 the GMC is required to keep up-to-date registers of
21 qualified doctors. The main register is the List of Registered Medical Practitioners
22 (LRMP). The LRMP is a list of all doctors registered to practise medicine in the UK,
23 and as such changes daily. [It lists those doctors who are \(or could\) practise](#)
24 [medicine, as well as those doctors who have been suspended or erased.](#) The GMC
25 provided us with a snapshot of doctors registered on the LRMP on the 29th May
26 2013. The list included [all](#) doctors who have been registered with the GMC [\(and](#)
27 [therefore eligible to actively practise medicine\)](#) at any point in the period 20th October
28 2005^a – 28th May 2013. The different categories of registration status included:
29 provisionally [or fully](#) registered ~~with a licence; provisionally registered without a~~
30 ~~licence; registered with a licence; registered without a licence;~~ suspended; not
31 registered – administrative reason, ~~or ; not registered~~ – deceased, ~~or having~~
32 ~~relinquished registration;~~ [and](#) not registered – erased after Fitness to Practise panel
33 hearing; ~~and not registered~~ ~~having relinquished registration.~~ The database
34 provided details of doctor's sex; the year, country, and institutions of the doctor's
35 primary medical qualification [and the doctor's current registration status, including](#)
36 [whether they currently had any sanctions on their medical registration \(see below for](#)
37 [details\).](#) It classified doctors as General Practitioners (GPs) (on the GP register) and
38 [as hospital specialists \(on the Specialist register\).](#) Doctors who are neither on the
39 GP or Specialist registers are doctors who have not undertaken or completed
40 speciality training; ~~date of entry on the GP and/or Specialist registers (when they~~
41 ~~complete speciality training and qualify as a specialist); and the doctor's current~~
42 ~~registration status, including whether they currently had any sanctions on their~~
43 ~~medical registration (see below for details).~~
44
45
46
47
48
49
50
51
52
53

54 ^a The 20th October 2005 was the date when the GMC first began to publish full details of a doctor's
55 registration status on the LRMP online.
56
57
58
59
60

Population

All doctors who were listed on the LRMP on the 29th May 2013 were included.

Primary outcome and exposure

The outcome of interest was sanctions on a doctor's medical registration on the 29th May 2013.

The types of sanctions included:

- **Warning:** issued when a doctor's performance has not been in keeping with the principles set by the GMC for doctors, but a restriction on the doctor's registration is not necessary. Warnings remain on the LRMP for a five year period;
- **Undertakings:** an agreement between the GMC and the doctor about the doctor's future practice. The doctor must adhere to these undertakings to maintain their registration;
- **Conditions:** set out by the GMC and restrict a doctor's practice. The doctor must comply with these conditions to maintain their registration. Conditions can initially be imposed for a maximum of three years and then be renewed in periods of up to 36 months;
- **Suspension or erasure:** the doctor's licence is withdrawn by the GMC and they are no longer able to practise. Suspension from the register can last up to 12 months, but may be indefinite in certain circumstances.

A sanction can be imposed if a doctor's fitness to practise has been proved to be impaired. The impairment can result from misconduct; poor professional performance; physical or mental ill health; or a conviction or fitness to practise determination by another regulatory body either in the UK or overseas¹². However it is recognised that the reason for impairment can cross more than one category (for example a doctor with a drug misuse problem could be classified as having mental ill health, yet the effects of the drug abuse could impact their professional performance). The duration of a sanction on a doctor's registration varies and it is possible for doctors to have more than one sanction against their registration and this typically represents the outcomes of different complaints. It was not possible to establish the date a sanction was imposed or the reason for why a sanction had been imposed from the available data.

1
2
3
4
5
6 The outcome of interest was collapsed into a binary variable: doctors with sanctions
7 against their registration; and doctors with no sanctions against their registration.
8
9

10 The exposure of interest was doctor's sex, as declared by the doctor to the GMC.
11

12 **Selection of variables**

13
14 The variables included in the study were selected before any statistical analysis.
15 Data was available on the year of primary medical qualification (PMQ), country of
16 PMQ and primary specialty, if on the Specialist or General Practitioner (GP)
17 Registers. These variables were selected as a priori confounders based on findings
18 from earlier research^{7,8,11,13}, which demonstrated that these factors may influence the
19 risk of receiving sanctions.
20
21

22 Once the variables had been selected, we performed a variable reduction process, to
23 reduce the number categories into meaningful categories. Once again, this was
24 performed before any statistical analysis. The variable 'year of PMQ' was converted
25 into 'number of years since qualification' by subtracting the year of PMQ from 2013
26^b. We then collapsed the variable into six categories. The first category '0-2 years'
27 represented Foundation Training, the second category '3-10 years' represented the
28 bulk of time a doctor would likely spend in Specialty Training. The subsequent
29 categories were divided into 10-year blocks. The variable 'country of PMQ' was
30 collapsed into three categories; 'UK', 'EEA' (European Economic Area) and
31 'International'. The list of countries included in the EEA category was obtained from
32 the European Union website¹⁴ and included all countries that were members before
33 May 2013. The variable 'specialty' was divided into fourteen categories. Doctors
34 who were not present on either the Specialist Register or the GP Register were
35 categorised as having 'no specialty' **and represented trainee and other non-specialist**
36 **doctors**. Doctors on both the Specialist Register and the GP Register were recorded
37 as having 'dual specialty' and doctors only on the GP register were categorised as
38 'GP'. For doctors only registered on the Specialist Register, their primary specialty
39 was taken and recorded into one of eleven categories. To categorise those doctors
40 on the Specialist Register two researchers (EU and CW) independently allocated
41 each primary specialty to a specialty category. Kappa statistic demonstrated a good
42 level of agreement (kappa = 0.72). Any disagreements about specialty category
43 allocation were resolved through discussion.
44
45
46
47
48
49
50
51

52
53 ^b As mentioned above, a doctor could appear in the LRMP dataset if they had been removed from the
54 medical register. The actual date of those doctors being removed could lie anytime between 20th
55 October 2005 and 28th May 2013. However, as no actual removal dates were given for those doctors,
56 we used 2013 for all doctors.
57
58
59
60

Statistical methods

We took a causal modelling analysis approach to analyse the data. We firstly performed bivariate analyses to look for crude associations in the data, followed by Mantel-Haenszel analyses, before going on to complete multivariate analyses using binary logistic regression modelling. The initial logistic regression model included only the exposure (sex) and outcome (sanctions) variables to provide a crude measure of effect. The final logistic regression model was built to include all potential confounder variables, while checking for multicollinearity. The final logistic regression model enabled the calculation of an adjusted measure of effect. The final model was assessed for the presence of effect modifiers following the findings from the Mantel-Haenszel analyses.

Statistical analyses were conducted using the software Stata 12/SE.

We used the STROBE Statement¹⁵ to guide our study report.

Results

There were 329,542 doctors on the LRMP on the 29th May 2013, of whom 40.3% were female. Table 1 shows the distribution of variables by the sex of doctors. The median number of years since qualification was 19 years. The distribution of the number of years since a doctor had qualified was skewed to the right with the majority of the doctors qualifying 11-20 years ago (28.1%). The majority of the doctors had received their PMQ from a UK medical school (59.3%).

Approximately half of all the doctors were neither on the GP Register nor the Specialist Register (51.0%), of which the majority (58.0%) had received their PMQ greater than 10 years previously. It is interesting to note that half of the doctors registered to practise medicine in the UK in this period were not registered specialists (they were neither on the GP or Specialist registers) and the majority of these doctors had qualified greater than ten years ago, suggesting that these doctors are not trainee doctors, but doctors who have elected not to complete specialty training.

Of those doctors who had specialised, General Practice was the most popular specialty (21.3%), followed by Medicine (6.6%). 0.5% of the doctors were on both the Specialist and GP Registers.

2697 (0.8%) doctors had sanctions against their registration on the 29th May 2013. There was a higher proportion of male doctors who had sanctions against their

1
2
3
4
5
6 registration when compared to female doctors (1.1% of all male doctors compared
7 with 0.4% of all female doctors, $\chi^2=505.4$, $P<0.001$). There was strong evidence for
8 an association between receiving sanctions and the number of years since received
9 PMQ, with doctors who qualified 31-40 years ago having the highest proportion of
10 sanctions; world region of PMQ, with doctors who qualified outside the EEA with the
11 highest proportion of doctors with sanctions; and specialty, with doctors on both the
12 Specialist and GP Registers having the highest proportion of doctors with sanctions.
13 These results are presented in Table 2.
14
15
16

17
18 Using bivariate analyses we compared female doctors to male doctors. There was a
19 strong trend between sex of a doctor and the number of years since the doctor
20 received their PMQ, with female doctors being more likely to have recently qualified
21 and the proportion of female doctors reducing as the number of years since PMQ
22 increased. We also found that female doctors were more likely to have qualified in
23 the UK (65.5% of all female doctors compared to 55.0% of all male doctors) and
24 male doctors were more likely to have qualified outside of the EEA (32.1% of all male
25 doctors compared to 22.5% of all female doctors). Approximately equal proportions
26 of male and female doctors qualified in the EEA (12.9% and 12.0% respectively).
27 Both sexes were more likely to be not registered in a specialty (GP or hospital),
28 though there was a slightly higher proportion of women when compared to men who
29 were not on the Specialist or GP Registers. When examining those doctors who
30 were registered in a specialty, a higher proportion of female doctors were on the GP
31 Register compared to male doctors (24.3% of female doctors compared with 19.3%
32 of male doctors) and a higher proportion of male doctors were registered with a
33 hospital specialty (32.0% of male doctors compared with 20.1% of female doctors).
34 In summary, number of years since received PMQ, world region where PMQ was
35 received, and registered specialty were associated with both the outcome (sanctions)
36 and the exposure (sex of a doctor) and as such we considered these variables as
37 confounders.
38
39
40
41
42
43
44
45

46 The unadjusted odds ratio for having sanctions against a doctor's registration
47 comparing female doctors with male doctors was 0.35 (95% CI: 0.32-0.38),
48 suggesting that being a female doctor is protective of receiving sanctions.
49

50 Mantel-Haenszel analyses and tests of homogeneity were conducted to examine the
51 change in the strength of the association between sanctions and sex while controlling
52 for each of the confounders separately.
53
54
55
56
57
58
59
60

1
2
3
4
5
6 There was strong evidence that the true odds ratios were different between the
7 different specialty categories ($P=0.0002$), therefore specialty was considered as an
8 effect modifier when conducting multivariate analyses.
9

10
11 Table 3 represents the results from the binary logistic regression model built to adjust
12 for all the variables. After taking into account the number of years since PMQ, world
13 region where the doctor received their PMQ and specialty, female doctors had nearly
14 a third of the odds of having sanctions on their registration compared to male doctors
15 (OR 0.37, 95% CI: 0.33-0.41, $P<0.0001$).
16

17
18 All of the a priori confounders were felt to be confounders because the adjusted odds
19 ratio changed when each variable was added to the model. We found no evidence
20 of multicollinearity.
21

22 The Mantel-Haenszel analyses suggested that specialty may be an effect modifier,
23 we therefore performed a statistical test for effect modification by firstly collapsing the
24 specialty variable into four groups to increase the power of the test. Table 4
25 demonstrates that specialty was felt to be an important effect modifier with female
26 doctors being less likely to receive sanctions when compared to male doctors, but
27 the effect was greater for GPs than for those doctors with no specialty or practising a
28 hospital specialty.
29
30
31

32
33 ~~Upon discovering the strong evidence for an association between doctor's sex and~~
34 ~~likelihood of receiving sanctions on a doctor's registration, we decided to further the~~
35 ~~findings by performing post-hoc analyses to establish whether the type of sanction~~
36 ~~imposed on a doctor's registration was associated with doctor's sex. All variables~~
37 ~~were categorised to create binary variables to ensure there were sufficient cases in~~
38 ~~each category of variable. The results displayed in Table 5 demonstrate that female~~
39 ~~doctors have reduced odds of having each type of sanction imposed on their~~
40 ~~registration when compared to their male colleagues. Female doctors had~~
41 ~~approximately one third of the odds of receiving a warning, being suspended or~~
42 ~~erased from the register and they had just over half the odds of receiving~~
43 ~~undertakings or conditions on their registration compared to male doctors. The~~
44 ~~Mantel-Haenszel analyses suggested that when examining the outcome 'warning'~~
45 ~~specialty may be an effect modifier, and when examining the outcome 'erased' world~~
46 ~~region where received PMQ may be an effect modifier, we therefore performed a~~
47 ~~statistical test for effect modification. Specialty was demonstrated to be an important~~
48 ~~effect modifier when examining the association between warning and sex, with~~
49 ~~female specialists having approximately half the odds of receiving a warning~~
50
51
52
53
54
55
56
57
58
59
60

~~compared to male specialists, whereas for male and female doctors without a specialty there was no strong evidence for a difference in the odds of receiving a warning (see Table 6). World region where a doctor received their PMQ was also shown to be an important effect modifier when examining the association between erasure and sex. Female doctors who had received their PMQ in the UK had approximately one fifth of the odds of being erased, whereas female doctors who received their PMQ outside of the UK had approximately one third of the odds of being erased when compared to their male colleagues (see Table 7).~~

Discussion

In our large cross-sectional study we found strong evidence that being female was associated with a reduction in odds of receiving sanctions (OR 0.35, 95% CI: 0.32-0.38) in the unadjusted model. Controlling for years since PMQ, world region where received PMQ, and specialty did slightly increase this odds ratio (OR 0.37, 95% CI: 0.33-0.41, $P < 0.0001$), but there remained strong evidence for the association between doctor's sex and receiving sanctions. There was evidence that the association varied with specialty, with female GPs being the least likely to have sanctions against their registration. ~~Post hoc analyses demonstrated the association between receiving a warning varied with specialty registration, with female specialists having less than half the odds of receiving a warning when compared to their male colleagues, but no real evidence for a difference between the sexes and receiving a warning in doctors who had not yet specialised. Post hoc analyses also provided evidence to show that the odds of being erased from the medical register varied depending on where a doctor had received their PMQ, with female doctors who had received their PMQ in the UK being the least likely to be erased from the medical register.~~

To our knowledge this is the first study in the UK to examine the association between doctor's sex and receiving sanctions against medical registration, while adjusting for known confounders. We believe that these known confounders have only been adjusted for in one other study which was conducted in the USA⁸.

Strengths and weaknesses of this study

One of the major strengths of this study is that we used a large national database. The advantage of using this dataset is two-fold; firstly, because a national database was used the findings of the study apply to all doctors registered to practise in the

1
2
3
4
5
6 UK; secondly, receiving sanctions is a rare outcome and using a large dataset is
7 crucial when examining rare outcomes.

8
9 A further strength of this study is that it adjusted for known confounders, all these
10 confounders have only been adjusted for in one previous study, which was
11 conducted in California⁸. Previous research on UK data did not adjust the measure
12 of effect of sex for potential confounders¹¹.

13
14 Finally, a further advantage was the completeness of the dataset. The data is
15 collected by the GMC for inclusion on the LRMP, and not research purposes.
16 Doctors are required to provide the data to the GMC to be registered and as such
17 there is no missing data. However, the fact the data is not collected for research
18 purposes is also a limitation of the study. The study was constrained by the
19 variables collected and made available by the GMC. As such, we were only able to
20 explore the variables available and we were unable to examine the effect of other
21 potential confounding factors or explore the reasons for why a sanction had been
22 imposed.

23
24 It could be argued that the reason for referral to the GMC could be a source of
25 residual confounding if systematic differences exist between the sexes. The GMC
26 may take action against a doctor's registration for a number of reasons, which can be
27 broadly divided into three major categories; including misconduct; poor professional
28 performance; or physical or mental ill health. The data available did not provide the
29 reasons or the category for why a sanction had been imposed, but a more detailed
30 evaluation of the reasons for referral to the GMC may go towards explaining the sex
31 difference observed. In their research, Alam et al.⁴ and Elkin et al.¹⁰, demonstrated
32 not only that male doctors were more likely to be subject to disciplinary action, but
33 that the main offense for which a doctor was being disciplined was sexual
34 misconduct. It is possible that male doctors are more likely to commit an offense
35 involving sexual misconduct than their female colleagues, which may go towards
36 explaining the sex difference seen in these populations. However, other studies in
37 this area did not find sexual misconduct to be the most common offense^{6,7,9}. As
38 such, exploring the offenses for which a doctor may receive disciplinary action in this
39 population may go towards explaining the sex difference observed and may help the
40 regulatory body and medical profession to introduce targeted interventions, such as
41 education programmes, to reduce the number of offenses.

42
43 A further source of residual confounding could be the route of referral. Doctors
44 practising in the UK can be referred to the GMC through five main routes: the public;
45 employers; doctors; the GMC; and the police¹⁶. It would be interesting to examine
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

whether the referral rate for each route demonstrates any sex differences, and if so, exploring the reasons for this difference.

A further limitation is that a doctor can apply for voluntary erasure from the LRMP during an investigation process. Once again, this is a potential source of residual confounding and it is possible that the sex of doctors who are subject to a complaints investigation and apply for voluntary erasure differs to those doctors who complete the investigative process and receive a sanction (however, ~~it is important to note that~~ the GMC's decision to grant a request for voluntary erasure is based on the public interest and the doctor's health and likelihood to return to practise¹⁷⁴). It is important to note that voluntary erasure is requested by doctors for multiple reasons other than being involved in an investigation process, including retiring permanently from practising medicine or leaving the UK to work permanently abroad. To explore whether voluntary erasure requests may explain the sex difference seen, the reason for why a voluntary erasure request was submitted would first have to be ascertained. This information was not available in the dataset used for this research, but could be requested and explored in future studies.

It is also of interest to note that certain sanctions (erasure and some suspensions) are permanent, whereas other sanctions are time limited. As such, the permanent sanctions may be over represented because they will never be removed from a doctor's registration. If male doctors are more likely to receive these permanent sanctions, this could lead to male doctors being over represented when examining the association between sex and sanctions, and may go towards explaining the sex difference observed between doctors who had sanctions imposed against their registration.

Comparison with other studies

Our main finding, that female doctors are less likely to be subject to disciplinary action when compared to their male colleagues, mirrors the results of several studies from across the world which have also examined the association between doctors' sex and disciplinary action.~~Several studies have examined the association between doctors' sex and disciplinary action, with the majority of these studies demonstrating that female doctors are less likely to be subject to disciplinary action than male doctors~~^{4,4,6,7,8,9,10,11,5,6,7,8,9}. However, the majority of these studies have been performed in the United States of America^{6,7,8,9}, Canada⁴, Australia and New Zealand¹⁰, where the medical and legal systems differ to the UK and therefore we felt that their findings may not be applicable to the UK population of doctors. These

1
2
3
4
5
6 studies' main objective was not necessarily to explore the association between
7 doctors' sex and disciplinary action. Some of these studies were descriptive and
8 those studies that did control for confounders did not, albeit for one study⁸, control for
9 the same confounders we have selected. To our knowledge, one study has been
10 performed in the UK using national data¹¹, however when examining the association
11 between doctors' sex and disciplinary action this study did not control for any
12 potential confounders.

13
14
15 The findings of this study are in agreement with previous research that has shown
16 that older doctors⁸, doctors who qualified outside of the country in which they are
17 practising^{11,13} and doctors of certain specialties⁷ are more likely to be subjected to
18 disciplinary action from a medical regulatory board. It has also been demonstrated in
19 previous studies that female doctors are more likely to have qualified more
20 recently than male doctors³, are more likely to have qualified in the country in which
21 they are practising¹⁸ and choose different specialties to male doctors¹⁹.

22
23
24 This study showed that the reason that male doctors receive more sanctions is not
25 because they qualified longer ago, nor because they are more likely to have qualified
26 outside the UK, despite both of those factors being associated with increased
27 likelihood of sanctions.
28
29

30 31 32 **Unanswered questions and future research**

33 This study has demonstrated that female doctors are less likely to receive sanctions
34 against their medical registration compared to male doctors, however it is not clear
35 why women are less likely to receive sanctions when compared to men. Exploring
36 the possible reasons for this sex difference in professional performance is required,
37 using a theoretical based approach. One theory suggested by some researchers is
38 that male and female doctors differ in communication style and hence the interaction
39 with patients and colleagues differed between the sexes, which could affect the risk
40 of being subject to a complaint^{20,21}. Future research could be performed to explore
41 this further and examine whether communication styles differ between male and
42 female doctors, and also whether the communication styles of doctors who receive
43 sanctions differ from doctors who have never received sanctions.
44
45
46
47
48

49 We have also demonstrated that the effect of sex on likelihood to receive sanctions
50 varied by specialty, with female GPs being the least likely to receive sanctions. It
51 has been demonstrated by an observational study of primary care physicians in the
52 USA that female primary care physicians spend more time with their patients when
53 compared to their male colleagues and they engaged more in conversation,
54
55
56
57
58
59
60

1
2
3
4
5
6 displaying more positive-talk, partnership-building, question-asking and information-
7 giving²². These differences in communication style and time spent with patients may
8 go towards explaining the larger sex discrepancy observed in GPs, however future
9 research is required to explore these possible reasons further.
10

11
12
13 Our results show that doctors who had been qualified for longer were more likely to
14 receive sanctions, it is therefore reasonable to hypothesise that the risk of receiving a
15 sanction increases with exposure. Therefore doctors who work part-time or have
16 fewer patient encounters may be less likely to receive sanctions against their
17 registration. Previous studies have demonstrated that female consultants have fewer
18 patient episodes and are more likely to work part-time when compared to their male
19 colleagues^{23,24}, it is therefore reasonable to hypothesise that the sex difference
20 observed in disciplinary action may be partly explained by the difference in work
21 patterns between the sexes. This hypothesis merits being explored further by
22 examining whether those doctors who receive sanctions are more likely to work full-
23 time and have more patient encounters than those doctors who have never received
24 sanctions.
25
26
27
28
29

30
31 A further possible explanation for the sex difference observed is perhaps that male
32 and female doctors are viewed and treated differently by the public, the profession
33 and the regulatory body. It is possible that there is a higher threshold of tolerance for
34 female doctors. The GMC are twice as likely to receive a complaint about a male
35 doctor than a female doctor¹⁶. It is reasonable to assume that as a result male
36 doctors are more likely to receive sanctions against their medical registration.
37 Research examining the perception of male and female doctors would be
38 warranted.~~We have also shown that female specialists are much less likely than~~
39 ~~male specialists to receive a warning, but the sex difference disappears for doctors~~
40 ~~who have not yet specialised. The association between sex and the other types of~~
41 ~~sanctions was not found to vary with specialty registration. Examining why receiving~~
42 ~~warnings varies according to specialty registration, with a sex difference being~~
43 ~~observed in specialists, merits being explored. Possibilities include that the threshold~~
44 ~~for delivering a warning to a non-specialist is lower than for a specialist because it~~
45 ~~may be more likely that a non-specialist is at an early stage of their career and~~
46 ~~perhaps the medical regulatory body feel it is important to highlight that behaviour~~
47 ~~which demonstrates a significant departure from the principles of Good Medical~~
48 ~~Practice as set out by the GMC will be dealt with seriously and the warning may be~~
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6 hoped to act as a deterrent for any future more serious demonstrations of departure
7 from the principles set out by the GMC.
8

9
10 Our results have demonstrated that female doctors who qualified in the UK are the
11 least likely to be erased from the medical register (the most severe sanction to be
12 imposed). Female doctors who qualified outside of the UK are less likely to be
13 erased from the medical register than their male colleagues who qualified outside of
14 the UK, but they are more likely to be erased than their female colleagues who
15 qualified in the UK. These results echo the findings of a cohort study conducted by
16 Humphrey et al.¹¹ who demonstrated that referrals to the GMC concerning doctors
17 who had received their PMQ outside of the UK was associated with the most severe
18 sanctions on their registration (suspension or erasure).
19

20
21 Our results also show that female doctors have approximately one third of the odds
22 of being erased or suspended, and just over half the odds of receiving undertakings
23 or conditions when compared to their male colleagues. These results suggest that,
24 with the exception of the sanction 'warning', the more severe the sanction
25 (suspension or erasure from the medical register) the more likely men will receive it.
26 Exploring the reasons for this sex difference in the severity of sanctions imposed
27 would be of interest. It is possible that male doctors' behaviour and actions warrant
28 the severest types of sanctions to be imposed, whereas female doctors' behaviour
29 and actions do not require such severe sanctions. Examining the reasons for why
30 doctors have received sanctions would go towards showing whether this is in fact the
31 case.
32
33

34
35 It should also be noted that this study was observational in design and as such
36 causality cannot be determined. It is possible that other factors, such as ethnicity,
37 may be confounding the association between doctors' sex and disciplinary action.
38 Research examining whether other potential confounders could explain the observed
39 association is required
40

41
42 The points discussed above highlight that the real interest of this research is not
43 about the outcome sanctions itself, but about trying to understand the differences
44 between male and female doctors that lead to the observed sex difference in
45 receiving sanctions. Investigations into why and how male and female medical
46 practises differ will in turn lead to being able to propose interventions to reduce not
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6 only the number of doctors referred to the medical regulatory body, but also the
7 difference between the sexes of doctors who are referred. Further exploration of why
8 doctors' sex may impact their professional performance is needed to enable the
9 profession to develop a better understanding of the factors associated with impaired
10 fitness to practise and crucially, how to better support those doctors and ensure
11 patient safety.

12 ~~It should also be noted that this study was observational in design and as such~~
13 ~~causality cannot be determined. It is possible that other factors, such as ethnicity,~~
14 ~~may be confounding the association between doctors' sex and disciplinary action.~~
15 ~~Research examining whether other potential confounders could explain the observed~~
16 ~~association is require~~

17 ~~Further exploration of why doctors' sex may impact their professional performance is~~
18 ~~needed to enable the profession to develop a better understanding of the factors~~
19 ~~associated with impaired fitness to practise and crucially, how to better support those~~
20 ~~doctors and ensure patient safe~~

21 **Conclusion**

22
23
24
25
26
27
28 In this study we demonstrated that female doctors practising in the UK were less
29 likely to receive sanctions on their medical registration when compared with their
30 male colleagues. These findings remained after adjusting for known confounders.
31 Reasons for why this sex difference exists needs to be examined.

32 **Acknowledgements**

33
34
35
36 We acknowledge Una Lane for facilitating access to the data and for answering our
37 queries on the dataset. We acknowledge Andrew Ledgard for clarifying our queries
38 on the dataset.
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Footnotes

Contributorship statement: EU conceived and designed the study with input from KW and JD. EU and CW categorised the data. EU analysed and interpreted the data with support from KW. EU drafted the manuscript and all authors participated in the revision process and have approved this submission for publication. EU is guarantor, had full access to all of the data in the study, and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding: No specific funding was obtained for this study. EU is a PhD student, and recipient of a UCL Impact studentship. None of the funders influenced the conduct of this research.

Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf. All authors declare no competing interests that may be relevant to the submitted work.

Ethical approval: The study is part of a research project that has received ethical approval from the UCL Research Ethics Committee.

Data sharing statement: No additional data available.

Transparency declaration: EU, as guarantor, affirms that this manuscript is an honest, accurate and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Copyright: The corresponding author has the right to grant on behalf of all authors and does grant on behalf of all authors, a worldwide licence to the Publishers and its licensees in perpetuity, in all forms, formats and media (whether known now or created in the future), to i) publish, reproduce, distribute, display and store the Contribution, ii) translate the Contribution into other languages, create adaptations, reprints, include within collections and create summaries, extracts and/or, abstracts of the Contribution, iii) create any other derivative work(s) based on the Contribution, iv) to exploit all subsidiary rights in the Contribution, v) the inclusion of electronic links from the Contribution to third party material where-ever it may be located; and, iv) licence any third party to do any or all of the above.

Table 1: Distribution of variables by sex of doctors.

Variable	Male N=196,814	Female N=132,728	Total N=329,542
Sanction imposed on registration			
No	194,633 (98.9%)	132,212 (99.6%)	326,845 (99.2%)
Yes	2,181 (1.1%)	516 (0.4%)	2,697 (0.8%)
No. of years since received PMQⁱ			
0-2 years	6,332 (3.2%)	8,830 (6.7%)	15,162 (4.6%)
3-10 years	28,548 (14.5%)	37,220 (28.0%)	65,768 (20.0%)
11-20 years	52,437 (26.6%)	40,023 (30.2%)	92,460 (28.1%)
21-30 years	39,146 (19.9%)	23,069 (17.4%)	62,215 (18.9%)
31-40 years	30,206 (15.4%)	12,136 (9.1%)	42,342 (12.9%)
≥41 years	40,145 (20.4%)	11,450 (8.6%)	51,595 (15.7%)
Region where received PMQ			
UK	108,323 (55.0%)	86,989 (65.5%)	195,312 (59.3%)
EEA ⁱⁱ	25,333 (12.9%)	15,880 (12.0%)	41,213 (12.5%)
International	63,158 (32.1%)	29,859 (22.5%)	93,017 (28.2%)
Specialty			
No Specialty	94,815 (48.2%)	73,309 (55.2%)	168,124 (51.0%)
Anaesthetics	8,710 (4.4%)	3,797 (2.9%)	12,507 (3.8%)
EM ⁱⁱⁱ	754 (0.4%)	209 (0.2%)	963 (0.3%)
GP ^{iv}	37,959 (19.3%)	32,264 (24.3%)	70,223 (21.3%)
Medicine	15,076 (7.7%)	6,775 (5.1%)	21,851 (6.6%)
O&G ^v	2,934 (1.5%)	1,966 (1.5%)	4,900 (1.5%)
Ophthalmology	2,508 (1.3%)	1,078 (0.8%)	3,586 (1.1%)
Paediatrics	3,906 (2.0%)	3,891 (2.9%)	7,797 (2.4%)
Pathology	5,589 (2.8%)	2,965 (2.2%)	8,554 (2.6%)
Psychiatry	5,494 (2.8%)	3,077 (2.3%)	8,571 (2.6%)
Radiology	172 (0.1%)	41 (0.03%)	213 (0.1%)
Surgery	16,452 (8.4%)	1,942 (1.5%)	18,394 (5.6%)
Other	1,330 (0.7%)	867 (0.7%)	2,197 (0.7%)
Dual Specialty	1,115 (0.6%)	547 (0.4%)	1,662 (0.5%)

ⁱPrimary Medical Qualification^{iv}General PracticeⁱⁱEuropean Economic Area^vObstetrics & GynaecologyⁱⁱⁱEmergency Medicine

Table 2: The distribution of sanctions for each variable and the association of individual factors with sanctions.

Variable	Total number of doctors	Sanctions (%)	p-value
Sex			<0.001
Male	196,814	1.1%	
Female	132,728	0.4%	
No. of years since received PMQⁱ			<0.001
0-2	15,162	0.1%	
3-10	65,768	0.6%	
11-20	92,460	0.8%	
21-30	62,215	1.1%	
31-40	42,342	1.4%	
≥41	51,595	0.7%	
Region where received PMQ			<0.001
UK	195,312	0.6%	
EEA ⁱⁱ	41,213	0.9%	
International	93,017	1.2%	
Specialty			<0.001
No Specialty	168,124	0.7%	
Anaesthetics	12,507	0.7%	
EM ⁱⁱⁱ	963	0.7%	
GP ^{iv}	70,223	1.2%	
Medicine	21,851	0.5%	
O&G ^v	4,900	1.2%	
Ophthalmology	3,586	0.5%	
Paediatrics	7,797	0.6%	
Pathology	8,554	0.6%	
Psychiatry	8,571	0.8%	
Radiology	213	0.5%	
Surgery	18,394	0.9%	
Other	2,197	0.3%	
Dual Specialty	1,662	1.4%	

ⁱPrimary Medical Qualification

^{iv}General Practice

ⁱⁱEuropean Economic Area

^vObstetrics & Gynaecology

ⁱⁱⁱEmergency Medicine

Table 3: The adjusted odds ratio for having sanctions against registration for each variable compared to its baseline having adjusted for all other variables.

Variable	Adjusted OR ⁱ	95% CI ⁱⁱ	p-value
Sex of a doctor			<0.0001
Male	1		
Female	0.37	0.33-0.41	
No. of years since received PMQ			<0.0001
0-2	1		
3-10	3.42	2.20-5.32	
11-20	3.85	2.48-5.98	
21-30	5.66	3.63-8.81	
31-40	6.44	4.13-10.05	
≥41	3.12	1.20-4.87	
Region where received PMQ			<0.0001
UK	1		
EEA	1.33	1.17-1.50	
International	1.65	1.51-1.80	
Specialty			<0.0001
No Specialty	1		
Anaesthetics	0.65	0.52-0.82	
EM	0.66	0.31-1.39	
GP	1.43	1.29-1.58	
Medicine	0.49	0.40-0.60	
O&G	1.22	0.93-1.59	
Ophthalmology	0.53	0.33-0.83	
Paediatrics	0.64	0.47-0.88	
Pathology	0.65	0.50-0.86	
Psychiatry	0.81	0.63-1.04	
Radiology	0.47	0.07-3.38	
Surgery	0.78	0.66-0.93	
Other	0.36	0.17-0.77	
Dual Specialty	1.37	0.90-2.09	

ⁱ Odds Ratio

ⁱⁱ Confidence Interval

Table 4: Stratum-specific odds ratios for having sanctions imposed on registration if the doctor is female for each specialty divided into four categories.

Variable	Stratum-Specific OR ⁱ	95% CI ⁱⁱ	p-value
Specialty Category			<0.0001
No Specialty	0.43	0.38-0.49	
GP	0.26	0.22-0.31	
Hospital Specialty	0.44	0.36-0.56	
Dual Specialty	0.09	0.13-0.70	

ⁱ Odds Ratio

ⁱⁱ Confidence Interval

Table 5: The unadjusted and adjusted odds ratio for having each type of sanction against registration for a female doctor when compared to a male doctor.

Sanction-type	Model 1		Model 2 [†]	
	Unadjusted-OR [‡]	95%-CI [§]	Adjusted-OR [‡]	95%-CI [§]
Warning	0.29	0.24-0.35	0.30	0.25-0.36
Undertakings	0.64	0.52-0.79	0.66	0.53-0.81
Conditions	0.48	0.39-0.59	0.54	0.44-0.67
Suspended	0.28	0.21-0.36	0.32	0.25-0.42
Erased	0.21	0.17-0.27	0.26	0.21-0.34

[†]Model adjusted for number of years since received PMQ, region where received PMQ and specialty

[‡]Odds Ratio

[§]Confidence Interval

Table 6: Stratum specific odds ratios for having a warning imposed on registration if the doctor is female for each specialty divided into two categories.

Variable	Stratum-Specific OR [†]	95% CI [‡]	p-value
Specialty-Category			0.0034
No-Specialty	0.90	0.67-1.20	
On-Specialist and/or-GP Registers	0.48	0.35-0.65	

[†]Odds Ratio

[‡]Confidence Interval

Table 7: Stratum specific odds ratios for being erased from the LRMP if the doctor is female for each region where received PMQ divided into two categories.

Variable	Stratum-Specific OR [†]	95% CI [‡]	p-value
Region where received PMQ-Category			0.0304
EEA and/or-International	0.32	0.24-0.44	
UK	0.18	0.11-0.28	

[†]Odds Ratio

[‡]Confidence Interval

References

1. General Medical Council. *The state of medical education and practice in the UK*. London: GMC; 2012.
2. Dyer C. GMC and vulnerable doctors: too blunt an instrument? *BMJ* 2013; 347: f6230.
3. Elston MA. *Women and medicine: the future*. London: Royal College of Physicians; 2009.
4. Alam A, Klemensberg J, Griesman J & Bell CM. The characteristics of physicians disciplined by professional colleges in Canada. *Open Medicine* 2011; 5(4): e173-e174.
5. Cardarelli R & Licciardone, JC. Factors associated with high-severity disciplinary action by a state medical board: a Texas study of medical license revocation. *JAOA* 2006; 106(3): 153-156.
6. Clay SW & Conaster RR. Characteristics of physicians disciplined by the State Medical Board of Ohio. *JAOA* 2003; 103(2): 81-88.
7. Khaliq AA, Dimassi H, Huang CY, Narine L & Smego RA Jr. Disciplinary action against physicians: who is likely to get disciplined? *The American Journal of Medicine* 2005; 118(7): 773-777.
8. Kohatsu ND, Gould D, Ross LK & Fox PJ. Characteristics associated with physician discipline: a case-control study. *Archives of Internal Medicine* 2004; 164(6): 653-658.
9. Morrison J & Wickersham P. Physicians disciplined by a State Medical Board. *JAMA* 1998; 279: 1889-1893.
10. Elkin KJ, Spittal MJ, Elkin DJ & Studdert DM. Doctors disciplined for professional misconduct in Australia and New Zealand, 2000-2009. *MJA* 2011; 194: 452-456.
11. Wakeford R. Who gets struck off? *BMJ* 2011; 343: d7842.

12. General Medical Council. *A guide for doctors referred to the GMC*. http://www.gmc-uk.org/concerns/doctors_under_investigation/a_guide_for_referred_doctors.asp (accessed December 2013)
13. Humphrey C, Hickman S & Gulliford MC. Place of medical qualification and outcomes of UK General Medical Council "fitness to practise" process: cohort study. *BMJ* 2011; 342: d1817.
14. European Union. *Countries*. http://europa.eu/about-eu/countries/index_en.htm (accessed May 2013).
15. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC & Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for Reporting Observational Studies. *PLoS Med* 2007; 4(10): e296.
16. General Medical Council. *The state of medical education and practice in the UK*. London: GMC; 2013.
17. General Medical Council. *Guidance on making decisions on voluntary erasure applications*. GMC; 2013.
18. Lambert TW, Goldacre MJ & Parkhouse J. Doctors who qualified in the UK between 1974 and 1993: age, gender, nationality, marital status and family formation. *Medical Education* 1998; 32(5): 533-537.
19. Lambert TW, Goldacre MJ, Edwards C & Parkhouse J. Career preferences of doctors who qualified in the United Kingdom in 1993 compared with those doctors qualifying in 1974, 1977, 1980, and 1983. *BMJ* 1996; 313(7048): 19-24.
20. Taragin TI, Wilczek AP, Karns ME, Trout, R & Carson JL. Physician demographics and the risk of medical malpractice. *The American Journal of Medicine* 1992; 93(5): 537-542.
21. Firth-Cozens, J. Doctors with difficulties: why so few women? *Postgraduate Medical Journal* 2008; 84(992): 318-320.
22. Roter D, Lipkin M & Korsgaard A. Sex differences in patients' and physicians' communication during primary care medical visits. *Medical Care* 1991; 29(11): 1083-1093.
23. Bloor K, Freemantle N & Maynard A. Gender and variation in activity rates of hospital consultants. *J R Soc Med* 2008; 101(1): 27-33.
24. Goldacre MJ, Lambert TW & Davidson JM. Loss of British-trained doctors from the medical workforce in Great Britain. *Med Educ* 2001; 35(4): 337-344.

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Y
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Y
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Y
Objectives	3	State specific objectives, including any prespecified hypotheses	Y
Methods			
Study design	4	Present key elements of study design early in the paper	Y
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Y
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	Y
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Y
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Y
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	N/A
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Y
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Y
		(b) Describe any methods used to examine subgroups and interactions	Y
		(c) Explain how missing data were addressed	N/A
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Y
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	Y
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Y

		(b) Report category boundaries when continuous variables were categorized	Y
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Y
Discussion			
Key results	18	Summarise key results with reference to study objectives	Y
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Y
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Y
Generalisability	21	Discuss the generalisability (external validity) of the study results	Y
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Y

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

**Disciplined doctors: does the sex of a doctor matter?
A cross-sectional study examining the association between
a doctor's sex and receiving sanctions against their medical
registration.**

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2014-005405.R2
Article Type:	Research
Date Submitted by the Author:	16-Jul-2014
Complete List of Authors:	Unwin, Emily; University College London, UCL Medical School Woolf, Katherine; University College London, UCL Medical School Wadlow, Clare; University College London, UCL Medical School Dacre, Jane; University College London, UCL Medical School
Primary Subject Heading:	Medical education and training
Secondary Subject Heading:	Health services research, Epidemiology
Keywords:	LAW (see Medical Law), MEDICAL EDUCATION & TRAINING, EPIDEMIOLOGY, GMC, Gender

SCHOLARONE™
Manuscripts

Title Page

Disciplined doctors: does the sex of a doctor matter? A cross-sectional study examining the association between a doctor's sex and receiving sanctions against their medical registration.

Emily Unwin, Katherine Woolf, Clare Wadlow, Jane Dacre

Corresponding author:

Prof Jane Dacre, Director UCL Medical School
UCL Medical School, 74 Huntley Street. London, WC1E 6AU. UK
j.dacre@ucl.ac.uk
Tel: 020 7679 0894
Fax: 020 7679 0890

Dr Emily Unwin, PhD student
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Dr Katherine Woolf, Lecturer
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Dr Clare Wadlow, Clinical training fellow
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Key words:

Law, Medical education & training, epidemiology, GMC, gender

Word count:

4767

Abstract

Objectives: To examine the association between doctors' sex and receiving sanctions on their medical registration, whilst controlling for other potentially confounding variables.

Design: Cross-sectional study.

Setting: The General Medical Council's (GMC) List of Registered Medical Practitioners (LRMP) database of doctors practising in the United Kingdom (UK).

Population: All doctors on the GMC's LRMP on 29th May 2013. The database included all doctors who are or have been registered to practice medicine in the UK since October 2005. The exposure of interest was doctor's sex. Confounding variables included years since primary medical qualification, world region of primary medical qualification and specialty.

Outcome measures: Sanctions on a doctor's medical registration. Sanction types included warning, undertakings, conditions, suspension or erasure from the register. Binary logistic regression modelling, controlling for the confounders, described the association between doctor's sex and sanctions on a doctor's medical registration.

Results: Of the 329,542 doctors on the LRMP, 2,697 doctors (0.8%) had sanctions against their registration, 516 (19.1%) of whom were female. In the fully adjusted model, female doctors had nearly a third of the odds (OR 0.37, 95% CI: 0.33-0.41) of having sanctions compared to male doctors. There was evidence that the association varies with specialty, with female doctors who had specialised as General Practitioners (GPs) being the least likely to receive sanctions compared to their male colleagues (OR 0.26, 95% CI: 0.22-0.31).

Conclusions: Female doctors have reduced odds of receiving sanctions on their medical registration when compared to their male colleagues. This association remained after adjustment for the confounding factors. These results are representative of all doctors registered to practice in the UK. Further exploration of why doctors' sex may impact their professional performance is underway.

Article summary

Strengths and limitations of this study

- We used a large national database with no missing data, so the findings of the study apply to all doctors registered to practise in the UK.
- Receiving sanctions is a rare outcome and using a large dataset is crucial when examining rare outcomes.
- This is one of the first studies of this nature on UK data that adjusted for known confounders.
- The study was constrained by the variables collected and made available by the GMC. So we were unable to examine the effect of other potential confounding factors.
- The data available did not provide the reasons for why a sanction had been imposed, nor data on those granted voluntary erasure. A more detailed evaluation of the reasons for referral to the GMC may go towards explaining the sex difference observed.

Introduction

The number of complaints about doctors' fitness to practise received by the UK medical regulatory body, the General Medical Council (GMC), has been increasing since 2007¹. Following a triage and investigation process by the GMC the outcome of a case against a doctor can be closed, or can result in a sanction against the doctor's registration. The cost of this regulatory process, both in terms of financial cost of the actual complaints investigation procedure, but also in terms of the loss of the medical workforce during the process, can be significant. The level of stress that a doctor endures while undergoing a fitness to practise investigation was recently reported in the BMJ and highlights the impact the complaints investigation procedure can have on the mental well being of doctors².

One of the most significant changes in the medical profession has been the increase in the number of women entering this previously male dominated profession. The number of female medical students has been increasing since the mid-1960s with female medical students outnumbering male medical students since the mid-1990s³. It is predicted that female doctors will outnumber their male colleagues by 2017³. This change in the demographic profile of UK doctors has brought with it a heightened interest in how the increase of female doctors may impact the profession.

Examining and understanding the predictors of doctors receiving sanctions may aid the medical profession in identifying doctors whose performance might raise future concerns, in order to support these doctors and help prevent GMC referral. Research from Canada, the United States of America and Australia and New Zealand has suggested that male and female doctors differ in terms of risk of disciplinary action, with male doctors being at increased risk^{4,5,6,7,8,9,10}. However, the applicability of the findings from these studies to the UK may be limited due to differences in both the medical and legal systems in these countries. In 2011 Wakeford explored the situation in the UK¹¹. He examined the factors associated with severest outcomes of the GMC disciplinary procedures, suspension or erasure from the medical register. In agreement with these worldwide studies, he demonstrated that female doctors were four times less likely to be disciplined when compared to male doctors. However, the interpretation of this finding is limited because the measure of effect for doctors' sex was not adjusted for potential confounders.

1
2
3 We aimed to examine the effect of doctors' sex on receiving sanctions against their
4 medical registration, while adjusting for known confounding factors. This would allow
5 for a meaningful comparison of male and female doctors and their experience of
6 disciplinary action in the UK.
7
8
9

10 **Methods**

11 **Study design, setting and source of data**

12 We conducted a cross-sectional study using UK-wide data. The data and permission
13 to use the data for research purposes were obtained from the GMC. This study is
14 part of a research project that has received ethical approval from the UCL Research
15 Ethics Committee.
16
17
18

19 Under the Medical Act 1983 the GMC is required to keep up-to-date registers of
20 qualified doctors. The main register is the List of Registered Medical Practitioners
21 (LRMP). The LRMP is a list of all doctors registered to practise medicine in the UK,
22 and as such changes daily. It lists those doctors who are (or could) practise
23 medicine, as well as those doctors who have been suspended or erased. The GMC
24 provided us with a snapshot of doctors registered on the LRMP on the 29th May
25 2013. The list included all doctors who have been registered with the GMC (and
26 therefore eligible to actively practise medicine) at any point in the period 20th October
27 2005^a – 28th May 2013. The different categories of registration status included:
28 provisionally or fully registered; suspended; not registered – administrative reason, or
29 deceased, or having relinquished registration; and not registered – erased after
30 Fitness to Practise panel hearing. The database provided details of doctor's sex; the
31 year, country, and institutions of the doctor's primary medical qualification and the
32 doctor's current registration status, including whether they currently had any
33 sanctions on their medical registration (see below for details). It classified doctors as
34 General Practitioners (GPs) (on the GP register) and as hospital specialists (on the
35 Specialist register). To become registered on the GP or Specialist registers a doctor
36 must be a fully qualified consultant or GP (i.e. the doctor has successfully completed
37 their Specialty Training). Doctors who are neither on the GP or Specialist registers
38 can be primarily divided into two groups; the first being doctors who are currently
39 undertaking a Specialty Training programme with the aim of becoming a GP or a
40 consultant in a specialty; and the second group being composed of doctors in non-
41 training posts. Non-training posts are doctors who are not fully qualified consultants
42 or GPs. Non-training posts are focused to meet the National Health Service (NHS)
43
44
45
46
47
48
49
50
51
52
53
54
55
56

57 ^a The 20th October 2005 was the date when the GMC first began to publish full details of a doctor's
58 registration status on the LRMP online.
59
60

1
2
3 service requirements and the doctors who choose to undertake a non-training post
4 do so for a variety of reasons including difficulty in obtaining a place in a Specialty
5 Training program due to the high competition, or doctors who prefer the work-life
6 balance the non-training post can provide¹².
7
8
9

10 **Population**

11 All doctors who were listed on the LRMP on the 29th May 2013 were included.
12
13

14 **Primary outcome and exposure**

15 The outcome of interest was sanctions on a doctor's medical registration on the 29th
16 May 2013.
17
18

19 The types of sanctions included:
20

- 21 • **Warning:** issued when a doctor's performance has not been in keeping with
22 the principles set by the GMC for doctors, but a restriction on the doctor's
23 registration is not necessary. Warnings remain on the LRMP for a five year
24 period;
25
- 26 • **Undertakings:** an agreement between the GMC and the doctor about the
27 doctor's future practice. The doctor must adhere to these undertakings to
28 maintain their registration;
29
- 30 • **Conditions:** set out by the GMC and restrict a doctor's practice. The doctor
31 must comply with these conditions to maintain their registration. Conditions
32 can initially be imposed for a maximum of three years and then be renewed in
33 periods of up to 36 months;
34
- 35 • **Suspension or erasure:** the doctor's licence is withdrawn by the GMC and
36 they are no longer able to practise. Suspension from the register can last up
37 to 12 months, but may be indefinite in certain circumstances.
38
39
40
41
42

43 A sanction can be imposed if a doctor's fitness to practise has been proved to be
44 impaired. The impairment can result from misconduct; poor professional
45 performance; physical or mental ill health; or a conviction or fitness to practise
46 determination by another regulatory body either in the UK or overseas¹³. However it
47 is recognised that the reason for impairment can cross more than one category (for
48 example a doctor with a drug misuse problem could be classified as having mental ill
49 health, yet the effects of the drug abuse could impact their professional
50 performance). The duration of a sanction on a doctor's registration varies and it is
51 possible for doctors to have more than one sanction against their registration and this
52 typically represents the outcomes of different complaints (For further information on
53
54
55
56
57
58
59
60

1
2
3 sanctions visit <http://www.gmc-uk.org/concerns/index.asp>). It was not possible to
4 establish the date a sanction was imposed or the reason for why a sanction had
5 been imposed from the available data.
6
7

8
9 The outcome of interest was collapsed into a binary variable: doctors with sanctions
10 against their registration; and doctors with no sanctions against their registration.
11

12
13 The exposure of interest was doctor's sex, as declared by the doctor to the GMC.
14
15

16 17 **Selection of variables**

18 The variables included in the study were selected before any statistical analysis.
19 Data was available on the year of primary medical qualification (PMQ), country of
20 PMQ and primary specialty, if on the Specialist or General Practitioner (GP)
21 Registers. These variables were selected as a priori confounders based on findings
22 from earlier research^{7,8,11,14}, which demonstrated that these factors may influence the
23 risk of receiving sanctions.
24
25

26
27 Once the variables had been selected, we performed a variable reduction process, to
28 reduce the number categories into meaningful categories. Once again, this was
29 performed before any statistical analysis. The variable 'year of PMQ' was converted
30 into 'number of years since qualification' by subtracting the year of PMQ from 2013
31^b. We then collapsed the variable into six categories. The first category '0-2 years'
32 represented Foundation Training, the second category '3-10 years' represented the
33 bulk of time a doctor would likely spend in Specialty Training. The subsequent
34 categories were divided into 10-year blocks. The variable 'country of PMQ' was
35 collapsed into three categories; 'UK', 'EEA' (European Economic Area) and
36 'International'. The list of countries included in the EEA category was obtained from
37 the European Union website¹⁵ and included all countries that were members before
38 May 2013. The variable 'specialty' was divided into fourteen categories. Doctors
39 who were not present on either the Specialist Register or the GP Register were
40 categorised as having 'no specialty' and represented trainee and other non-specialist
41 doctors. Doctors on both the Specialist Register and the GP Register were recorded
42 as having 'dual specialty' and doctors only on the GP register were categorised as
43 'GP'. For doctors only registered on the Specialist Register, their primary specialty
44 was taken and recorded into one of eleven categories. To categorise those doctors
45
46
47
48
49
50
51
52
53
54

55
56 ^b As mentioned above, a doctor could appear in the LRMP dataset if they had been removed from the
57 medical register. The actual date of those doctors being removed could lie anytime between 20th
58 October 2005 and 28th May 2013. However, as no actual removal dates were given for those doctors,
59 we used 2013 for all doctors.
60

1
2
3 on the Specialist Register two researchers (EU and CW) independently allocated
4 each primary specialty to a specialty category. Kappa statistic demonstrated a good
5 level of agreement ($\kappa = 0.72$). Any disagreements about specialty category
6 allocation were resolved through discussion.
7
8
9

10 11 **Statistical methods**

12 We took a causal modelling analysis approach to analyse the data. We firstly
13 performed bivariate analyses to look for crude associations in the data, followed by
14 Mantel-Haenszel analyses, before going on to complete multivariate analyses using
15 binary logistic regression modelling. The initial logistic regression model included
16 only the exposure (sex) and outcome (sanctions) variables to provide a crude
17 measure of effect. The final logistic regression model was built to include all
18 potential confounder variables, while checking for multicollinearity. The final logistic
19 regression model enabled the calculation of an adjusted measure of effect. The final
20 model was assessed for the presence of effect modifiers following the findings from
21 the Mantel-Haenszel analyses.
22
23
24
25
26
27
28

29 Statistical analyses were conducted using the software Stata 12/SE.
30
31

32 We used the STROBE Statement¹⁶ to guide our study report.
33
34

35 **Results**

36 There were 329,542 doctors on the LRMP on the 29th May 2013, of whom 40.3%
37 were female. Table 1 shows the distribution of variables by the sex of doctors. The
38 median number of years since qualification was 19 years. The distribution of the
39 number of years since a doctor had qualified was skewed to the right with the
40 majority of the doctors qualifying 11-20 years ago (28.1%). The majority of the
41 doctors had received their PMQ from a UK medical school (59.3%).
42
43
44
45

46 Approximately half of all the doctors were neither on the GP Register nor the
47 Specialist Register (51.0%), of which the majority (58.0%) had received their PMQ
48 greater than 10 years previously. It is interesting to note that half of the doctors
49 registered to practise medicine in the UK in this period were not registered specialists
50 (they were neither on the GP or Specialist registers) and the majority of these
51 doctors had qualified greater than ten years ago, suggesting that these doctors are
52 not trainee doctors, but doctors who have elected not to complete specialty training
53 and are currently working in a non-training post. Of those doctors who had
54
55
56
57
58
59
60

1
2
3 specialised, General Practice was the most popular specialty (21.3%), followed by
4 Medicine (6.6%). 0.5% of the doctors were on both the Specialist and GP Registers.
5
6

7
8 2697 (0.8%) doctors had sanctions against their registration on the 29th May 2013.
9 There was a higher proportion of male doctors who had sanctions against their
10 registration when compared to female doctors (1.1% of all male doctors compared
11 with 0.4% of all female doctors, $\chi^2=505.4$, $P<0.001$). There was strong evidence for
12 an association between receiving sanctions and the number of years since received
13 PMQ, with doctors who qualified 31-40 years ago having the highest proportion of
14 sanctions; world region of PMQ, with doctors who qualified outside the EEA with the
15 highest proportion of doctors with sanctions; and specialty, with doctors on both the
16 Specialist and GP Registers having the highest proportion of doctors with sanctions.
17 These results are presented in Table 2.
18
19
20
21
22
23

24 Using bivariate analyses we compared female doctors to male doctors. There was a
25 strong trend between sex of a doctor and the number of years since the doctor
26 received their PMQ, with female doctors being more likely to have recently qualified
27 and the proportion of female doctors reducing as the number of years since PMQ
28 increased. We also found that female doctors were more likely to have qualified in
29 the UK (65.5% of all female doctors compared to 55.0% of all male doctors) and
30 male doctors were more likely to have qualified outside of the EEA (32.1% of all male
31 doctors compared to 22.5% of all female doctors). Approximately equal proportions
32 of male and female doctors qualified in the EEA (12.9% and 12.0% respectively).
33 Both sexes were more likely to be not registered in a specialty (GP or hospital),
34 though there was a slightly higher proportion of women when compared to men who
35 were not on the Specialist or GP Registers. When examining those doctors who
36 were registered in a specialty, a higher proportion of female doctors were on the GP
37 Register compared to male doctors (24.3% of female doctors compared with 19.3%
38 of male doctors) and a higher proportion of male doctors were registered with a
39 hospital specialty (32.0% of male doctors compared with 20.1% of female doctors).
40 In summary, number of years since received PMQ, world region where PMQ was
41 received, and registered specialty were associated with both the outcome (sanctions)
42 and the exposure (sex of a doctor) and as such we considered these variables as
43 confounders.
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 The unadjusted odds ratio for having sanctions against a doctor's registration
4 comparing female doctors with male doctors was 0.35 (95% CI: 0.32-0.38),
5 suggesting that being a female doctor is protective of receiving sanctions.
6

7 Mantel-Haenszel analyses and tests of homogeneity were conducted to examine the
8 change in the strength of the association between sanctions and sex while controlling
9 for each of the confounders separately.
10

11 There was strong evidence that the true odds ratios were different between the
12 different specialty categories ($P=0.0002$), therefore specialty was considered as an
13 effect modifier when conducting multivariate analyses.
14
15

16
17
18 Table 3 represents the results from the binary logistic regression model built to adjust
19 for all the variables. After taking into account the number of years since PMQ, world
20 region where the doctor received their PMQ and specialty, female doctors had nearly
21 a third of the odds of having sanctions on their registration compared to male doctors
22 (OR 0.37, 95% CI: 0.33-0.41, $P<0.0001$).
23

24 All of the a priori confounders were felt to be confounders because the adjusted odds
25 ratio changed when each variable was added to the model. We found no evidence
26 of multicollinearity.
27

28 The Mantel-Haenszel analyses suggested that specialty may be an effect modifier,
29 we therefore performed a statistical test for effect modification by firstly collapsing the
30 specialty variable into four groups to increase the power of the test. Table 4
31 demonstrates that specialty was felt to be an important effect modifier with female
32 doctors being less likely to receive sanctions when compared to male doctors, but
33 the effect was greater for GPs than for those doctors with no specialty or practising a
34 hospital specialty.
35
36
37
38
39
40
41
42

43 Discussion

44 In our large cross-sectional study we found strong evidence that being female was
45 associated with a reduction in odds of receiving sanctions (OR 0.35, 95% CI: 0.32-
46 0.38) in the unadjusted model. Controlling for years since PMQ, world region where
47 received PMQ, and specialty did slightly increase this odds ratio (OR 0.37, 95% CI:
48 0.33-0.41, $P<0.0001$), but there remained strong evidence for the association
49 between doctor's sex and receiving sanctions. There was evidence that the
50 association varied with specialty, with female GPs being the least likely to have
51 sanctions against their registration.
52
53
54
55
56
57
58
59
60

1
2
3 To our knowledge this is the first study in the UK to examine the association between
4 doctor's sex and receiving sanctions against medical registration, while adjusting for
5 known confounders. We believe that these known confounders have only been
6 adjusted for in one other study which was conducted in the USA⁸.
7
8
9

10 **Strengths and weaknesses of this study**

11 One of the major strengths of this study is that we used a large national database.
12 The advantage of using this dataset is two-fold; firstly, because a national database
13 was used the findings of the study apply to all doctors registered to practise in the
14 UK; secondly, receiving sanctions is a rare outcome and using a large dataset is
15 crucial when examining rare outcomes.
16
17
18

19 A further strength of this study is that it adjusted for known confounders, all these
20 confounders have only been adjusted for in one previous study, which was
21 conducted in California⁸. Previous research on UK data did not adjust the measure
22 of effect of sex for potential confounders¹¹.
23
24
25

26 Finally, a further advantage was the completeness of the dataset. The data is
27 collected by the GMC for inclusion on the LRMP, and not research purposes.
28 Doctors are required to provide the data to the GMC to be registered and as such
29 there is no missing data. However, the fact the data is not collected for research
30 purposes is also a limitation of the study. The study was constrained by the
31 information collected and made available by the GMC. As such, we were only able
32 to explore the variables available. We were unable to examine the effect of other
33 potential confounding factors or explore the reasons for why a sanction had been
34 imposed, nor were we able to establish the date a sanction had been imposed.
35
36
37
38

39 It could be argued that the reason for referral to the GMC could be a source of
40 residual confounding if systematic differences exist between the sexes. The GMC
41 may take action against a doctor's registration for a number of reasons, which can be
42 broadly divided into three major categories; misconduct; poor professional
43 performance; or physical or mental ill health. The data available did not provide the
44 reasons or the category for why a sanction had been imposed, but a more detailed
45 evaluation of the reasons for referral to the GMC may go towards explaining the sex
46 difference observed. In their research, Alam et al.⁴ and Elkin et al.¹⁰, demonstrated
47 not only that male doctors were more likely to be subject to disciplinary action, but
48 that the main offense for which a doctor was being disciplined was sexual
49 misconduct. It is possible that male doctors are more likely to commit an offense
50 involving sexual misconduct than their female colleagues, which may go towards
51 explaining the sex difference seen in these populations. However, other studies in
52
53
54
55
56
57
58
59
60

1
2
3 this area did not find sexual misconduct to be the most common offense^{6,7,9}. As
4 such, exploring the offenses for which a doctor may receive disciplinary action in this
5 population may go towards explaining the sex difference observed and may help the
6 regulatory body and medical profession to introduce targeted interventions, such as
7 education programmes, to reduce the number of offenses.
8
9

10 A further source of residual confounding could be the route of referral. Doctors
11 practising in the UK can be referred to the GMC through five main routes; the public;
12 employers; doctors; the GMC; and the police¹⁷. It would be interesting to examine
13 whether the referral rate for each route demonstrates any sex differences, and if so,
14 exploring the reasons for this difference.
15
16
17

18 A further limitation is that a doctor can apply for voluntary erasure from the LRMP
19 during an investigation process. Once again, this is a potential source of residual
20 confounding and it is possible that the sex of doctors who are subject to a complaints
21 investigation and apply for voluntary erasure differs to those doctors who complete
22 the investigative process and receive a sanction (however, the GMC's decision to
23 grant a request for voluntary erasure is based on the public interest and the doctor's
24 health and likelihood to return to practise¹⁸). It is important to note that voluntary
25 erasure is requested by doctors for multiple reasons other than being involved in an
26 investigation process, including retiring permanently from practising medicine or
27 leaving the UK to work permanently abroad. To explore whether voluntary erasure
28 requests may explain the sex difference seen, the reason for why a voluntary erasure
29 request was submitted would first have to be ascertained. This information was not
30 available in the dataset used for this research, but could be requested and explored
31 in future studies.
32
33
34
35
36
37
38

39 It is also of interest to note that certain sanctions (erasure and some suspensions)
40 are permanent, whereas other sanctions are time limited. As such, the permanent
41 sanctions may be over represented because they will never be removed from a
42 doctor's registration. If male doctors are more likely to receive these permanent
43 sanctions, this could lead to male doctors being over represented when examining
44 the association between sex and sanctions, and may go towards explaining the sex
45 difference observed between doctors who had sanctions imposed against their
46 registration.
47
48
49
50
51

52 Finally, a further limitation of the study is that nearly half of the doctors in the
53 population were not recorded on the GP or Specialist registers and were therefore
54 classified as not having a specialty. Doctors who are not on the GP or Specialist
55 registers typically fall into one of two categories; either a doctor who is on a Specialty
56 Training programme with the aim of becoming a GP or a consultant in a specialty; or
57
58
59
60

1
2
3 doctors who have chosen to work in a non-training post. It was not possible from the
4 information made available by the GMC to examine these two categories. It would
5 be of interest to explore if the proportions of male and female doctors differ in these
6 two categories and to examine whether the risk of disciplinary action differs for
7 doctors who are in a Specialty Training post compared to doctors who are working in
8 a non-training post. It would also be of interest if further information about the type of
9 non-training post these doctors were working in and to examine the association with
10 receiving sanctions.
11
12
13
14
15

16 17 18 **Comparison with other studies**

19 Our main finding, that female doctors are less likely to be subject to disciplinary
20 action when compared to their male colleagues, mirrors the results of several studies
21 from across the world which have also examined the association between doctors'
22 sex and disciplinary action^{4,6,7,8,9,10,11}. However, the majority of these studies have
23 been performed in the United States of America^{6,7,8,9}, Canada⁴, Australia and New
24 Zealand¹⁰, where the medical and legal systems differ to the UK and therefore we felt
25 that their findings may not be applicable to the UK population of doctors. These
26 studies' main objective was not necessarily to explore the association between
27 doctors' sex and disciplinary action. Some of these studies were descriptive and
28 those studies that did control for confounders did not, albeit for one study⁸, control for
29 the same confounders we have selected. To our knowledge, one study has been
30 performed in the UK using national data¹¹, however when examining the association
31 between doctors' sex and disciplinary action this study did not control for any
32 potential confounders.
33
34
35
36
37
38
39
40

41 The findings of this study are in agreement with previous research that has shown
42 that older doctors⁸, doctors who qualified outside of the country in which they are
43 practising^{11,14} and doctors of certain specialties⁷ are more likely to be subjected to
44 disciplinary action from a medical regulatory board. It has also been demonstrated in
45 previous studies that female doctors are more likely to be have qualified more
46 recently than male doctors³, are more likely to have qualified in the country in which
47 they are practising¹⁹ and choose different specialties to male doctors²⁰.

48 This study showed that the reason that male doctors receive more sanctions is not
49 because they qualified longer ago, nor because they are more likely to have qualified
50 outside the UK, despite both of those factors being associated with increased
51 likelihood of sanctions.
52
53
54
55
56
57
58
59
60

Unanswered questions and future research

This study has demonstrated that female doctors are less likely to receive sanctions against their medical registration compared to male doctors, however it is not clear why women are less likely to receive sanctions when compared to men. Exploring the possible reasons for this sex difference in professional performance is required, using a theoretical based approach. One theory suggested by some researchers is that male and female doctors differ in communication style and hence the interaction with patients and colleagues differed between the sexes, which could affect the risk of being subject to a complaint^{21,22}. Future research could be performed to explore this further and examine whether communication styles differ between male and female doctors, and also whether the communication styles of doctors who receive sanctions differ from doctors who have never received sanctions.

We have also demonstrated that the effect of sex on likelihood to receive sanctions varied by specialty, with female GPs being the least likely to receive sanctions. It has been demonstrated by an observational study of primary care physicians in the USA that female primary care physicians spend more time with their patients when compared to their male colleagues and they engaged more in conversation, displaying more positive-talk, partnership-building, question-asking and information-giving²³. These differences in communication style and time spent with patients may go towards explaining the larger sex discrepancy observed in GPs, however future research is required to explore these possible reasons further.

Our results show that doctors who had been qualified for longer were more likely to receive sanctions, it is therefore reasonable to hypothesise that the risk of receiving a sanction increases with exposure. Therefore doctors who have fewer patient encounters may be less likely to receive sanctions against their registration. Previous studies have demonstrated that female consultants have fewer patient episodes and are more likely to work part-time (and thus have fewer patient encounters) when compared to their male colleagues^{24,25}, it is therefore reasonable to hypothesise that the sex difference observed in disciplinary action may be partly explained by the difference in work patterns between the sexes. This hypothesis merits being explored further by examining whether certain work patterns (i.e. part-time compared to full-time work) are more likely to be associated with receiving sanctions.

1
2
3 A further possible explanation for the sex difference observed is perhaps that male
4 and female doctors are viewed and treated differently by the public, the profession
5 and the regulatory body. It is possible that there is a higher threshold of tolerance for
6 female doctors. The GMC are twice as likely to receive a complaint about a male
7 doctor than a female doctor¹⁷. It is reasonable to assume that as a result male
8 doctors are more likely to receive sanctions against their medical registration.
9 Research examining the perception of male and female doctors would be warranted.
10
11

12
13
14
15 It should also be noted that this study was observational in design and as such
16 causality cannot be determined. It is possible that other factors, such as ethnicity,
17 may be confounding the association between doctors' sex and disciplinary action.
18 Research examining whether other potential confounders could explain the observed
19 association is required
20
21
22
23

24 The points discussed above highlight that the real interest of this research is not
25 about the outcome sanctions itself, but about trying to understand the differences
26 between male and female doctors that lead to the observed sex difference in
27 receiving sanctions. Investigations into why and how male and female medical
28 practises differ will in turn lead to being able to propose interventions to reduce not
29 only the number of doctors referred to the medical regulatory body, but also the
30 difference between the sexes of doctors who are referred. Further exploration of why
31 doctors' sex may impact their professional performance is needed to enable the
32 profession to develop a better understanding of the factors associated with impaired
33 fitness to practise and crucially, how to better support those doctors and ensure
34 patient safety.
35
36
37
38
39
40
41
42
43

44 **Conclusion**

45 In this study we demonstrated that female doctors practising in the UK were less
46 likely to receive sanctions on their medical registration when compared with their
47 male colleagues. These findings remained after adjusting for known confounders.
48 Reasons for why this sex difference exists needs to be examined.
49
50
51
52
53
54
55
56
57
58
59
60

Footnotes

Acknowledgements

We acknowledge Una Lane for facilitating access to the data and for answering our queries on the dataset. We acknowledge Andrew Ledgard for clarifying our queries on the dataset.

Contributorship statement: EU conceived and designed the study with input from KW and JD. EU and CW categorised the data. EU analysed and interpreted the data with support from KW. EU drafted the manuscript and all authors participated in the revision process and have approved this submission for publication. EU is guarantor, had full access to all of the data in the study, and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding: No specific funding was obtained for this study. EU is a PhD student, and recipient of a UCL Impact studentship. None of the funders influenced the conduct of this research.

Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf. All authors declare no competing interests that may be relevant to the submitted work.

Ethical approval: The study is part of a research project that has received ethical approval from the UCL Research Ethics Committee.

Data sharing statement: No additional data available.

Transparency declaration: EU, as guarantor, affirms that this manuscript is an honest, accurate and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Copyright: The corresponding author has the right to grant on behalf of all authors and does grant on behalf of all authors, a worldwide licence to the Publishers and its licensees in perpetuity, in all forms, formats and media (whether known now or created in the future), to i) publish, reproduce, distribute, display and store the

1
2
3 Contribution, ii) translate the Contribution into other languages, create adaptations,
4 reprints, include within collections and create summaries, extracts and/or, abstracts
5 of the Contribution, iii) create any other derivative work(s) based on the Contribution,
6 iv) to exploit all subsidiary rights in the Contribution, v) the inclusion of electronic links
7 from the Contribution to third party material where-ever it may be located; and, iv)
8 licence any third party to do any or all of the above.
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1: Distribution of variables by sex of doctors.

Variable	Male N=196,814	Female N=132,728	Total N=329,542
Sanction imposed on registration			
No	194,633 (98.9%)	132,212 (99.6%)	326,845 (99.2%)
Yes	2,181 (1.1%)	516 (0.4%)	2,697 (0.8%)
No. of years since received PMQⁱ			
0-2 years	6,332 (3.2%)	8,830 (6.7%)	15,162 (4.6%)
3-10 years	28,548 (14.5%)	37,220 (28.0%)	65,768 (20.0%)
11-20 years	52,437 (26.6%)	40,023 (30.2%)	92,460 (28.1%)
21-30 years	39,146 (19.9%)	23,069 (17.4%)	62,215 (18.9%)
31-40 years	30,206 (15.4%)	12,136 (9.1%)	42,342 (12.9%)
≥41 years	40,145 (20.4%)	11,450 (8.6%)	51,595 (15.7%)
Region where received PMQ			
UK	108,323 (55.0%)	86,989 (65.5%)	195,312 (59.3%)
EEA ⁱⁱ	25,333 (12.9%)	15,880 (12.0%)	41,213 (12.5%)
International	63,158 (32.1%)	29,859 (22.5%)	93,017 (28.2%)
Specialty			
No Specialty	94,815 (48.2%)	73,309 (55.2%)	168,124 (51.0%)
Anaesthetics	8,710 (4.4%)	3,797 (2.9%)	12,507 (3.8%)
EM ⁱⁱⁱ	754 (0.4%)	209 (0.2%)	963 (0.3%)
GP ^{iv}	37,959 (19.3%)	32,264 (24.3%)	70,223 (21.3%)
Medicine	15,076 (7.7%)	6,775 (5.1%)	21,851 (6.6%)
O&G ^v	2,934 (1.5%)	1,966 (1.5%)	4,900 (1.5%)
Ophthalmology	2,508 (1.3%)	1,078 (0.8%)	3,586 (1.1%)
Paediatrics	3,906 (2.0%)	3,891 (2.9%)	7,797 (2.4%)
Pathology	5,589 (2.8%)	2,965 (2.2%)	8,554 (2.6%)
Psychiatry	5,494 (2.8%)	3,077 (2.3%)	8,571 (2.6%)
Radiology	172 (0.1%)	41 (0.03%)	213 (0.1%)
Surgery	16,452 (8.4%)	1,942 (1.5%)	18,394 (5.6%)
Other	1,330 (0.7%)	867 (0.7%)	2,197 (0.7%)
Dual Specialty	1,115 (0.6%)	547 (0.4%)	1,662 (0.5%)

ⁱPrimary Medical QualificationⁱⁱEuropean Economic AreaⁱⁱⁱEmergency Medicine^{iv}General Practice^vObstetrics & Gynaecology

Table 2: The distribution of sanctions for each variable and the association of individual factors with sanctions.

Variable	Total number of doctors	Sanctions (%)	p-value
Sex			<0.001
Male	196,814	1.1%	
Female	132,728	0.4%	
No. of years since received PMQⁱ			<0.001
0-2	15,162	0.1%	
3-10	65,768	0.6%	
11-20	92,460	0.8%	
21-30	62,215	1.1%	
31-40	42,342	1.4%	
≥41	51,595	0.7%	
Region where received PMQ			<0.001
UK	195,312	0.6%	
EEA ⁱⁱ	41,213	0.9%	
International	93,017	1.2%	
Specialty			<0.001
No Specialty	168,124	0.7%	
Anaesthetics	12,507	0.7%	
EM ⁱⁱⁱ	963	0.7%	
GP ^{iv}	70,223	1.2%	
Medicine	21,851	0.5%	
O&G ^v	4,900	1.2%	
Ophthalmology	3,586	0.5%	
Paediatrics	7,797	0.6%	
Pathology	8,554	0.6%	
Psychiatry	8,571	0.8%	
Radiology	213	0.5%	
Surgery	18,394	0.9%	
Other	2,197	0.3%	
Dual Specialty	1,662	1.4%	

ⁱPrimary Medical QualificationⁱⁱEuropean Economic AreaⁱⁱⁱEmergency Medicine^{iv}General Practice^vObstetrics & Gynaecology

Table 3: The adjusted odds ratio for having sanctions against registration for each variable compared to its baseline having adjusted for all other variables.

Variable	Adjusted OR ⁱ	95% CI ⁱⁱ	p-value
Sex of a doctor			
			<0.0001
Male	1		
Female	0.37	0.33-0.41	
No. of years since received PMQ			
			<0.0001
0-2	1		
3-10	3.42	2.20-5.32	
11-20	3.85	2.48-5.98	
21-30	5.66	3.63-8.81	
31-40	6.44	4.13-10.05	
≥41	3.12	1.20-4.87	
Region where received PMQ			
			<0.0001
UK	1		
EEA	1.33	1.17-1.50	
International	1.65	1.51-1.80	
Specialty			
			<0.0001
No Specialty	1		
Anaesthetics	0.65	0.52-0.82	
EM	0.66	0.31-1.39	
GP	1.43	1.29-1.58	
Medicine	0.49	0.40-0.60	
O&G	1.22	0.93-1.59	
Ophthalmology	0.53	0.33-0.83	
Paediatrics	0.64	0.47-0.88	
Pathology	0.65	0.50-0.86	
Psychiatry	0.81	0.63-1.04	
Radiology	0.47	0.07-3.38	
Surgery	0.78	0.66-0.93	
Other	0.36	0.17-0.77	
Dual Specialty	1.37	0.90-2.09	

ⁱ Odds Ratioⁱⁱ Confidence Interval**Table 4:** Stratum-specific odds ratios for having sanctions imposed on registration if the doctor is female for each specialty divided into four categories.

Variable	Stratum-Specific OR ⁱ	95% CI ⁱⁱ	p-value
Specialty Category			
			<0.0001
No Specialty	0.43	0.38-0.49	
GP	0.26	0.22-0.31	
Hospital Specialty	0.44	0.36-0.56	
Dual Specialty	0.09	0.13-0.70	

ⁱ Odds Ratioⁱⁱ Confidence Interval

References

1. General Medical Council. *The state of medical education and practice in the UK*. London: GMC; 2012.
2. Dyer C. GMC and vulnerable doctors: too blunt an instrument? *BMJ* 2013; 347: f6230.
3. Elston MA. *Women and medicine: the future*. London: Royal College of Physicians; 2009.
4. Alam A, Klemensberg J, Griesman J et al. The characteristics of physicians disciplined by professional colleges in Canada. *Open Medicine* 2011; 5(4): e173-e174.
5. Cardarelli R & Licciardone, JC. Factors associated with high-severity disciplinary action by a state medical board: a Texas study of medical license revocation. *JAOA* 2006; 106(3): 153-156.
6. Clay SW & Conaster RR. Characteristics of physicians disciplined by the State Medical Board of Ohio. *JAOA* 2003; 103(2): 81-88.
7. Khaliq AA, Dimassi H, Huang CY et al. Disciplinary action against physicians: who is likely to get disciplined? *The American Journal of Medicine* 2005; 118(7): 773-777.
8. Kohatsu ND, Gould D, Ross LK et al. Characteristics associated with physician discipline: a case-control study. *Archives of Internal Medicine* 2004; 164(6): 653-658.
9. Morrison J & Wickersham P. Physicians disciplined by a State Medical Board. *JAMA* 1998; 279: 1889-1893.
10. Elkin KJ, Spittal MJ, Elkin DJ et al. Doctors disciplined for professional misconduct in Australia and New Zealand, 2000-2009. *MJA* 2011; 194: 452-456.
11. Wakeford R. Who gets struck off? *BMJ* 2011; 343: d7842.
12. National Health Service – Medical Careers. *Non-training posts*. https://www.medicalcareers.nhs.uk/career_options/working_as_a_doctor/non-training_posts.aspx (accessed July 2014).
13. General Medical Council. *A guide for doctors referred to the GMC*. http://www.gmc-uk.org/concerns/doctors_under_investigation/a_guide_for_referred_doctors.asp (accessed December 2013).
14. Humphrey C, Hickman S & Gulliford MC. Place of medical qualification and outcomes of UK General Medical Council “fitness to practise” process: cohort study. *BMJ* 2011; 342: d1817.
15. European Union. *Countries*. http://europa.eu/about-eu/countries/index_en.htm (accessed May 2013).
16. Von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for Reporting Observational Studies. *PLoS Med* 2007; 4(10): e296.
17. General Medical Council. *The state of medical education and practice in the UK*. London: GMC; 2013.
18. General Medical Council. *Guidance on making decisions on voluntary erasure applications*. GMC; 2013.
19. Lambert TW, Goldacre MJ & Parkhouse J. Doctors who qualified in the UK between 1974 and 1993: age, gender, nationality, marital status and family formation. *Medical Education* 1998; 32(5): 533-537.
20. Lambert TW, Goldacre MJ, Edwards C & Parkhouse J. Career preferences of doctors who qualified in the United Kingdom in 1993 compared with those doctors qualifying in 1974, 1977, 1980, and 1983. *BMJ* 1996; 313(7048): 19-24.
21. Taragin TI, Wilczek AP, Karns ME, et al. Physician demographics and the risk of medical malpractice. *The American Journal of Medicine* 1992; 93(5): 537-542.
22. Firth-Cozens, J. Doctors with difficulties: why so few women? *Postgraduate Medical Journal* 2008; 84(992): 318-320.
23. Roter D, Lipkin M & Korsgaard A. Sex differences in patients’ and physicians’ communication during primary care medical visits. *Medical Care* 1991; 29(11): 1083-1093.
24. Bloor K, Freemantle N & Maynard A. Gender and variation in activity rates of hospital consultants. *J R Soc Med* 2008; 101(1): 27-33.
25. Goldacre MJ, Lambert TW & Davidson JM. Loss of British-trained doctors from the medical workforce in Great Britain. *Med Educ* 2001; 35(4): 337-344.

Title Page

**Disciplined doctors: does the sex of a doctor matter?
A cross-sectional study examining the association between a doctor's
sex and receiving sanctions against their medical registration.**

Emily Unwin, Katherine Woolf, Clare Wadlow, Jane Dacre

Corresponding author:

Prof Jane Dacre, Director UCL Medical School
UCL Medical School, 74 Huntley Street. London, WC1E 6AU. UK
j.dacre@ucl.ac.uk
Tel: 020 7679 0894
Fax: 020 7679 0890

Dr Emily Unwin, PhD student
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Dr Katherine Woolf, Lecturer
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Dr Clare Wadlow, Clinical training fellow
UCL Medical School, Royal Free Hospital, London, NW3 2PF. UK

Key words:

Law, Medical education & training, epidemiology, GMC, gender

Word count:

4767

Abstract

Objectives: To examine the association between doctors' sex and receiving sanctions on their medical registration, whilst controlling for other potentially confounding variables.

Design: Cross-sectional study.

Setting: The General Medical Council's (GMC) List of Registered Medical Practitioners (LRMP) database of doctors practising in the United Kingdom (UK).

Population: All doctors on the GMC's LRMP on 29th May 2013. The database included all doctors who are or have been registered to practice medicine in the UK since October 2005. The exposure of interest was doctor's sex. Confounding variables included years since primary medical qualification, world region of primary medical qualification and specialty.

Outcome measures: Sanctions on a doctor's medical registration. Sanction types included warning, undertakings, conditions, suspension or erasure from the register. Binary logistic regression modelling, controlling for the confounders, described the association between doctor's sex and sanctions on a doctor's medical registration.

Results: Of the 329,542 doctors on the LRMP, 2,697 doctors (0.8%) had sanctions against their registration, 516 (19.1%) of whom were female. In the fully adjusted model, female doctors had nearly a third of the odds (OR 0.37, 95% CI: 0.33-0.41) of having sanctions compared to male doctors. There was evidence that the association varies with specialty, with female doctors who had specialised as General Practitioners (GPs) being the least likely to receive sanctions compared to their male colleagues (OR 0.26, 95% CI: 0.22-0.31).

Conclusions: Female doctors have reduced odds of receiving sanctions on their medical registration when compared to their male colleagues. This association remained after adjustment for the confounding factors. These results are representative of all doctors registered to practice in the UK. Further exploration of why doctors' sex may impact their professional performance is underway.

Article summary

Strengths and limitations of this study

- We used a large national database with no missing data, so the findings of the study apply to all doctors registered to practise in the UK.
- Receiving sanctions is a rare outcome and using a large dataset is crucial when examining rare outcomes.
- This is one of the first studies of this nature on UK data that adjusted for known confounders.
- The study was constrained by the variables collected and made available by the GMC. So we were unable to examine the effect of other potential confounding factors.
- The data available did not provide the reasons for why a sanction had been imposed, nor data on those granted voluntary erasure. A more detailed evaluation of the reasons for referral to the GMC may go towards explaining the sex difference observed.

Introduction

The number of complaints about doctors' fitness to practise received by the UK medical regulatory body, the General Medical Council (GMC), has been increasing since 2007¹. Following a triage and investigation process by the GMC the outcome of a case against a doctor can be closed, or can result in a sanction against the doctor's registration. The cost of this regulatory process, both in terms of financial cost of the actual complaints investigation procedure, but also in terms of the loss of the medical workforce during the process, can be significant. The level of stress that a doctor endures while undergoing a fitness to practise investigation was recently reported in the BMJ and highlights the impact the complaints investigation procedure can have on the mental well being of doctors².

One of the most significant changes in the medical profession has been the increase in the number of women entering this previously male dominated profession. The number of female medical students has been increasing since the mid-1960s with female medical students outnumbering male medical students since the mid-1990s³. It is predicted that female doctors will outnumber their male colleagues by 2017³. This change in the demographic profile of UK doctors has brought with it a heightened interest in how the increase of female doctors may impact the profession.

Examining and understanding the predictors of doctors receiving sanctions may aid the medical profession in identifying doctors whose performance might raise future concerns, in order to support these doctors and help prevent GMC referral. Research from Canada, the United States of America and Australia and New Zealand has suggested that male and female doctors differ in terms of risk of disciplinary action, with male doctors being at increased risk^{4,5,6,7,8,9,10}. However, the applicability of the findings from these studies to the UK may be limited due to differences in both the medical and legal systems in these countries. In 2011 Wakeford explored the situation in the UK¹¹. He examined the factors associated with severest outcomes of the GMC disciplinary procedures, suspension or erasure from the medical register. In agreement with these worldwide studies, he demonstrated that female doctors were four times less likely to be disciplined when compared to male doctors. However, the interpretation of this finding is limited because the measure of effect for doctors' sex was not adjusted for potential confounders.

1
2
3 We aimed to examine the effect of doctors' sex on receiving sanctions against their
4 medical registration, while adjusting for known confounding factors. This would allow
5 for a meaningful comparison of male and female doctors and their experience of
6 disciplinary action in the UK.
7
8
9

10 **Methods**

11 **Study design, setting and source of data**

12 We conducted a cross-sectional study using UK-wide data. The data and permission
13 to use the data for research purposes were obtained from the GMC. This study is
14 part of a research project that has received ethical approval from the UCL Research
15 Ethics Committee.
16
17

18 Under the Medical Act 1983 the GMC is required to keep up-to-date registers of
19 qualified doctors. The main register is the List of Registered Medical Practitioners
20 (LRMP). The LRMP is a list of all doctors registered to practise medicine in the UK,
21 and as such changes daily. It lists those doctors who are (or could) practise
22 medicine, as well as those doctors who have been suspended or erased. The GMC
23 provided us with a snapshot of doctors registered on the LRMP on the 29th May
24 2013. The list included all doctors who have been registered with the GMC (and
25 therefore eligible to actively practise medicine) at any point in the period 20th October
26 2005^a – 28th May 2013. The different categories of registration status included:
27 provisionally or fully registered; suspended; not registered – administrative reason, or
28 deceased, or having relinquished registration; and not registered – erased after
29 Fitness to Practise panel hearing. The database provided details of doctor's sex; the
30 year, country, and institutions of the doctor's primary medical qualification and the
31 doctor's current registration status, including whether they currently had any
32 sanctions on their medical registration (see below for details). It classified doctors as
33 General Practitioners (GPs) (on the GP register) and as hospital specialists (on the
34 Specialist register). To become registered on the GP or Specialist registers a doctor
35 must be a fully qualified consultant or GP (i.e. the doctor has successfully completed
36 their Specialty Training). Doctors who are neither on the GP or Specialist registers
37 can be primarily divided into two groups; the first being doctors who are currently
38 undertaking a Specialty Training programme with the aim of becoming a GP or a
39 consultant in a specialty; and the second group being composed of doctors in non-
40 training posts are doctors who have not undertaken or completed speciality training.
41 Non-training posts are doctors who are not fully qualified consultants or GPs. Non-
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56

57 ^a The 20th October 2005 was the date when the GMC first began to publish full details of a doctor's
58 registration status on the LRMP online.
59
60

training posts are focused to meet the National Health Service (NHS) service requirements and the doctors who choose to undertake a non-training post do so for a variety of reasons including difficulty in obtaining a place in a Specialty Training program due to the high competition, or doctors who prefer the work-life balance the non-training post can provide¹².

Population

All doctors who were listed on the LRMP on the 29th May 2013 were included.

Primary outcome and exposure

The outcome of interest was sanctions on a doctor's medical registration on the 29th May 2013.

The types of sanctions included:

- **Warning:** issued when a doctor's performance has not been in keeping with the principles set by the GMC for doctors, but a restriction on the doctor's registration is not necessary. Warnings remain on the LRMP for a five year period;
- **Undertakings:** an agreement between the GMC and the doctor about the doctor's future practice. The doctor must adhere to these undertakings to maintain their registration;
- **Conditions:** set out by the GMC and restrict a doctor's practice. The doctor must comply with these conditions to maintain their registration. Conditions can initially be imposed for a maximum of three years and then be renewed in periods of up to 36 months;
- **Suspension or erasure:** the doctor's licence is withdrawn by the GMC and they are no longer able to practise. Suspension from the register can last up to 12 months, but may be indefinite in certain circumstances.

A sanction can be imposed if a doctor's fitness to practise has been proved to be impaired. The impairment can result from misconduct; poor professional performance; physical or mental ill health; or a conviction or fitness to practise determination by another regulatory body either in the UK or overseas¹³. However it is recognised that the reason for impairment can cross more than one category (for example a doctor with a drug misuse problem could be classified as having mental ill health, yet the effects of the drug abuse could impact their professional performance). The duration of a sanction on a doctor's registration varies and it is possible for doctors to have more than one sanction against their registration and this

1
2
3 typically represents the outcomes of different complaints.—(For further information on
4 [sanctions visit http://www.gmc-uk.org/concerns/index.asp](http://www.gmc-uk.org/concerns/index.asp)). It was not possible to
5
6 establish the date a sanction was imposed or the reason for why a sanction had
7
8 been imposed from the available data.
9

10
11 The outcome of interest was collapsed into a binary variable: doctors with sanctions
12 against their registration; and doctors with no sanctions against their registration.
13

14
15 The exposure of interest was doctor's sex, as declared by the doctor to the GMC.
16

17 18 **Selection of variables**

19
20 The variables included in the study were selected before any statistical analysis.
21 Data was available on the year of primary medical qualification (PMQ), country of
22 PMQ and primary specialty, if on the Specialist or General Practitioner (GP)
23 Registers. These variables were selected as a priori confounders based on findings
24 from earlier research^{7,8,11,14}, which demonstrated that these factors may influence the
25 risk of receiving sanctions.
26
27

28
29 Once the variables had been selected, we performed a variable reduction process, to
30 reduce the number categories into meaningful categories. Once again, this was
31 performed before any statistical analysis. The variable 'year of PMQ' was converted
32 into 'number of years since qualification' by subtracting the year of PMQ from 2013
33
34 ^b. We then collapsed the variable into six categories. The first category '0-2 years'
35 represented Foundation Training, the second category '3-10 years' represented the
36 bulk of time a doctor would likely spend in Specialty Training. The subsequent
37 categories were divided into 10-year blocks. The variable 'country of PMQ' was
38 collapsed into three categories; 'UK', 'EEA' (European Economic Area) and
39 'International'. The list of countries included in the EEA category was obtained from
40 the European Union website¹⁵ and included all countries that were members before
41 May 2013. The variable 'specialty' was divided into fourteen categories. Doctors
42 who were not present on either the Specialist Register or the GP Register were
43 categorised as having 'no specialty' and represented trainee and other non-specialist
44 doctors. Doctors on both the Specialist Register and the GP Register were recorded
45 as having 'dual specialty' and doctors only on the GP register were categorised as
46 'GP'. For doctors only registered on the Specialist Register, their primary specialty
47
48
49
50
51
52
53
54

55
56 ^b As mentioned above, a doctor could appear in the LRMP dataset if they had been removed from the
57 medical register. The actual date of those doctors being removed could lie anytime between 20th
58 October 2005 and 28th May 2013. However, as no actual removal dates were given for those doctors,
59 we used 2013 for all doctors.
60

1
2
3 was taken and recorded into one of eleven categories. To categorise those doctors
4 on the Specialist Register two researchers (EU and CW) independently allocated
5 each primary specialty to a specialty category. Kappa statistic demonstrated a good
6 level of agreement ($\kappa = 0.72$). Any disagreements about specialty category
7 allocation were resolved through discussion.
8
9

10 11 12 **Statistical methods**

13 We took a causal modelling analysis approach to analyse the data. We firstly
14 performed bivariate analyses to look for crude associations in the data, followed by
15 Mantel-Haenszel analyses, before going on to complete multivariate analyses using
16 binary logistic regression modelling. The initial logistic regression model included
17 only the exposure (sex) and outcome (sanctions) variables to provide a crude
18 measure of effect. The final logistic regression model was built to include all
19 potential confounder variables, while checking for multicollinearity. The final logistic
20 regression model enabled the calculation of an adjusted measure of effect. The final
21 model was assessed for the presence of effect modifiers following the findings from
22 the Mantel-Haenszel analyses.
23
24
25
26
27
28

29
30 Statistical analyses were conducted using the software Stata 12/SE.
31

32
33 We used the STROBE Statement¹⁶ to guide our study report.
34
35

36 37 **Results**

38 There were 329,542 doctors on the LRMP on the 29th May 2013, of whom 40.3%
39 were female. Table 1 shows the distribution of variables by the sex of doctors. The
40 median number of years since qualification was 19 years. The distribution of the
41 number of years since a doctor had qualified was skewed to the right with the
42 majority of the doctors qualifying 11-20 years ago (28.1%). The majority of the
43 doctors had received their PMQ from a UK medical school (59.3%).
44
45

46
47 Approximately half of all the doctors were neither on the GP Register nor the
48 Specialist Register (51.0%), of which the majority (58.0%) had received their PMQ
49 greater than 10 years previously. It is interesting to note that half of the doctors
50 registered to practise medicine in the UK in this period were not registered specialists
51 (they were neither on the GP or Specialist registers) and the majority of these
52 doctors had qualified greater than ten years ago, suggesting that these doctors are
53 not trainee doctors, but doctors who have elected not to complete specialty training
54 and are currently working in a non-training post. Of those doctors who had
55
56
57
58
59
60

1
2
3 specialised, General Practice was the most popular specialty (21.3%), followed by
4 Medicine (6.6%). 0.5% of the doctors were on both the Specialist and GP Registers.
5
6

7
8 2697 (0.8%) doctors had sanctions against their registration on the 29th May 2013.
9 There was a higher proportion of male doctors who had sanctions against their
10 registration when compared to female doctors (1.1% of all male doctors compared
11 with 0.4% of all female doctors, $\chi^2=505.4$, $P<0.001$). There was strong evidence for
12 an association between receiving sanctions and the number of years since received
13 PMQ, with doctors who qualified 31-40 years ago having the highest proportion of
14 sanctions; world region of PMQ, with doctors who qualified outside the EEA with the
15 highest proportion of doctors with sanctions; and specialty, with doctors on both the
16 Specialist and GP Registers having the highest proportion of doctors with sanctions.
17 These results are presented in Table 2.
18
19
20
21
22
23

24 Using bivariate analyses we compared female doctors to male doctors. There was a
25 strong trend between sex of a doctor and the number of years since the doctor
26 received their PMQ, with female doctors being more likely to have recently qualified
27 and the proportion of female doctors reducing as the number of years since PMQ
28 increased. We also found that female doctors were more likely to have qualified in
29 the UK (65.5% of all female doctors compared to 55.0% of all male doctors) and
30 male doctors were more likely to have qualified outside of the EEA (32.1% of all male
31 doctors compared to 22.5% of all female doctors). Approximately equal proportions
32 of male and female doctors qualified in the EEA (12.9% and 12.0% respectively).
33 Both sexes were more likely to be not registered in a specialty (GP or hospital),
34 though there was a slightly higher proportion of women when compared to men who
35 were not on the Specialist or GP Registers. When examining those doctors who
36 were registered in a specialty, a higher proportion of female doctors were on the GP
37 Register compared to male doctors (24.3% of female doctors compared with 19.3%
38 of male doctors) and a higher proportion of male doctors were registered with a
39 hospital specialty (32.0% of male doctors compared with 20.1% of female doctors).
40 In summary, number of years since received PMQ, world region where PMQ was
41 received, and registered specialty were associated with both the outcome (sanctions)
42 and the exposure (sex of a doctor) and as such we considered these variables as
43 confounders.
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 The unadjusted odds ratio for having sanctions against a doctor's registration
4 comparing female doctors with male doctors was 0.35 (95% CI: 0.32-0.38),
5 suggesting that being a female doctor is protective of receiving sanctions.
6

7 Mantel-Haenszel analyses and tests of homogeneity were conducted to examine the
8 change in the strength of the association between sanctions and sex while controlling
9 for each of the confounders separately.
10

11 There was strong evidence that the true odds ratios were different between the
12 different specialty categories ($P=0.0002$), therefore specialty was considered as an
13 effect modifier when conducting multivariate analyses.
14
15

16
17
18 Table 3 represents the results from the binary logistic regression model built to adjust
19 for all the variables. After taking into account the number of years since PMQ, world
20 region where the doctor received their PMQ and specialty, female doctors had nearly
21 a third of the odds of having sanctions on their registration compared to male doctors
22 (OR 0.37, 95% CI: 0.33-0.41, $P<0.0001$).
23
24

25 All of the a priori confounders were felt to be confounders because the adjusted odds
26 ratio changed when each variable was added to the model. We found no evidence
27 of multicollinearity.
28

29 The Mantel-Haenszel analyses suggested that specialty may be an effect modifier,
30 we therefore performed a statistical test for effect modification by firstly collapsing the
31 specialty variable into four groups to increase the power of the test. Table 4
32 demonstrates that specialty was felt to be an important effect modifier with female
33 doctors being less likely to receive sanctions when compared to male doctors, but
34 the effect was greater for GPs than for those doctors with no specialty or practising a
35 hospital specialty.
36
37
38
39
40
41
42

43 Discussion

44 In our large cross-sectional study we found strong evidence that being female was
45 associated with a reduction in odds of receiving sanctions (OR 0.35, 95% CI: 0.32-
46 0.38) in the unadjusted model. Controlling for years since PMQ, world region where
47 received PMQ, and specialty did slightly increase this odds ratio (OR 0.37, 95% CI:
48 0.33-0.41, $P<0.0001$), but there remained strong evidence for the association
49 between doctor's sex and receiving sanctions. There was evidence that the
50 association varied with specialty, with female GPs being the least likely to have
51 sanctions against their registration.
52
53
54
55
56
57
58
59
60

1
2
3 To our knowledge this is the first study in the UK to examine the association between
4 doctor's sex and receiving sanctions against medical registration, while adjusting for
5 known confounders. We believe that these known confounders have only been
6 adjusted for in one other study which was conducted in the USA⁸.
7
8
9

10 **Strengths and weaknesses of this study**

11 One of the major strengths of this study is that we used a large national database.
12 The advantage of using this dataset is two-fold; firstly, because a national database
13 was used the findings of the study apply to all doctors registered to practise in the
14 UK; secondly, receiving sanctions is a rare outcome and using a large dataset is
15 crucial when examining rare outcomes.
16
17

18 A further strength of this study is that it adjusted for known confounders, all these
19 confounders have only been adjusted for in one previous study, which was
20 conducted in California⁸. Previous research on UK data did not adjust the measure
21 of effect of sex for potential confounders¹¹.
22

23 Finally, a further advantage was the completeness of the dataset. The data is
24 collected by the GMC for inclusion on the LRMP, and not research purposes.
25 Doctors are required to provide the data to the GMC to be registered and as such
26 there is no missing data. However, the fact the data is not collected for research
27 purposes is also a limitation of the study. The study was constrained by the
28 information variables collected and made available by the GMC. As such, we were
29 only able to explore the variables available. Wand we were unable to examine the
30 effect of other potential confounding factors or explore the reasons for why a
31 sanction had been imposed, nor were we able to establish the date a sanction had
32 been imposed.
33
34
35
36
37
38
39
40

41 It could be argued that the reason for referral to the GMC could be a source of
42 residual confounding if systematic differences exist between the sexes. The GMC
43 may take action against a doctor's registration for a number of reasons, which can be
44 broadly divided into three major categories; misconduct; poor professional
45 performance; or physical or mental ill health. The data available did not provide the
46 reasons or the category for why a sanction had been imposed, but a more detailed
47 evaluation of the reasons for referral to the GMC may go towards explaining the sex
48 difference observed. In their research, Alam et al.⁴ and Elkin et al.¹⁰, demonstrated
49 not only that male doctors were more likely to be subject to disciplinary action, but
50 that the main offense for which a doctor was being disciplined was sexual
51 misconduct. It is possible that male doctors are more likely to commit an offense
52 involving sexual misconduct than their female colleagues, which may go towards
53
54
55
56
57
58
59
60

1
2
3 explaining the sex difference seen in these populations. However, other studies in
4 this area did not find sexual misconduct to be the most common offense^{6,7,9}. As
5 such, exploring the offenses for which a doctor may receive disciplinary action in this
6 population may go towards explaining the sex difference observed and may help the
7 regulatory body and medical profession to introduce targeted interventions, such as
8 education programmes, to reduce the number of offenses.
9

10
11 A further source of residual confounding could be the route of referral. Doctors
12 practising in the UK can be referred to the GMC through five main routes; the public;
13 employers; doctors; the GMC; and the police¹⁷. It would be interesting to examine
14 whether the referral rate for each route demonstrates any sex differences, and if so,
15 exploring the reasons for this difference.
16
17

18
19 A further limitation is that a doctor can apply for voluntary erasure from the LRMP
20 during an investigation process. Once again, this is a potential source of residual
21 confounding and it is possible that the sex of doctors who are subject to a complaints
22 investigation and apply for voluntary erasure differs to those doctors who complete
23 the investigative process and receive a sanction (however, the GMC's decision to
24 grant a request for voluntary erasure is based on the public interest and the doctor's
25 health and likelihood to return to practise¹⁸). It is important to note that voluntary
26 erasure is requested by doctors for multiple reasons other than being involved in an
27 investigation process, including retiring permanently from practising medicine or
28 leaving the UK to work permanently abroad. To explore whether voluntary erasure
29 requests may explain the sex difference seen, the reason for why a voluntary erasure
30 request was submitted would first have to be ascertained. This information was not
31 available in the dataset used for this research, but could be requested and explored
32 in future studies.
33
34
35
36
37
38
39
40

41 It is also of interest to note that certain sanctions (erasure and some suspensions)
42 are permanent, whereas other sanctions are time limited. As such, the permanent
43 sanctions may be over represented because they will never be removed from a
44 doctor's registration. If male doctors are more likely to receive these permanent
45 sanctions, this could lead to male doctors being over represented when examining
46 the association between sex and sanctions, and may go towards explaining the sex
47 difference observed between doctors who had sanctions imposed against their
48 registration.
49
50
51
52

53 Finally, a further limitation of the study is that nearly half of the doctors in the
54 population were not recorded on the GP or Specialist registers and were therefore
55 classified as not having a specialty. Doctors who are not on the GP or Specialist
56 registers typically fall into one of two categories; either a doctor who is on a Specialty
57
58
59
60

Training programme with the aim of becoming a GP or a consultant in a specialty; or doctors who have chosen to work in a non-training post. It was not possible from the information made available by the GMC to examine these two categories. It would be of interest to explore if the proportions of male and female doctors differ in these two categories and to examine whether the risk of disciplinary action differs for doctors who are in a Specialty Training post compared to doctors who are working in a non-training post. It would also be of interest if further information about the type of non-training post these doctors were working in and to examine the association with receiving sanctions.

Comparison with other studies

Our main finding, that female doctors are less likely to be subject to disciplinary action when compared to their male colleagues, mirrors the results of several studies from across the world which have also examined the association between doctors' sex and disciplinary action^{4,6,7,8,9,10,11}. However, the majority of these studies have been performed in the United States of America^{6,7,8,9}, Canada⁴, Australia and New Zealand¹⁰, where the medical and legal systems differ to the UK and therefore we felt that their findings may not be applicable to the UK population of doctors. These studies' main objective was not necessarily to explore the association between doctors' sex and disciplinary action. Some of these studies were descriptive and those studies that did control for confounders did not, albeit for one study⁸, control for the same confounders we have selected. To our knowledge, one study has been performed in the UK using national data¹¹, however when examining the association between doctors' sex and disciplinary action this study did not control for any potential confounders.

The findings of this study are in agreement with previous research that has shown that older doctors⁸, doctors who qualified outside of the country in which they are practising^{11,14} and doctors of certain specialties⁷ are more likely to be subjected to disciplinary action from a medical regulatory board. It has also been demonstrated in previous studies that female doctors are more likely to be have qualified more recently than male doctors³, are more likely to have qualified in the country in which they are practising¹⁹ and choose different specialties to male doctors²⁰.

This study showed that the reason that male doctors receive more sanctions is not because they qualified longer ago, nor because they are more likely to have qualified outside the UK, despite both of those factors being associated with increased likelihood of sanctions.

Unanswered questions and future research

This study has demonstrated that female doctors are less likely to receive sanctions against their medical registration compared to male doctors, however it is not clear why women are less likely to receive sanctions when compared to men. Exploring the possible reasons for this sex difference in professional performance is required, using a theoretical based approach. One theory suggested by some researchers is that male and female doctors differ in communication style and hence the interaction with patients and colleagues differed between the sexes, which could affect the risk of being subject to a complaint^{21,22}. Future research could be performed to explore this further and examine whether communication styles differ between male and female doctors, and also whether the communication styles of doctors who receive sanctions differ from doctors who have never received sanctions.

We have also demonstrated that the effect of sex on likelihood to receive sanctions varied by specialty, with female GPs being the least likely to receive sanctions. It has been demonstrated by an observational study of primary care physicians in the USA that female primary care physicians spend more time with their patients when compared to their male colleagues and they engaged more in conversation, displaying more positive-talk, partnership-building, question-asking and information-giving²³. These differences in communication style and time spent with patients may go towards explaining the larger sex discrepancy observed in GPs, however future research is required to explore these possible reasons further.

Our results show that doctors who had been qualified for longer were more likely to receive sanctions, it is therefore reasonable to hypothesise that the risk of receiving a sanction increases with exposure. Therefore doctors who ~~work part time or~~ have fewer patient encounters may be less likely to receive sanctions against their registration. Previous studies have demonstrated that female consultants have fewer patient episodes and are more likely to work part-time (and thus have fewer patient encounters) when compared to their male colleagues^{24,25}, it is therefore reasonable to hypothesise that the sex difference observed in disciplinary action may be partly explained by the difference in work patterns between the sexes. This hypothesis merits being explored further by examining whether certain work patterns (i.e. part-time compared to full-time work) are more likely to be associated with receiving sanctions. ~~these doctors who receive sanctions are more likely to work full time and~~

~~have more patient encounters than those doctors who have never received sanctions.~~

A further possible explanation for the sex difference observed is perhaps that male and female doctors are viewed and treated differently by the public, the profession and the regulatory body. It is possible that there is a higher threshold of tolerance for female doctors. The GMC are twice as likely to receive a complaint about a male doctor than a female doctor¹⁷. It is reasonable to assume that as a result male doctors are more likely to receive sanctions against their medical registration. Research examining the perception of male and female doctors would be warranted.

It should also be noted that this study was observational in design and as such causality cannot be determined. It is possible that other factors, such as ethnicity, may be confounding the association between doctors' sex and disciplinary action. Research examining whether other potential confounders could explain the observed association is required

The points discussed above highlight that the real interest of this research is not about the outcome sanctions itself, but about trying to understand the differences between male and female doctors that lead to the observed sex difference in receiving sanctions. Investigations into why and how male and female medical practises differ will in turn lead to being able to propose interventions to reduce not only the number of doctors referred to the medical regulatory body, but also the difference between the sexes of doctors who are referred. Further exploration of why doctors' sex may impact their professional performance is needed to enable the profession to develop a better understanding of the factors associated with impaired fitness to practise and crucially, how to better support those doctors and ensure patient safety.

Conclusion

In this study we demonstrated that female doctors practising in the UK were less likely to receive sanctions on their medical registration when compared with their male colleagues. These findings remained after adjusting for known confounders. Reasons for why this sex difference exists needs to be examined.

Acknowledgements

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

We acknowledge Una Lane for facilitating access to the data and for answering our queries on the dataset. We acknowledge Andrew Ledgard for clarifying our queries on the dataset.

For peer review only

Footnotes

Contributorship statement: EU conceived and designed the study with input from KW and JD. EU and CW categorised the data. EU analysed and interpreted the data with support from KW. EU drafted the manuscript and all authors participated in the revision process and have approved this submission for publication. EU is guarantor, had full access to all of the data in the study, and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding: No specific funding was obtained for this study. EU is a PhD student, and recipient of a UCL Impact studentship. None of the funders influenced the conduct of this research.

Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf. All authors declare no competing interests that may be relevant to the submitted work.

Ethical approval: The study is part of a research project that has received ethical approval from the UCL Research Ethics Committee.

Data sharing statement: No additional data available.

Transparency declaration: EU, as guarantor, affirms that this manuscript is an honest, accurate and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Copyright: The corresponding author has the right to grant on behalf of all authors and does grant on behalf of all authors, a worldwide licence to the Publishers and its licensees in perpetuity, in all forms, formats and media (whether known now or created in the future), to i) publish, reproduce, distribute, display and store the Contribution, ii) translate the Contribution into other languages, create adaptations, reprints, include within collections and create summaries, extracts and/or, abstracts of the Contribution, iii) create any other derivative work(s) based on the Contribution, iv) to exploit all subsidiary rights in the Contribution, v) the inclusion of electronic links from the Contribution to third party material where-ever it may be located; and, iv) licence any third party to do any or all of the above.

Table 1: Distribution of variables by sex of doctors.

Variable	Male N=196,814	Female N=132,728	Total N=329,542
Sanction imposed on registration			
No	194,633 (98.9%)	132,212 (99.6%)	326,845 (99.2%)
Yes	2,181 (1.1%)	516 (0.4%)	2,697 (0.8%)
No. of years since received PMQⁱ			
0-2 years	6,332 (3.2%)	8,830 (6.7%)	15,162 (4.6%)
3-10 years	28,548 (14.5%)	37,220 (28.0%)	65,768 (20.0%)
11-20 years	52,437 (26.6%)	40,023 (30.2%)	92,460 (28.1%)
21-30 years	39,146 (19.9%)	23,069 (17.4%)	62,215 (18.9%)
31-40 years	30,206 (15.4%)	12,136 (9.1%)	42,342 (12.9%)
≥41 years	40,145 (20.4%)	11,450 (8.6%)	51,595 (15.7%)
Region where received PMQ			
UK	108,323 (55.0%)	86,989 (65.5%)	195,312 (59.3%)
EEA ⁱⁱ	25,333 (12.9%)	15,880 (12.0%)	41,213 (12.5%)
International	63,158 (32.1%)	29,859 (22.5%)	93,017 (28.2%)
Specialty			
No Specialty	94,815 (48.2%)	73,309 (55.2%)	168,124 (51.0%)
Anaesthetics	8,710 (4.4%)	3,797 (2.9%)	12,507 (3.8%)
EM ⁱⁱⁱ	754 (0.4%)	209 (0.2%)	963 (0.3%)
GP ^{iv}	37,959 (19.3%)	32,264 (24.3%)	70,223 (21.3%)
Medicine	15,076 (7.7%)	6,775 (5.1%)	21,851 (6.6%)
O&G ^v	2,934 (1.5%)	1,966 (1.5%)	4,900 (1.5%)
Ophthalmology	2,508 (1.3%)	1,078 (0.8%)	3,586 (1.1%)
Paediatrics	3,906 (2.0%)	3,891 (2.9%)	7,797 (2.4%)
Pathology	5,589 (2.8%)	2,965 (2.2%)	8,554 (2.6%)
Psychiatry	5,494 (2.8%)	3,077 (2.3%)	8,571 (2.6%)
Radiology	172 (0.1%)	41 (0.03%)	213 (0.1%)
Surgery	16,452 (8.4%)	1,942 (1.5%)	18,394 (5.6%)
Other	1,330 (0.7%)	867 (0.7%)	2,197 (0.7%)
Dual Specialty	1,115 (0.6%)	547 (0.4%)	1,662 (0.5%)

ⁱPrimary Medical QualificationⁱⁱEuropean Economic AreaⁱⁱⁱEmergency Medicine^{iv}General Practice^vObstetrics & Gynaecology

Table 2: The distribution of sanctions for each variable and the association of individual factors with sanctions.

Variable	Total number of doctors	Sanctions (%)	p-value
Sex			<0.001
Male	196,814	1.1%	
Female	132,728	0.4%	
No. of years since received PMQⁱ			<0.001
0-2	15,162	0.1%	
3-10	65,768	0.6%	
11-20	92,460	0.8%	
21-30	62,215	1.1%	
31-40	42,342	1.4%	
≥41	51,595	0.7%	
Region where received PMQ			<0.001
UK	195,312	0.6%	
EEA ⁱⁱ	41,213	0.9%	
International	93,017	1.2%	
Specialty			<0.001
No Specialty	168,124	0.7%	
Anaesthetics	12,507	0.7%	
EM ⁱⁱⁱ	963	0.7%	
GP ^{iv}	70,223	1.2%	
Medicine	21,851	0.5%	
O&G ^v	4,900	1.2%	
Ophthalmology	3,586	0.5%	
Paediatrics	7,797	0.6%	
Pathology	8,554	0.6%	
Psychiatry	8,571	0.8%	
Radiology	213	0.5%	
Surgery	18,394	0.9%	
Other	2,197	0.3%	
Dual Specialty	1,662	1.4%	

ⁱPrimary Medical QualificationⁱⁱEuropean Economic AreaⁱⁱⁱEmergency Medicine^{iv}General Practice^vObstetrics & Gynaecology

Table 3: The adjusted odds ratio for having sanctions against registration for each variable compared to its baseline having adjusted for all other variables.

Variable	Adjusted OR ⁱ	95% CI ⁱⁱ	p-value
Sex of a doctor			
			<0.0001
Male	1		
Female	0.37	0.33-0.41	
No. of years since received PMQ			
			<0.0001
0-2	1		
3-10	3.42	2.20-5.32	
11-20	3.85	2.48-5.98	
21-30	5.66	3.63-8.81	
31-40	6.44	4.13-10.05	
≥41	3.12	1.20-4.87	
Region where received PMQ			
			<0.0001
UK	1		
EEA	1.33	1.17-1.50	
International	1.65	1.51-1.80	
Specialty			
			<0.0001
No Specialty	1		
Anaesthetics	0.65	0.52-0.82	
EM	0.66	0.31-1.39	
GP	1.43	1.29-1.58	
Medicine	0.49	0.40-0.60	
O&G	1.22	0.93-1.59	
Ophthalmology	0.53	0.33-0.83	
Paediatrics	0.64	0.47-0.88	
Pathology	0.65	0.50-0.86	
Psychiatry	0.81	0.63-1.04	
Radiology	0.47	0.07-3.38	
Surgery	0.78	0.66-0.93	
Other	0.36	0.17-0.77	
Dual Specialty	1.37	0.90-2.09	

ⁱ Odds Ratio

ⁱⁱ Confidence Interval

Table 4: Stratum-specific odds ratios for having sanctions imposed on registration if the doctor is female for each specialty divided into four categories.

Variable	Stratum-Specific OR ⁱ	95% CI ⁱⁱ	p-value
Specialty Category			
			<0.0001
No Specialty	0.43	0.38-0.49	
GP	0.26	0.22-0.31	
Hospital Specialty	0.44	0.36-0.56	
Dual Specialty	0.09	0.13-0.70	

ⁱ Odds Ratio

ⁱⁱ Confidence Interval

References

1. General Medical Council. *The state of medical education and practice in the UK*. London: GMC; 2012.
2. Dyer C. GMC and vulnerable doctors: too blunt an instrument? *BMJ* 2013; 347: f6230.
3. Elston MA. *Women and medicine: the future*. London: Royal College of Physicians; 2009.
4. Alam A, Klemensberg J, Griesman J & Bell CM. The characteristics of physicians disciplined by professional colleges in Canada. *Open Medicine* 2011; 5(4): e173-e174.
5. Cardarelli R & Licciardone, JC. Factors associated with high-severity disciplinary action by a state medical board: a Texas study of medical license revocation. *JAOA* 2006; 106(3): 153-156.
6. Clay SW & Conaster RR. Characteristics of physicians disciplined by the State Medical Board of Ohio. *JAOA* 2003; 103(2): 81-88.
7. Khaliq AA, Dimassi H, Huang CY, Narine L & Smego RAJr. Disciplinary action against physicians: who is likely to get disciplined? *The American Journal of Medicine* 2005; 118(7): 773-777.
8. Kohatsu ND, Gould D, Ross LK & Fox PJ. Characteristics associated with physician discipline: a case-control study. *Archives of Internal Medicine* 2004; 164(6): 653-658.
9. Morrison J & Wickersham P. Physicians disciplined by a State Medical Board. *JAMA* 1998; 279: 1889-1893.
10. Elkin KJ, Spittal MJ, Elkin DJ & Studdert DM. Doctors disciplined for professional misconduct in Australia and New Zealand, 2000-2009. *MJA* 2011; 194: 452-456.
11. Wakeford R. Who gets struck off? *BMJ* 2011; 343: d7842.
12. National Health Service – Medical Careers. *Non-training posts*. https://www.medicalcareers.nhs.uk/career_options/working_as_a_doctor/non-training_posts.aspx (accessed July 2014).
13. General Medical Council. *A guide for doctors referred to the GMC*. http://www.gmc-uk.org/concerns/doctors_under_investigation/a_guide_for_referred_doctors.asp (accessed December 2013).
14. Humphrey C, Hickman S & Gulliford MC. Place of medical qualification and outcomes of UK General Medical Council “fitness to practise” process: cohort study. *BMJ* 2011; 342: d1817.
15. European Union. *Countries*. http://europa.eu/about-eu/countries/index_en.htm (accessed May 2013).
16. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC & Vandembroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for Reporting Observational Studies. *PLoS Med* 2007; 4(10): e296.
17. General Medical Council. *The state of medical education and practice in the UK*. London: GMC; 2013.
18. General Medical Council. *Guidance on making decisions on voluntary erasure applications*. GMC; 2013.
19. Lambert TW, Goldacre MJ & Parkhouse J. Doctors who qualified in the UK between 1974 and 1993: age, gender, nationality, marital status and family formation. *Medical Education* 1998; 32(5): 533-537.
20. Lambert TW, Goldacre MJ, Edwards C & Parkhouse J. Career preferences of doctors who qualified in the United Kingdom in 1993 compared with those doctors qualifying in 1974, 1977, 1980, and 1983. *BMJ* 1996; 313(7048): 19-24.
21. Taragin TI, Wilczek AP, Karns ME, Trout, R & Carson JL. Physician demographics and the risk of medical malpractice. *The American Journal of Medicine* 1992; 93(5): 537-542.
22. Firth-Cozens, J. Doctors with difficulties: why so few women? *Postgraduate Medical Journal* 2008; 84(992): 318-320.
23. Roter D, Lipkin M & Korsgaard A. Sex differences in patients’ and physicians’ communication during primary care medical visits. *Medical Care* 1991; 29(11): 1083-1093.
24. Bloor K, Freemantle N & Maynard A. Gender and variation in activity rates of hospital consultants. *J R Soc Med* 2008; 101(1): 27-33.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

25. Goldacre MJ, Lambert TW & Davidson JM. Loss of British-trained doctors from the medical workforce in Great Britain. *Med Educ* 2001; 35(4): 337-344.

For peer review only

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Y
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Y
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Y
Objectives	3	State specific objectives, including any prespecified hypotheses	Y
Methods			
Study design	4	Present key elements of study design early in the paper	Y
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Y
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	Y
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Y
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Y
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	N/A
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Y
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Y
		(b) Describe any methods used to examine subgroups and interactions	Y
		(c) Explain how missing data were addressed	N/A
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Y
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	Y
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Y

		(b) Report category boundaries when continuous variables were categorized	Y
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Y
Discussion			
Key results	18	Summarise key results with reference to study objectives	Y
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Y
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Y
Generalisability	21	Discuss the generalisability (external validity) of the study results	Y
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Y

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.