

PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (<http://bmjopen.bmj.com/site/about/resources/checklist.pdf>) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

TITLE (PROVISIONAL)	What explains wage differences between male and female Brazilian physicians? A cross-sectional nationwide study
AUTHORS	Mainardi, Giulia Marcelino; Cassenote, Alex; Guilloux, Aline; Miotto, Bruno; Scheffer, Mario Cesar

VERSION 1 - REVIEW

REVIEWER	Eric Apaydin RAND Corporation, USA Doctor Evidence, USA
REVIEW RETURNED	09-Jun-2018

GENERAL COMMENTS	<p>This is an analysis of the male-female income difference among Brazilian physicians using a national survey. The data seems excellent, but the analysis and presentation of the results could be improved.</p> <p>Overall: Please provide some context for employment of physicians in Brazil. In the US, many physicians are not employed and independently insurers for medical care, so the physician gender income gap is quite puzzling. If Brazilian physicians are employed and negotiate salaries upon hire, direct discrimination could potentially explain the gender gap. If physicians are blindly paid based on the care they perform, other factors would likely explain the gap. Please add this context to your introduction and discussion.</p> <p>Next, your results were relatively hard to follow. As a reader, I'm unsure what to take away from so much information. It would be better to bring the hierarchical model out of the appendix (Table S2) and put Tables 2-5 in the appendix or cut them entirely. The reader wants to know what to take away from your results -- i.e., your full model doesn't explain the income gap. Pages and pages of summary statistics are more confusing than helpful. Please consolidate this section and present your most important results more prominently.</p> <p>Introduction: Line 75: Medicine, engineering and law should not be capitalized. Line 76: What do you mean by this sentence? Hourly wage? Please clarify. Lines 81-84: Consider adding more up-to-date references here, like Apaydin 2018, Ly 2016, Jena 2016, and Desai 2016.</p> <p>Methods: Line 172: Consider using purchasing power parity instead of the raw exchange rate. PPP for Brazil in 2013 was R\$1.65 to \$1, which means that cost of living was 25% cheaper in</p>
-------------------------	---

	<p>Brazil compared to the US. This comparison is more fair than just using the exchange rate.</p> <p>Results: Line 220: Age can't be a percentage. I think there is a category missing here.</p> <p>Line 222: Consider presenting chi-2 statistics to show that this categories differed significantly by gender.</p> <p>Table 1: What does "no medical specialty" mean? Primary care? Internal medicine? Please clarify.</p>
--	---

REVIEWER	Carolina Ciacci University of Salerno, Dpt Medicine and Surgery
REVIEW RETURNED	08-Sep-2018

GENERAL COMMENTS	<p>The paper under review deals with the issue of gender-related wage disparity among Brazilian physicians. The paper reports a valuable work, although there are some major issues that if solved would help average readers to understand the findings better.</p> <ol style="list-style-type: none"> 1. The respondents were 2400 Brazilian physicians. It is not clear how many of those eligible did not respond or refused to respond and if there were among them any differences (gender?). 2. I could not find in results the working position of participants (apical, not-apical) which I believe should have been one of the first questions in the 30-min interview. How many men were in apical position in their working position compared to women? 3. It appears that more men than women work in private hospitals. Could the wage difference be attributable to differences in wage among private and public hospitals/settings? 4. The wage was similar in men and women working in the same category (for ex. Family health strategy) 5. Has Brazil laws that fix the wage per category and position or there is for physicians some sort of individual contracts (in private hospitals, for example) that can explain the gender-related wage difference? 6. The title is promising, but the reasons for which there is a gender-related wage difference in Brazil are not clearly discussed. The discussion should be therefore improved and the references updated to 2018. In particular, what will make the difference is to present all the possible explanation of such a phenomenon. <p>I suggest the authors read the following papers:</p> <p>Analysis of gender-based differences among surgeons in Japan: results of a survey conducted by the Japan Surgical Society. Part 1: Working style. Kawase K, Nomura K, Tominaga R, Iwase H, Ogawa T, Shibasaki I, Shimada M, Taguchi T, Takeshita E, Tomizawa Y, Nomura S, Hanazaki K, Hanashi T, Yamashita H, Kokudo N, Maeda K. Surg Today. 2018 Jan;48(1):33-4</p> <p>Reasons for choosing the profession and profile of newly qualified physicians in Brazil.</p> <p>Equal work for unequal pay: the gender reimbursement gap for healthcare providers in the United States.</p> <p>Desai T, Ali S, Fang X, Thompson W, Jawa P, Vachharajani T. Scheffer MC, Guilloux AG, Poz MR, Schraiber LB. Rev Assoc Med Bras (1992). 2016 Dec;62(9):853-861</p>
-------------------------	--

	<p>Satisfaction and motivation of general physicians toward their career. Barikani A et al. Glob J Health Sci. (2012) Postgrad Med J. 2016 Oct;92(1092):571-5.</p> <p>Why does the gender income gap still exist? Female physicians paid \$350,000 to \$2.3 million less than their male peers. Collins B Md Med. 2013;14(3):21-3.</p> <p>Gender equality in medicine: What do gastroenterologists from Italy think of it? Ciacci C; 2017, Leandro G, Testoni PA. Dig Liver Dis. 2018 Jul;50(7):725-727</p> <p>Minor</p> <p>In Results : in the following sentence 'female 26.7% (95%CI 24.1%-29.5%) versus male 17.8% (95%CI 15.8-19.9)], private hospitals [male 42.4% (95%CI 39.8%-45.0%) versus female 32.2% (95%CI 29.4%-35.1%)], family health strategy [female 26.6% (95%CI 23.6%-29.0%) versus 21.3% (95%CI 19.2% - 23.5%)], time in practice [male <10 years 25.8% (95%CI 39.8%-45.0%) versus female 34.5% (95%CI 31.6%-37.6%)], weekly workload (hours) [male >60 hours 36.5% (95%CI 33.9%-39.0) versus female 26.7% (95%CI 24.0%-29.7%)' please present the comparison always as female vs male, as it has done for the majority of cases.</p> <p>Table 2 should be moved in the supplementary material section as the primary data are reported in the text.</p> <p>The section analysing the influence of independent factors presented in table S2 should be moved in the supplementary documents section</p>
--	---

REVIEWER	Karen Dwyer Deakin University Australia
REVIEW RETURNED	19-Sep-2018

GENERAL COMMENTS	<p>This is an important paper outlining gender inequities within the medical profession. I congratulate the authors on addressing this issue.</p> <p>Most of my comments related to minor editorial issues:</p> <p>abstract: line 37 >US\$ 10,762 add per month</p> <p>line 164: through to.....remove to</p> <p>line 220: age ...I think >60 should be added</p> <p>In this result part significance values should be added</p> <p>line 230: hours....per month???</p> <p>line 242: women are (not is)</p> <p>line 253: should read men are more likely to earn >US\$10762/month</p> <p>line 272: Only in pediatrics, orthopedics, and trauma specialties the proportion of women in the lowest wage range was not significant - what was the PR in these specialities??</p> <p>line 300: (≥ US\$ 10,762 add per month</p>
-------------------------	--

REVIEWER	Suad Hannawi Ministry of Health and Prevention United Arab Emirates
REVIEW RETURNED	21-Sep-2018

GENERAL COMMENTS	The study is well designed and written How many physicians had been contacted to get 2400 individuals who accepted to participate Page 7 author stated “characteristics of the medical work including of degree of dedication to medical work” had been included. I am not sure what variables talk about the dedication to medical work. Clarify Table 1. why the total number of the participants had been mentioned for some variables and not for other variables (like place of work)? Insert the missing total figure
-------------------------	---

VERSION 1 – AUTHOR RESPONSE

Reviewer 1

1. “... Please provide some context for employment of physicians in Brazil.”

We believe that the modifications included in the revised manuscript (lines 101-106 and 413-417) should fulfill the Reviewer 1’s concerns about the multiple employment modalities observed in Brazil.

2. “...your results were relatively hard to follow. As a reader, I'm unsure what to take away from so much information. It would be better to bring the hierarchical model out of the appendix (Table S2) and put Tables 2-5 in the appendix or cut them entirely. The reader wants to know what to take away from your results -- i.e., your full model doesn't explain the income gap.”

The modifications suggested by the Reviewer 1 regarding the presentation of results were extremely helpful. We transferred Tables 2 to 5 to the supplementary file and relocated S2 table to the main manuscript, now shown as Table 2. We hope that these modification can help readers to easily follow the results. We also believe that the main results are now more identifiable, but the most significant findings are in fact highlighted in the discussion section.

3. Minor revision issues

3.1 Line 75: Medicine, engineering and law should not be capitalized.

The sentence was modified, as suggested.

3.2 Line 76: What do you mean by this sentence? Hourly wage? Please clarify.

The sentence was modified, as suggested.

3.3 Lines 81-84: Consider adding more up-to-date references here, like Apaydin 2018, Ly 2016, Jena 2016, and Desai 2016.

After careful reading, the references suggested were included in the manuscript.

3.4 Line 172: Consider using purchasing power parity instead of the raw exchange rate. PPP for Brazil in 2013 was R\$1.65 to \$1, which means that cost of living was 25% cheaper in Brazil compared to the US. This comparison is more fair than just using the exchange rate.

This is a very interesting observation. However, we believe that the present analysis should use the exchange rate values instead, to minimize the effect of the high PPP variability within Brazilian regions, and to facilitate international comparison. We stated this very same justification in the main text (lines 186-194).

3.5 Line 220: Age can't be a percentage. I think there is a category missing here.

The sentence was corrected, as suggested.

3.6 Line 222: Consider presenting chi-2 statistics to show that this categories differed significantly by gender.

We haven't used the chi-2 analysis because there is no hypothesis test for this assumption. We opted for using the overlapping of confidence intervals to analyze the heterogeneity of the factors.

3.7 Table 1: What does "no medical specialty" mean? Primary care? Internal medicine? Please clarify.

The term specialist refers to physicians that obtained the title of specialist by officially recognized specialty societies, through the Brazilian Medical Association - AMB, or by concluding Medical Residency programs accredited to the National Medical Residency Commission – CNRM. Physicians with no specialty in Brazil are often called generalists (which differs from those specialized in Internal Medicine), and often work in primary care services. We believe that this distinction is not fundamental to the overall understanding of our results, however we included this explanation as a footnote in Table 1.

Reviewer 2

1. "The respondents were 2400 Brazilian physicians. It is not clear how many of those eligible did not respond or refused to respond and if there were among them any differences (gender?)."

Substitution was carried out exclusively in cases of unsuccessful contact or refusal to participate in our survey; 2,400 physicians were randomly selected and five substitutions were identified for each individual. Substitution sampling followed the same stratification criteria used for the initial sample calculation. We controlled sample replacements for state, region, sex and age, meaning that every physician who refused to participate was replaced by an individual with the same characteristics to avoid selection bias. A more detailed section was introduced in lines 137-151 to avoid any misinterpretation.

2. "I could not find in results the working position of participants (apical, not-apical) which I believe should have been one of the first questions in the 30-min interview. How many men were in apical position in their working position compared to women?"

This particular question was not included in the questionnaire. However, the apical positions in Brazil are frequently filled by physicians with longer professional trajectories, therefore we consider that the variables "time in practice" and "specialization" can indirectly reflect apical positions.

3. "It appears that more men than women work in private hospitals. Could the wage difference be attributable to differences in wage among private and public hospitals/settings?"

As accurately observed by the Reviewer 2, there is indeed a difference in the proportion of male physicians working in hospitals and private services than women, which could contribute to the wage gap found in our analysis. However, a previous study from our group using the same database (Miotto et al. 2018) has found a high proportion of male doctors working as dual practitioners or exclusively in private services, with a specialist profile and many years of medical training. Due to the collinearity effect between the variables "time in practice" and "specialty" with the variable and "Place of work", we chose to work with the former, which added greater explicability to the phenomenon of gender pay

gap. This is indeed an important observation by Reviewer 2, and a brief explanation regarding this issue is now presented in the revised manuscript (lines 363-376).

4. “The wage was similar in men and women working in the same category (for ex. Family health strategy)”

The most relevant factor in relation to the workplace was the difference in the proportion of male and female doctors working in the private office. It is known that this workplace provides higher salaries in Brazil. In the proposed model we prioritized the variable “work in private practice” as an exogenous variable, since it is more explicable to the variance of the model. In relation specifically to the cited example, family health strategy is provided by a governmental program, therefore the salary of men and women are exactly the same in all national territory.

5. “Has Brazil laws that fix the wage per category and position or there is for physicians some sort of individual contracts (in private hospitals, for example) that can explain the gender-related wage difference? “

Brazil does not have any type of regulation that guarantees wage equality between men and women. The forms of hiring are very diverse, and the revised manuscript now includes a brief description of this scenario. We believe that the modifications included in the revised manuscript (lines 101-106 and 413-417) should fulfill the Reviewer’s concerns about the multiple employment modalities observed in Brazil.

6. “The title is promising, but the reasons for which there is a gender-related wage difference in Brazil are not clearly discussed. The discussion should be therefore improved and the references updated to 2018. In particular, what will make the difference is to present all the possible explanation of such a phenomenon...”

As suggested, the most recent studies were included in the references. We highlight, however, that the large majority of the studies could not explain wage gap differences. As we mentioned now in lines 377-387, probably only cultural or behavioral variables may give light to this issue. Our study design (cross-sectional) has no power to identify if the income difference is derived from unequal contract remuneration or if this disparity arises throughout the medical career. In order to address this limitation, we evaluated the variable “time in practice” categorically and noticed that the differences are observed in all categories, meaning that the wage disparity is not produced throughout the medical career. We believe that gender, per se, might explain wage disparity found.

7. Minor revision issues

7.1 “...in the following sentence ‘female 26.7% (95%CI 24.1%-29.5%) versus male 17.8% (95%CI 15.8-19.9)], private hospitals [male 42.4% (95%CI 39.8%-45.0%) versus female 32.2% (95%CI 29.4%-35.1%)], family health strategy [female 26.6% (95%CI 23.6%-29.0%) versus 21.3% (95%CI 19.2% -23.5%)], time in practice [male <10 years 25.8% (95%CI 39.8%-45.0%) versus female 34.5% (95%CI 31.6%-37.6%)], weekly workload (hours) [male >60 hours 36.5% (95%CI 33.9%-39.0) versus female 26.7% (95%CI 24.0%-29.7%)’ please present the comparison always as female vs male, as it has done for the majority of cases.

The substitutions were performed, as suggested.

7.2 “Table 2 should be moved in the supplementary material section as the primary data are reported in the text. The section analyzing the influence of independent factors presented in table S2 should be moved in the supplementary documents section”

Tables 2 to 5 were entirely moved to supplementary file, as suggested by Reviewer 1, to give a more friendly reading to average readers.

Reviewer 3

1. "line 37 >US\$ 10,762 add per month"

The text was modified, as suggested.

2. "line 164: through to.....remove to "

The sentence was modified, as suggested.

3. "line 220: age ...I think >60 should be added. In this result part significance values should be added

We haven't used the chi-2 analysis because there is no hypothesis test for this assumption. We opted for using the overlapping of confidence intervals to analyze the heterogeneity of the factors.

4. line 230: hours....per month???"

The text was modified, as suggested.

5. "line 242: women are (not is) line 253: should read men are more likely to earn >US\$10762/month"

The text was modified, as suggested.

6. "line 272: Only in pediatrics, orthopedics, and trauma specialties the proportion of women in the lowest wage range was not significant - what was the PR in these specialties??"

As the PR values showed no different significant values, we chose to present this data only in the Table (now shown in S3 Table).

6. "line 300: (\geq US\$ 10,762 add per month"

The text was modified, as suggested.

Reviewer 4

1. "How many physicians had been contacted to get 2400 individuals who accepted to participate"

Substitution was carried out exclusively in cases of unsuccessful contact or refusal to participate in our survey; 2,400 physicians were randomly selected and five substitutions were identified for each individual. Substitution sampling followed the same stratification criteria used for the initial sample calculation. We controlled sample replacements for state, region, sex and age, meaning that every physician who refused to participate was replaced by an individual with the same characteristics to avoid selection bias. A more detailed section was introduced in lines 137-151 to avoid any misinterpretation.

2. "Page 7 author stated "characteristics of the medical work including of degree of dedication to medical work" had been included. I am not sure what variables talk about the dedication to medical work. Clarify"

The text was modified, as suggested.

3. "Table 1. why the total number of the participants had been mentioned for some variables and not for other variables (like place of work)? Insert the missing total figure"

The total number was suppressed because physicians can work in multiple places of work. It is an important observation, and the description was added to table 1 as a footnote

We sincerely appreciate all the remarks and suggestions given by the Editor and the Reviewers. We believe that the changes required have truly improved the manuscript, and would like to thank the BMJ Open team for the time taken in the task.

VERSION 2 – REVIEW

REVIEWER	Eric Apaydin Greater Los Angeles VA, USA RAND Corporation, USA
REVIEW RETURNED	16-Nov-2018

GENERAL COMMENTS	Thank you for addressing my concerns -- I have no further suggestions for revision.
-------------------------	---

REVIEWER	carolina ciacci University of Salerno Italy
REVIEW RETURNED	14-Nov-2018

GENERAL COMMENTS	The Authors complied with the reviewers' requests and very much improved the readability of the paper. However, the request of improving the Discussion commenting their data in comparison with the others', updating the references, was only partly accomplished.
-------------------------	--

REVIEWER	Suad Hannawi Ministry of Health and Prevention United Arab Emirates, Dubai
REVIEW RETURNED	29-Nov-2018

GENERAL COMMENTS	Manuscript title: What explain wages differences between male and female Brazilian physicians? The study is well designed and written How many physicians had been contacted to get 2400 individuals who accepted to participate Page 7 author stated "characteristics of the medical work including of degree of dedication to medical work" had been included. I am not sure what variables talk about the dedication to medical work. Clarify Table 1. why the total number of the participants had been mentioned for some variables and not for other variables (like place of work)? Insert the missing total figure
-------------------------	--

VERSION 2 – AUTHOR RESPONSE

Reviewer 2

1. The Authors complied with the reviewers' requests and very much improved the readability of the paper.

However, the request of improving the Discussion commenting their data in comparison with the others', updating the references, was only partly accomplished.

We once again would like to thank the reviewer 2 suggestions. As the others 4 reviewers involved in the reviewing process of this manuscript, we strongly believe that the latest version of the manuscript, especially the discussion section, has improved significantly, bringing our findings in the light of the most recent literature. Even so, we added new segments and new references, which can be found in lines 353-58; 375-6; 384-88; 412-15. The current manuscript also presents now 62 references, which we hope it might fulfill the Reviewer's 2 concerns.

Reviewer 4

1. How many physicians had been contacted to get 2400 individuals who accepted to participate?

Once the sample size and replacing parameters were controlled to avoid bias, according to what was described in line 138-45 "...the physician's distribution for gender, age, state and location of address (city capital and countryside) were preserved in sampling groups to reflect the population's distribution. The individuals selected in the original sample could be replaced by other individual only if not accessible or if those contacted refused to participate. Reposition individuals were drawn from the same sampling group, meaning that every physician who refused to participate was replaced by an individual with the same characteristics, to minimize participation bias.",

we believe that if this information was included in the manuscript, it would mislead the average reader, therefore we considered it to be unnecessary.

2. Page 7 author stated "characteristics of the medical work including of degree of dedication to medical work" had been included. I am not sure what variables talk about the dedication to medical work. Clarify

As described in page 7, line 164, independent variables were divided in two distinct groups: one related to socio-demographic characteristics (gender, age, Brazilian region, location of address), and another related to characteristics of the medical work (city of work, administrative nature of services, place of medical work, physician office work, on-call services, number of weekly on-call shifts, time in practice, total weekly workload, medical specialty and physician's specialties). Monthly wage was the dependent variable and it was defined as the income exclusively obtained with medical activities. We would like to thank the reviewer's suggestion, but we believe that this section is already sufficiently clear in the manuscript.

3. Table 1. why the total number of the participants had been mentioned for some variables and not for other variables (like place of work)? Insert the missing total figure

The absence of a total in Table 1 reflects the multiplicity of options that each physician could choose when answering some of the questions of the questionnaire. In this case, the total could be more than 100%, and we opted to not include this number to not mislead the average readers.

We sincerely appreciate all the suggestions given by the Reviewers. We believe that the changes required have truly improved the manuscript, and would like to thank the BMJ Open team for the time taken in the task.