PEER REVIEW HISTORY

This paper was submitted to the JECH but declined for publication following peer review. The authors addressed the reviewers' comments and submitted the revised paper to BMJ Open. The paper was subsequently accepted for publication at BMJ Open.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Early life-course socioeconomic position, adult work-related factors and oral health disparities: Cross-sectional analysis of the J-SHINE study.
AUTHORS	Tsuboya, Toru; Aida, Jun; Kawachi, Ichiro; Katase, Kazuo; Osaka, Ken

VERSION 1 - REVIEW

REVIEWER	Rodrigo Lopez Section of Periodontology Faculty of Health Sciences, Aarhus University, Aarhus, Denmark
REVIEW RETURNED	02-Jun-2014

GENERAL COMMENTS	Specific comments: Title could be shorter/simpler. In abstract a) I suggest to change 'quantified the association' to investigated the association'. b) Using the term 'Influence' represents a time sequence that cannot be investigated in a cross sectional design c) Please reformulate: "we cross-sectionally assessed" d) "Logistic regression model" to "A logistic regression model". e) "rations" to "ratios". f) The authors conclude: "We found oral health disparity across SEP among workers in Japan. The association between occupation and SROH was mostly explained…". Why mostly? g) The sentence "Improving childhood poverty and workplace environment may be an approach to reduce oral health disparities" is not commensurate with the study design and the study results. Page 4 Sentence "Therefore, it is likely that the results of the present study could be generalizable to the target population" is value assessment that it is not commensurate with the study, please avoid. Page 5 Sentence: "they estimated that the global burden of oral conditions.." Who estimated?

	Sentence “the estimated that the global burden of oral conditions would increase by approximately 20%, from 12.4 million years in 1990 to 15.0 million years in 2010.1, 2 In additional to their high prevalence, oral health conditions are a major contributor to socioeconomic disparities in health.” Please reformulate for clarity and precision. Please delete or reformulate: “Oral health is an exquisitely sensitive “mirror” of socioeconomic conditions –e.g. nutrition, preventive practices, and access to oral health care – as well as an important marker of future physical health conditions (e.g. cardiovascular disease)”. Sentence: ”reported clear social gradients” clear or significant? Clear is a value assessment. The same issue in next page. Sentence: “Psychological stress is a risk factor…”. Prospective longitudinal evidence available is not enough to call it risk factor, please correct/elaborate on this issue. Sentence: “In this study, we first examined approximately three thousand workers…”. Please state the precise number. Were these clinical examinations? Methods How was randomization performed and subjects contacted? It is important to investigate why they did not answer. With data from the other answers this might be possible. Sentence: “The questionnaire was self-administered using a computer-assisted” Which questionnaire? Were participants asked to categorize their age? Concerning marital status. What if partner has died? Page 7 Sentence: “…and is regarded as the most academically valid”. Please delete academically and reformulate. Sentence: “conditions in your household at age five (fifteen)?”. I do not understand this, 5 or 15? On: ““4.well off 5. well off””. What is the difference between 4 and 5? A subset of items from BJSQ was used. Please address validity issues of only including seven questions from the total. On modelling: Including several covariates in the model which somehow overlap representing SEP may be problematic. Please explain how you dealt with this and how you dealt with effect modification. Page 9 Please describe with more details: “Dummy variables were used for missing data in all analysis”. How was this achieved?

	Discussion It is not discussed whether the differences found can be attributed to knowledge, values, access to resources to pay for treatment or what. There are competing explanations that ought to be discussed. Self-rated assessment may diverge from clinical findings and this may be strongly related to social Inequalities. Validation data would be important and strengthen this study. Page 14 The author state: “with respect to age, sex, and education21. Therefore, it is likely that the results of the present study could be generalizable to the target population”. I think that this is not enough. The risk for selection bias is not minor and this possibility ought to be discussed with more detail. Sentence: “We found oral health disparities across various SEPs, and that workplace-related factors substantially explained the association between occupations and SROH”. I think it is too bold to state ‘explain’, when all estimates were rather modest in size. Please reformulate. The strategy for modelling ought to be explained in more detail. Is this a single model? An explanation on the decision for this categorization of variables is missing. Please reformulate table legends to better represent content. Concerning STROBE table. I find that a number of items (5 to 12) are incomplete or not addressed in the report. Please review. Interactions or effect modification were not addressed, this is relevant. Quest: “Give reasons for non-participation at each stage”. I could not find this information. The manuscript would improve with a comprehensive language revision.

REVIEWER	Carol Guarnizo-Herreño Department of Epidemiology and Public Health University College London United Kingdom
REVIEW RETURNED	10-Jun-2014

GENERAL COMMENTS	This manuscript aimed to explore the association between self-rated oral health and different socio-economic position indicators (including measures of childhood SEP) in a sample of Japanese adults. This topic is very interesting and the study builds upon existing literature by assessing the role of workplace-related factors as potential mediators in the association between occupational social class and oral health. The methods are clearly presented and the analytical approach is relevant to answering the study question. The paper is also generally well written. I consider this a valuable contribution and just have some minor recommendations for improvement:

	1. For the background, the authors might consider an additional study that has explored the association between occupational social class and oral health. The study by Sanders and Spencer (2004) found that Australian adults in blue collar occupations had higher self-reported tooth loss and social impacts from oral conditions, compared to those in the upper white-collar group. The reference is: Sanders AE, Spencer AJ. Social inequality in perceived oral health among adults in Australia. Aust N Z J Public Health. 2004;28:159-66. 2. The methods section states that the measures of income and wealth were both categorized in three groups with different cut-off points. It would be useful to include in the paper a brief mention of the criteria used for grouping these variables. Are the groups reflecting tertiles of the distribution of each measure? or, do they respond to other criteria such as the poverty line in Japan (in the case of income)? 3. On another measurement issue, the categories of marital status used in the study were married and single. So, I wonder how divorced/separated and widow people were classified? If the authors did not find participants in these categories, it might be worth mentioning it. 4. The dummy variable adjustment method was selected in this paper as the method to deal with missing data. Although this approach has been used in previous studies, there is a debate in the literature about it with authors like Allison (2001) and Jones (1996) being very critical. They stated that it has been shown that this method produces biased estimates regardless of the missingness mechanism. In his book, Allison (2001) presents a simulation to illustrate the problem. So, I would recommend including in the manuscript the reasons to choose this method (instead of multiple imputation, for example) and the potential limitations of it. 5. When talking about the potential explanations for the relationship between SEP and SROH, the authors might consider mentioning psychosocial factors in addition to oral health related behaviours and preventive dental care (explored in the paper). Among those psychosocial factors, self-esteem and sense of coherence are especially relevant for oral health. The psychosocial mechanisms have been shown to be particularly important for periodontal disease and self-rated oral health (the measure of oral health used in the paper). 6. When presenting the results, it would be beneficial to indicate which SEP indicators showed significant associations for the intermediate levels, and for which indicators that was the case only for the lowest SEP level. For example, while for occupation, income and childhood SEP the association with SROH was significant for the lowest levels, for education and wealth the relationship was comparatively larger in magnitude and significant for the intermediate levels as well. 7. For the discussion section, I suggest to consider another paper which also assessed the relationship between SEP at childhood and oral health: Thomson WM, Poulton R, Milne BJ, Caspi A, Broughton JR, Ayers KMS. Socioeconomic inequalities in oral health in childhood and adulthood in a birth cohort. Community Dent Oral

	Epidemiol. 2004;32:345-53. Typos: Page 7, line 11 please amend 5. very well off Page 6 and tables: please change GBD for GBP (British Pounds)

REVIEWER	Peter Milgrom University of Washington USA
REVIEW RETURNED	20-Jul-2014

GENERAL COMMENTS	This is a straightforward retrospective cohort study examining the role of socioeconomic factors on self-reported oral health of Japanese workers. The research lacks a comprehensive model to guide the empirical testing although the hypothesis is clear and the methods are generally appropriate. Its ok to test a reduced model but the lack of an overall framework is troublesome. For example, what about the impact of the use of dental care on oral health? The manuscript contains many grammatical errors and the references are not in the required style. The abbreviation GBD is used repeatedly for Great Britain pounds (GBP). Most readers will be unfamiliar with the Japanese health care system. The paper would be improved if a description were provided. For example, many workers, if not most, have access to a national insurance system that includes some dental benefits. This may also be true for children. The methods need clarification. The authors cite two American papers for the reliability and validity of the outcome measure. They provide no evidence that the measure and its response categories are reliable and valid in Japanese, the apparent language of the study. Terms like "wealth" are used without definition and are somewhat inconsistent with that used in the tables. The references for some measures are in papers that are not yet available in print: this makes it difficult to know whether the measures are reliable and valid. The reader should not have to go searching for basic information about the methods in the study. The authors should address potential recall bias with the measures. The approach to selection bias could potentially be more sophisticated. Propensity scores or forms of matching might have been explored. The paper would be improved if the descriptive statistics regarding the outcome measure were included in the paper. The authors may wish to review the literature again. There are other social gradients papers that might be cited.

VERSION 1 – AUTHOR RESPONSE

Response to reviewer comments
Dear Dr. Rodrigo Lopez,

Thank you for giving us valuable suggestions for improvement and for pointing out our mistakes. These points have been rewritten into proper sentences.
We think your comments have allowed us to significantly improve our paper. Thank you.

>Title could be shorter/simpler.

Response)
As suggested, the title has been changed to be shorter as below.

"Oral health disparities across socioeconomic position: the influence of economic difficulties in childhood and current work-related factors from J-SHINE study"

In abstract

a) I suggest to change ‘quantified the association’ to investigated the association’.

Response)
As suggested, “quantified the association” has been changed to “investigated the association”

b) Using the term ‘Influence’ represents a time sequence that cannot be investigated in a cross sectional design

Response)
As suggested, “influence” has been changed to “associations”.

c) Please reformulate: “we cross-sectionally assessed”

Response)
As suggested, the sentence has been changed as below.

“We performed a cross-sectional study, including 3,201 workers aged 25-50 years old, to assess self-rated oral health (SROH).“

d) “Logistic regression model” to ”A logistic regression model”.

Response)
As suggested, “Logistic regression model” has been changed to ”A logistic regression model”.

e) “rations” to “ratios”.

Response)
As suggested, “rations” has been changed to “ratios”

f) The authors conclude: “We found oral health disparity across SEP among workers in Japan. The

association between occupation and SROH was mostly explained…". Why mostly?

Response)
The reason we used "mostly" was that approximately 60% of the association between occupation and SROH was explained by job-related factors. "Approximately 60%" was calculated as (1.44-1.18)/(1.44-1)=59.1%. The odds ratio for the association between blue collar workers and poor SROH in age- and sex- adjusted model was 1.44 (Table2), and the odds ratio for the association between blue collar workers and poor SROH in multivariate adjusted model was 1.18 (Table4).

g) The sentence "Improving childhood poverty and workplace environment may be an approach to reduce oral health disparities" is not commensurate with the study design and the study results.

Response)
As suggested, the sentence has been deleted.

Page 4
Sentence "Therefore, it is likely that the results of the present study could be generalizable to the target population" is value assessment that it is not commensurate with the study, please avoid.

Response)
As suggested, the sentence has been deleted.

Page 5
Sentence: "they estimated that the global burden of oral conditions.." Who estimated?

Response)
As suggested, " they" has been changed to "Marcenes W, et al" [see page 4, 48th line]

Sentence "the estimated that the global burden of oral conditions would increase by approximately 20%, from 12.4 million years in 1990 to 15.0 million years in 2010.1, 2 In additional to their high prevalence, oral health conditions are a major contributor to socioeconomic disparities in health." Please reformulate for clarity and precision.

Response)
As suggested, the explanation has been added.

"Using disability-adjusted life years (DALYs), which is an index of measuring disease burden in society, and is calculated as sum of years of life lost due to premature mortality and years lived with disability, Marcenes et al estimated that the global burden of oral conditions would increase by approximately 20% from 1990 to 2010." [see page 4, 45th line]

Please delete or reformulate: "Oral health is an exquisitely sensitive "mirror" of socioeconomic conditions –e.g. nutrition, preventive practices, and access to oral health care – as well as an important marker of future physical health conditions (e.g. cardiovascular disease)".

Response)
As suggested, the sentence has been changed.

“Oral health reflects individuals’ socioeconomic conditions as well as an important marker of future physical health conditions (e.g. cardiovascular disease).” [see page 4, 52nd line]

Sentence: ”reported clear social gradients” clear or significant? Clear is a value assessment. The same issue in next page.

Response)
As suggested, ” clear” has been changed to “significant” [see page 4, 64th line] & [see page 5, 68th line]

Sentence: “Psychological stress is a risk factor…”. Prospective longitudinal evidence available is not enough to call it risk factor, please correct/elaborate on this issue.

Response)
As suggested, the sentence has been changed.

“oral diseases, such as periodontitis, and gingivitis, are also associated with psychological stress..” [see page 5,76th line]

Sentence: “In this study, we first examined approximately three thousand workers…”. Please state the precise number. Were these clinical examinations?

Response)
As suggested, the precise number has been added.
Clinical examinations were not performed in the participants.

“…we first examined data of 3,201 workers aged 25-50 years old in Japan...” [see page5, 82nd line]

Methods
How was randomization performed and subjects contacted?

Response)
As suggested, the explanation has been added as below.

“In brief, between October 2010 and February 2011, 13,920 community-dwelling residents aged 25 to 50 years were probabilistically and randomly selected from four municipalities in and around Tokyo, Japan, with using the Basic Resident Registration System. Independent survey agencies were contracted to conduct the surveys, and the professional surveyors who had more than three years of experience in conducting interview-based social surveys made contacts with the eligible individuals after attending training sessions to conduct the J-SHINE study.” [see page 5, 92nd line-]

It is important to investigate why they did not answer. With data from the other answers this might be possible.

Response)
As suggested, the explanation has been added as below.

“The main reasons the surveyors were not able to receive responses from the eligible participants were as follows: “inaccessible contact (n=4371)” and “refusal of invitation (n=3677)”.” [see page 6, 98th line]

Sentence: “The questionnaire was self-administered using a computer-assisted” Which questionnaire?

Response)
As suggested, the sentence has been changed as below.

“A questionnaire was self-administered using a computer-assisted personal interview format,…”[see page 6, 102nd line]

Were participants asked to categorize their age?

Response)
Participants originally answered their age as integral values, and the authors categorized in the present study. The explanation has been added.

“age (categorized as 25-29, 30-34, 35-39, 40-44, and 45-50 years old)” [see page 6, 111th line]

Concerning marital status. What if partner has died?

Response)
Description on marital status has been changed as “marital status (categorized as married/not married)” [see page 6, 112th line]
Participants whose partner had died were categorized to “not married”.

Page 7
Sentence: “…and is regarded as the most academically valid”. Please delete academically and reformulate.

Response)
As suggested, “academically” has been deleted.

Sentence: “conditions in your household at age five (fifteen)?”. I do not understand this, 5 or 15?

Response)
The participants answered both. The sentence has been changed.

… and “How would you rate the economic conditions in your household at age fifteen?” [see page 7, 137th line]

On: ““4.well off 5. well off””. What is the difference between 4 and 5?

Response)
“Very” has been added to 5. [see page 7, 140th line]

A subset of items from BJSQ was used. Please address validity issues of only including seven questions from the total.

Response)
It is a good point. As to the validity of the 7-item (and 6items), we have revised the description as below.

“Finally, the 7 items for job stress and the 6 items for social support at workplace were not validated. However, both have been used in practice in Japan, and the internal consistency of the scale in the present participants was acceptably high: Cronbach’s alpha coefficient was 0.90 for the 7 items for job stress, and 0.91 for the 6 items for social support. Future studies should employ well-validated questions on job stress and social support.” [see page 15, 330th line]

On modelling: Including several covariates in the model which somehow overlap representing SEP may be problematic. Please explain how you dealt with this and how you dealt with effect modification.

Response)
Socioeconomic position is a multi-dimensional concept, and it is routine to include as many markers of SEP as possible (e.g. income, education, occupation) in the same regression models. Although doing so raises the potential for multi-collinearity, we checked the variance inflation factors (VIFs) and they were all within acceptable range (< 2.0).

Besides, we had checked “AIC” and “-2log” of various models shown as below, and found that the final model, shown in Table4, had the smallest “AIC” and “-2log”, which means, we think, the model is best from a statistical standpoint. Therefore, we had chosen the final model.

Models that we have checked “AIC” and “-2log”
1) sex- and age-adjusted
2) 1+ marital status
3) 2+job stress
4) 3+social support in the workplace
5) 4+working hours
6) 5+emplotment status

Descriptions on effect modification have been added as below.

“Interactions between sex and the other variables (age/marital status/job stress/social support in the workplace/working hour/type of employment) were tested by entering multiplicative interaction terms into the multivariate adjusted model, because employment situation in Japan is highly different in men and women.” [see page 9, 175th line]
“None of the interactions were significant; occupation (p=0.19), age (p=0.74), marital status (p=0.44), job stress (p=0.25), job support (p=0.50), working hours (p=0.83), and type and employment (p=0.73).” [see page 11, 222nd line]

Page 9
Please describe with more details: “Dummy variables were used for missing data in all analysis”. How was this achieved?

Response)
As suggested, the explanation has been added in the Statistical analysis.

“dummy variables were used for missing data, with creation of a categorical indicator for missing responses (missing category)” [see page 9, 172nd line]

Discussion

It is not discussed whether the differences found can be attributed to knowledge, values, access to resources to pay for treatment or what. There are competing explanations that ought to be discussed.

Response)
It is a good point. As to “whether the differences found can be attributed to knowledge, values, access to resources to pay for treatment or what”, we had described as below in the Discussion in the submitted manuscript. We did not collect information on detailed mechanisms, and hence the explanations for the associations must remain speculative. For example, it is possible that education leads to better oral hygiene practices, or that higher income leads to better access to dental checkups. However, additional research is needed to elaborate on these mechanisms. Meantime, a major conclusion of our analysis is that job stress can explain more than half of the association between occupational SES and oral health.

“One reason why people with higher SEP had better SROH may be related to preventive practices – e.g. dental flossing or use of interdental brush (interproximal brush). Neamatol et al. reported that students with doctorate or masters degrees flossed more than those with bachelor degree or less, while Tseveenjav et al. reported that people with higher educational attainment performed cleaning more than the others.30 Another reason people in higher SEP had better SROH might be utilization of preventive dentistry. People with lower incomes tend to use preventive dental service less frequently, and the difference of use in preventive service might explain the social gradient of SROH. In fact, in the present study, approximately one in three participants (32.3%) among the richest group made a preventive dental clinic visit in the past year, whereas only one in four participants (24.7%) among the poorest group did so. On the other hand, we did not observe a big difference among rich and poor participants in the use of dental services for treatment; 42.3% for the richest group versus 41.4% for the poorest group. Thus, the pathway from lower household income to poor SROH might be through preventive dental service utilization.” [see page 11, 238th line]

Self-rated assessment may diverge from clinical findings and this may be strongly related to social Inequalities. Validation data would be important and strengthen this study.

Response)
Unfortunately, we have not performed validation study between SROH and clinical examination in the present sample. Therefore, we are not able to precisely discuss whether the bias between self-rated scale and clinical examinations are related to social inequalities. However, we have information on how many teeth the participants had been removed. We examined the association between poor SROH and number of removed tooth, and found that poor SROH was significantly more prevalent among those who had more removed tooth. We believe this might be evidence that the scale of SROH we used was to some extent reliable. We added the sentence below in the limitation part.

“As far as we know, no previous studies have validated the scale in Japanese yet, but we have confirmed that poor SROH was significantly associated with number of removed tooth in the sample (Appendix Table2), and this might support that the scale is also valid in Japanese. Future studies are needed to clarify the validity of the scale in Japanese.” [see page 14, 307th line]

Appendix Table2. Association between poor self-rated oral health(SROH) and self-reported number of removed tooth

	Number of removed tooth						
	0	1	2	3	4	More than 4	p-value
Poor SROH Number	300	112	94	67	52	135	<.0001
(%)	(17.2)	(30.0)	(34.7)	(45.0)	(48.6)	(58.4)	
Total	1740	373	271	149	107	231	

Page 14
The author state: “with respect to age, sex, and education21. Therefore, it is likely that the results of the present study could be generalizable to the target population”. I think that this is not enough. The risk for selection bias is not minor and this possibility ought to be discussed with more detail.

Response)
As suggested, the explanation has been added to the Limitation.

” Therefore, it is likely that the selection bias does not matter in terms of age, sex and education. We are not able to discuss selection bias precisely because we do not have other information among non-responders, such as smoking habit, income and so on.” [see page 14, 316th line]

Sentence: “We found oral health disparities across various SEPs, and that workplace-related factors substantially explained the association between occupations and SROH”. I think it is too bold to state ‘explain’, when all estimates were rather modest in size. Please reformulate.

Response)
As suggested, the sentence has been changed as below.

“We found oral health disparities across various SEPs, and that work-related factors could account for more than half the association between occupation and SROH ” [see page 15, 338th line]

The strategy for modelling ought to be explained in more detail. Is this a single model? An explanation on the decision for this categorization of variables is missing.

Response)
We included all the variables, shown in Table4, into one regression model. We did not employ a step-wise sequence of models. As to the modelling, we decided the final model, shown in Table4, because we, as described in the Introduction, hypothesized that job stress (including work hours) – as well as stress-buffering factors such as workplace social support – would mediate the association between occupational class and oral health. Besides, in terms of statistics, the final model, shown in Table4,

was supported as the best model because the model had the smallest “AIC” and “-2log”.

As to an explanation on the decision for this categorization of variables, the explanation on categorization of variables (income/wealth) has been added. When we employed dichotomizing or quartiles, the results were similar.

“Annual household income was divided into tertiles; less than JPY 5 million (Approximately GBP 29,400), JPY 5 to 7.5 million (GBP 29,400-44,100), or more than JPY 7.5 million (GBP 44,100). Wealth was based on household financial and other assets (e.g. stock, bond, and so on) and was divided into tertiles; less than JPY 3 million (GBP 17,600), JPY 3 to 5 million (GBP 17,600-29,400), or more than JPY 5 million (GBP 29,400).” [see page 7, 121st line]

Please reformulate table legends to better represent content.

Response)
As suggested, footnotes have been added.

Concerning STROBE table. I find that a number of items (5 to 12) are incomplete or not addressed in the report. Please review.

Response)
As suggested, we have reviewed STROBE table.

Interactions or effect modification were not addressed, this is relevant.

Response)
As suggested, the explanation on interactions/effect modification has been added.

”Interactions between sex and the other variables (age/marital status/job stress/social support in the workplace/working hour/type of employment) were tested by entering multiplicative interaction terms into the multivariate adjusted model, because employment situation in Japan is highly different in men and women.” [see Method, page 9, 175th line]
“None of the interaction terms were significant; occupation (p=0.19), age (p=0.74), marital status (p=0.44), job stress (p=0.25), job support (p=0.50), working hours (p=0.83), and type and employment (p=0.73).”[see Result, page 11, 222nd line]

Quest: “Give reasons for non-participation at each stage”. I could not find this information.

Response)
As suggested, the explanation has been added.

“The main reasons the surveyors were not able to receive responses from the eligible participants were as follows: “inaccessible contact (n=4371)” and “refusal of invitation (n=3677)”. [see page 6, 98th line]

The manuscript would improve with a comprehensive language revision.

Response)
As suggested, we carefully improved the language.

In closing, let us thank you once again for your extremely cogent comments which have helped us improve the quality of our paper.

Response to reviewer comments

Dear Dr. Carol Guarnizo-Herreño:

Thank you for giving us valuable suggestions for improvement and pointing out our mistakes. These points have been rewritten into proper sentences. The authors also appreciate very much that Dr. Carol Guarnizo-Herreño kindly and specifically showed the valuable articles. We think your comments have allowed us to significantly improve our paper. Thank you.

1. For the background, the authors might consider an additional study that has explored the association between occupational social class and oral health. The study by Sanders and Spencer (2004) found that Australian adults in blue collar occupations had higher self-reported tooth loss and social impacts from oral conditions, compared to those in the upper white-collar group. The reference is: Sanders AE, Spencer AJ. Social inequality in perceived oral health among adults in Australia. Aust N Z J Public Health. 2004;28:159-66.

Response)
As suggested, the article has been added to the Introduction.

“Sanders et al. examined data of 3,678 adults in Australia and reported that upper white collar workers reported less social impact, measured by the 14-item Oral Health Impact Profile, than did workers in lower white-collar or blue-collar occupations.” [see page 4, 64th line]

2. The methods section states that the measures of income and wealth were both categorized in three groups with different cut-off points. It would be useful to include in the paper a brief mention of the criteria used for grouping these variables. Are the groups reflecting tertiles of the distribution of each measure? or, do they respond to other criteria such as the poverty line in Japan (in the case of income)?

Response)
As suggested, the explanation has been added to the Method.

"Annual household income was divided into tertiles"[see page 7 121st line].
"Wealth was based on household financial and other assets (e.g. stock, bond, and so on) and was divided into tertiles" [see page 7,124th paragraph]

3. On another measurement issue, the categories of marital status used in the study were married and single. So, I wonder how divorced/separated and widow people were classified? If the authors did not find participants in these categories, it might be worth mentioning it.

Response)
As suggested, the sentence on marital status has been corrected as “married / not married” [see page 6, 112nd line].

Divorced/separated and widow people were classified into “not married”.

4. The dummy variable adjustment method was selected in this paper as the method to deal with missing data. Although this approach has been used in previous studies, there is a debate in the literature about it with authors like Allison (2001) and Jones (1996) being very critical. They stated that it has been shown that this method produces biased estimates regardless of the missingness mechanism. In his book, Allison (2001) presents a simulation to illustrate the problem. So, I would recommend including in the manuscript the reasons to choose this method (instead of multiple imputation, for example) and the potential limitations of it.

Response)
As suggested, we performed multiple imputations (MI), and replaced Table4 with the result from MI. “The previous Table4”, where dummy categories were used for missing data, was moved to “Appendix Table1” so that readers could compare the result from MI with one from dummy categories.

5. When talking about the potential explanations for the relationship between SEP and SROH, the authors might consider mentioning psychosocial factors in addition to oral health related behaviours and preventive dental care (explored in the paper). Among those psychosocial factors, self-esteem and sense of coherence are especially relevant for oral health. The psychosocial mechanisms have been shown to be particularly important for periodontal disease and self-rated oral health (the measure of oral health used in the paper).

Response)
As suggested, the description on psychosocial factors has been added to the Discussion.

“Another explanation for the relationship between SEP and SROH might be through psychosocial factors. S.R. Baker et al reported that greater sense of coherence and higher self-esteem were linked to better oral health perceptions. Therefore, these factors might be mediators between SEP and SROH because those who are in higher SEP, including occupations, have, in general, higher self-esteem and sense of coherence.” [see page 12, 253th line]

6. When presenting the results, it would be beneficial to indicate which SEP indicators showed significant associations for the intermediate levels, and for which indicators that was the case only for the lowest SEP level. For example, while for occupation, income and childhood SEP the association with SROH was significant for the lowest levels, for education and wealth the relationship was comparatively larger in magnitude and significant for the intermediate levels as well.

Response)
As suggested, the explanation has been added to the Result.

“The association with SROH was significant only for the lowest levels in occupation, income and childhood SEP, while the association was comparatively larger in magnitude and significant for the intermediate levels as well as for the lowest levels in education and wealth.” [see page 10, 199th line]

7. For the discussion section, I suggest to consider another paper which also assessed the relationship between SEP at childhood and oral health: Thomson WM, Poulton R, Milne BJ, Caspi A, Broughton JR, Ayers KMS. Socioeconomic inequalities in oral health in childhood and adulthood in a birth cohort. Community Dent Oral Epidemiol. 2004;32:345-53.

Response)
As suggested, the description has been added to the Discussion.

“Thomson et al. examined 789 individuals and revealed that those who were in low socioeconomic status at age 5 years were more likely to have lost a tooth in adulthood because of caries and had greater prevalence and extent of periodontitis.” [see page 13, 283rd line]

Typos:
Page 7, line 11 please amend 5. very well off
Page 6 and tables: please change GBD for GBP (British Pounds)

Response)
As suggested, the typos have been corrected.

In closing, let us thank you once again for your extremely cogent comments which have helped us improve the quality of our paper.

Response to reviewer comments

Dear Dr. Peter Milgrom:

Thank you for giving us valuable suggestions for improvement and pointing out our mistakes. These points have been rewritten into proper sentences. We think your comments have allowed us to significantly improve our paper. Thank you.

This is a straightforward retrospective cohort study examining the role of socioeconomic factors on self-reported oral health of Japanese workers. The research lacks a comprehensive model to guide the empirical testing although the hypothesis is clear and the methods are generally appropriate. Its ok to test a reduced model but the lack of an overall framework is troublesome. For example, what about the impact of the use of dental care on oral health?

Response)
As suggested, the explanation on the theoretical model between occupation and oral health has been added.

"Psychological stress is associated with the workplace-related factors as well as occupations, and, on the other hand, oral disease, such as periodontitis and gingivitis, are also associated with psychological stress. Therefore, workplace-related factors may be candidates for mitigating oral health disparities, and we hypothesized that job stress (including work hours) – as well as stress-buffering factors such as workplace social support – would mediate the association between occupational class and oral health.” [see the Introduction, 75th line]

As to the impact of the use of dental care on oral health, we had discussed as below in the Discussion section.

“In fact, in the present study, approximately one in three participants (32.3%) among the richest group made a preventive dental clinic visit in the past year, whereas only one in four participants (24.7%) among the poorest group did so. On the other hand, we did not observe a big difference among rich and poor participants in the use of dental services for treatment; 42.3% for the richest group versus 41.4% for the poorest group. Thus, the pathway from lower household income to poor SROH might be through preventive dental service utilization.” [see page 12, 246th line]

The manuscript contains many grammatical errors and the references are not in the required style.

Response)
Grammatical errors and references have been carefully corrected.

The abbreviation GBD is used repeatedly for Great Britain pounds (GBP).

Response)
All of the “GBD” has been changed “GBP”.

Most readers will be unfamiliar with the Japanese health care system. The paper would be improved if a description were provided. For example, many workers, if not most, have access to a national insurance system that includes some dental benefits. This may also be true for children.

Response)
As suggested, the explanation has been added to the Discussion.

“Our finding is notable for demonstrating oral health disparities even in Japan, where the citizens, including children, have access to dental services with relatively low out-of-pocket cost” [see page 11, 229th line]

The methods need clarification.
The authors cite two American papers for the reliability and validity of the outcome measure. They provide no evidence that the measure and its response categories are reliable and valid in Japanese, the apparent language of the study.

Response)
As suggested, the explanation has been added.

“The validation studies were conducted in English, and the present study was conducted in Japanese. As far as we know, no previous studies have validated the scale in Japanese yet. However, we have confirmed that poor SROH was significantly associated with number of removed tooth in the sample (Appendix Table2). Ando et al confirmed the validity of self-reported number of remaining teeth and clinical examination in Japanese. Therefore, this might support that the scale in Japanese is also valid. Future studies are needed to clarify the validity of the scale in Japanese.” [see page 14,306th line]

Terms like "wealth" are used without definition and are somewhat inconsistent with that used in the tables.

Response)
As suggested, the explanation has been added.

“Wealth was based on household financial and other assets (e.g. stock, bond, and so on) and was divided into tertiles” [see page 7, 124th line]

The references for some measures are in papers that are not yet available in print: this makes it difficult to know whether the measures are reliable and valid. The reader should not have to go searching for basic information about the methods in the study.

Response)
As suggested, the references have been corrected.

The authors should address potential recall bias with the measures.

Response)
As suggested, the explanation has been added.

"Attention should be given to the positive association between current poor SROH and economic disadvantage in childhood, because the assessments of economic disadvantage in childhood were based on the participants’ recall (recall bias)." [see page 15, 323th line]

The approach to selection bias could potentially be more sophisticated. Propensity scores or forms of matching might have been explored.

Response)
We think selection bias could have occurred as a result of non-responders. Unfortunately, this problem cannot be corrected by a propensity score matching approach, since it is only possible to calculate propensity scores based on only observed covariates. An explanation described below on selection bias has been added in the Limitation.

“We are not able to discuss selection bias precisely because we do not have other information among non-responders, such as smoking habit, income and so on.” [see page 15,317th line]

The paper would be improved if the descriptive statistics regarding the outcome measure were included in the paper.

Response)
As suggested, the description on the distribution of SROH has been added in the Result.

“The distribution of answers for the SROH was as follows; 1.excellent (N of 407), 2.good (N of 772), 3.fair (N of 1155), 4.not so good (N of 738) and 5.poor (N of 129).” [see page 9, 188rd line]

The authors may wish to review the literature again. There are other social gradients papers that might be cited.

Response)
As suggested, the authors have reviewed the literature again, and other social gradients paper has been added.

Ref 5. Thomson WM, Poulton R, Milne BJ, et al. Socioeconomic inequalities in oral health in childhood and adulthood in a birth cohort. Community dentistry and oral epidemiology 2004;32(5):345-53.

Ref 18. Sanders AE, Spencer AJ. Social inequality in perceived oral health among adults in Australia. Australian and New Zealand journal of public health 2004;28(2):159-66.

In closing, let us thank you once again for your extremely cogent comments which have helped us improve the quality of our paper.

VERSION 2 – REVIEW

REVIEWER	Carol C. Guarnizo-Herreno Department of Epidemiology and Public Health University College London UK
REVIEW RETURNED	24-Aug-2014

GENERAL COMMENTS	The authors have done a nice job of addressing the reviewers' comments. I strongly recommend publication of this article. It adds important evidence to the literature by assessing the role of workplace-related factors as potential mediators in the association between occupational social class and oral health.

REVIEWER	Peter Milgrom University of Washington, USA
REVIEW RETURNED	28-Aug-2014

GENERAL COMMENTS	The authors have made a number of changes in the manuscript that have improved its readability. Nevertheless, the paper still contains numerous grammatical and style (for example the use of first initials in references with the text) errors and the references are not consistently in the required style. The extensive use of abbreviations detracts from the acceptability of this otherwise useful paper. The author should clarify if there was ethics review of this work. It is unclear from the paper whether the analysis was solely on de-identified publicly available data. The title should include the design of the study. The abstract should include the source of the data and the response rate. Most readers will be unfamiliar with the Japanese health care system. While a very brief description was added, this could be expanded further. It would be helpful to know whether the Japanese system allows for paid leave for dental appointments, for example.