PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Cause-specific sickness absence trends by occupational class and industrial sector in the context of recent labour market changes: a Finnish panel data study
AUTHORS	Leinonen, Taina; Viikari-Juntura, Eira; Husgafvel-Pursiainen, Kirsti; Solovieva, Svetlana

VERSION 1 – REVIEW

REVIEWER	Marlen Toch-Marquardt Norwegian University of Science and Technology, Norway
REVIEW RETURNED	06-Nov-2017

| GENERAL COMMENTS | **Review for BMJ Open**

This is an interesting article analysing sickness absence by occupational class and industrial sector in Finland in the context of recent labour market changes. The authors present a thoroughly prepared analysis. However, the manuscript could benefit from some revisions and clarifications. Major revision and resubmit would be my suggestion.

General remarks: the authors might want to have another read-through to improve readability (and thus illegibility) of the manuscript. In many instances, sentences are too long and/or complicated.

Below comments are presented in chronological order.

Abstract:

- The Results part is too long and could be more precise.

Strength and limitations of the study

- 3rd bullet point: In the abstract, the authors state that this is a |

register-based panel data study. Why are you stating here that longitudinal population-based register data were used? Please revise.

Introduction:

- The title of the article indicates that the authors intend to show results in the light of "recent labour market changes". However, there are no explanations of what nature these changes are or what implications this might have. Please add a paragraph that discusses recent labour market changes and how these might affect health and sickness absence (e.g. in relation to sectors etc.).

- Page 4, 2nd paragraph, line 49: Check the use of "occupational grade". This is not the correct term. The correct term "occupational class" has been used in the title. Please check throughout the entire manuscript.

- Page 5, 1st paragraph, line 8: Please revise "We used large register data (…)". Do you mean e.g. large register based data sets? Please check this through the entire manuscript, since there are several instances where this is not used coherently.

- Page 5, 1st paragraph, line 17: the study does not cover "(…) a period with various changes in the labour market in Finland as well as in other European countries (…)". This is one of the many examples where a revision of the text would make a huge difference for the readability (as well as illegibility) of the manuscript. Please revise.

- Please make sure to explain the aim of the paper thoroughly. This cannot be done solely by stating the research questions.

Material and Methods:

- Page 6, 2nd paragraph, line 30-32: Why does excluding people who did not live in Finland two years prior to the baseline increase the comparability of the populations? Please explain.

- Page 6, 2nd paragraph, last sentence: Please revise this sentence. For example, make a table with this information and then state in the

text that there were around 1.1 million persons per year in the study. This would increase readability immensely.

Sickness absence outcome:

- Why did the authors restrict their sample for sickness spells lasting at least 2 weeks? Explain!

Occupational class and industrial sector:

- Why did the authors divide occupational classes into the threefold measure? When classifying upper non-manual and lower non-manual workers why not dividing manual workers into skilled and unskilled?

- The classification of sectors is not satisfying. Category 5, or other sectors, comprises a vast array of different types of work environments, which are not related in any way. This category includes ca. 40% of all persons in the sample, which most likely has an effect on the results. Please revise your analysis with another categorisation. For example, divide the non-manual and manual occupations and leave agriculture and fishing as a single category.

Covariates:

- Why dividing education into higher (1) and lower (2) tertiary? If this classification makes a big difference in the analysis, then explain.

Statistical methods:

- You are calculating GGE based on logistic regression. Why are you showing estimated proportions instead of odds ratios? Since this is an uncommon way of showing results, some explanation is needed.

Results:

- This section is excessively long. Furthermore, this is again a section with very long and complicated sentences, which make it very hard to follow. Please revise and concentrate on the most important things.

- Page 13, 2nd paragraph, line 38: This should be "(…) lowest **in** this group" instead of "among this group".

Discussion:

- Again, revise the sentence structure.

- Page 14, 3rd paragraph, line 46 ff.: This is the first time the authors talk about the economic recession. Please make sure this issue gets a paragraph in the introduction.

- Page 15, 1st paragraph, 2nd part: Very good point! Please make sure that all paragraphs in the discussion are thought through equally well.

- Same page, 2nd paragraph, first sentence: What are the authors trying to say with this sentence? Please reformulate.

- Same page, 3rd paragraph, first sentence: Please see comment above.

- Page 16, 2nd paragraph, 1st line: What is a "more limited decrease?" Please rephrase.

- Same page, same paragraph, line 43-47: This is exactly the same reasoning as on page 15, lines 33-35. Furthermore, this needs a reference. Please revise

- Page 17, 2nd paragraph, last sentence: Reference needed.

- Page 18, 1st paragraph, last sentence. Why are the results "generalizable to other countries"? Which labour market changes are the authors talking about?

GENERAL COMMENTS	Tthe Finnish study provides a number of useful data for understanding the phenomenon of absenteeism in relation to certain occupstional profiles. To increase the interest of the study for readers, it might be useful to clarify the differences between long-term absences, such as those studied here, and short-term absences. The two types of absence are differently associated with psychosocial variables and stress factors [see: Magnavita N, Garbarino S. Is absence related to work stress? A repeated cross-sectional study on a special police force. Am J Ind Med. 2013; 56(7):765-75. doi: 10.1002/ajim.22155.]

REVIEWER	Eila Kankaanpää University of Eastern Finland Finland
REVIEW RETURNED	06-Dec-2017

GENERAL COMMENTS	This could be an interesting study: sickness absence is an important indicator for health and work. Still, it was hard to find rationale for this study - "[…] remains unclear" (p. 4), "very little is known" (p. 5) are quite vague. I hope you can better argument why this kind of information is needed and for whom (this is also needed for writing the conclusions). If you could put more emphasis on the word work (and working life in general) in this study the interpretation of the results would be much stronger. The authors are studying trends and focused on a period during which there were huge changes in the Finnish economy. Therefore, giving information on the fluctuation of the economy is important. For example, the changes in GNP could be useful. In addition, industry specific employment rates during the study period should be given to readers. I checked some industries and looks like that the recession hit industries with different lags and strength (and the least the health and social services). This kind of information might help you to make conclusions about the trends in the labour market and sickness absence. You would benefit from using studies from labour economics, e.g. the study by Hesselius in The Journal of Socio-Economics (2007) shows that higher sickness absence increases the risk of unemployment. This might explain also the differences in trends during recession in your study. Individuals with high sickness absence will be unemployed (the average rate lowers). If the risk of being unemployed varies per industry, e.g. health and social work is "safe" compared to manufacturing, this could explain at least partly your results. In general, I wish there would be much more interpretation and explanation of the results. Descriptive studies are important. Still, I would appreciate if interpretation and conclusions would be backed up with literature/theories. Now you propose that "preventive measures should be targeted especially at work ability related to mental and musculoskeletal health among non-manual employees in the health and social sector […]". If you have a look at the Supplementary Table 2 you could instead propose that the salaries of health and social personnel should be higher. Further, your conclusions of preventive measures is not based on your study (you did not study the effectiveness or magnitude of preventive measures). Conclusions could be strengthened by searching for information: injury-related sickness absence (the statistics for occupational diseases and accidents, p. 15, row 49), the share of distant work

	(page 16, row 47/48), ill-health selection out of work (page 18, row 36-38, your own data).
	The data consists of three consecutive cohorts each followed for three years. Would be interesting to know how big was the share of individuals who were included in the study during all 3-year periods and what happened to those who dropped out (unemployed? retired?). This comment concerns also your list of strengths (page 3). You state that "without missing information and loss to follow-up".
	Many continuous covariates were categorized (age, income, time spent in employment, number of employment periods). Usually, it is better to keep them continuous. I wonder if you would have got different results with other (panel) models, having the number of sickness days continuous.
	These are only minor comments:
	1. Keywords could be different (already in subject headings)
	2. Page 2, row 13. add "in Finland" in the end of the last sentence.
	3. Page 2, conclusions in the abstract do not have anything about labour market changes (should)
	4. Page 15, row 10/11, number sickness, of missing(?)
	5. The text "The panels are presented in different scales" should be added to all Figure captions where needed

VERSION 1 – AUTHOR RESPONSE

Editorial Requirements:

- Please revise the Strengths and Limitations section (after the abstract) to focus on the methodological strengths and limitations of your study rather than summarizing the results.

Authors' response: We have now reformulated the Strengths and Limitations section (page 3).

Reviewer(s)' Comments to Author:

Reviewer: 1

Reviewer Name: Marlen Toch-Marquardt
Institution and Country: Norwegian University of Science and Technology, Norway Please state any competing interests: None declared

Please leave your comments for the authors below
This is an interesting article analysing sickness absence by occupational class and industrial sector in Finland in the context of recent labour market changes. The authors present a thoroughly prepared analysis. However, the manuscript could benefit from some revisions and clarifications. Major revision and resubmit would be my suggestion.

General remarks: the authors might want to have another read-through to improve readability (and thus illegibility) of the manuscript. In many instances, sentences are too long and/or complicated.

Authors' response: We appreciate this comment. We have revised the text throughout the manuscript in order to make it clearer.

Below comments are presented in chronological order.

Abstract:

- The Results part is too long and could be more precise.

Authors' response: We have now shortened and reformulated the Results part of the Abstract (pages 2-3).

Strength and limitations of the study

- 3rd bullet point: In the abstract, the authors state that this is a register-based panel data study. Why are you stating here that longitudinal population-based register data were used? Please revise.

Authors' response: We now refer to "register-based data sets" in the bullet point (page 3).

Introduction:

- The title of the article indicates that the authors intend to show results in the light of "recent labour market changes". However, there are no explanations of what nature these changes are or what implications this might have. Please add a paragraph that discusses recent labour market changes and how these might affect health and sickness absence (e.g. in relation to sectors etc.).

Authors' response: We thank the Reviewer for this good comment and agree that the manuscript benefits from a clearer focus on the context relating to labour market changes. We have now revised and expanded the Introduction section accordingly. We have also revised the Discussion section in order to focus more on the labour market changes.

- Page 4, 2nd paragraph, line 49: Check the use of "occupational grade". This is not the correct term. The correct term "occupational class" has been used in the title. Please check throughout the entire manuscript.

Authors' response: We have now used occupational class instead of occupational grade throughout the manuscript.

- Page 5, 1st paragraph, line 8: Please revise "We used large register data (…)". Do you mean e.g. large register based data sets? Please check this through the entire manuscript, since there are several instances where this is not used coherently.

Authors' response: We have now used the formulation suggested by the Reviewer throughout the manuscript.

- Page 5, 1st paragraph, line 17: the study does not cover "(…) a period with various changes in the labour market in Finland as well as in other European countries (…)". This is one of the many examples where a revision of the text would make a huge difference for the readability (as well as illegibility) of the manuscript. Please revise.

Authors' response: We have removed this sentence. Labour market changes are now discussed in earlier paragraphs (pages 6-7).

- Please make sure to explain the aim of the paper thoroughly. This cannot be done solely by stating the research questions.

Authors' response: We have now stated the aim of the study before the research questions (page 7): "We thereby aimed to explore whether occupational class and industrial sector differences in cause-specific sickness absence trends were influenced by changes in the characteristics of the wage-earner population over a period of major economic fluctuations." We have also stated the rationale behind this aim more clearly in the Introduction section (pages 6-7): "However, the contribution of the recession of the late 2000s to changes in the occupational class differences in sickness absence remains unclear. Moreover, information on trends in sickness absence by industrial sector are altogether lacking. Further, little is known of whether occupational class and industrial sector differences in sickness absence trends can be attributed to longer-term structural changes in the labour market, such as those related to educational attainment, income, private versus public sector employment, or other employment patterns. Information on sickness absence trends and their explanations would help identify vulnerable groups in order to prevent work disability and extend working careers."

Material and Methods:

- Page 6, 2nd paragraph, line 30-32: Why does excluding people who did not live in Finland two years prior to the baseline increase the comparability of the populations? Please explain.

Authors' response: We have now explained the issue with more detail (page 9): "Finally, we excluded those who did not live in Finland two years before the end of the year preceding the study year (0.2%). We did this because we used the population samples from the end of years 2004, 2007, and 2010 to form the study population in years 2005–2007, 2008–2010, and 2011–2013, respectively; since the study population in years 2007, 2010, and 2013 by design lived in Finland two years before, we applied the same inclusion criteria for all of the years."

- Page 6, 2nd paragraph, last sentence: Please revise this sentence. For example, make a table with this information and then state in the text that there were around 1.1 million persons per year in the study. This would increase readability immensely.

Authors' response: We have now reformulated the sentence (page 9): "The final study population consisted of around 1.1 million individuals per study year (Supplementary Table 1)".

Sickness absence outcome:

- Why did the authors restrict their sample for sickness spells lasting at least 2 weeks? Explain!

Authors' response: Thank you for pointing out this important issue. Description of our outcome measure was previously unclear. We have now described it with more detail (page 9): "In Finland, sickness absence is compensated by the Social Insurance Institution of Finland after a period of ten working days that are typically paid by the employer.[19] Only sickness absence spells compensated by the Social Insurance Institution are registered at the national level and included in our data. The outcome of this study was therefore based on sickness absence that by definition lasted around two calendar weeks or more. We used repeated dichotomous measures of whether a study person had a new onset of compensated sickness absence in a particular calendar year." We have also changed the wording related to the length of the absences in other parts of the manuscript.

Occupational class and industrial sector:

- Why did the authors divide occupational classes into the threefold measure? When classifying upper non-manual and lower non-manual workers why not dividing manual workers into skilled and unskilled?

Authors' response: We agree that division of manual workers into skilled and unskilled might provide additional information. However, our primary interest was on industrial sectors within the occupational classes. Among manual workers, some of the industrial sectors are very small, and could not be investigated if manual workers were further divided into two.

- The classification of sectors is not satisfying. Category 5, or other sectors, comprises a vast array of different types of work environments, which are not related in any way. This category includes ca. 40% of all persons in the sample, which most likely has an effect on the results. Please revise your analysis with another categorisation. For example, divide the non-manual and manual occupations and leave agriculture and fishing as a single category.

Authors' response: We appreciate this comment and acknowledge that previously the issue was not properly addressed in the manuscript. The category "other" includes sectors that would be too small to examine separately. Also the group agriculture and fishing is small in our study, because we exclude self-employed people. We agree that the category "other" is extremely heterogeneous. We therefore do not show results for this category when presenting the results on industrial sectors within occupational classes in Figures 2 and 3. We have now justified our choices (page 11): "When examining industrial sectors within the three occupational classes, we only show results for the four large industrial sectors 1–4. The category "other" consisted of heterogeneous smaller sectors which could not be examined separately due to small number of events." We have now also specified in various places in the manuscript that we examine "four large industrial sectors".

Covariates:

- Why dividing education into higher (1) and lower (2) tertiary? If this classification makes a big difference in the analysis, then explain.

Authors' response: We have now explained the content of the two categories (page 11): "1) higher tertiary (Master's or equivalent level, or higher), 2) lower tertiary (Bachelor's or equivalent level)". We now also justify this categorization (page 11): "Tertiary education was divided into two levels, because the proportion of those with higher tertiary education in particular increased during the study period (Supplementary Table 1)."

Statistical methods:

- You are calculating GGE based on logistic regression. Why are you showing estimated proportions instead of odds ratios? Since this is an uncommon way of showing results, some explanation is needed.

Authors' response: If the odds ratio of sickness absence for group 1 compared to group 2 increases, we would not know whether this is a result of e.g. sickness absence increasing more in group 1 or sickness absence decreasing more in group 2. We have now addressed the issue in the text (page 12): "Estimated proportions demonstrate the magnitude and direction of changes in the level of sickness absence among different groups, which would not be revealed solely on the basis of information on changes in the differences between the groups."

Results:

- This section is excessively long. Furthermore, this is again a section with very long and complicated sentences, which make it very hard to follow. Please revise and concentrate on the most important things.

Authors' response: We have now shortened and revised the Results section. Some of the information regarding the used disease groups has been moved to the Material and methods/Statistical Methods section (page 12).

- Page 13, 2nd paragraph, line 38: This should be "(…) lowest in this group" instead of "among this group".

Authors' response: We have corrected this.

Discussion:

- Again, revise the sentence structure.

Authors' response: We have revised the text throughout the Discussion section.

- Page 14, 3rd paragraph, line 46 ff.: This is the first time the authors talk about the economic recession. Please make sure this issue gets a paragraph in the introduction.

Authors' response: We have now addressed the recession in the Introduction section (pages 6-7). We have also addressed the recession more thoroughly in various parts of the Discussion section.

- Page 15, 1st paragraph, 2nd part: Very good point! Please make sure that all paragraphs in the discussion are thought through equally well.

Authors' response: We have tried to clarify the text in other parts of the Discussion section.

- Same page, 2nd paragraph, first sentence: What are the authors trying to say with this sentence? Please reformulate.

Authors' response: We have simplified the sentence (page 20): "We found that occupational class differences decreased also in sickness absence due to injuries." We further revised the whole paragraph.

- Same page, 3rd paragraph, first sentence: Please see comment above.

Authors' response: We have removed this sentence.

- Page 16, 2nd paragraph, 1st line: What is a "more limited decrease?" Please rephrase.

Authors' response: We have corrected this to "smaller decrease" (page 21).

- Same page, same paragraph, line 43-47: This is exactly the same reasoning as on page 15, lines 33-35. Furthermore, this needs a reference. Please revise

Authors' response: We have removed the sentence and revised the whole paragraph (pages 21-22).

- Page 17, 2nd paragraph, last sentence: Reference needed.

Authors' response: We did not find an appropriate reference, so we have reformulated the sentence (page 23): "More research is needed to determine whether e.g. changes in working conditions or types of jobs within the trade sector contributed to the trends."

- Page 18, 1st paragraph, last sentence. Why are the results "generalizable to other countries"? Which labour market changes are the authors talking about?

Authors' response: We have revised the sentence (page 23): "Our findings may be generalizable to countries in which the manufacturing sector in particular was affected by the recession of the late 2000s and in which also the sickness benefit system is relatively generous."

Reviewer: 2
Reviewer Name: Nicola Magnavita
Institution and Country: Università Cattolica del Sacro Cuore, Rome, Italy Please state any competing interests: None declared

Please leave your comments for the authors below The Finnish study provides a number of useful data for understanding the phenomenon of absenteeism in relation to certain occupstional profiles. To increase the interest of the study for readers, it might be useful to clarify the differences between long-term absences, such as those studied here, and short-term absences. The two types of absence are differently associated with psychosocial variables and stress factors [see: Magnavita N, Garbarino S. Is absence related to work stress? A repeated cross-sectional study on a special police force. Am J Ind Med. 2013; 56(7):765-75. doi: 10.1002/ajim.22155.]

Authors' response: We thank the reviewer for pointing out this important issue. We have now used this reference and discussed the use of particular measures of sickness absence more thoroughly (pages 23-24): "Our outcome measure was based on national data on compensated sickness absence spells that begin after a period of ten working days. Sickness absence spells that did not exceed ten working days were therefore not covered. Moreover, our outcome measure was based on new onset of sickness absence. The predictors of sickness absence might be different when examining e.g. the occurrence of short-term spells, the number of spells of different lengths, or the total number of absence days.[32-36]"

Reviewer: 3

Reviewer Name: Eila Kankaanpää
Institution and Country: University of Eastern Finland, Finland Please state any competing interests: None declared

Please leave your comments for the authors below This could be an interesting study: sickness absence is an important indicator for health and work. Still, it was hard to find rationale for this study - "[…] remains unclear" (p. 4), "very little is known" (p. 5) are quite vague. I hope you can better argument why this kind of information is needed and for whom (this is also needed for writing the conclusions). If you could put more emphasis on the word work (and working life in general) in this study the interpretation of the results would be much stronger.

Authors' response: We thank the Reviewer for this good comment. We have revised and expanded the whole Introduction section in order to focus more on the context of labour market changes and to describe the rational more clearly. We have also made large revisions throughout the Discussion section in order to focus more on the labour market changes.

The authors are studying trends and focused on a period during which there were huge changes in the Finnish economy. Therefore, giving information on the fluctuation of the economy is important. For example, the changes in GNP could be useful. In addition, industry specific employment rates during the study period should be given to readers. I checked some industries and looks like that the recession hit industries with different lags and strength (and the least the health and social services). This kind of information might help you to make conclusions about the trends in the labour market and sickness absence.

Authors' response: We appreciate this comment and have included such information in the Introduction section (page 6): "Firstly, particular sectors including manufacturing and construction were hit hard by the economic recession of the late 2000s, whereas other sectors such health and social services were less affected.[15] In Finland, the economic recession peaked in 2009. This was the only year in which the change in the GDP was negative (-6.5%). A specific feature for Finland was that there was another decline in the GDP after 2011. The manufacturing sector was affected the most: the number of wage earners employed in this sector decreased by 9.4% between 2008 and 2009, while the corresponding decrease in the total wage-earner population was 3.8%.[16]" The recession did not appear to lead to reduced employment in the examined other three sectors than the manufacturing sector. When looking at statistics on the absolute number of people employed in these sectors as well as on the proportion of all wage earners employed in these sectors, there were no large changes in the trade sector or in the health and social work sector after 2009, and there was some increase in the knowledge work sector.

You would benefit from using studies from labour economics, e.g. the study by Hesselius in The Journal of Socio-Economics (2007) shows that higher sickness absence increases the risk of unemployment. This might explain also the differences in trends during recession in your study. Individuals with high sickness absence will be unemployed (the average rate lowers). If the risk of being unemployed varies per industry, e.g. health and social work is "safe" compared to manufacturing, this could explain at least partly your results. In general, I wish there would be much more interpretation and explanation of the results. Descriptive studies are important. Still, I would appreciate if interpretation and conclusions would be backed up with literature/theories. Now you propose that "preventive measures should be targeted especially at work ability related to mental and musculoskeletal health among non-manual employees in the health and social sector [...]". If you have a look at the Supplementary Table 2 you could instead propose that the salaries of health and social personnel should be higher. Further, your conclusions of preventive measures is not based on your study (you did not study the effectiveness or magnitude of preventive measures).

Authors' response: We agree with these interesting points. We have now referenced Hesselius 2007 and also included references to other studies addressing the association between unemployment and sickness absence (page 19-20): "Employees who were strongly affected by labour market insecurity and the threat of unemployment may have been less willing to be absent from work despite their health problems.[1, 3, 21-23] It is also possible that during the recession, affected groups of employees had stronger ill-health-related selection out of employment.[24-26] The decline in sickness absence during the recession could thus have been attributable to excess employment exit among individuals with a higher likelihood of sickness absence.[27]" We have also reformulated the whole Conclusions section (both in the Abstract on page 3 and in the main text on pages 24-25). We have removed the sentences on preventive measures and instead addressed the importance of the interplay between the effects of occupational class and industrial sector on sickness absence. We have also revised other parts of the Discussion section in order to strengthen the interpretations of our findings.
Conclusions could be strengthened by searching for information: injury-related sickness absence (the statistics for occupational diseases and accidents, p. 15, row 49), the share of distant work (page 16, row 47/48), ill-health selection out of work (page 18, row 36-38, your own data).

Authors' response: We think that this is a good point. We have now expanded our discussion on labour market changes, including the increase in distant work (pages 21-22): "Other findings nevertheless indicated polarization in the labour market of Finland and other Nordic countries between the mid-1990s and mid-2000s, which was interpreted as partly relating to technological advances in the period. The proportion of occupations at both the top and the bottom ends of the wage distribution increased: engineering professionals and other professionals at the top level and personal and protective services at the bottom level became more common. Accordingly, the proportion of occupations at the intermediate level of the wage distribution decreased mainly due to a reduction in office clerks, i.e. routine non-manual employees.[29]. Corresponding changes may have occurred in our study period and affected the job distributions within the occupational classes. A further notable change in the Finnish labour market is that the proportion of employees performing distant work increased from 10% in 2003 to 20% in 2013.[30] This may have contributed to the decrease in sickness absence among particular groups of employees. It is likely that upper non-manual employees are more able to perform distant work while being ill than lower non-manual employees or manual workers." Unfortunately, our data do not cover all injury-related sickness absences, which makes interpretation of the findings difficult. We now address this issue in the Discussion (page 20): "Absences due to some injuries such as occupational accidents were not included in our data, because these are covered by other insurers than the Social Insurance Institution of Finland (see the Material and methods section for more details). The proportion covered by these other insurers may vary over time and by occupational class. Making interpretations of trends in sickness absence due to injuries is therefore difficult." Our data also do not include information on different measures of health, so it is not possible to assess ill-health selection out of work. Using sickness absence history as a health measure is problematic because of the maximum limits of compensated days in the sickness benefit system, after which disability pension can be applied. We do not have data on absences prior to our study period, either. However, we have now expanded the discussion on health-based selection (please see our response to the third comment).

The data consists of three consecutive cohorts each followed for three years. Would be interesting to know how big was the share of individuals who were included in the study during all 3-year periods and what happened to those who dropped out (unemployed? retired?). This comment concerns also your list of strengths (page 3). You state that "without missing information and loss to follow-up".

Authors' response: These are good points. We have reformulated the sentences related to missing information (pages 3 and 23): "did not have the problem of missing information due to non-response". We have also clarified the issue of how the study population was formed (page 8): "Criteria for being included in the study population were applied separately to each study year. An individual could thus be excluded in one year and included in others." We have also included information on the share of individuals who were included in the study in all three years (page 9): "After all exclusions, 74.0% of the remaining individuals were included in the study population in each of the three consecutive years (calculated among those who fit the age range 25–59 in all three years)." We also give proportions of those excluded for different reasons (pages 8-9).

Many continuous covariates were categorized (age, income, time spent in employment, number of employment periods). Usually, it is better to keep them continuous. I wonder if you would have got different results with other (panel) models, having the number of sickness days continuous.

Authors' response: We considered using some of the covariates as continuous. However, the association between age and sickness absence was not always linear. For example in mental disorders, the risk was highest in the middle age groups. For income we decided to use inflation-corrected quintiles, because we thought that this would be the easiest way to interpret changes between the years. We categorized time spent in employment and number of employment periods,

because most people spent the whole year in employment and had only one employment episode. We wanted to keep these large groups separate. We also considered the use of different measures of sickness absence, but ended up with using an incident measure. Various other measures of sickness absence could also be used, including prevalence, number of days, number of episodes, and length of episodes. Each of these measure a somewhat different phenomenon, and comparing the different outcome measures in beyond the scope of our study. The number of compensated sickness absence days would still not cover spells that last ten working days or less. Furthermore, the number of compensated sickness absence days in a particular year is strongly dependent on sickness absence days in previous years because of the maximum limits of compensated days in the sickness benefit system. We have, however, now discussed the use of particular measures of sickness absence more thoroughly (pages 23-24): "Our outcome measure was based on national data on compensated sickness absence spells that begin after a period of ten working days. Sickness absence spells that did not exceed ten working days were therefore not covered. Moreover, our outcome measure was based on new onset of sickness absence. The predictors of sickness absence might be different when examining e.g. the occurrence of short-term spells, the number of spells of different lengths, or the total number of absence days.[32-36]"

These are only minor comments:

1. Keywords could be different (already in subject headings)

Authors' response: The keywords were previously selected from the list in the submission system. We have now replaced these with more suitable ones.

2. Page 2, row 13. add "in Finland" in the end of the last sentence.

Authors' response: We added "in many countries" (page 2), because the addressed labour market changes have occurred not only in Finland, but also in other countries. We now discuss these changes in the Introduction section (page 6).

3. Page 2, conclusions in the abstract do not have anything about labour market changes (should)

Authors' response: We have revised the Conclusions section (both in the Abstract on page 3 and in the main text on pages 24-25).

4. Page 15, row 10/11, number sickness, of missing(?)

Authors' response: We have corrected this.

5. The text "The panels are presented in different scales" should be added to all Figure captions where needed

Authors' response: The text is included in the captions of figures in which the panels have different scales, i.e. in Figure 1, Figure 2, and Supplementary Figure 1.

VERSION 2 – REVIEW

REVIEWER	Nicola Magnavita
	Università Cattolica del Sacro Cuore, Roma, Italy
REVIEW RETURNED	06-Jan-2018

GENERAL COMMENTS	I think the manuscript has been improved

REVIEWER	Marlen Toch-Marquardt Norwegian University of Science and Technology, Norway
REVIEW RETURNED	12-Jan-2018

GENERAL COMMENTS	I congratulate the authors to this very much improved manuscript. It is clearly visible that the authors put a huge amount of effort into the preparation of this draft. I agree with all the changes to the manuscript and would like to recommend this article to be accepted for publication.

REVIEWER	Eila Kankaanpää University of Eastern Finland
REVIEW RETURNED	04-Jan-2018

GENERAL COMMENTS	Well done. The article has improved a lot. Still some (and probably late) comments: - injuries could have been left out. Probably a great majority of them is filed to other registries. You could also have chosen fewer diagnoses. For example, only two stable diseases that you could compare with musculoskeletal and mental diseases that might be more affected by economic fluctuation. - you replied to my comment on continuity of the variables. I still insist that model with continuous variables would have been better (no changes needed). The relationship does not have to be linear.

VERSION 2 – AUTHOR RESPONSE

Authors' response to the review of the Manuscript ID bmjopen-2017-019822.R1 entitled "Cause-specific sickness absence trends by occupational class and industrial sector in the context of recent labour market changes: a Finnish panel data study"

Editorial Requirements:

- Please provide a section detailing the the ethical oversight and methods used to compile and protect the data. Please include details about whether the data used was fully anonymised, publicly available and if it's possible for someone else access it.

Authors' response: We have now added this information to the end of the manuscript: "Ethics approval: The researchers used fully anonymous register data. Research using such data does not need to undergo review by an ethics committee according to Finnish legislation. Statistics Finland linked its data to those of the Social Insurance Institution of Finland and the Finnish Centre for Pensions, after which the data were anonymized and stored by Statistics Finland. The researchers analyzed the anonymous data using a remote access system. All output extracted from the system was approved by Statistics Finland to ensure compliance with data protection regulations. The data can only be accessed by the individual researchers who have obtained permission from each of the administrative sources providing the data."

Reviewer(s)' Comments to Author:

Reviewer: 1

Reviewer Name: Marlen Toch-Marquardt

Institution and Country: Norwegian University of Science and Technology, Norway Please state any competing interests: None declared

Please leave your comments for the authors below I congratulate the authors to this very much improved manuscript. It is clearly visible that the authors put a huge amount of effort into the preparation of this draft. I agree with all the changes to the manuscript and would like to recommend this article to be accepted for publication.

Authors' response: Thank you for the review.

Reviewer: 2

Reviewer Name: Nicola Magnavita

Institution and Country: Università Cattolica del Sacro Cuore, Roma, Italy Please state any competing interests: None declared

Please leave your comments for the authors below I think the manuscript has been improved

Authors' response: Thank you for the review.

Reviewer: 3

Reviewer Name: Eila Kankaanpää

Institution and Country: University of Eastern Finland Please state any competing interests: None declared

Please leave your comments for the authors below Well done. The article has improved a lot.

Still some (and probably late) comments:

- injuries could have been left out. Probably a great majority of them is filed to other registries. You could also have chosen fewer diagnoses. For example, only two stable diseases that you could compare with musculoskeletal and mental diseases that might be more affected by economic fluctuation.

Authors' response: We appreciate this comment and believe that it helped us further improve the manuscript. We now include six diseases groups instead of the previous eight. We left out injuries, because not much can be said about this disease group due to incomplete coverage in our data. We also left out the smaller disease group of nervous diseases, which was very stable over time. We revised Figure 1 and the text in all parts of the manuscript accordingly. We believe that by including fewer disease groups, the main findings stated in the discussion became clearer.

- you replied to my comment on continuity of the variables. I still insist that model with continuous variables would have been better (no changes needed). The relationship does not have to be linear.

Authors' response: Thank you for this comment. We understand the Reviewer's viewpoint and have ourselves carefully considered the use of continuous variables. However, as justified in our previous response to the Reviewers, we believe that we made solid choices with respect to the use of the variables for the purposes of this study. We therefore chose to keep the original analyses.

REVIEWER	Eila Kankaanpää University of Eastern Finland, Finland
REVIEW RETURNED	23-Feb-2018

GENERAL COMMENTS	Well done!