PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form ([see an example](#)) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below. Some articles will have been accepted based in part or entirely on reviews undertaken for other BMJ Group journals. These will be reproduced where possible.

ARTICLE DETAILS

TITLE (PROVISIONAL)	History of labour market attachment as a determinant of health status: a 12-year follow-up of the Northern Swedish Cohort
AUTHORS	Waenerlund, Anna-Karin; Gustafsson, Per; Hammarström, Anne; Virtanen, Pekka

VERSION 1 - REVIEW

REVIEWER	Saija Mauno University of Jyvaskyla Finland
REVIEW RETURNED	23-Oct-2013

GENERAL COMMENTS	Review on study "Are changes in labour market attachment over 12 years related to health status"? BMI Open
	This study investigated how labour market attachment trajectories were related to perceived mental and physical health. The study was longitudinal and conducted in northern Sweden. The theme is topical and interesting and the study is valuable due to its long-term follow-up period. The study also used an innovative statistical methodology, which has not often been used in occupational health research. I have few comments and suggestions, which are perhaps worth of considering before publishing the study.
	Introduction is really, even too, compact. I think that the authors could discuss more why poor labour market attachment would relate to poor health. Probably there are many potential mediating pathways (e.g. differences in work quality/job characteristics, perceived economic stress, job insecurity, life dissatisfaction etc.), which explain the relationships. Even though, that these mediators were not investigated in this study, it would be nice to see some explanative routes behind the relationships. I would also like to see more discussion about trajectory analysis and how it fits particularly to an examination of labour market attachment and changes in it. This kind of discussion was presented in the discussion section but I think it would be important to explicate the added value of this approach (particularly in this study) also in the introduction. The definition of labour market attachment could also be better explained; is it totally a new concept, if not, how it relates to other similar types of constructs? I don't mean that the authors should write a really long introduction but just to give somewhat more comprehensive information on these phenomena.
	It became clear in the methods that this data have been used in earlier publications. Authors should make clear that this present study is not just a replication of other published studies that are based on this same data (p. 5). The description of labour attachment groups could be clearer (p. 6), it was too difficult to follow; maybe

because the description was so brief. Some justification to use these selected covariates should be presented (p. 7). Trajectory analysis could be better described; e.g., how the numbers of trajectories were specified, and how authors defined the best fitting solution?

Results were clearly presented and tables were informative. In discussion, authors could do better job in thinking, which mechanisms are responsible for negative health effects of poor labour market attachment. I'm sure that it is not an issue what is your job contract or career line but different psychosocial risk factors that come along with poorer labour market status. The Swedish context could be also more discussed; for instance, there were some interesting gender differences even though Sweden is top-countries what is comes to gender equality in the labour market. In addition, authors need to note would these results be generalizable in other countries, outside of Scandinavia.

Hopefully these comments are useful in revising the paper.

REVIEWER	Imma Cortès-Franch
	Occupational Health Unit of Barcelona Coordinator
	Public Health Agency of Barcelona
	Spain
REVIEW RETURNED	05-Nov-2013

GENERAL COMMENTS	This manuscript addresses a relevant question in the field of occupational health and also provides new knowledge in the broad scope of social epidemiology, highlighting the influence of long-term labour market attachment (LMA) on health. The study helps to clarify previous heterogeneous results about the relation between different forms of labour instability and health and importantly gives recommendations for policymakers to consider the potentially 'scarring' effect of low levels of LMA. This is a key question in the current economic crisis.
	Despite the relatively low number of people followed-up, the study has some strengths, such as the prospective design and the few people lost-to-follow up. Furthermore, innovation of using a method rarely used in research on labour history to overcome the limitations of cross-sectional studies is commendable. Some suggestions to improve the understanding of the manuscript are provided below.
	Method
	The key result of this article is the positive relation between LMA and health, LMA decreasing as health worsens. One major consideration arises from this point: the construction of the categories of LMA. Although authors describe it in the method section, certain questions could be better explained. For example, why is the category 'entrepreneur' more attached than all other forms of temporary employment or why is 'in employment policy measure' the lowest level of temporary employment?. See the next section (Results) for more comments about classifying trajectories into tracks. Also, the 2.5 years minimum for 'out of labour market' was chosen so as not to include workers studying or on parental leave. Given the importance of this category, a brief explanation of this should be provided. On these lines, perhaps authors could refine the selection

of people out of work, considering the level of education and parental status (having child).

The covariate socioeconomic position includes the self-employed who were put together with upper white-collar workers. This could lead to a misclassification because the self-employed can be both white (upper or lower) and blue-collar, and self-employment could be related to the LMA tracks that include the category 'entrepreneur'. Given the difficulties of placing self-employed (or entrepreneurs) in relation to socioeconomic position and LMA, perhaps an option could be exclude them, if it does not affect the statistical power.

Once the explanation about the categories of LMA has been improved, an analysis might be performed to test for a gradient in the relation between LMA trajectories and indicators of health.

The answer 'No' to the question 'Are the methods described sufficiently to allow the study to be repeated?' is related to the fact that the authors refer to two previous studies cited in references. The importance of the construction of the tracks of the LMA trajectory may call for details about this point.

Results

Authors must argue the inclusion of track 6 in the 'strengthening' category of LMA. According to Figure 1, this track has a permanently high level of attachment trajectory. This issue is of importance because track 6 is the largest group.

Adding the track of permanent people to facilitate comparison with the other levels of strength of attachment would improve the understanding of Figure 1.

It would be easier to follow the text if the OR were accompanied by the correspondent confident interval, instead of the reader having to go to the Table 2.

Discussion

Authors point out that worse health among poorly attached workers to the labour market is partly explained by other risk factors, such as being single, having previous poor health and having more frequent experience of unemployment, while not considering other important risk factors associated with poor attachment: vulnerability, limited workplace rights and social protection, and hazardous working conditions. All of them are dimensions of precariousness that have been related to poor health outcomes.

As the authors point out recall bias could be a limitation in the measurement of LMA history but the affirmation that this could cause an underestimation of time in non-permanent contracts needs more clarification.

A point of discussion that may deserve attention in order to generalize results among other countries is that of the characteristics of social and labour politics in Sweden, which can

	protect health among poorly attached workers.
	Finally, if it is permitted for the manuscript to be longer, recommendations about future research could improve the usefulness of the study, for example: taking into account other dimensions of precariousness related to poor attachment trajectories, conducting studies with more subjects in order to analyse groups more exposed to flexible employment, such as blue-collar workers or women, and conducting similar studies in other countries with different kinds of social and labour market policies.
	Key messages
	A key point seems to be missed regarding the first objective. The authors neglected to highlight that a substantial portion of the workers followed in the study remained poorly attached to the labour marked for more than 12 years.

VERSION 1 – AUTHOR RESPONSE

Reviewer 1
This study investigated how labour market attachment trajectories were related to perceived mental and physical health. The study was longitudinal and conducted in northern Sweden. The theme is topical and interesting and the study is valuable due to its long-term follow-up period. The study also used an innovative statistical methodology, which has not often been used in occupational health research. I have few comments and suggestions, which are perhaps worth of considering before publishing the study.

R1Question 1 Introduction is really, even too, compact. I think that the authors could discuss more why poor labour market attachment would relate to poor health. Probably there are many potential mediating pathways (e.g. differences in work quality/job characteristics, perceived economic stress, job insecurity, life dissatisfaction etc.), which explain the relationships. Even though, that these mediators were not investigated in this study, it would be nice to see some explanative routes behind the relationships. I would also like to see more discussion about trajectory analysis and how it fits particularly to an examination of labour market attachment and changes in it. This kind of discussion was presented in the discussion section but I think it would be important to explicate the added value of this approach (particularly in this study) also in the introduction. The definition of labour market attachment could also be better explained; is it totally a new concept, if not, how it relates to other similar types of constructs? I don't mean that the authors should write a really long introduction but just to give somewhat more comprehensive information on these phenomena.

Answer:
The reviewers suggestions are highly relevant. First, we have revised the introduction by opening up that poor labour market attachment may act on poor health through a range of possible unfavourable employment and life circumstances that could offer explanative routes.

Secondly, we have clarified the definition of labour market attachment, which indeed is a concept previously known. What is new in this study is, how we have chosen to apply the concept in the relation the statistical procedure, which rather new in the field of public health. This allows us to get a different picture of labour market history and transition over a time-span longer than most other studies in this field.

Sections of text changed: Introduction, page 2, 1st paragraph.
To the individual, the consequence of the flexible employment means that attachment to a workplace is weak and commonly interrupted by unemployment and other episodes out of work. In order to capture the total spectrum of employment relations, both with regard to quality and quantity, we have chosen to work with the concept of 'labour market attachment' (LMA) in this study. In our definition of the LMA spectra we have included permanent, non-permanent employment, unemployment and those who are exempted from working [1-3]
Introduction, page 2-3, 2nd paragraph.

Previous studies has proposed that temporary employment could be a risk of poor psychosocial work characteristics[4] with temporary employees more commonly experiencing job insecurity and having a low cash margin [5], which are some of the factors that can be a potential pathways linking weak LMA to poor health. We have for example shown that long term temporary employees often experience difficulties to work full-time (underemployment) which influences their financial situation in a negative way [6]which can be a source of worry.[7] Poor health could also be mediated through job strain, although it seems as this group affected more by limited influence or control rather than high demands.[8]

Introduction, page 5, 4rd paragraph.

The few available studies about labour market trajectories in field of public health have measured LMA in a few time points, e.g. between one time point to another[4] and the goal has been descriptive rather than analytic.[9, 10] In the present study, we have applied a refined scale with regard to LMA. In the measure we have included a spectrum of types of employment situations and also covered a time-span of 12 year.

Method, measurement, LMA history, page 5, 1st paragraph.
We name the response variable of the trajectory analysis as "labour market attachment" (LMA). It aims to serve as a conceptual and empirical tool to sort out the employment statuses of the post-industrial labour market into a continuum [11, 12]. Crudely, it "refers to whether or not people have continuous employment (for example all year or only part of it) and whether or not they have periods of unemployment" [13] At headline level [14] there are four major classes of LMA: non-employment, unemployment, temporary employment and permanent employment. Within each class, several subclasses can be discerned. In the present study, the interest focuses on differential temporary employment. Seen through LMA, temporary employment covers a set of positions defined by formal job contracts, regardless of the psychological contract [15], job commitment [16] or perceived job insecurity [17]

Introduction, page 4-5, 3rd paragraph.
There are a lot of studies about particular labour market status as predictor of health. An inherent problem of such studies is the amount of exposure: cross-sectional information of the status includes great variation, a variable based on duration of the ongoing status is bound to use cross-sectional health data, and in prospective follow-up settings there may be periods in several statuses during the follow-up. The problem is of special importance in research of the health effects of atypical employment, as there are a wide range of statuses between permanent employment and overt unemployment. To address this topic, we have introduced a score that sums up the exposure to different types of non-permanent employment during the follow-up [18]. The score, however, does not take into account timing of the exposures. One way to capture the status chains, or the passages in and the transitions between different labour market positions, is provided by trajectory analysis. Applying this method with a four class response variable (permanent employment, non-permanent employment, unemployment and out of the labour force) the members of the Northern Swedish

Cohort have been clustered onto six different 'labour market attachment tracks'[1]. For the trajectory analysis of the present study, labour market attachment was measured by a ten class indicator, in order to articulate in more detail the trajectories of non-permanent employment and their association with health.

R1Question 2 It became clear in the methods that this data have been used in earlier publications. Authors should make clear that this present study is not just a replication of other published studies that are based on this same data (p. 5). The description of labour attachment groups could be clearer (p. 6), it was too difficult to follow; maybe because the description was so brief. Some justification to use these selected covariates should be presented (p. 7). Trajectory analysis could be better described; e.g., how the numbers of trajectories were specified, and how authors defined the best fitting solution?

Answer:
The dataset has been previously used but this study is original and different then previous studies both with regard to methodology and substantive issues, including research questions addressed. In the text we have now specified that the ranking of contract has been used in partly previous research but with the aim to research on accumulation of temporary employment. We have extended the description of the labour market attachment groups and added some justification behind selected covariates. The statistic section on the trajectory analysis has been developed to hold more detail.

Clarification of how the data has been used previously and description of the LMA groups
Section; Methods, LMA history, page 7, paragraph 1-2.

We name the response variable of the trajectory analysis as "labour market attachment" (LMA). It aims to serve as a conceptual and empirical tool to sort out the employment statuses of the post-industrial labour market into a continuum .[11, 12] Crudely, it "refers to whether or not people have continuous employment (for example all year or only part of it) and whether or not they have periods of unemployment" [13] At headline level [14] there are four major classes of LMA: non-employment, unemployment, temporary employment and permanent employment. Within each class, several subclasses can be discerned. In the present study, the interest focuses on differential temporary employment. Seen through LMA, temporary employment covers a set of positions defined by formal job contracts, regardless of the psychological contract, [15] job commitment [16] or perceived job insecurity.[17]

The ranking of contracts has been tested in previous research on accumulation of temporary employment[18] and was based on Aronsson's core-periphery model [19]which proposes that there is a health gradient in relation to type of employment contract. The model ranks contracts based on duration, possibility of on the job training, autonomy, and job security.[19]

Justification of the selected covariates are described in the Method section, covariates, page 7, paragraph 1-3.

More women than men have poor LMA in terms of temporary employment. [20] Gender has been considered as an important factor in relation to poor LMA and illness, where women's health might be at greater risk. [21] Also partnership and parenthood are important factors in relation to LMA as these two may be postponed due to insecure working arrangement [22, 23], which could influence social aspects related to illness [22]. Marriage or having a partner is also important to consider when studying LMA, as it can be beneficial to health and financial resources [24]. Socio-economic position strong predictor of health [25-28]. LMA have been shown to be related to occupational class [22] it is important to consider socio-economic position as a possible confounder when studying the

relationship between temporary employment and illness. Another factor of relevance when studying the relationship between LMA and illness is previous health. If previous health is not considered in these types of studies, there is a possibility of drawing faulty conclusions regarding the causality of the relationship. [29, 30].

Description of trajectories: Section: Methods, Statistics, page 9, paragraph 1-3

The participants were clustered according to the development of their LMA over the 12 years applying trajectory analysis.[31] The method has been established as a way of studying individual developmental courses over age or time, and for identifying distinctive groups of individual trajectories within the population that emerge, instead of predefined criteria, from the data itself. Trajectory analysis consists of three steps. First, the appropriate probabilistic model is chosen for the response variable. Second step is to define degree of the polynomial form of the trajectories. Finally, the number of the clusters is decided, employing the statistical information criteria and the 'common sense criteria' with respect to the substance and aims of the study. As a result, the developmental trajectories within clusters are as similar as possible, and trajectories between clusters are as different as possible.[32] At individual level, cluster membership is dictated by the highest calculated posterior probability of belonging to a particular cluster.

Trajectory analyses were conducted with Mplus program package. The analysis allowed for 12 time points, and the first and the second half of every second year were chosen in order to take into account possible systematic seasonal variation of LMA.

We used logistic regression (odds ratio and 95% CI) to test whether LMA history was associated with non-optimal self-rated health and psychological distress at age 42. Adjustments were made for the health indicator at age 30, gender, socioeconomic position, parental status and marital status. SPSS v17 was used for the regression analyses. Women and men were analysed together to preserve power.

Section Results page 10-11, paragraph 1-4

The data consists of 10 class ordinal indicator of LMA, and the form of probability distribution of longitudinal sequence of measurement for such variable is the multinomial distribution.

The adjusted Bayesian information criterion (BIC) value decreased from 17435.474 for the linear model to 16656.622 for the quadratic polynomial model, indicating that the latter can be preferred over the former. Other information criteria provided by the Mplus program as well pointed in the same direction.

Optimal number of trajectories was searched by checking the solutions up to nine. The adjustedn Bayesian information criterion (adj. BIC) was used fo choosing the solution.[33] The Adj. BIC value (as well as the other information criteria) decreased when the number of trajectories was increased, rapidly in the beginning and slower in the end. From seven-trajectory to eight-trajectory solution the figure decreased from 17856.940 to 17606.402. Thereafter the decrease slowed down. We decided to continue with eight trajectories, as this solution provided, in addition to detailed depiction of differential LMA, the opportunity to exclude the cluster with zero LMA that was out of our research interest.

Figure 1 illustrates the 'labour market tracks' based on means of the LMA scores at each time point of the individuals classified into each trajectory. Individuals on track 1 (3% of the cohort) also were excluded, as they were mainly disability pension recipients and their health was poor by definition. The track of 'permanent' employment throughout the follow-up included more than half of the cohort,

whereas the remaining six clusters were relatively small and there were relatively similar tracks. We collapsed these six clusters into three as follows. A considerable part (tracks 2 and 3) maintained a continuously 'high level' of attachment, and about 12% (tracks 5 and 7) displayed a 'strengthening' of attachment towards the end of the follow-up. The attachment was permanently weak in about one of 10 (track 8), and a small cluster with a U-shaped pattern (track 4) was also seen; we decided to collapse these clusters and defined their attachment as 'poor'. In addition to being substantially grounded, this collapsing provided statistical power for subsequent analyses. Thus, we arrived at a four class 'LMA history' variable that comprised 'permanent', 'high level', 'strengthening' and 'poor' LMA (Figure 2).

R1Question 3 Results were clearly presented and tables were informative. In discussion, authors could do better job in thinking, which mechanisms are responsible for negative health effects of poor labour market attachment. I'm sure that it is not an issue what is your job contract or career line but different psychosocial risk factors that come along with poorer labour market status. The Swedish context could be also more discussed; for instance, there were some interesting gender differences even though Sweden is top-countries what is comes to gender equality in the labour market. In addition, authors need to note would these results be generalizable in other countries, outside of Scandinavia.

Answer: First, regarding mechanisms. As well as presenting some possible mediators in the introduction (see comment 1 above) , we have included a section on potential pathways between poor LMA and negative health effects, giving some nuance to the discussion.

Change in manuscript: Discussion, page 17, 1st paragraph:

As described in the introduction job insecurity, finical stress, lack of reciprocity, uncertainty, lack of autonomy are some of the broad range of potential pathways linking temporary employment to poor health in previous studies [4, 5, 34-37]. Although mediating mechanisms has not been within the scope of this paper, our results can understood in the light of potential pathways presented in previous research.

Second, regarding the Swedish setting. Sweden is a top-ranked country in terms of gender equality. Even so, we found more women in the two trajectories with the least LMA. We interpret this as a result of the gender segregated labour market. Although women are active in the labour market to a great extent in Sweden, women and men are found working in different sectors and temporary contracts are frequently used in the women dominated sectors in Sweden.
Discussion, page 17, 2nd paragraph.
Further, we found more women than men in this least favourable situation. This is probably explained by the widespread use of 'on-demand employment contracts' in women-dominated sectors of business[20] such as care and welfare and education [38] which are two industries which together stands for 33% of all temporary contracts in Sweden[6]. As such, even in a comparatively gender equal labour market setting of Sweden, the present study shows that women are still exposed to potentially health hazardous labour market positions to a greater degree than men.
Third, we discuss the context of the Swedish labour market to increase the possibility to judge it the results could be generalizable to other contexts.
Discussion, methodological considerations, page 18-19, 2nd paragraph.
It is plausible that health effects of poor labour market attachment operate depending on the social context. For example, health implications might be more of less evident depending on structural factors such as national labour market policies, education system and legislation.[39] Although, some

researchers suggest that flexible employment isn't related to poor health in welfare regimes with strong labour market regulations, such as Scandinavia,[40] the present study suggests the contrary. Swedish unions has criticised the current national labour market regulations, for being too liberal, regarding temporary employment. With current regulation it's possible hire a substitute for up to two years and after that hire the same person on a general temporary employment contract for up to two years, this causes a situation where people are at risk of becoming long term temporary.[41] As a result of this approximately 10% of all temporary employees has been employed by the same employer for 5 years or more. The Swedish labour market regulation could therefore be a reason to the noticeable finding in this study; where a substantial part of the workers followed remained poorly attached over the 12 years which was examined. Long term temporary employment could be a future problem, and also a relevant group to study further in future research.

Hopefully these comments are useful in revising the paper.

Reviewer Name Imma Cortès-Franch
Institution and Country Occupational Health Unit of Barcelona Coordinator
Public Health Agency of Barcelona
Spain
Please state any competing interests or state 'None declared': None declared

Reviewer 2
This manuscript addresses a relevant question in the field of occupational health and also provides new knowledge in the broad scope of social epidemiology, highlighting the influence of long-term labour market attachment (LMA) on health. The study helps to clarify previous heterogeneous results about the relation between different forms of labour instability and health and importantly gives recommendations for policymakers to consider the potentially 'scarring' effect of low levels of LMA. This is a key question in the current economic crisis.

Despite the relatively low number of people followed-up, the study has some strengths, such as the prospective design and the few people lost-to-follow up. Furthermore, innovation of using a method rarely used in research on labour history to overcome the limitations of cross-sectional studies is commendable. Some suggestions to improve the understanding of the manuscript are provided below.

Method

R2 Question 1 The key result of this article is the positive relation between LMA and health, LMA decreasing as health worsens. One major consideration arises from this point: the construction of the categories of LMA. Although authors describe it in the method section, certain questions could be better explained. For example,

a. why is the category 'entrepreneur' more attached than all other forms of temporary employment or
b. why is 'in employment policy measure' the lowest level of temporary employment?.
See the next section (Results) for more comments about classifying trajectories into tracks.
c. Also, the 2.5 years minimum for 'out of labour market' was chosen so as not to include workers studying or on parental leave. Given the importance of this category, a brief explanation of this should be provided.

d. On these lines, perhaps authors could refine the selection of people out of work, considering the level of education and parental status (having child).

Answer: We have based the scale on Aronsson's core-periphery model, but also extended some aspects. The scale is hypothetical and does indeed have some limitations, however this is a attempt to consider the variations of employment situations in the labour market.

a. We have suggested entrepreneurs as a group in between the permanent employees and the temporary employees (in regard to labour market position). Because this specific group has characteristics that is similar to permanent employees (e.g. high decision latitude), but who also can have elements associated with temporary employment (e.g. income insecurity). Therefore we have placed the entrepreneurs between permanent and temporary employees.

b.´In employment policy measure´ combined with the group 'unemployed' is at the lower spectrum with regard to labour market position (not temporary employment). This group is actively looking for employment and available to the labour market but currently not employed. This situation makes this group more attached compared to those 'out of the labour market' but less attached to those currently having employment of any type.

c. In the group 'out of labour market', we did set a limit of a minimum of 2.5 years. This limitation criterion was to reduce the numbers of people in this category due to temporary circumstances. Such as education or parental leave. (As we don't consider getting education or parental leave as poor LMA)
This strategy seem likely to be successful, as the class 1, has a severely high OR compared to the other groups. Analysis (data not shown) showed extra high OR for poor health status suggesting that this group is mainly constituted by those with early retirement or sickness benefit. This is supported by additional analysis showing that a majority (20 out of 30) of the individuals in class 1 have answered that they are on early retirement or claiming sickness benefit (in a different question).

d. We consider this group to mainly consist of people on early retirement (supported by additional analysis), this part of this group can although have higher education and also be parents (not a contradiction) therefore additional analysis on education or parental status would not help to understand better.

Here is also a table on the coding of the categories.
Type of labour market position Strength of labour market attachment
(10 strong- 1 weak)
Permanent employment 10
Entrepreneur 9
Employed in project 8
Substitute 7
Probationary employment 6
On-demand worker 5
Seasonal worker 4
Temporary employee for other reasons 3
In employment policy measure 2
Unemployed 2
Out of the labour market 1

Change in manuscript: Methods, LMA history, page 7, 1st paragraph.

The ranking of contracts has been tested in previous research on accumulation of temporary employment[18] and was based on Aronsson's core-periphery model [19]which proposes that there is a health gradient in relation to type of employment contract. The model ranks contracts based on duration, possibility of on the job training, autonomy, and job security.[19] However, we have

extended the ranking by also include three labour market positions of non-employment.

As the last category 'out of labour market' was given the lowest score in relation to LMA. The intention for this group was that it was suppose to be contained by those mainly on sickness benefit (supported by analysis, data not shown), not those temporarily not working due to parental leave or education).

R2Question 2 The covariate socioeconomic position includes the self-employed who were put together with upper white-collar workers. This could lead to a misclassification because the self-employed can be both white (upper or lower) and blue-collar, and self-employment could be related to the LMA tracks that include the category 'entrepreneur'. Given the difficulties of placing self-employed (or entrepreneurs) in relation to socioeconomic position and LMA, perhaps an option could be exclude them, if it does not affect the statistical power.

Answer: This is a good point. As the reviewer anticipated, we are unfortunately not able to exclude this group due to power problems, as sample size is rather limited this could possibly lead to type II error. However, we have described in the methodical considerations how our analysis might be affected by this situation of overlapping variables. We also consider the entrepreneurs to be part of the upper white collar as they are owners of the production means and highest in the hierarchy of decision making.

Change in manuscript: Discussion, methodological considerations, page 20, 2nd paragraph.

The LMA variable and socioeconomic position is partly overlapping as the group of entrepreneurs both is part of the SEP classification and the LMA variable. This overlap could cause over adjustment in the logistic regression analysis. As these two variables partly measure the same phenomenon, adjusting for socioeconomic position could adjust part of the true effect of LMA.

R2Question 3 Once the explanation about the categories of LMA has been improved, an analysis might be performed to test for a gradient in the relation between LMA trajectories and indicators of health.

Answer: We have clarified the categories of LMA (see question 1) and added new figures to make it easier to interpret which classes belongs to which category. Go to question five to view the figures. This argues to also keep the trajectory analysis unchanged.

R2Question 4 The answer 'No' to the question 'Are the methods described sufficiently to allow the study to be repeated?' is related to the fact that the authors refer to two previous studies cited in references. The importance of the construction of the tracks of the LMA trajectory may call for details about this point.

Answer: The statistics and results in relation to the construction of the tracks has been described in greater detail, in the Method section/ Statistics page 9 and also in the Results page 9-11.

Change in manuscript: Method, Statistics page 9, paragraph 1-3

The participants were clustered according to the development of their LMA over the 12 years applying trajectory analysis.[31] The method has been established as a way of studying individual developmental courses over age or time, and for identifying distinctive groups of individual trajectories within the population that emerge, instead of predefined criteria, from the data itself. Trajectory analysis consists of three steps. First, the appropriate probabilistic model is chosen for the response variable. Second step is to define degree of the polynomial form of the trajectories. Finally, the

number of the clusters is decided, employing the statistical information criteria and the 'common sense criteria' with respect to the substance and aims of the study. As a result, the developmental trajectories within clusters are as similar as possible, and trajectories between clusters are as different as possible.[32] At individual level, cluster membership is dictated by the highest calculated posterior probability of belonging to a particular cluster.

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Section Results page 10-11, paragraph 1-4

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Results

R2Question 5 Authors must argue the inclusion of track 6 in the 'strengthening' category of LMA. According to Figure 1, this track has a permanently high level of attachment trajectory. This issue is of

importance because track 6 is the largest group.

Answer: We interpret the reviews comment as there has been a misinterpretation of figure 1. Class 6 is indeed the largest group and have permanent high level of attachment; this class is included in the 'Permanent employment' track. We believe that the figure is difficult to read due to the many classes displayed in the same graph, therefore we have included 4 graphs extracted from figure 1. Here it is more clearly that class 6 is part of the "Permanent employment" category. If it is requested we would be glad to include these graphs in paper.

Change in manuscript:

R2Question 6 Adding the track of permanent people to facilitate comparison with the other levels of strength of attachment would improve the understanding of Figure 1.

Answer:
Referring to the answer to question 5, the track of permanent employment is the category which we have compared to the other levels of strength of attachment. We hope this can became more clear by viewing the graphs above. It is indeed valid to use the permanently employed as our reference group, and that is exactly what was done in the analyses. We apologise for the confusion and hope that the added figure will make the track operationalization clearer and avoid future misunderstandings.

R2Question 7 It would be easier to follow the text if the OR were accompanied by the correspondent confident interval, instead of the reader having to go to the Table 2.

Answer:
We have accompanied the OR by corresponding confident interval in the text describing table 2.

Discussion

R2Question 8 Authors point out that worse health among poorly attached workers to the labour market is partly explained by other risk factors, such as being single, having previous poor health and having more frequent experience of unemployment, while not considering other important risk factors associated with poor attachment: vulnerability, limited workplace rights and social protection, and hazardous working conditions. All of them are dimensions of precariousness that have been related to poor health outcomes.

Answer: There is indeed other risk factors part from those considered in this study that could explain our results further. We have considered this by adding a paragraph in the section regarding limitations and recommendations for future research.

Change in manuscript: Discussion, page 19, 2nd paragraph.
In this study we have focused on poor LMA as a risk factor for poor health, there are however a range of other circumstances the relates to precarious employment which could explain the results, such as vulnerability, lack of benefits, low wages, disempowerment[21].

R2Question 9 As the authors point out recall bias could be a limitation in the measurement of LMA history but the affirmation that this could cause an underestimation of time in non-permanent contracts needs more clarification.

Answer: This is a valid point by reviewer and was based on our guessed on what seemed more likely. However, we concede that this is merely speculation and that recall bias could result in both over- and

underestimation. Therefore, we have removed the last part of the sentence: "which could cause an underestimation of time in non-permanent contracts".

R2Question 10 A point of discussion that may deserve attention in order to generalize results among other countries is that of the characteristics of social and labour politics in Sweden, which can protect health among poorly attached workers.

Answer: We have added a discussion regarding the characteristics and social and labour policies in Sweden (see above comment 3 by reviewer 1).

Change in manuscript: Discussion, Methodological consideration, page 18-19, 2nd paragraph
It is plausible that health effects of poor labour market attachment operate depending on the social context. E.g. that health implications might be more of less evident depending on structural factors such as national labour market policies, education system and legislation.[39] Sweden is part of the Scandinavian welfare regimes which are considered to have strong Social Democratic values and government funded benefits during episodes of unemployment. The welfare state Sweden could therefore possible reduce negative health effects of flexible employment,[40] which is in contrast to the results in our study. However, Swedish unions has criticised the current labour market regulations for being too liberal regarding temporary employment. With current regulation it's possible hire a substitute for up to two years and after that hire the same person on a general temporary employment contract for up to two years, this causes a situation where people are at risk of becoming long term temporary.[41] As a result of this approximately 10% of all temporary employees has been employed by the same employer for 5 years or more. The Swedish labour market regulation could therefore be a reason to the noticeable finding in this study; where a substantial part of the workers followed remained poorly attached over the 12 years which was examined. Long term temporary employment could be a future problem, and also a relevant group to study further in future research.

R2Question 11 Finally, if it is permitted for the manuscript to be longer, recommendations about future research could improve the usefulness of the study, for example: taking into account other dimensions of precariousness related to poor attachment trajectories, conducting studies with more subjects in order to analyse groups more exposed to flexible employment, such as blue-collar workers or women, and conducting similar studies in other countries with different kinds of social and labour market policies.

Answer: We have considered your recommendations of future research to improve the usefulness of the study and integrated a new section on this topic in the discussion.

Change in manuscript: Discussion, methodological considerations, page 19, 2nd paragraph.
Sample size was limited in this study which is pointing towards potential future research recommendations. Future research would benefit from analysing datasets with a larger sample size to be able to e.g. stratify analysis on gender or socioeconomic position. This could enrich the understanding of the field of LMA and illness by being able to discern context specific differences in relation to specifically exposed groups. Further we would recommend future research to elaborate on other aspects of precariousness linked to poor LMA, such as vulnerability, lack of benefits, low wages, disempowerment.[21] Lastly, future research should explore the validity of LMA in a different context, e.g. country with different social and labour policies.

Key messages

R2Question 12 A key point seems to be missed regarding the first objective. The authors neglected to

highlight that a substantial portion of the workers followed in the study remained poorly attached to the labour marked for more than 12 years.

Answer: This is a key point that we have neglected to highlight. We have added a paragraph to highlight this issue.

Change in manuscript: Discussion, Methodological considerations, page18-19,2nd paragraph
With current regulation it's possible hire a substitute for up to two years and after that hire the same person on a general temporary employment contract for up to two years, this causes a situation where people are at risk of becoming long term temporary.[41] As a result of this approximately 10% of all temporary employees has been employed by the same employer for 5 years or more. The Swedish labour market regulation could therefore be a reason to the noticeable finding in this study; where a substantial part of the workers followed remained poorly attached over the 12 years which was examined. Long term temporary employment could be a future problem, and also a relevant group to study further in future research.

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VERSION 2 – REVIEW

REVIEWER	Saija Mauno University of Tampere, Finland, and University of Jyväskylä, Finland
REVIEW RETURNED	12-Dec-2013

GENERAL COMMENTS	Authors have done good job in revising the paper and I don't have additional comments. However, the paper would benefit from proper proofreading because there were some mistakes (e.g. Studies has shown -> Studies have shown...). Sometimes proofreading services are provided by the journal but still the final version should be good English. Minor resision was selected because the article needs proofreading.

REVIEWER	Immaculada Cortès-Franch Occupational Health Unit of Barcelona Public Health Agency of Barcelona Spain
REVIEW RETURNED	18-Dec-2013

GENERAL COMMENTS	Authors must argue the inclusion of track 6 in the 'strengthening' category of LMA. According to Figure 1, this track has a permanently high level of attachment trajectory. This issue is of importance because track 6 is the largest group. On another hand it would be necessary to show the difference between this track and the track of permanent people. A revision of written English of the new paragraphs added by authors in pages 17, 18 and 19 of the manuscript (marked on yellow in the text) is needed.

VERSION 2 – AUTHOR RESPONSE

Reviewer 1. Request 1.Minor resision was selected because the article needs proofreading.

Response to reviewer 1 request 1: The Manuscript has been edited by a professional proofreading service and lingual and grammatical changes has been made throughout the manuscript to improve the standard of the English.

Changes in manuscript: A version with track changes is provided along with the new version, so the changes made can be followed.

Reviewer Name Immaculada Cortès-Franch
Institution and Country Occupational Health Unit of Barcelona
Public Health Agency of Barcelona
Spain
Please state any competing interests or state 'None declared': None declared.

Reviewer 2, request 1. Authors must argue the inclusion of track 6 in the 'strengthening' category of LMA. According to Figure 1, this track has a permanently high level of attachment trajectory. This issue is of importance because track 6 is the largest group. On another hand it would be necessary to show the difference between this track and the track of permanent people.

Response to reviewer 2, request 1.

Here a reiteration of the previous response in revision 1 is provided.
Answer: We interpret the reviews comment as there has been a misinterpretation of figure 1. Class 6 is indeed the largest group and have permanent high level of attachment; this class is included in the 'Permanent employment' track. We believe that the figure is difficult to read due to the many classes displayed in the same graph, therefore we have included 4 graphs extracted from figure 1. Here it is more clearly that class 6 is part of the "Permanent employment" category. If it is requested we would be glad to include these graphs in paper.
(Please note that figure 2 can't be included in response box in the submission system, it has to be viewed as attached figure.)

In addition to this these changes requested in revision 1, these following changes has been made in the manuscript to make sure the will be no further misinterpretation regarding which classes belongs to which category. See (Results, page 12, 4th paragraph)

Thus, we arrived at a four class 'LMA history' variable that comprised 'permanent'(class 6), 'high level'(class 2 and 3), 'strengthening'(class 5 and 7) and 'poor' (class 4 and 8) LMA (Figure 2).

Reviewer 2, request 2. A revision of written English of the new paragraphs added by authors in pages 17, 18 and 19 of the manuscript (marked on yellow in the text) is needed.

Response to reviewer 2, request 2. A revision of the written English in the new paragraphs has been made and in accordance with a professional proof reading service. To follow the changes in the manuscript a version with track changes is provided along with the new version.