

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Trends in socioeconomic inequalities in five major risk factors for cardiovascular disease in the Korean population: a cross sectional study using data from the Korea National Health and Nutrition Examination Survey, 2001-2014
AUTHORS	Kim, Yoon Jung; Lee, Ji Sung; Park, Juri; Choi, Dong Seop; Kim, Doo Man; Lee, Kee-Hyoung; Kim, Ho Yeon; Kim, Sin Gon; Lee, Juneyoung

VERSION 1 - REVIEW

REVIEWER	Dr Shaun Scholes Epidemiology and Public Health University College London United Kingdom
REVIEW RETURNED	16-Sep-2016

GENERAL COMMENTS	<p>The authors of this study examined trends in socioeconomic inequalities in five major CVD risk factors (smoking, obesity, diabetes, hypertension and hypercholesterolemia) using data from the Korean National Health and Nutrition Examination Survey (2001 to 2013-14). I have a keen interest in trends in socioeconomic inequalities in CVD risk factors, and it is excellent to see a manuscript showing trends in Korea. It is a well-written manuscript that is very easy to follow. However, I have a number of comments (many of which are technical and minor, but still important) which are intended to strengthen the quality of the manuscript. I am willing to review a revised manuscript.</p> <p>(1) The authors briefly discuss response rates, but there is no mention of any possible patterns of bias related to response. Has there been any work in Korea on socioeconomic differences in the propensity to respond to the survey? Similarly, the authors do not provide any estimates of item non-response (e.g. of those who had a health interview, what % went on to have a health examination: and was this associated with socioeconomic status). Not accounting for this may have implications in terms of underestimating inequalities.</p> <p>(2) The authors only show trends in relative inequalities. I recommend that the authors report both absolute and relative measures. For background please see the paper:</p> <p>King et al "Use of relative and absolute effect measures in reporting health inequalities: structured review" BMJ 2012;345:e5774 (http://www.bmj.com/content/345/bmj.e5774),</p> <p>or at the very least justify using only relative measures and consistently refer to trends in "relative" inequalities.</p>
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	<p>(3) In relation to the logistic regression modelling the authors do not explain how age is adjusted for (though we can make an educated guess) and the authors do not explain how survey year was entered in the model.</p> <p>(4) Given that the authors use household income it may be important to know how many adults were interviewed per household.</p> <p>(5) My preference would be to see the estimates in Supplementary Table 1 as part of Table 1. It is also important to clarify whether these prevalence estimates are age adjusted.</p> <p>(6) It would be helpful to label Q1 and Q4 in all Tables as Q1 (highest income) and Q4 as (lowest income)</p> <p>(7) I would like to see Supplementary Table 2 as Table 6. I do not agree with a view that non-significance means it can be relegated to supplementary data. But I accept others may disagree.</p> <p>(8) Could the authors reconsider their interpretation of the SES – obesity association among women. The authors point to “gender differences in attitudes towards body image in Korea” and then mention an International survey of university students. I do not see the relevance of this survey in terms of SES and age (the minimum age in this study is 25). The authors mention more structural explanations for the SES-diabetes association: and I would like the authors to consider whether the same sorts of structural explanations are also relevant for the SES-obesity association.</p> <p>(9) The authors do not explain the rationale for choosing these five risk factors.</p> <p>(10) The authors do not provide information on how medication use was established.</p> <p>(11) The authors may wish to consider the issue of statistical power as a limitation to the study. It may be the case that large sample sizes are necessary to be fully able to detect significant changes in the RII (especially when also stratifying by sex).</p> <p>(12) The authors should also acknowledge that different methods of measuring trends in socioeconomic health inequalities may lead to different conclusions about whether relative inequalities are increasing or decreasing:</p> <p>Young-Ho Khang et al “Monitoring trends in socioeconomic health inequalities: it matters how you measure” BMC Public Health 2008;8:66.</p>
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REVIEWER	Seung-Hwan Lee Division of Endocrinology and Metabolism, Department of Internal Medicine, Seoul St.Mary's Hospital, Korea
REVIEW RETURNED	23-Sep-2016

GENERAL COMMENTS	In this manuscript, Kim et al. examined the odds of having major cardiovascular risk factors according to socioeconomic status in Korean subjects using nationally representative data obtained from
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	<p>2001 to 2014. They further investigated the trends in socioeconomic inequalities of these risk factors, and conclude that socioeconomic inequalities in smoking, obesity and diabetes had worsened in women but not in men. Although cross-sectional nature of this study limits the interpretation of the data, some important suggestions could be made in public health perspective.</p> <p>Specific comments</p> <ol style="list-style-type: none"> 1. Age and sex are major factors affecting the relationship between socioeconomic status and various diseases or risk factors. Furthermore, as the authors state, rapid changes in social environment in Korea during last decades influenced the young and old people to have quite different characteristics. Although the analyses are performed after age-adjustment, I think subgroup analysis according to age groups may have additional value in this study. 2. In tables, the authors only showed 'P for trend' values for RII. Please include P values for the ORs(95% CI) according to education or income groups in each year to show whether there is a significant differences in the odds of having risk factors according to socioeconomic subgroups. 3. Please include research ethics statement such as informed consent and ethics approval. 4. Please described the number of subjects excluded in this study by each exclusion criteria. Were the subjects with missing values for any of 5 major risk factors excluded in the analysis? 5. The authors state decline in response rate in KNHANES as a limitation of this study. But the specific value is not described.
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REVIEWER	Sara Jayne Long DECIPHer 1-3 Museum Place Cardiff UK
REVIEW RETURNED	23-Sep-2016

GENERAL COMMENTS	<p>General: The main focus seems to be on gender differences in the associations of socioeconomic status with CVD risk factors. Presenting separate models for gender is not a robust a basis for the main conclusion (that inequalities are stronger for women than men). I suggest that authors model Gender*SES interaction terms to formally test whether the difference in trends between men and women is significant, if this is the main conclusion the authors want to focus on.</p> <p>Abstract Setting: A nationally representative population survey database Take out 'indeed' on line 33. Key words: include cvd risk factors</p> <p>Introduction Repetition on line 25: 'over time in the US over time.' Line 27: Remove 'of' ('However, studies in England and Australia</p>
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	<p>failed to provide strong evidence of that')</p> <p>Lines 32-44: "Korea, a recently developed country, has experienced rapid socioeconomic growth during the last 50 years. There has been a 10-fold increase in the per capita gross national income over the past 30 years (to \$27,000 US in 2015), but, at the same time, there has also been a widening gap in socioeconomic circumstances.[9-10] Thus, it remains unclear whether the increased overall wealth has resulted in improved health status across all segments of the population." The authors talk about rapid growth over the last 30-50 years, and state it is unclear whether this increase in wealth has resulted in improved health status. The data cover a 14 year period; thus cannot fully explore whether the increase in wealth over 30/50 years is associated with improved health status.</p> <p>Line 53: using a nationwide survey data > using national survey data</p> <p>Methods</p> <p>Socioeconomic status (SES) indicators: "The measure of income was equivalised gross household income per month, defined as household income/number of family members 0.5 to adjust for an effect of the number of individuals in the household; we used an equivalence scale of 0.5 for household size."</p> <p>Authors need to explain 'equivalised', and any methodology.</p> <p>It is not quite clear what RII is. This needs clarification, and should be reported in the SES indicators section. Is this a robust measure that has been used elsewhere? Beyond these comments, I cannot comment further on this methodology and it would be more appropriate for another reviewer with expertise to comment.</p> <p>Results</p> <p>Diabetes</p> <p>"Although no significant time trends in socioeconomic inequalities was seen in men, significantly increasing inequality in diabetes were noticed in women, especially by income (0.76, 0.36-1.58 in 2001; 2.56, 1.55-4.22 in 2014, RII, 95% CI, p=0.01, respectively; Table 4)."</p> <p>Analysis by education showed that the inequality in diabetes decreased in women, but the analysis by income showed a trend for increase. I suggest the authors acknowledge and explain such patterns.</p> <p>Spelling for KHANES in table 4 is incorrect.</p> <p>Discussion</p> <p>Line 52: trends, not trend. Nation; not nations.</p>
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VERSION 1 – AUTHOR RESPONSE

Reviewer 1

Reviewer Name: Dr. Shaun Scholes

Institution and country: Epidemiology and Public Health, University College London, United Kingdom

Please state any competing interests: None declared

Please leave your comments for the authors below

The authors of this study examined trends in socioeconomic inequalities in five major CVD risk factors (smoking, obesity, diabetes, hypertension and hypercholesterolemia) using data from the Korean National Health and Nutrition Examination Survey (2001 to 2014). I have a keen interest in trends in socioeconomic inequalities in CVD risk factors, and it is excellent to see a manuscript showing trends

in Korea. It is well-written manuscript that is very easy to follow. However, I have a number of comments (many of which are technical and minor, but still important) which are intended to strengthen the quality of the manuscript. I am willing to review a revised manuscript.

(1) The authors briefly discuss response rates, but there is no mention of any possible patterns of bias related to response. Has there been any work in Korea on socioeconomic differences in the propensity to respond to the survey? Similarly, the authors do not provide any estimates of item non-response (e.g. of those who had a health interview, what % went on to have a health examination: and was this associated with socioeconomic status). Not accounting for this may have implications in terms of underestimating inequalities.

Thank you for your pointed question

The decreased response rate is a weakness of the KNHANES data. A previous report noted the need for non-response bias analysis would be needed. (Epidemiol Health 2014;36:e2014002) To our knowledge, no previous study has reported an association between non-response rate and socioeconomic status.

We revised the text in discussion section as follows.

Third, the steady decline in response rates in the KNHANES should not be overlooked, which could result in underestimating inequalities.

(2) The authors only show trends in relative inequalities. I recommend that the authors report both absolute and relative measures. For background please see the paper:

King et al "Use of relative and absolute effect measures in reporting health inequalities: structured review" BMJ 2012;345:e5774 (<http://www.bmj.com/content/345/bmj.e5774>)

Or at the very least justify using only relative measures and consistently refer to trends in "relative" inequalities.

Thank you very much for your valuable comment. According to your suggestion, we added the data on the trends in absolute inequalities as supplementary tables. We would like to mention that there was no difference in the trends between relative and absolute inequalities.

(3) In relation to the logistic regression modeling the authors do not explain how age is adjusted for (though we can make an educated guess) and the authors do not explain how survey year was entered in the model.

Thank you for your comment. The text has been revised as follows.

In this study, the RII of major CVD risk factors is presented using the odds ratio and 95% confidence interval computed from binary logistic regression analysis adjusted for age. Trends in the RII were examined by estimating the P value for an interaction term of SES indicator and the variables that identified the year of the data in the model. Survey year was entered into the model as a numerical value (e.g., 2001 for KNHANES II), and the sample weights of the KNHANES were taken into consideration in all analyses. Significance levels were set at a two-tailed p-value <0.05. All analyses were conducted using the SAS software version 9.4 (SAS Institute, Cary, NC).

(4) Given that the authors use household income it may be important to know how many adults were interviewed per household.

There were average 2 adults per household being interviewed in the KNHANES. Details of the information for each wave of the KNHANES are as follows.

KNHANES II (2001): 2.24

KNHANES III (2005): 2.13

KNHANES IV (2007-2009): 1.96

KNHANES V (2010-2012): 2.0

KNHANES VI (2013-2014): 2.0

(5) My preference would be to see the estimates in Supplementary Table 1 as part of Table 1. It is also important to clarify whether these prevalence estimates are age-adjusted.

We changed the prevalence estimates from crude to age-adjusted prevalence values and revised the manuscript accordingly.

(6) It would be helpful to label Q1 and Q4 in all Tables as Q1 (highest income) and Q4 as (lowest income)

Thank you for your comment for enhancing readability of our table. The labels are changed as you suggested.

(7) I would like to see Supplementary Table 2 as Table 6. I do not agree with a view that non-significance means it can be relegated to supplementary data. But I accept others may disagree. We agreed with your point and have changed Supplementary Table 2 to Table 6.

(8) Could the authors reconsider their interpretation of the SES and obesity association among women. The authors point to “gender differences in attitudes toward body image in Korea” and then mention an International survey of university students. I do not see the relevance of this survey in terms of SES and age (the minimum age in this study is 25). The authors mention more structural explanations are also relevant for the SES-obesity association.

Thank you for this comment.

We have revised the paragraph as follows.

(original manuscript) A previous study reported that according to the recent International Health Behavior Survey of university students in 22 countries, the country with highest proportion of respondents who reported ‘trying to lose weight was Korea.[27] We also found increased socioeconomic inequality in obesity according to income in Korean women. This could be related to increased sensitivity about obesity in Korean women such that those who had financial ability may have engaged in weight-reduction efforts

(revised manuscript) Men and women could have different attitudes toward body weight status and may use different methods for controlling body weight. As societies develop, women tend to acquire a more negative attitude toward obesity than do men. Additionally, public attitudes are more strongly negative towards obese women than towards obese men. Thus, women are more likely to use their resources to pursue a thinner body than are men, and women tend to shift their diet and activity patterns to a healthier lifestyle more rapidly than do men.[26-27]

(9) The authors do not explain the rationale for choosing these five risk factors.

The five risk factors were selected because four (smoking, hypertension, serum total cholesterol, diabetes mellitus) are major independent risk factors for cardiovascular disease (Assessment of cardiovascular risk by use of multiple-risk-factor assessment equations: A statement of healthcare professionals from the American Heart Association and American College of Cardiology, *Circulation* 1999;100:1481-92). Obesity was included because it is a predisposing factor that could enhance the impact of the aforementioned four independent risk factors.

We added following information in the revised manuscript.

As for CVD risk factors, smoking, hypertension, diabetes mellitus and hypercholesterolemia were examined because these are major independent risk factors for cardiovascular disease. Obesity was also included due to its role of predisposing factor that could enhance the impact of the four independent risk factors.

(10) The authors do not provide information on how medication use was established.

We appreciate your comment. Unfortunately, however, no definition of medication use was included in the KNHANES survey. Therefore, we defined the respondents of currently taking medications, such as anti-hypertensive or anti-hyperglycaemic agents, as those having a prior diagnosis of diabetes and hypertension.

(11) The authors may wish to consider the issue of statistical power as a limitation to the study. It may be the case that large sample sized are necessary to be fully able to detect significant changes in the RII (especially when also stratifying by sex).

It is true that a statistical significance evaluated through p-values is sensible when large dataset is used. This is why we present all of our statistical analysis results for RIIs by confidence intervals. A p-value is examined and presented only for the test of a trend of RIIs. We also would like to note that a complex sampling design used in the KNHANES has been accounted in our analyses by accounting its survey weight through the use of the SURVEYMEANS and SURVEYFREQ procedures in SAS.

This analysis would alleviate the dependency of statistical significance on a large sample size in the

comparison of subjects' characteristics across the waves of KNHANES in Table 1.

(12) The authors should also acknowledge that different methods of measuring trends in socioeconomic health inequalities may lead to different conclusions about whether relative inequalities are increasing or decreasing.

Thank you for this comment. As we answered in your comment #2, we added the trends in absolute inequalities as supplementary tables. There was no difference in trends between relative and absolute inequalities.

Reviewer 2

Reviewer Name: Seung-Hwan Lee

Institution and Country: Division of Endocrinology and Metabolism, Department of Internal Medicine, Seoul St. Mary's Hospital, Korea

Please state any competing interests: None declared

Please leave your comments for the authors below

In this manuscript, Kim et al. examined the odds of having major cardiovascular risk factors according to socioeconomic status in Korean subjects using nationally representative data obtained from 2001 to 2014. They further investigated the trends in socioeconomic inequalities of these risk factors and conclude that socioeconomic inequalities in smoking, obesity and diabetes had worsened in women but not in men. Although cross-sectional nature of this study limits the interpretations of the data, some important suggestions could be made in public health perspective.

Specific comments

1. Age and sex are major factors affecting the relationship between socioeconomic status and various disease and risk factors. Furthermore, as the authors state, rapid changes in social environment in Korea during last decades influenced the young and old people to have quite different characteristics. Although the analyses are performed after age-adjustment, I think subgroup analysis according to age groups may have additional value in this study.

Thank you for this comment. We attempted to analyze the data according to age groups, but age-adjusted prevalence of smoking, especially among young women, was too low to have statistical power. Please understand that we decided not to report the subgroup analysis results

2. In Tables, The authors only showed 'P for trend' values for RII. Please include P values for the ORs (95%CI) according to education or income groups in each year to show whether there is a significant differences in the odds of having risk factors according to socioeconomic subgroups.

We appreciate your suggestion. Providing p-values would certainly help for readers to read tables; however, just because of the space limitation of manuscript, we decided to report 95% confidence intervals only along with their ORs. We hope that readers can understand statistical significance of analysis results by checking whether a value of 1.0 is included in the confidence interval or not.

3. Please include research ethics statement such as informed consent and ethics approval.

Thank you for this comment. The text below has been added to the manuscript.

All procedures and protocols of the study were approved by the institutional review board of Korea Centers for Disease Control and Prevention (KCDC) since 2007. Written informed consent regarding the survey and blood analysis has been obtained from all participants since 2001.

But we didn't take any approval of our own study protocol because the data of KNHANES was publicly released.

4. Please described the number of subjects excluded in this study by each exclusion criteria. Were the subjects with missing values for any of 5 major risk factors excluded in the analysis?

We appreciate your insightful comment. We also added a figure describing study enrollment.

5. The authors state decline in response rate in KNHANES as a limitation of this study. But the specific value is not described.

Thank you for your kind comment, which is similar to the first comment of Reviewer 1.

The response rate for each KNHANES survey is shown in the table below.

Response rate KNHANES II

(2001) KNHANES III

(2005) KNHANES IV

(2007-2009) KNHANES V

(2010-2012) KNHANES VI

(2013-2014)

Total 92.3% 99.1% 78.4% 80.8% 78.6%

The decreased response rate is weakness of KNHANES data. A previous report stated that a non-response bias analysis should be performed. (Epidemiol Health 2014;36:e2014002)

We also revised the discussion section as follows.

Third, the steady decline in response rates in the KNHANES should not be overlooked, which could result in underestimating inequalities.

Reviewer 3

Reviewer Name: Sara Jayne Long

Institution and Country: DECIPHER, 1-3 Museum Place, Cardiff, UK

Please state any competing interests: None declared

Please leave your comments for the authors below

General: The main focus seems to be on gender differences in the associations of socioeconomic status with CVD risk factors. Presenting separate models for gender is not a robust basis for the main conclusion (that inequalities are stronger for women than men). I suggest that authors model Gender*SES interaction terms to formally test whether the difference in trends between men and women is significant, if this is the main conclusion the authors want to focus on.

Thank you for your comment. We checked an interaction effect between gender and SES on RII by including Gender*SES interaction term in the model. As you can see in the following table, there are significant interaction effects in both education and income levels by gender for the trend in the inequalities in CVD risk factors except hypercholesterolemia. These results support our analysis of separate evaluation of RII trends by gender.

We added following sentence in the manuscript.

There were significant interaction effects between gender and SES (education and income levels) on RII except for hypercholesterolemia. Specifically, p-values for gender by education interactions were <.001, <.001, .0002, <.0001 and .7679 for smoking, obesity, diabetes, hypertension and hypercholesterolemia, respectively. For gender by income interactions, they were <.001, <.001, .0326, .0484 and .3019, respectively. Therefore, we examined trends in socioeconomic inequalities in those major CVD risk factors by gender.

Abstract

Setting: A nationally representative population survey database

Take out 'indeed' on line 33.

Key words: include cvd risk factors

Thank you for your comments. We have revised the text of the manuscript accordingly.

Introduction

Repetition on line 25: 'over time in the US over time.'

According to your comment, they are deleted.

Line 27: Remove 'of' (However, studies in the England and Australia failed to provide strong evidence of that')

We removed it according to your guidance.

Lines 32-44: "Korea, a recently developed country, has experienced rapid socioeconomic growth during the last 50 years. There has been a 10-fold increase in the per capita gross national income

over the past 30 years (to \$27,000 US in 2015), but, at the same time, there has also been a widening gap in socioeconomic circumstances. Thus, it remains unclear whether the increased overall wealth has resulted in improved health status across all segments of the population.” The authors talk about rapid growth over the last 30-50 years, and state it is unclear whether this increase in wealth has resulted in improved health status. The data cover a 14 year period; thus cannot fully explore whether the increase in wealth over 30/50 years is associated with improved health status

Thank you for your fine remark of our over-interpretation. We have revised out those sentences as follows.

Korea, a recently developed country, has experienced rapid socioeconomic growth. The per capita gross national income has increased 2.5-fold over the past 14 years (from \$11,000 US in 2001 to \$27,000 US in 2014), but the gap in socioeconomic circumstances has widened during this period.[9-10] Thus, it remains unclear whether the increased overall wealth has improved health status of all segments of the population.

Line 53: using a nationwide survey data > using national survey data
It has been changed. Thank you.

Methods

Socioeconomic status (SES) indicators: “The measure of income was equivalised gross household income per month, defined as household income/number of family members 0.5 to adjust for an effect of the number of individuals in the household; we used an equivalence scale of 0.5 for household size.”

Authors need to explain ‘equivalised’, and methodology.

We defined equivalised income as total household income divided by the square root of the number of household members. This income scale has been widely used in previous studies.

(PLoS One 2015;10(1):e0117034, BMJ Open 2014;4(8):e005710, Preventive Medicine 2010;51:460-5)

We revised the text as follows to clarify the definition.

The measure of income was equivalised gross household income per month, defined as total household income divided by the square root of the number of household members to adjust for the effect of the number of individuals in the household.

It is not quite clear what RII is. This needs clarification, and should be reported in the SES indicators section. Is this a robust measure that has been used elsewhere? Beyond these comments, I cannot comment further on this methodology and it would be more appropriate for another reviewer with expertise to comment.

Thank you for this comment

Relative index of inequality (RII) is a commonly used measure to assess health inequality in social science. (Soc Sci Med 1997;44(6):757-71, J Epidemiol Community Health 2004;58(4):308-14, Int J Epidemiol 2004;33(2):299-308)

We explained RII, in detail, in Statistical Analysis Section as follows.

The relative index of inequality (RII), a measure of effect that permits meaningful comparisons of socioeconomic health inequalities over survey periods was computed. The RII enables direct comparisons between life-course SES variables with regard to the proportions of the population in different categories. To obtain the RII for each indicator of SES, a score between 0 (for the highest SES) and 1 (for the lowest SES) was assigned to each category based on the proportion of subjects above the midpoint in the category. For example, if 10% of the subjects were in the highest educational category, participants in the group were represented by the range 0–0.1 and given a score of 0.05 (half of 0.1). If 20% of the population were in the next group, participants in the group were given a score of 0.20 (0.1 plus 0.2/2). The RII was obtained by regressing the outcome on each of the SES scores and was directly interpretable for each SES indicator used to compare participants with lowest SES (1) with those with the highest SES (0). In this study, the RII of major CVD risk factors is presented using the odds ratio and 95% confidence interval computed from binary logistic

regression analysis adjusted for age

Results

Diabetes

“Although no significant time trends in socioeconomic inequalities was seen in men, significantly increasing inequality in diabetes were noticed in women, especially by income (0.76, 0.36-1.58 in 2001; 2.56, 1.55-4.22 in 2014, RII, 95% CI, $p=0.01$, respectively; Table 4).” Analysis by education showed that inequality in diabetes decreased in women, but the analysis by income showed a trend for increase. I suggest that the authors acknowledge and explain such patterns.

Thank you for your comment. We thought that reasons of the health inequality in diabetes showing opposite direction in education and income among Korean women is partly due to rapid social change, especially higher education attainment, among Korean women.

We explained the reason in following paragraph in the manuscript.

Trends in socioeconomic inequalities in obesity and diabetes among women are increased by income level, however, it was not significant when they were measured by education. We noted that rapid social change has affected the meaning of education level; for example, the proportion of women who had an education level of college or above was 24% in KNHANES II (2001). However, it was ~40% in KNHANES VI (2013-2014). Thus, caution is needed in comparing education groups across time, especially in rapidly changing societies. In addition, it could be better to divide education level into equal division to investigate health inequalities.

Spelling of KHANES in table 4 is incorrect.

Thank you. We corrected it.

Discussion

Line 52: trends, not trend. Nation: not nations

These grammatical errors are corrected. Thank you for your kind review.

VERSION 2 – REVIEW

REVIEWER	Dr Shaun Scholes University College London, United Kingdom
REVIEW RETURNED	15-Dec-2016

GENERAL COMMENTS	<p>Many thanks for the opportunity to review this paper covering trends in socioeconomic inequalities in five major CVD risk factors in the Korean population.</p> <p>I number my comments in line with my first review:</p> <p>(1) The authors have the opportunity to comment on any SES differences in missing data (item non-response). For example, Figure 1 shows of the 42,725 participants the analytical sample for hypercholesterolemia was 34,226 (80% with valid data). The authors could estimate the % with valid cholesterol data by SES: and so indicate whether item non-response was associated with SES.</p> <p>(2) I welcome the new tables showing absolute inequalities. Could the authors mention this in the methods rather than just mentioning it in the discussion. Plus, could the supplementary tables be presented to just 1 decimal place. Also, the confidence intervals for the prevalence estimates appear to be very (unrealistically) narrow. I recommend the authors take another look at those.</p> <p>(3) The description of the modelling is improved in the revised</p>
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	<p>version.</p> <p>(5-7) The tables are improved in the revised version.</p> <p>(8) The interpretation of the SES and obesity association among women is also improved in the revised version.</p> <p>(9) The authors explain that “obesity was included because it is a predisposing factor that could enhance the impact of the aforementioned four independent risk factors”. I am not quite sure what is meant here. In addition, should obesity also be considered as an independent risk factor?</p> <p>(10) I think we misunderstood each other regarding medication use. As with smoking, could the authors explicitly write the questions asked about use of medication. For example, are participants asked specifically about anti-hyperglycaemic agents or anti-hypertensive agents: or are they simply asked to list all medications they are currently taking?</p> <p>Additional comments</p> <p>(1) The discussion in the revised manuscript contains duplicated text.</p> <p>(2) Could the authors consistently discuss the prevalence of CVD risk factors rather than ‘rate’.</p>
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REVIEWER	Seung-Hwan Lee Division of Endocrinology and Metabolism, Department of Internal Medicine, Seoul St.Mary's Hospital, Korea
REVIEW RETURNED	27-Dec-2016

GENERAL COMMENTS	For my previous comment No. 5, I would recommend to include the response rate of each KNHANES in the manuscript.
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REVIEWER	Long, Sara Jayne Cardiff University, UK
REVIEW RETURNED	16-Dec-2016

GENERAL COMMENTS	The reviewer completed the checklist but made no further comments.
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VERSION 2 – AUTHOR RESPONSE

Reviewer:1

Reviewer Name: Dr Shaun Scholes

Institution and Country: University College London, United Kingdom

Please state any competing interests: None declared

Please leave your comments for the authors below

Many thanks for the opportunity to review this paper covering trends in socioeconomic inequalities in five major risk factors in the Korean population.

I number my comment in line with my first review:

(1) The authors have the opportunity to comment on any SES differences in missing data (item non-

response). For example, Figure 1 shows of the 24,725 participants the analytical sample for hypercholesterolemia was 32,226 (80% with the valid data). The authors could estimate the % with valid cholesterol data by SES, and so indicate whether item non-response was associated with SES. According to your suggestion, we added new supplementary tables 6-10, which compared SES distribution of responders with that of non-responders for each CVD risk factor. Except for education level in smoking and obesity, the distribution of education and income levels between responder and non-responders were significantly differ in most risk factors, which implied that item non-responses were associated with SES. We mentioned it in discussion section of the revised manuscript as a limitation.

(2) I welcome the new tables showing absolute inequalities. Could the authors mention this in the method rather than just mentioning it in the discussion. Plus could the supplementary tables be presented to just 1 decimal place. Also. The confidence intervals for the prevalence estimates appear to be very (unrealistically) narrow. I recommend the authors take another look at those.

Thank you for your suggestion. We mentioned absolute inequalities in method section (statistical method). The supplementary tables are also presented using one decimal place. Please note that the age-adjusted prevalence was calculated using a direct standardization method which was performed by using the STDRATE Procedure in SAS program. In this calculation, study samples were weighted so that a total number of subjects were as large as Korean population. This leads to a very small SE. Unfortunately, there is no way to obtain a robust SE in this direct standardization method. Therefore, we decided to show the age-adjusted prevalence only in tables.

(3) The description of the modeling is improved in the revised version

: Thank you.

(5-7) The tables are improved in the revised version.

: Thank you.

(8) The interpretation of the SES and obesity association among women is also improved in the revised version

: Thank you.

(9) The authors explain that "obesity was included because it is predisposing factor that could enhance the impact of the aforementioned four independent risk factors". I am not quite sure what is meant here. In addition, should obesity also be considered as an independent risk factor?

To make a clarification, we revised the manuscript as follows.

(original) As for CVD risk factors, smoking, hypertension, diabetes mellitus and hypercholesterolemia were examined because these are major independent risk factors for cardiovascular disease. Obesity was also included due to its role of predisposing factor that could enhance the impact of the four independent risk factors.

(revised) Smoking, obesity, diabetes, hypertension and hypercholesterolemia were examined because these are major independent risk factors for CVD.[13]

(10) I think we misunderstood each other regarding medication use. As with smoking, could the authors explicitly write the questions asked about use of medication. For example, are participants asked specifically about anti-hyperglycaemic agents or anti-hypertensive agents: or are they simply asked to list all medications they are currently taking?

As your suggestion, an exact phrase of the question used in the survey was included in the revised manuscript.

(original) Prior diagnosis of diabetes and hypertension by a physician and current use of anti-hypertensive and anti-hyperglycaemic agents are included in the questionnaire.

(revised) Prior diagnosis of diabetes and hypertension by a physician and current use of anti-hypertensive and anti-hyperglycaemic agents are included in the questionnaire (for example, for treatment of diabetes, "what is your treatment for diabetes mellitus?", with the following answer categories: insulin, oral hypoglycemic agents or lifestyle modification.)

Additional comments

(1) The discussion in the revised manuscript contains duplicated text.

Thank you. Duplicated explanations are deleted.

(2) Could the authors consistently discuss the prevalence of CVD risk factors rather than 'rate'.

Thank you for your comment. The terms of 'rate' has been changed to 'prevalence'.

Reviewer: 3

Reviewer Name: Sara Jayne Long

Institution and Country: Cardiff University, UK

Please state any competing interests: None declared

Please leave your comments for the authors below.

NA

Reviewer: 2

Reviewer Name: Seung-Hwan Lee

Institution and Country: Division of Endocrinology and Metabolism, Department of Internal Medicine, Seoul St. Mary's Hospital, Korea

Please state any competing interests: None declared.

Please leave your comments for the authors below.

For my previous comment No. 5, I would recommend to include the response rate of each KNHANES in the manuscript.

Yes, we included response rates of each KNHANES in the revised manuscript as follows.

The response rates were 92.3%, 99.1%, 78.4%, 80.8%, and 78.6% for KNHANES II, III, IV, V, and VI, respectively.

VERSION 3 – REVIEW

REVIEWER	Dr Shaun Scholes University College London
REVIEW RETURNED	30-Jan-2017

GENERAL COMMENTS	<p>The authors have added new supplementary tables 6-10, which compare the SES distribution of responders with that of non-responders for each CVD risk factor. These show that item non-response was associated with SES. This limitation is now mentioned in the Discussion. I welcome this additional information.</p> <p>I also welcome the new mention of absolute inequalities into the method section (statistical method). As I suspected, the narrow CIs for the directly age-standardised prevalence estimates arise through the use of weights that sum to the overall population size (thereby underestimating the uncertainty in the estimates). My preference would be to see this explained to the reader in a footnote to the supplementary tables.</p>
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VERSION 3 – AUTHOR RESPONSE

Reviewer:1

Scholes, Shaun

UCL, Dept of Epidemiology and Public Health

Please leave your comments to the authors below

The authors have added new supplementary tables 6-10, which compare the SES distribution of responders with that of non-responders for each CVD risk factor. These show that item non-response was associated with SES. This limitation is now mentioned in the discussion. I welcome this additional information.

Thank you.

I also welcome the new mention of absolute inequalities into the method section (statistical method). As I suspected, the narrow CIs for the directly age-standardised prevalence estimates arise through the use of weight that sum to the overall population size (thereby underestimating the uncertainty in the estimates). My preference would be to see this explained to the reader in a footnote to the supplementary tables.

Thank you for comment. In revised manuscript, we added footnotes in Table 1 as well as in supplementary tables explaining why small SE's and, thereby narrow confidence intervals, were obtained.