PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Neighborhood- and Individual-level Socioeconomic Status and Self-reported Management of Ischemic Heart Disease: Cross-sectional Results from the Korea Health Examinees Study
AUTHORS	Heo, Jongho; Oh, Juhwan; Lee, Hwa-Young; Choi, Ji-Yeob; Kim, Sujin; Subramanian, S V; Lee, Jong-Koo; Kang, Daehee

VERSION 1 – REVIEW

REVIEWER	Veronesi Giovanni University of Insubria, Varese, Italy
REVIEW RETURNED	29-Jan-2018

GENERAL COMMENTS	In this paper, the authors investigate the association between neighborhood and individual socio-economic status and self-reported management of IHD, in a cross-sectional, population-based study in Korea. The novelty of the study lies in the generalization to an Asian population of an association that has been mainly investigated so far in Europe or North America. The study rationale is clear and the statistical analyses, including the two-level hierarchical model, are sound. However, I have some major concerns when reading this paper. The first concern is on the results. In Table 1, the probability of proper management across educational classes is 86%, 80% ad 82% in “<= middle school”, “high school” and “>= college”, respectively. This means that this probability decreases for increasing education. Now, it Table 2, if the first class is the reference and the outcome is the probability of proper management, how can ORs for “high school” and “college” be larger than 1? In the remaining variables there is some consistency between Table 1 and Table 2, except maybe for Occupation (blue collars and other, in particular). The authors should check their model and in case comment on these discrepancies. The second concern is on the study methods, and on how neighborhood-level variables were obtained. From the description, it seems that the authors simply averaged the individual-level income of study participants within each neighborhood. Generally, these aggregated-level SES measures are obtained from external sources, to reflect also the SES position of individuals not included into the study sample, but living in the same neighborhood. If obtained from individual-level average of study participants, individual- and neighborhood-level variables will be highly correlated; their use in the same model can be questionable; and it is not clear what one class will add to the other. Actually, in Model 3 neighborhood-level estimates are substantially modified, while individual-level ones are not.

	Finally, there are a couple of important study limitations not even mentioned by the authors. One is the lack of any clinical information, including presence of comorbidities, severity of and time since the acute event. These are potential confounders, since they may affect the IHD management and could be differently distributed among SES classes. The second one is on the study outcome. By reading the response option on page 6 it does not seem that the combination of (a) and (b) can define a “proper management”, since there is no information on the appropriateness in the received treatment nor on patients adherence to therapy. To this reviewer, the study variable is more “ongoing treatment yes vs. no“. These limitations should be addressed, and the paper adequately modified accordingly. Other minor comments: - I am not a clinician, but the expression “clinical guidelines for incident IHD” has poor meaning to me (Introduction, line 18). I think “guidelines for secondary IHD prevention” or similar is more appropriate. - In the introduction, in the sentence: “As this increase may be due to…, IHD management may significantly reduce disparities in post-IHD survival…”. It is unclear how the first half of the sentence (before the coma) has to deal with the second half. Also, in the next sentence the fact that the “individual- and neighborhood-level SES” can be considered as “the main determinants of IHD management in Korea” is questionable. Maybe the authors can better argument these concepts. - In the study methods, individual level SES measures (education, income, marital status) should not be considered as “covariates”, but as main individual level exposure variables. - In the statistical analysis, how were the neighborhood-level variables included into the model? From Table 2 one may argue that the authors first derived sample quartiles and then added it as a continuous variable to the model. This should be specified and motivated in the text. - In the results section, Table 1 presents raw percentages, while the comment on page 8 (line 30 to 40) is relative to column percentage. So the comment is not consistent with the presented data. I would suggest to make a choice (raw or column) and to stay with it in the table and in the text. - In the study limitations, the fact that the selection bias due to differential survival lead to an underestimate of study results is not immediate. One additional sentence detailing why this is the case would be desirable.

REVIEWER	Nihaya Doud Ben-Gurion University of the Negev, Israel
REVIEW RETURNED	16-Feb-2018

GENERAL COMMENTS	This is a well written paper. I have one main comment: It is not clear why men and women are included in the same analysis. I suggest to examine interactions with gender and decide whether to calculate multivariate models for each gender group. minor comments: In Table 1, add the P-values. add yea i the title In Table 2, no need for the p-values when the 95%CI are shown.

REVIEWER	Tiffany Powell-Wiley NHLBI, NIH, Bethesda, MD, USA
REVIEW RETURNED	19-Feb-2018

GENERAL COMMENTS	Heo and colleagues examine the relationship between neighborhood-level and individual level SES and the perceived management of incident ischemic heart disease for a population-based cohort in South Korea. This type of research is important and timely as we work to better understand the role of social determinants of health and cardiovascular disease. However, there are several items that should be addressed to improve the clarity and impact of the manuscript. 1. Have the survey measures of self-reported IHD management been validated? Can the authors provide any estimates of misclassification of management based on incorrect knowledge, distrust of health care providers, or other potential barriers to perceived adequacy of care? 2. There was no assessment of mortality in the study, but in the abstract and in certain places in the discussion, there is language that makes it seem as though mortality is a outcome of the study. This language should be modified to make it clear that mortality is not an outcome of the study although it improved management of ischemic heart disease may translate into lower cardiovascular mortality in the future. 3. The authors must acknowledge that the neighborhood variables may have bias. For instance, how do we know how the income and education level of those in study (assuming their income and education was used to calculate average for neighborhood) compare to those in catchment area of an exam center? 4. How do we know that study participants will visit the exam center closest to where they live? It would be nice to know the denominator of the populations in specific neighborhoods included in the study. 5. Given that the entire country is not represented, what parts are represented and why is the entire country not represented? Since the entire country is not represented, a map would be nice to show the areas in the study. Additionally, it would be nice to know the socio-demographics compared between those areas of the country that are included and that are not included in the study. 6. Methods - Table 1 should be referenced in the results section and not the methods.

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Comment 1: The first concern is on the results. In Table 1, the probability of proper management across educational classes is 86%, 80% ad 82% in “<= middle school”, “high school” and “>= college”, respectively. This means that this probability decreases for increasing education. Now, it Table 2, if the first class is the reference and the outcome is the probability of proper management, how can ORs for “high school” and “college” be larger than 1? In the remaining variables there is some consistency between Table 1 and Table 2, except maybe for Occupation (blue collars and other, in particular). The authors should check their model and in case comment on these discrepancies.

Response: We have corrected these errors and re-analyzed our dataset. Please see the revised Table 1. (page 18)

Comment 2: The second concern is on the study methods, and on how neighborhood-level variables were obtained. From the description, it seems that the authors simply averaged the individual-level income of study participants within each neighborhood. Generally, these aggregated-level SES measures are obtained from external sources, to reflect also the SES position of individuals not included into the study sample, but living in the same neighborhood. If obtained from individual-level average of study participants, individual- and neighborhood-level variables will be highly correlated; their use in the same model can be questionable; and it is not clear what one class will add to the other. Actually, in Model 3 neighborhood-level estimates are substantially modified, while individual-level ones are not.
Response: We appreciate your comments. To address your concerns regarding the strong correlations between individual- and neighborhood-level variables, we have used the regional median income status and the regional mean percentage of college graduates for neighborhood-level independent variables, which were derived from a nationally and regionally representative dataset. We have added relevant sentences to the Methods as shown below:
"The main neighborhood-level SES variables were (1) the regional median income status and (2) the regional mean percentage of college graduates. Seventeen neighborhoods were defined as 17 major cities and metropolitan areas (mean population: 201,210, range: 115,000-574,000) associated with 17 large general hospitals (Figure 1). The total catchment area of these hospitals covered 6.6% of the total Korean population. We obtained neighborhood-level SES data from a nationally and regionally representative dataset, Korea Community Health Survey (https://chs.cdc.go.kr/chs/index.do), which has been conducted in 253 communities annually since 2008. This survey aims to estimate regional patterns of disease prevalence and morbidity, as well as to understand the personal lifestyle and health behavior.18 An average of 800-900 adults (age: ≥19 years) who resided in each neighborhood were selected using the probability proportional to sampling and systematic sampling methods. The sampling strategies are described in more detail elsewhere.18 We calculated exogenous neighborhood-level SES measures using regional mean centering of the percentage of college graduates and median centering of the income status of the survey years. We then linked the regional SES indicators to our main dataset using the neighborhood identifier and the year variable. A comparison of socio-demographic characteristics between neighborhoods included and not included in the study revealed that the former was comprised of younger (age: 49.2 vs. 52.9 years), more highly educated (college graduates: 43.9% vs. 33.0%), and wealthier (the top 25% of household incomes: 30.9% vs. 27.8%) population." (page 7, line 1-19)

Comment 3: Finally, there are a couple of important study limitations not even mentioned by the authors. One is the lack of any clinical information, including presence of comorbidities, severity of and time since the acute event. These are potential confounders, since they may affect the IHD management and could be differently distributed among SES classes.
Response: To control for the influences of comorbidities, we inserted variables concerning the presence of comorbidities (hypertension, diabetes, and hyperlipidemia) in the main models. However, we could not control for IHD severity or the time elapsed since the acute event because of data limitations. We have added this information as a limitation, as shown below:
[In the Method-covariates Section] "The individual-level covariates included sex, age, marital status occupation, and comorbidities. Age was categorized into 40–50, 51–60, or 61+ years. Marital status was dichotomized into living with a spouse or not. Occupation was categorized as white collar, blue collar, housewife, or other. Comorbidities were defined as the presence of hypertension, diabetes, or hyperlipidemia at the time of survey." (page 8, lines 2–7)
[In the Discussion-limitation Section] "Third, we were not able to control for IHD or time elapsed since the acute event because of data limitations." (page 12, lines 16–17)

Comment 4: The second one is on the study outcome. By reading the response option on page 6 it does not seem that the combination of (a) and (b) can define a “proper management”, since there is no information on the appropriateness in the received treatment nor on patients adherence to therapy. To this reviewer, the study variable is more “ongoing treatment yes vs. no“. These limitations should be addressed, and the paper adequately modified accordingly.
Response: We appreciate your comment and revise the manuscript accordingly. We also have carefully translated the categories to convey the meanings clearly:
[In the Method-Study outcome Section] “The sub-population that responded “yes” then answered a sub-question regarding the current status of disease management for which the following options were available: (a) “condition has been good or improved due to management”; (b) “is currently managed and treated”; (c) “was previously managed but is now neglected”; and (d) “neither managed nor treated.” We dichotomized these responses as “ongoing management” by combining (a) with (b) versus “failure of ongoing management” (reference) by combining (c) with (d), respectively.” (page 6, lines 15–21)
[In the Discussion-limitation Section] “Additionally, the participants’ responses regarding ongoing IHD management may not have been confirmed by medical professionals whether the received treatment or participants’ adherence to therapy was clinically appropriate.” (page 12, lines 13–16)

Other minor comments:
Comment 5: I am not a clinician, but the expression “clinical guidelines for incident IHD” has poor meaning to me (Introduction, line 18). I think “guidelines for secondary IHD prevention” or similar is more appropriate.
Response: Thanks a lot for this suggestion. We agree on that so now we have revised the phrase per your suggestion. (page 4, lines 5–6)

Comment 6: In the introduction, in the sentence: “As this increase may be due to…, IHD management may significantly reduce disparities in post-IHD survival…”. It is unclear how the first half of the sentence (before the coma) has to deal with the second half. Also, in the next sentence the fact that the “individual- and neighborhood-level SES” can be considered as “the main determinants of IHD management in Korea” is questionable. Maybe the authors can better argument these concepts.
Response: We agree with you. We appreciate your comments, and now we have revised the sentence as below:
“Although the IHD-related mortality rate in 2011 remained lower in Korea (42 per 100,000 individuals) than in Western countries, the incidence of IHD in Korea has increased by 60% during the past decade14 consequent to increases in body mass index values and an increasingly westernized diet among middle-aged adults.15 Secondary IHD mortality may be significantly reduced by ongoing IHD management involving both proper quality treatment and lifestyle modification, which may be shaped by neighborhood contexts as well as individual characteristics. Therefore, this study aimed to evaluate the individual- and neighborhood-level SES as the main determinants of ongoing IHD management in Korea, using baseline data from a large population-based cohort study with a multi-level framework.” (page 4, line 21–page 5, line 8)

Comment 7: In the study methods, individual level SES measures (education, income, marital status) should not be considered as “covariates”, but as main individual level exposure variables.
Response: We also think so. Thanks for the suggestion. We have revised the subtitle as suggested (page 8, line 2).

Comment 8: In the statistical analysis, how were the neighborhood-level variables included into the model? From Table 2 one may argue that the authors first derived sample quartiles and then added it as a continuous variable to the model. This should be specified and motivated in the text.

Response: Thanks for this comments. We have now revised them according to the comments. We now have consistently treated the variable as a continuous variable not to make readers confused. We dropped the Figure 1 and revised sentences explaining the variable, for example as below:
“The main neighborhood-level SES variables were (1) the regional median income status and (2) the regional mean percentage of college graduates.” (page 7, lines 1–2)

Comment 9: In the results section, Table 1 presents raw percentages, while the comment on page 8 (line 30 to 40) is relative to column percentage. So the comment is not consistent with the presented data. I would suggest to make a choice (raw or column) and to stay with it in the table and in the text.
Response: agree on this comment. Thanks a lot. Now we used column % consistently between table and text. For example, we have revised the part as below:
“Table 1 presents the characteristics of participants with IHD from the HEXA-Gem dataset (n = 2,932), stratified by self-reported IHD management. Men had higher proportions of self-reported ongoing management than women (89.0% vs. 79.7%). Participants of younger groups had higher proportions of failures of ongoing IHD management (40–49: 28.7% vs. 50–59: 16.5% vs. 60–69: 11.7%).” (page 9, lines 13–17)
Table 1. Characteristics of the study sample from the Korea HEXA-Gem dataset (N = 2,932), 2005-2013, stratified by self-reported ongoing management of post-ischemic heart disease

	Ongoing management			
	Yes (N = 2,474, 84.4%)		No (N = 458, 15.6%)	
	N	(%)	N	(%)
Sex	Men	1,307	89.0	161	11.0 *
	Women	1,167	79.7	297	20.3
Age (years)	40–49	251	71.3	101	28.7 *
	50–59	959	83.5	190	16.5
	60–69	1,264	88.3	167	11.7
Education	≤Middle school	1,095	86.4	172	13.6 *
	High school	868	82.0	191	18.0
	≥College	487	84.3	91	15.7
	Missing	24	85.7	4	14.3
Income (million Korean won)	<1	419	84.3	78	15.7 *
	1–2	595	87.4	86	12.6
	2–4	802	84.9	143	15.1
	≥4	416	80.9	98	19.1
	Missing	242	82.0	53	18.0
Occupation	White collar	643	82.0	141	18.0 *
	Blue collar	377	85.9	62	14.1
	Housewife	745	81.2	173	18.8
	Other	479	91.1	47	8.9
	Missing	230	86.8	35	13.2
Marital status	Living with spouse	2,173	84.8	388	15.2
	Living without spouse	293	80.7	70	19.3
	Missing	8	100.0	0	0.0
Comorbidities	Hypertension	1,296	80.5	315	19.5 *
	No hypertension	1,178	89.2	143	10.8
	Diabetes	1,982	83.3	398	16.7 *
	No diabetes	492	89.1	60	10.9
	Hyperlipidemia	1,945	84.4	360	15.6
	No hyperlipidemia	529	84.4	98	15.6

* Differences between two groups for the all variables were considered significant at a p value <0.05

Comment 10: In the study limitations, the fact that the selection bias due to differential survival lead to an underestimate of study results is not immediate. One additional sentence detailing why this is the case would be desirable.
Response: Thanks for the suggestion. We have clarified the limitation by adding sentences explaining the underestimation as below:
“Fourth, selection bias may have been introduced by non-random survey participation and attrition. Disadvantaged individuals were less likely to participate regular health examinations and were more likely to drop out in the survey, possibly due to a failure of ongoing management. This bias would have led to underestimating the likelihood of failure of ongoing management among disadvantaged individuals.” (page 12, lines 17–21)
Reviewer: 2

This is a well written paper. I have one main comment:

Comment 1: It is not clear why men and women are included in the same analysis. I suggest to examine interactions with gender and decide whether to calculate multivariate models for each gender group.
Response: Thanks for the comments. We also thought that you suggested. However, there were no gender differences. For this, a Chow test was conducted to test potential gender differences regarding the slopes and intercepts. However, this test confirmed the lack of differences in these parameters between the gender-stratified regressions. We have added the following relevant sentences to the Methods as shown below:
“We did not stratify the analyses by gender because a Chow test [47] failed to detect significant differences in the slopes and intercepts of the gender-stratified regressions [F (1, 2,364) =0.95, P=0.3309].” (page 9, lines 8–10)

Minor comments:
Comment 2: In Table 1, add the P-values. add yea i the title
Response: We have used asterisks to indicate p-values that meet the 0.05 level and have added the year of the study to the title. (page 18)

Comment 3: In Table 2, no need for the p-values when the 95%CI are shown.
Response: Per your suggestion, we have deleted the p-value column. (page 19)

Reviewer: 3
Comment 1: Have the survey measures of self-reported IHD management been validated? Can the authors provide any estimates of misclassification of management based on incorrect knowledge, distrust of health care providers, or other potential barriers to perceived adequacy of care?
Response: Another team is currently conducting research that addresses the validation of self-reported answers based on a reference to medical records.

Comment 2: There was no assessment of mortality in the study, but in the abstract and in certain places in the discussion, there is language that makes it seem as though mortality is a outcome of the study. This language should be modified to make it clear that mortality is not an outcome of the study although it improved management of ischemic heart disease may translate into lower cardiovascular mortality in the future.
Response: We agree on that. Now we have revised the following lines in the abstract (page 2) as below. Thanks a lot for this comment:

“Objective: Several studies identified neighborhood context as a predictor of prognosis in ischemic heart disease (IHD). The present study investigates the relationships of neighborhood- and individual-level socioeconomic status (SES) with the odds of proper management of IHD, using baseline cohort survey data from the Korea Health Examinees-Gem study.”
“Conclusions: Our study suggests that policies or interventions aimed at improving the quality and availability of medical resources in low-income areas may associate with ongoing IHD management. Moreover, patient-centered education is essential for ongoing IHD management, especially when targeted to IHD patients with a low education level.”
However, we were unable to identify the area of the discussion that might confuse readers. We are willing to address more specific suggestions made by the reviewer regarding the areas that require revision.

Comment 3: The authors must acknowledge that the neighborhood variables may have bias. For instance, how do we know how the income and education level of those in study (assuming their income and education was used to calculate average for neighborhood) compare to those in catchment area of an exam center?
Response: We appreciate your comments. Another reviewer commented similar opinion. So we substituted these variable with another secondary data sources, which is nationally and regionally representative. We have used regional-level median centering of regional income and mean education status for neighborhood-level independent variables through linking the regional-level SES measures from the external data to our main dataset. We have added sentences in Methods as below:
“The main neighborhood-level SES variables were (1) the regional median income status and (2) the regional mean percentage of college graduates. Seventeen neighborhoods were defined as 17 major cities and metropolitan areas (mean population: 201,210, range: 115,000-574,000) associated with 17 large general hospitals (Figure 1). The total catchment area of these hospitals covered 6.6% of the total Korean population. We obtained neighborhood-level SES data from a nationally and regionally representative dataset, Korea Community Health Survey (https://chs.cdc.go.kr/chs/index.do), which has been conducted in 253 communities annually since 2008. This survey aims to estimate regional patterns of disease prevalence and morbidity, as well as to understand the personal lifestyle and health behavior.18 An average of 800-900 adults (age: ≥19 years) who resided in each neighborhood were selected using the probability proportional to sampling and systematic sampling methods. The sampling strategies are described in more detail elsewhere.18 We calculated exogenous neighborhood-level SES measures using regional mean centering of the percentage of college graduates and median centering of the income status of the survey years. We then linked the regional SES indicators to our main dataset using the neighborhood identifier and the year variable. A comparison of socio-demographic characteristics between neighborhoods included and not included in the study revealed that the former was comprised of younger (age: 49.2 vs. 52.9 years), more highly educated (college graduates: 43.9% vs. 33.0%), and wealthier (the top 25% of household incomes: 30.9% vs. 27.8%) population.” (page 7, line 1-19)

Comment 4: How do we know that study participants will visit the exam center closest to where they live? It would be nice to know the denominator of the populations in specific neighborhoods included in the study.
Response: We had the same concern and mentioned as the 5th limitation, so we agree with your comments. However, unfortunately, it is impossible to confirm whether participants visited the general hospitals within their regions in which individual residents live because the addresses of participants were confidential. We also found no other study that shows whether Korean visited health facilities in regions other than they live for health examination. However, we believe the improved accessibility to the health examination service in Korea contexts induces participants to visit health facilities within their regions. We are sorry about insufficient mentioning about this limitation acknowledgment in the

first draft. Now we have inserted this potential bias more in the limitation section We revised the limitation as below:
“Fifth, we assumed that most participants visited the general hospitals within the region they lived. This assumption is highly plausible, given the improved accessibility to the health examination service in Korea contexts, as the National Health Insurance Program provides free regular health examinations and medical facilities within and between regions exhibit minimal variations in examination quality.32 However, we could not completely exclude the possibility that participants may have visited general hospitals in other neighborhoods to seek better-quality evaluations.” (page 12, lines 22–page 13, lines 4)
We have also mentioned populations in neighborhoods included in the study as below:
“Seventeen neighborhoods were defined as 17 major cities and metropolitan areas (mean population: 201,210, range: 115,000-574,000) associated with 17 large general hospitals (Figure 1).” (page 7, lines 2–4)

Comment 5: Given that the entire country is not represented, what parts are represented and why is the entire country not represented? Since the entire country is not represented, a map would be nice to show the areas in the study. Additionally, it would be nice to know the socio-demographics compared between those areas of the country that are included and that are not included in the study.
Response: A map of the study area is shown in Figure 1. Although the size of the study area seems relatively small, please note that the survey was conducted in major Korean cities and metropolitan areas, which have relatively higher population densities.
We have added the following sentence regarding socio-demographic comparisons between areas that were and were not included in the study:
“A comparison of socio-demographic characteristics between neighborhoods included and not included in the study revealed that the former was comprised of younger (age: 49.2 vs. 52.9 years), more highly educated (college graduates: 43.9% vs. 33.0%), and wealthier (median neighborhood income: 5.96 vs. 5.45) population.” (page 7, lines 14–19)

Comment 6: Methods - Table 1 should be referenced in the results section and not the methods.
Response: We apologize for the mal-positioning of the contents. We have newly positioned the sentence in the results section now. (page 9, line 13)

VERSION 2 – REVIEW

REVIEWER	Veronesi Giovanni University of Insubria, Varese, Italy
REVIEW RETURNED	27-Apr-2018

GENERAL COMMENTS	The authors made a good job in addressing all my previous concerns. However, I keep having some difficulties with my previously raised point 1, which I try to argument more clearly. From the data presented in Table 1, the crude OR estimate for high school vs. ≤middle school (reference) is 0.71. Similarly, for ≥college vs. ≤ middle school (reference), the crude OR is 0.84. These crude estimates suggest an inverse association (if any) between education and proper management. However, in Table 2 Model 2, this association is completely reversed: OR = 1.46 (vs. crude 0.71) for high school, and 2.04 (vs. crude 0.84) for ≥ college. This can be either due to miss-labelling of educational level in the model, or to adjustment for the remaining covariates. In any case,

	since the difference is rather important, and education is the main finding of this paper, I encourage the authors to fully explore this issue. A supplementary material table with crude estimate; age and sex-adjusted estimate; and fully adjusted estimate may help. In the main text, a sentence on this new finding can be reported. Otherwise, the reader will stay with some doubts on the large discrepancy between Table 1 and Table 2 for the main exposure variable. To complete this argument, also the newly added covariates "hypertension" and "diabetes" suffer from the same problem (crude OR for hypertension yes vs. no 0.50; model 2 OR = 1.67; crude OR for diabetes yes vs. no 0.61, model 2 OR = 1.13).

REVIEWER	Nihaya Daoud Ben-Gurion University of the Negev
REVIEW RETURNED	04-May-2018

GENERAL COMMENTS	This study aims to "investigate the relationships of neighborhood- and individual-level socioeconomic status (SES) with the odds of ongoing management of IHD, using baseline survey data from the Korea Health Examinees-Gem study". The study design and methods are sound, and the results are interesting and new for Korea. Comments: Methods: Previous research shows that the men and women have different patterns of self-care management of chronic diseases. The current paper analyzed the total sample without examining differences between men and women. Interactions of the main associations with gender should be examined. Discussion: Individual and neighborhood SES are important for IHD management, however previous research showed that barriers to self-care management are also important specifically among low SES groups. Lifestyle behaviors are more difficult to manage than taking medications.

REVIEWER	Tiffany Powell-Wiley NHLBI, NIH, USA
REVIEW RETURNED	10-May-2018

GENERAL COMMENTS	I have no further comments for the paper.

VERSION 2 – AUTHOR RESPONSE

Reviewer: 1

Comment 1: The authors made a good job in addressing all my previous concerns. However, I keep having some difficulties with my previously raised point 1, which I try to argument more clearly. From the data presented in Table 1, the crude OR estimate for high school vs. ≤middle school (reference) is 0.71. Similarly, for ≥college vs. ≤ middle school (reference), the crude OR is 0.84. These crude estimates suggest an inverse association (if any) between education and proper

management. However, in Table 2 Model 2, this association is completely reversed: OR = 1.46 (vs. crude 0.71) for high school, and 2.04 (vs. crude 0.84) for ≥ college. This can be either due to miss-labelling of educational level in the model, or to adjustment for the remaining covariates. In any case, since the difference is rather important, and education is the main finding of this paper, I encourage the authors to fully explore this issue. A supplementary material table with crude estimate; age and sex-adjusted estimate; and fully adjusted estimate may help. In the main text, a sentence on this new finding can be reported. Otherwise, the reader will stay with some doubts on the large discrepancy between Table 1 and Table 2 for the main exposure variable.

Comment 2: To complete this argument, also the newly added covariates "hypertension" and "diabetes" suffer from the same problem (crude OR for hypertension yes vs. no 0.50; model 2 OR = 1.67; crude OR for diabetes yes vs. no 0.61, model 2 OR = 1.13).

Response: We found out coding error and apologize that we had make minor error in the process of coding variables. We have recoding all the variables from beginning using original dataset; however, we confirm that there is little difference.in terms of magnitude and significance. Accordingly, we have revised texts where mainly reported estimates as well as the Table 1 and 2. As the reviewer suggested, we have additionally presented appendix table; however, if the reviewer does not mind, we suggest not including supplementary file to be succinct even if this is online journal.

Table 1. Characteristics of the study sample from the Korea HEXA-Gem dataset (N = 2,932), 2005-2013, stratified by self-reported ongoing management of post-ischemic heart disease

		Ongoing management				
		Yes (N = 2,366, 80.7%)		No (N = 566, 19.3%)		
		N	(%)	N	(%)	
Sex	Men	1,261	85.9	207	14.1	*
	Women	1,105	75.5	359	24.5	
Age (years)	40–49	248	70.5	104	29.5	*
	50–59	904	78.7	245	21.3	
	60–69	1,214	84.8	217	15.2	
Education	≤Middle school	987	77.8	281	22.2	*
	High school	868	82.0	191	18.0	
	≥College	487	84.3	91	15.7	
	Missing	24	85.7	3	11.1	
Income (million Korean won)	<1	779	83.1	159	16.9	*
	1–2	588	80.8	140	19.2	
	2–4	418	78.3	116	21.7	
	≥4	581	79.4	151	19.3	
	Missing	204	69.2	91	30.9	
Occupation	White collar	618	78.8	166	21.2	*
	Blue collar	359	81.8	80	18.2	
	Housewife	702	76.5	216	23.5	

	Other	466	88.6	60	11.4	
	Missing	221	83.4	44	16.6	
Marital status	Living with spouse	2,073	80.9	488	19.1	
	Living without spouse	293	79	78	21.0	
Comorbidities	Hypertension	1,104	84.5	202	15.5	*
	No hypertension	1,262	77.6	364	22.4	
	Diabetes	465	85.3	80	14.6	*
	No diabetes	1,901	79.6	486	20.4	
	Hyperlipidemia	476	79.7	121	20.3	
	No hyperlipidemia	1,890	80.9	445	19.1	

* Differences between two groups for the all variables were considered significant at a p value <0.05

Table 2. Estimations from the two-level multilevel logistic regression models of self-reported ongoing management among ischemic heart disease survivors in the Korea HEXA-Gem dataset, 2005-2013

	Model 1		Model 2		Model 3	
	Odds Ratio	(95% Credible Interval)	Odds Ratio	(95% Credible Interval)	Odds Ratio	(95% Credible Interval)
Fixed Parameters						
Sex (ref. Female)						
Male			1.83	(1.38–2.39)	1.81	(1.37–2.32)
Age (years; ref. 40–49)						
50–59			1.57	(1.16–2.07)	1.57	(1.14-2.07)
61–69			2.19	(1.60–2.94)	2.19	(1.56-2.93)
Education (ref. ≤Middle school)						
High school			1.35	(1.06-1.66)	1.33	(1.08-1.65)
≥College			1.52	(1.14-2.02)	1.63	(1.22-2.12)
Income (ref. <1 million Korean won)						
1–2 million			0.89	(0.50-1.49)	0.88	(0.37-1.48)

2–4 million			1.09	(0.63-1.76)	1.14	(0.66-1.87)
≥4 million			1.26	(0.85-1.81)	1.07	(0.70-1.65)
Marital status (ref. Living with spouse)						
Living without spouse			1.08	(0.82–1.42)	1.09	(0.80-1.44)
Occupation (ref. White collar)						
Blue collar			1.	(0.79–	1.1	(0.81-
Housewife			1.	(0.84–	1.1	(0.85-
Other			1.	(1.00–	1.4	(0.99-
Hypertension (ref. No)						
Yes			1.	(1.20–	1.4	(1.21-
Diabetes (ref. No)						
Yes			1.	(0.91–	1.2	(0.91-
Hyperlipidemia (ref. No)						
Yes			0.	(0.67–	0.9	(0.68-
Neighborhood-level income status	1.39	(1.15–1.66)			1.22	(1.01–1.61)
Neighborhood-level % of college graduates or higher	1.06	(0.86–1.30)			1.12	(0.89–1.41)
Random Parameters						
Between-neighborhood variance	0.11	(0.02–0.32)	0.14	(0.03–0.37)	0.16	(0.03–0.46)
DIC	2853.90		2756.97		2754.86	

Note: Model 1 included the neighborhood-level SES only; model 2 included individual-level factors only; model 3 included all individual. All models were controlled for year dummies.

Appendix table 1. Estimations from the two-level multilevel logistic regression models of self-reported ongoing management among ischemic heart disease survivors in the Korea HEXA-Gem dataset, 2005-2013

	Model 1		Model 2		Model 3	
	Odds Ratio	(95% Credible Interval)	Odds Ratio	(95% Credible Interval)	Odds Ratio	(95% Credible Interval)
Fixed Parameters						
Sex (ref. Female)						
Male			1.87	(1.51-2.25)	1.81	(1.37-2.32)
Age (years; ref. 40–49)						

50–59			1.67	(1.23-2.17)	1.57	(1.14-2.07)
61–69			2.58	(1.90-3.37)	2.19	(1.56-2.93)
Education (ref. ≤Middle school)						
High school	1.37	(1.09-1.70)	1.36	(1.08–1.72)	1.33	(1.08-1.65)
≥College	1.62	(1.19-2.20)	1.59	(1.17–2.13)	1.63	(1.22-2.12)
Income (ref. <1 million Korean won)						
1–2 million	0.91	(0.46-1.51)	0.93	(0.50–1.48)	0.88	(0.37-1.48)
2–4 million	1.11	(0.55-2.06)	1.21	(0.72–1.95)	1.14	(0.66-1.87)
≥4 million	1.24	(0.80-1.86)	1.25	(0.77–1.95)	1.07	(0.70-1.65)
Marital status (ref. Living with spouse)						
Living without spouse					1.09	(0.80-1.44)
Occupation (ref. White collar)						
Blue collar					1.1	(0.81-
Housewife					1.1	(0.85-
Other					1.4	(0.99-
Hypertension (ref. No)						
Yes					1.4	(1.21-
Diabetes (ref. No)						
Yes					1.2	(0.91-
Hyperlipidemia (ref. No)						
Yes					0.9	(0.68-
Neighborhood-level income status	1.38	(1.15-1.66)	1.27	(1.08-1.69)	1.22	(1.01–1.61)
Neighborhood-level % of college graduates or higher	1.02	(0.85-1.22)	1.13	(0.92-1.39)	1.12	(0.89–1.41)
Random Parameters						
Between-neighborhood variance	0.15	(0.04-0.43)	0.15	(0.04-0.38)	0.16	(0.03–0.46)
DIC	2844.59		2764.15		2754.86	

Note: Model 1 included income, education, and the neighborhood-level SES only; model 2 included sex and age to the model 1; model 3 included all individual. All models were controlled for year dummies

Reviewer: 2

Comment 1: Methods: Previous research shows that the men and women have different patterns of self-care management of chronic diseases. The current paper analyzed the total sample without examining differences between men and women. Interactions of the main associations with gender should be examined.

Response: We appreciate your comments. However, the issue was raised during the previous review, and we have added the following relevant sentences to the Methods as shown below:

"We did not stratify the analyses by gender because a Chow test [47] failed to detect significant differences in the slopes and intercepts of the gender-stratified regressions [F (1, 2,364) =0.95, P=0.3309]." (page 9, lines 8–10)

A Chow test was conducted to test potential gender differences regarding the slopes and intercepts. However, this test confirmed the lack of differences in these parameters between the gender-stratified regressions.

Comment 2: Discussion: Individual and neighborhood SES are important for IHD management, however previous research showed that barriers to self-care management are also important specifically among low SES groups. Lifestyle behaviors are more difficult to manage than taking medications.

Response: We agree that lifestyle behaviors are also important factors in IHD incidence or prevalence. However, the outcome variable in our study, self-reported current management status after incident angina or myocardial infarction, encompasses lifestyle behaviors for post-IHD management as well as medical utilization including medications (Please see Study outcome). We also have explicated the barriers to self-care management related to lifestyles behaviors in IHD management through explaining mechanisms how lower-income neighborhoods might hinder lifestyle behaviors as below:

"Second, residents in higher-income neighborhoods may enjoy a more favorable social environment for IHD management, which might include an increased interest in health maintenance and a greater amount of social support from neighbors.[24] Third, residents of lower-income neighborhoods might have reduced access to health-oriented features such as recreation spaces and walkable environments[25] and stores that sell healthy foods,[26] concomitant with increased access to stores selling cigarettes and/or alcohol[27] and exposure to other environmental stressors. These factors may have important implications for self-care practices." (page 10, lines 20- page 11, lines 4)

Reviewer: 3

Comment 1: I have no further comments for the paper

VERSION 3 – REVIEW

REVIEWER	Veronesi Giovanni University of Insubria, Varese, Italy
REVIEW RETURNED	03-Aug-2018

GENERAL COMMENTS	With the changes made to Table 1, the crude and the adjusted ORs for education, hypertension and diabetes are now going in the same direction. Therefore, I agree with the authors that there is no need to include the Appendix Table I as supplementary material. Since the findings from Table 2 did not qualitatively change, study conclusions are supported by the presented data. I have no further comments to add.

REVIEWER	Dr. Nihaya Daoud Ben-Gurion University of the Negev
REVIEW RETURNED	03-Aug-2018

GENERAL COMMENTS	The paper has improved. Please add the distribution of the neighborhood variables to Table 1.

VERSION 3 – AUTHOR RESPONSE

Reviewer: 1

Comment 1: With the changes made to Table 1, the crude and the adjusted ORs for education, hypertension and diabetes are now going in the same direction. Therefore, I agree with the authors that there is no need to include the Appendix Table I as supplementary material. Since the findings from Table 2 did not qualitatively change, study conclusions are supported by the presented data. I have no further comments to add.

Response: We appreciate your confirmation. We have excluded the Appendix Table I in the final submission.

Reviewer: 2

Comment 1: The paper has improved. Please add the distribution of the neighborhood variables to Table 1.

Response: We have added the distribution of the neighborhood variables to Table 1 as below.

Table 1. Characteristics of the study sample from the Korea HEXA-Gem dataset (N = 2,932), 2005-2013, stratified by self-reported ongoing management of post-ischemic heart disease

	Ongoing management	
	Yes	No
	(N = 2,366, 80.7%)	(N = 566, 19.3%)

Individuals		N	(%)	N	(%)	
Sex	Men	1,261	85.9	207	14.1	*
	Women	1,105	75.5	359	24.5	
Age (years)	40–49	248	70.5	104	29.5	*
	50–59	904	78.7	245	21.3	
	60–69	1,214	84.8	217	15.2	
Education	≤Middle school	987	77.8	281	22.2	*
	High school	868	82.0	191	18.0	
	≥College	487	84.3	91	15.7	
	Missing	24	85.7	3	11.1	
Income (million Korean won)	<1	779	83.1	159	16.9	*
	1–2	588	80.8	140	19.2	
	2–4	418	78.3	116	21.7	
	≥4	581	79.4	151	19.3	
	Missing	204	69.2	91	30.9	
Occupation	White collar	618	78.8	166	21.2	*
	Blue collar	359	81.8	80	18.2	
	Housewife	702	76.5	216	23.5	
	Other	466	88.6	60	11.4	
	Missing	221	83.4	44	16.6	
Marital status	Living with spouse	2,073	80.9	488	19.1	
	Living without spouse	293	79	78	21.0	
Comorbidities	Hypertension	1,104	84.5	202	15.5	*
	No hypertension	1,262	77.6	364	22.4	
	Diabetes	465	85.3	80	14.6	*
	No diabetes	1,901	79.6	486	20.4	
	Hyperlipidemia	476	79.7	121	20.3	
	No hyperlipidemia	1,890	80.9	445	19.1	
Neighborhoods		Mean		SD		
Neighborhood-level income status		0.46		0.98		
Neighborhood-level % of college graduates or higher		0.10		0.07		

* Differences between two groups for the all variables were considered significant at a p value <0.0