



Impact of the gap between socioeconomic stratum and subjective social class on depressive symptoms: Unique insights from a longitudinal analysis



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ABSTRACT

Our objective was to investigate whether gaps between socioeconomic stratum and subjective social class affect the prevalence of depressive symptoms. We collected data from the Korean Health Panel Survey, years 2009 and 2011, and performed a longitudinal analysis of 12,357 individuals at baseline (2009), estimating the prevalence of depressive symptoms among individuals with disparate socioeconomic stratum (High, Middle, or Low household income and education level, respectively) and subjective social class (High, Middle, or Low). The odds ratio for depressive symptoms among individuals with High household income and High social class, or Low household income and Low social class, was 0.537 and 1.877, respectively ($p < 0.0001$), and that among individuals with High education level and High social class, or Low education and Low social class, was 0.700 and 1.597, respectively ($p: 0.001, p < 0.0001$, respectively). The likelihood of having depressive symptoms increased within each level of income and education, as the subjective social class decreased from High to Low. The adjusted effect of the gap between socioeconomic stratum and subjective social class on depressive symptoms deteriorated, as a whole, across the socioeconomic spectrum. The gap between socioeconomic stratum and perceived position in the social hierarchy explains a substantial part of inequalities in the prevalence of depressive symptoms. It is important to consider the impact of discrepancies between different measures of socioeconomic well-being on depressive symptoms rather than looking at the subjective social class alone.

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1. Introduction

Although numerous studies have documented the associations between indicators of socioeconomic status (SES) and a variety of health outcomes (Adler et al., 1993; Duleep, 1989; Feldman et al., 1989), comprehensive indicators of SES are not routinely collected in South Korea. The data deficiency was highlighted at a 1996 federally sponsored health conference on SES (Measuring Social Inequalities. The National Institutes of health, September 28–30, 1994), and was also noted by the National Committee on Vital and Health Statistics. Despite a growing awareness of the need for the

regular collection of SES indicators, however, there is little agreement on which indicators should be gathered (Lee et al., 1995).

In general, SES indicators are meant to provide information about access to social and economic resources. Indicators of education level are important determinants of employment and economic circumstances (Pscharoupoulos, 1985), which are linked to health outcomes through specific work conditions and levels of consumption. Education may also be associated with health outcomes through its connection to health-related behaviors. Individuals with higher levels of education are more likely to engage in a range of health-enhancing self-maintenance activities (Lynch JW, 1997; Ross and Wu, 1995; Davey Smith et al., 1998).

Household income, in another widely used indicator of SES. Household income indicates a standard of living and the opportunities household members experience through the sharing of goods and services. Many public health studies in the USA typically include only one question about “annual family income” at a single

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point in time (Krieger et al., 1997). Income level and income dynamics both have import implications for health outcomes (Goodman et al., 2003), and many previous studies provide evidence of strong income gradients in health outcomes (Adler and Epel, 2000).

Subjective social class (i.e., self-rated social position) is an important predictor of health outcomes (Marmot, 2004) and is associated with self-rated health, mortality, cardiovascular disease, diabetes, and depression (Adler et al., 2008; Adler and Epel, 2000; Ghaed and Gallo, 2007; Goodman et al., 2003; Kopp et al., 2004; Singh-Manoux et al., 2003). The subjective social class captures the “cognitive averaging” of socioeconomic and other social characteristics which, in theory, can be observed objectively (Singh-Manoux et al., 2005). In other words, asking respondents to judge their social class allows them to account for the more nuanced facets of their unique SES, as well as their past and future prospects.

Although routine analysis using conceptually coherent and consistent measures of social class remains rare, income, deprivation, wealth, and education have been used to measure social class (Krieger et al., 1997). There have been many studies showing positive associations between socioeconomic stratum (i.e., income and education) and health outcomes, and between subjective social class and health outcomes; however, no study to date has examined or compared the impact of gaps between socioeconomic stratum and subjective social class on depressive symptoms. Therefore, this study aims to confirm the impact of such gaps; measured as the difference between subjective social class and household income and education level, respectively; on depressive symptoms.

2. Methods

2.1. Study sample

We used data from the Korean Health Panel Survey. Detailed data and information on families and individuals were collected from a nationally representative sample of households. The initial 2008 baseline data included 21,283 individuals in 7009 households. The numbers of individuals and households in 2009, 2010, and 2011 were 19,154 and 6314; 17,878 and 5956; and 17,037 and 5741; respectively. For our analysis, we used the 2009 and 2011 data, which included the social class variable and subjective questions about social class targeted at adults over the age of 18.

Among the 2009 data, we excluded 93 individuals without information on household income, 6516 individuals without information on subjective social class, and 188 individuals without information on smoking status. Thus, the 2009 data included a total of 12,357 individuals. Among the 2011 data, we excluded five individuals without information on household income and 5274 individuals without information on subjective social class. Thus, the 2011 data included a total of 11,758 individuals.

9945 participants responded on both panel surveys in 2009 and 2011, in addition, 2413 participated in 2009 only and 1814 solely in 2011. Thus, a total number of enrolled subjects in this study were 14,172. A repeated-measurement using generalized linear mixed model (Glimmix) with a binary distribution was performed for this analysis. Therefore, those who participated once (2009 or 2011) were measured once, and those who participated in both surveys were counted twice.

2.2. Study variables

2.2.1. Depressive symptoms

Self-reported data regarding depressive symptoms was extracted from responses to the question: “Have you ever felt sadness or despair, which hindered everyday life continuing for 2 weeks or

more during a 1-year time period?” The presence of depressive symptoms was categorized as either “yes” or “no.”

2.2.2. Household income

Equivalized household income can be viewed as an indicator of the economic resources available to each individual within a household. Mean equivalized household income is usually calculated by adding the equivalized household incomes of all persons in the household, and then dividing by the number of persons, which enables people in large households to have the same contribution to the mean household income as people living alone (Australian Bureau of Statistics, 2006). Therefore, the equivalized household income is the total household income adjusted by an equivalence scale to facilitate comparisons between households of differing size and composition, reflecting the requirement of a larger household to have a higher level of income than a smaller household to achieve the same standard of living. Household income was calculated by dividing the yearly household income by the square root of the number of persons in the household (Sung Jin, 2006). Household incomes were ranked from lowest to highest and grouped into three groups (High, Middle, and Low) using the SAS Rank function.

2.2.3. Education level

Education level was categorized into three groups: middle school or lower (Low), high school (Middle), and college or higher (High).

2.2.4. Subjective social class

Subjective social class was measured by asking the respondents to assess their social class using a pictorial representation of a ladder. Pictures of ladders with 10 rungs were shown along with the following instructions: “think of this ladder as representing where people stand in South Korea. At the top of the ladder are the people who are the best off—those who have the most money, the most education and the most respected jobs. At the bottom are the people who are the worst off—who have the least money, least education and the least respected jobs or no jobs.” The respondents were asked to consider their current situation and rank themselves within South Korea. The items were coded so that a higher score indicated a higher subjective social class. We categorized the self-reported social class from lowest to highest using the SAS Rank function. We analyzed the impact of the relative social class (High, Middle, or Low) on the presence of depressive symptoms in terms of the gap between the social class and the socioeconomic stratum, defined as the equivalized household income and the education level.

2.2.5. The gap between socioeconomic stratum and subjective social class

The gap represents the difference between the subjective social class and the household income and education level, respectively. We categorized the reported gaps into nine groups: High SES (education or household income) and Low subjective social class, High SES and Middle subjective social class, High SES and High subjective social class, Middle SES and Low subjective social class, Middle SES and Middle subjective social class, Middle SES and High subjective social class, Low SES and Low subjective social class, Low SES and Middle subjective social class, and Low SES and High subjective social class.

2.3. Control variables

Residential regions were categorized as urban (Seoul, Daejeon, Daegu, Busan, Incheon, Kwangju, or Ulsan) or rural (areas not classified as a city). Employment status was divided into two

Table 1
General demographic characteristics of the study sample at baseline (2009).

	Total	Unweighted %	Weighted %	Depressive symptoms						Weighted p-value
				Yes			No			
				N	Unweighted %	Weighted %	N	Unweighted %	Weighted %	
Gender										
Male	5396	43.7	44.5	430	8.0	8.0	4966	92.0	92.0	<0.0001
Female	6961	56.3	55.5	903	13.0	12.8	6058	87.0	87.2	
Age										0.000
≤29	1547	12.5	16.5	164	10.6	10.4	1383	89.4	89.6	
30–39	2424	19.6	21.9	245	10.1	10.1	2179	89.9	89.9	
40–49	2641	21.4	22.9	251	9.5	9.7	2390	90.5	90.3	
50–59	2184	17.7	17.4	218	10.0	9.8	1966	90.0	90.2	
60–69	2010	16.3	12.2	243	12.1	12.0	1767	87.9	88.0	
≥70	1551	12.6	9.2	212	13.7	14.4	1339	86.3	85.6	
Residential region										0.457
Urban	5613	45.4	47.5	611	10.9	10.9	5002	89.1	89.1	
Rural	6744	54.6	52.5	722	10.7	10.4	6022	89.3	89.6	
Marital status										<0.0001
Married	8980	72.7	70.3	855	9.5	9.5	8125	90.5	90.5	
Single	3377	27.3	29.7	478	14.2	13.5	2899	85.9	86.5	
Economic activity status										<0.0001
Yes	7398	59.9	61.2	670	9.1	9.2	6728	90.9	90.8	
No	4959	40.1	38.8	663	13.4	13.0	4296	86.6	87.0	
Alcohol consumption										0.002
Never	2551	20.6	19.1	291	11.4	11.2	2260	88.6	88.8	
1 time per month	4370	35.4	35.1	522	12.0	11.9	3848	88.1	88.1	
2–3 times per week	1838	14.9	15.8	185	10.1	10.1	1653	89.9	89.9	
≥1 times per week	3598	29.1	30.1	335	9.3	9.2	3263	90.7	90.8	
Smoking status										0.034
Never smoker	7778	62.9	63.0	889	11.4	11.2	6889	88.6	88.8	
Former smoker	1839	14.9	13.8	178	9.7	9.7	1661	90.3	90.3	
Current smoker	2740	22.2	23.3	266	9.7	9.7	2474	90.3	90.3	
Exercise										0.046
Never	6948	56.2	55.2	792	11.4	11.1	6156	88.6	88.9	
1–2 times per week	1454	11.8	12.8	164	11.3	11.6	1290	88.7	88.4	
3–4 times per week	1441	11.7	12.0	149	10.3	10.4	1292	89.7	89.6	
5–6 times per week	1404	11.4	11.7	139	9.9	9.8	1265	90.1	90.2	
Everyday	1110	9.0	8.2	89	8.0	8.1	1021	92.0	91.9	
Chronic disease										<0.0001
Yes	6902	55.9	50.9	891	12.9	13.1	6011	87.1	86.9	
No	5455	44.2	49.1	442	8.1	8.1	5013	91.9	91.9	
Total	12,357	100.0	100.0	1333	10.8	10.7	11,024	89.2	89.3	

categories: employed and unemployed (including housewives and students). Individuals were classified as currently married or never married, with the latter group including those previously married, widowed, or divorced. Chronic diseases were also included in our models, and questions about alcohol use, smoking status, and days of exercise per week were included as covariates.

2.4. Analytical approach and statistics

The Chi-squared test and a longitudinal data analysis were used to investigate the impact of the gap between SES and subjective social class on depressive symptoms. We ran a generalized linear mixed model (Glimmix) with a binary distribution, which controls for characteristics that change over time, such as confounding variables other than gender. For all analyses, the criterion for significance was a two-tailed *p*-value ≤ 0.05. All analyses were conducted using the SAS statistical software package version 9.2 (SAS Institute Inc., Cary, NC, USA).

2.4.1. Generalized linear mixed effects model (SAS® Proc Glimmix)

Proc Glimmix is a generalized linear model procedure that permits the specification of a mixed logistic regression model. The use of a generalized linear mixed model was required in order to handle the unbalanced data with correlated outcomes and missing data. In all mixed models presented, only the intercept was allowed

to vary between subjects, and the regression slopes were assumed to be fixed effects; random intercept models were applied to our data. The random intercept variance is reported as σ^2 (Arrandale et al., 2009).

Depressive symptom (yes/no) was the outcome in all generalized linear mixed models. Covariates of interest from all subjects were added to the model to determine their effects on the probability of reporting depressive symptom. To determine whether the probability of depressive symptom changed over time, we included time (year) in the model as a categorical covariate; the regression coefficient was used to estimate both the change in probability of depressive symptom and independent variables, annually (Arrandale et al., 2009).

3. Results

3.1. Incidence and prevalence in depressive symptom

According to our study, 1333 subjects felt depressive symptom in 2009, and 946 in 2011. 829 subjects in 2009 reported depressive symptom in 2009 only, while 596 subjects in 2011 only. Total 8301 participants responded ‘not feeling depressive symptom’ in 2009 and 2011 (Table 3).

Table 1 lists the general characteristics of the covariates according to the presence of depressive symptoms. Table 2 shows the

general characteristics of the variables on income and subjective social class at the baseline (2009). The baseline weighted prevalence of depressive symptoms per year among individuals whose household income matched their subjective social class was 12.0% (High income and High social class), 10.3% (Medium income and Medium social class), and 8.0% (Low income and Low social class).

Table 4 shows a scale with overestimation, accurate, and underestimation. The odds ratio (OR) of overestimation when an individual's subjective social class is higher than his/her SES for household income was 0.839 time lower (95% CI: 0.746–0.944) compared to accurate when an individual's subjective social class is equal to his/her SES and the OR of underestimation when an individual's subjective social is lower than his/her SES for household income was 1.142 times higher (95% CI: 1.028–1.268) compared to accurate when an individual's subjective social class is equal to his/her SES. The OR of overestimation when an individual's subjective social class is higher than his/her SES for education was 0.667 times lower (95% CI: 0.589–0.754) compared to accurate when an individual's subjective social class is equal to his/her SES and the OR of underestimation when an individual's subjective social is lower

Table 3

Changes, incidence and prevalence in depressive symptom for 2 years.

Categories	N	%
Depressive symptom in 2009 & nonresponse in 2011	285	2.0
Depressive symptom in 2009 & depressive symptom in 2011	219	1.6
No depressive symptom in 2009 & nonresponse in 2011	2128	15.0
No depressive symptom in 2009 & depressive symptom in 2011	596	4.2
Nonresponse in 2009 & depressive symptom in 2011	131	0.9
Nonresponse in 2009 & no depressive symptom in 2011	1683	11.9
Depressive symptom in 2009 & no depressive symptom in 2011	829	5.9
No depressive symptom in 2009 & no depressive symptom in 2011	8301	58.6

than his/her SES for education was 1.239 times higher (95% CI: 1.113–1.380) compared to accurate when an individual's subjective social class is equal to his/her SES.

Table 5 shows the impact of the gap between subjective social class and household income (Fig. 1) and education (Fig. 2), respectively, on depressive symptoms. OR of individuals with Low household income and Low subjective social class was the highest probability of depressive symptoms (OR: 1.877; 95% CI:

Table 2

General characteristics of interesting variables at baseline (2009).

	Total	Unweighted %	Weighted %	Depressive symptom						Weighted p-value
				Yes			No			
				N	Unweighted %	Weighted %	N	Unweighted %	Weighted %	
Gap between Income and Subjective Social Class										
HH [High–High]	1605	13.0	13.3	191	11.9	12.0	1414	88.1	88.0	<0.0001
HM [High–Mid]	839	6.8	7.5	64	7.6	8.1	775	92.4	91.9	
HL [High–Low]	645	5.2	5.7	80	12.4	12.5	565	87.6	87.5	
MH [Mid–High]	2527	20.5	17.8	454	18.0	18.2	2073	82.0	81.8	
MM [Mid–Mid]	1061	8.6	9.0	105	9.9	10.3	956	90.1	89.7	
ML [Mid–Low]	2263	18.3	20.2	132	5.8	5.6	2131	94.2	94.4	
LH [Low–High]	1069	8.7	7.6	82	7.7	7.9	987	92.3	92.1	
LM [Low–Mid]	855	6.9	6.3	111	13.0	13.3	744	87.0	86.7	
LL [Low–Low]	1493	12.1	12.6	114	7.6	8.0	1379	92.4	92.0	
Gap between Education and Subjective Social Class										
HH [High–High]	2276	18.4	20.7	157	6.9	6.9	2119	93.1	93.1	<0.0001
HM [High–Mid]	955	7.7	9.0	85	8.9	9.0	870	91.1	91.0	
HL [High–Low]	871	7.1	8.2	103	11.8	12.1	768	88.2	87.9	
MH [Mid–High]	1562	12.6	13.0	96	6.2	6.1	1466	93.9	93.9	
MM [Mid–Mid]	988	8.0	8.3	98	9.9	10.5	890	90.1	89.5	
ML [Mid–Low]	1487	12.0	12.6	212	14.3	14.2	1275	85.7	85.8	
LH [Low–High]	987	8.0	6.7	75	7.6	7.8	912	92.4	92.2	
LM [Low–Mid]	812	6.6	5.5	97	12.0	12.6	715	88.1	87.4	
LL [Low–Low]	2419	19.6	15.9	410	17.0	17.3	2009	83.1	82.7	
Gap between Income and Subjective Social Class										
Overestimation	3089	25.0	26.5	335	10.8	11.0	2754	89.2	89.0	0.0114
Accurate	5851	47.4	46.9	691	11.8	11.3	5160	88.2	88.7	
Underestimation	3417	27.7	26.5	307	9.0	9.2	3110	91.0	90.8	
Gap between Education and Subjective Social Class										
Overestimation	3313	26.8	29.9	400	12.1	12.1	2913	87.9	87.9	<0.0001
Accurate	5683	46.0	45.0	665	11.7	11.2	5018	88.3	88.8	
Underestimation	3361	27.2	25.2	268	8.0	8.0	3093	92.0	92.0	
Income										
Low	4451	36.0	31.7	647	14.5	14.7	3804	85.5	85.3	<0.0001
Middle	4159	33.7	34.9	410	9.9	10.1	3749	90.1	89.9	
High	3747	30.3	33.4	276	7.4	7.4	3471	92.6	92.6	
Education										
≤Middle school	4218	34.1	28.1	582	13.8	14.1	3636	86.2	85.9	<0.0001
High school	4037	32.7	33.9	406	10.1	10.2	3631	89.9	89.8	
≥College	4102	33.2	38.0	345	8.4	8.5	3757	91.6	91.5	
Subjective Social Class										
Low	4777	38.7	36.8	725	15.2	15.1	4052	84.8	84.9	<0.0001
Middle	2755	22.3	22.8	280	10.2	10.4	2475	89.8	89.6	
High	4825	39.1	40.4	328	6.8	6.8	4497	93.2	93.2	
Total	12,357	100.0	100.0	1333	10.8	10.7	11,024	89.2	89.3	

Table 4
Adjusted effect of gap between household income (education) and subjective social class on depressive symptom.

	Household income			Education		
	OR	95% CI	P-value	OR	95% CI	P-value
Scale of estimation						
Overestimation	.839	.746 .944	.004	.667	.589 .754	<.0001
Accurate	1.000			1.000		
Underestimation	1.142	1.028 1.268	.013	1.239	1.113 1.380	<.0001
Gender						
Male	1.000			1.000		
Female	1.949	1.678 2.263	<.0001	2.169	1.869 2.518	<.0001
Age						
≤29	1.277	1.011 1.613	.040	1.054	0.849 1.308	0.636
30–39	1.473	1.189 1.824	.000	1.199	0.983 1.461	0.073
40–49	1.397	1.144 1.706	.001	1.250	1.034 1.510	.021
50–59	1.255	1.047 1.505	.014	1.398	1.168 1.675	.000
60–69	1.077	0.898 1.291	0.423	1.081	0.902 1.295	0.399
≥70	1.000			1.000		
Household income						
Low	N/A			1.912	1.681 2.175	<.0001
Middle				1.385	1.231 1.558	<.0001
High				1.000		
Education						
Low	1.601	1.365 1.878	<.0001	N/A		
Middle	1.155	1.021 1.306	.023			
High	1.000					
Residential region						
Urban						
Rural	1.022	0.932 1.119	0.644	1.015	0.926 1.112	0.750
Marital status						
Married	1.000			1.000		
Single	1.574	1.406 1.761	<.0001	1.432	1.279 1.603	<.0001
Economic activity status						
Yes	1.000			1.000		
No	1.339	1.212 1.478	<.0001	1.206	1.092 1.332	.000
Alcohol consumption						
Never	1.000			1.000		
1 times per month	0.991	0.877 1.121	0.889	1.003	0.887 1.134	0.961
2–3 times per week	0.922	0.782 1.087	0.335	0.967	0.820 1.141	0.695
≥1 times per week	1.061	0.919 1.225	0.417	1.121	0.970 1.294	0.122
Smoking status						
Never smoker	1.000			1.000		
Former smoker	1.553	1.298 1.857	<.0001	1.459	1.219 1.747	<.0001
Current smoker	1.570	1.335 1.846	<.0001	1.517	1.290 1.785	<.0001
Exercise						
Never	1.000			1.000		
1–2 times per week	1.159	1.010 1.331	.035	1.172	1.021 1.346	0.024
3–4 times per week	0.895	0.771 1.039	0.145	0.904	0.778 1.050	0.187
5–6 times per week	0.921	0.787 1.078	0.305	0.942	0.804 1.103	0.455
Everyday	0.859	0.706 1.044	0.127	0.874	0.718 1.064	0.180
Chronic disease						
Yes	1.715	1.537 1.914	<.0001	1.744	1.564 1.946	<.0001
No	1.000			1.000		
Year						
2009	1.515	1.384 1.659	<.0001	1.461	1.334 1.601	<.0001
2011	1.000			1.000		

1.559–2.261) compared to middle SES and middle subjective social class, and the OR of individuals with High household income and High subjective social class was 0.537 time higher (95% CI: 0.438–0.658) compared to middle SES and middle subjective social class. In the Education section, the OR for individuals having Low education level and Low subjective social status was the highest probability for depressive symptoms (OR: 1.597; 95% CI: 1.302–1.957) compared to middle SES and middle subjective social class, and the OR for individuals with High education level and High subjective social status was 0.700 times higher (95% CI: 0.568–0.862) compared to middle SES and middle subjective social class.

Additionally, we analyzed the association between depressive symptoms and socioeconomic stratum (household income and education) and subjective social class, respectively (Table 6). The

adjusted effect of the association between socioeconomic stratum and subjective social class on depressive symptom deteriorated across the socioeconomic spectrum.

4. Discussion

Our primary purpose was to investigate the impact of gaps between socioeconomic stratum and subjective social class on depressive symptoms in a longitudinal model using a nationally representative sample of the general population of South Korea. Our results show that gaps between socioeconomic stratum and subjective social class tend to increase the prevalence of depressive symptoms.

Within each level of household income, the likelihood that an individual had depressive symptoms increased as the subjective

Table 5
Adjusted effect of gap between household income (education) and subjective social class on depressive symptom.

	Household income			Education		
	OR	95% CI	P-value	OR	95% CI	P-value
Gap between Household income (Education) and Subjective Social Class						
HH [High–High]	0.537	.438 .658	<.0001	0.700	.568 .862	.001
HM [High–Mid]	0.814	0.646 1.027	0.082	0.911	0.723 1.148	0.428
HL [High–Low]	1.347	1.080 1.680	.008	1.391	1.121 1.727	.003
MH [Mid–High]	0.760	.613 .943	.013	.591	.471 .742	<.0001
MM [Mid–Mid]	1.000			1.000		
ML [Mid–Low]	1.370	1.133 1.658	.001	1.357	1.116 1.650	.002
LH [Low–High]	0.949	0.743 1.211	0.673	0.833	0.642 1.081	0.170
LM [Low–Mid]	1.304	1.029 1.654	.028	1.084	0.840 1.400	0.535
LL [Low–Low]	1.877	1.559 2.261	<.0001	1.597	1.302 1.957	<.0001
Gender						
Male	1.000			1.000		
Female	2.005	1.727 2.328	<.0001	2.004	1.726 2.327	<.0001
Age						
≤29	1.572	1.239 1.993	.000	1.590	1.254 2.016	.000
30–39	1.685	1.357 2.091	<.0001	1.694	1.364 2.102	<.0001
40–49	1.621	1.325 1.982	<.0001	1.616	1.322 1.976	<.0001
50–59	1.523	1.269 1.828	<.0001	1.525	1.271 1.831	<.0001
60–69	1.108	0.925 1.329	0.266	1.110	0.926 1.330	0.261
≥70	1.000			1.000		
Household income						
Low	N/A			1.586	1.386 1.814	<.0001
Middle				1.206	1.068 1.362	.003
High				1.000		
Education						
Low	1.149	0.974 1.356	0.098	N/A		
Middle	0.956	0.842 1.085	0.480			
High	1.000					
Residential region						
Urban	1.000			1.000		
Rural	0.985	0.899 1.080	0.751	0.988	0.901 1.083	0.799
Marital status						
Married	1.000			1.000		
Single	1.364	1.219 1.528	<.0001	1.363	1.217 1.526	<.0001
Economic activity status						
Yes	1.000			1.000		
No	1.248	1.129 1.379	<.0001	1.250	1.132 1.381	<.0001
Alcohol consumption						
Never	1.000			1.000		
1 times per month	1.020	0.902 1.154	0.749	1.020	0.902 1.154	0.754
2–3 times per week	0.985	0.835 1.163	0.861	0.984	0.834 1.161	0.845
≥1 times per week	1.132	0.980 1.308	0.092	1.131	0.979 1.306	0.095
Smoking status						
Never smoker	1.000			1.000		
Former smoker	1.437	1.222 1.691	<.0001	1.438	1.223 1.691	<.0001
Current smoker	1.465	1.224 1.753	<.0001	1.463	1.223 1.751	<.0001
Exercise						
Never	1.000			1.000		
1–2 times per week	1.251	1.088 1.438	.002	1.249	1.087 1.435	.002
3–4 times per week	0.941	0.809 1.094	0.426	0.940	0.809 1.093	0.422
5–6 times per week	0.947	0.808 1.109	0.500	0.948	0.809 1.111	0.510
Everyday	0.873	0.717 1.063	0.176	0.874	0.718 1.064	0.180
Chronic disease						
Yes	1.686	1.510 1.883	<.0001	1.688	1.512 1.885	<.0001
No	1.000			1.000		
Year						
2009	1.460	1.332 1.600	<.0001	1.459	1.332 1.599	<.0001
2011	1.000			1.000		

social class decreased from High to Low. There was a similar trend within each level of education. Overall, individuals, with Low household income or education level and Low subjective social class, were more likely to have depressive symptoms than those with High household income and High subjective social class. The associations were independent of sociodemographic variables (household income/education, age, gender, residential region, marital status, and economic status), health-risk behavioral variables (smoking status, alcohol consumption, and exercise), health status (chronic disease), and year.

4.1. The association between gap and depressive symptoms

The association between socioeconomic status, such as income and education level and subjective social class, and depressive symptom has been proven through many previous studies (Adler et al., 1993; Duleep, 1989; Feldman et al., 1989). Similarly, we also suggest both variables (including gaps between income and subjective social class, and that of education and subjective social class) have meaningful influence on depressive symptom. As Figs. 1 and 2 indicate, values of regression coefficient (values of slope) vary according to socioeconomic stratum and compositions of subjective social class. This means that depressive symptom must be considered through multi-dimensional measurement tools, not by just a single measure. In conclusion, our studies support previous researches with additional concrete evidence.

Some poor countries with little social inequality have higher life expectancies than rich countries with more social inequality, suggesting that the psychological perception of increased inequality may damage health outcomes (Wilkinson, 1996). Based on research showing the health effects of income inequality, Wilkinson (Wilkinson, 1999) argued that absolute levels of social class are not as important for health outcomes as is inequality resulting from relative standing. In other words, relative social class is an important predictor of health outcomes. Wilkinson (Wilkinson, 1996) also claimed, based on the finding that countries with more social inequality have relatively low life expectancies, that income inequality is a consistent predictor of morbidity and mortality.

Several studies using various methods have shown a positive relationship between social class and health (Adler et al., 1994). Investigations between social class and health have estimated social class in several ways, including by income, occupational status, educational attainment, and combinations thereof (Daly et al., 2002). Data from the USA indicate that, despite difficulties in obtaining accurate income data, even simple categorical measures of annual personal and family income at a single point in time are strongly associated with myriad health outcomes (Adler and Epel, 2000). In the USA in 1986, for example, only 4.3% of the population with an income of at least \$35,000 reported having “fair or poor” health, whereas 20.4% of the population with an income under \$10,000 reported the same (Health and Human Services, 1991). Two recent studies using zip code-based measures of median family income in the USA provide evidence of strong income gradients in mortality over a 16-year period (Smith et al., 1996a; Smith et al., 1996b). Other studies used census-based income data to document socioeconomic disparities in cancer prevalence and survival rates (Devesa and Diamond, 1980, 1983; Greenwald et al., 1994).

Socioeconomic stratum is linked to the risks of disease and premature death (Adler et al., 1999), and increasing social inequalities in health coupled with growing inequalities in income and wealth have focused attention on social class as a key determinant of health (Krieger et al., 1997). One previous study showed a clear association between lower SES and higher mortality rates and, furthermore, that the effects of health-related behaviors are appear greater when they are assessed longitudinally (Stringhini et al., 2010). Another study of health disparities over the past decade suggests that subjective perceptions of social class are related to health (Adler et al., 1994), although the relationship between health outcomes and traditional SES indicators such as income, occupation, and education has a much longer history.

Our analysis suggests that it is important to consider the impact of the gaps between socioeconomic stratum and subjective social class on depressive symptoms instead of considering the impact of subjective social class alone. Our findings also suggest that previous studies (Kopp et al., 2004; Miyakawa et al., 2012) have overstated

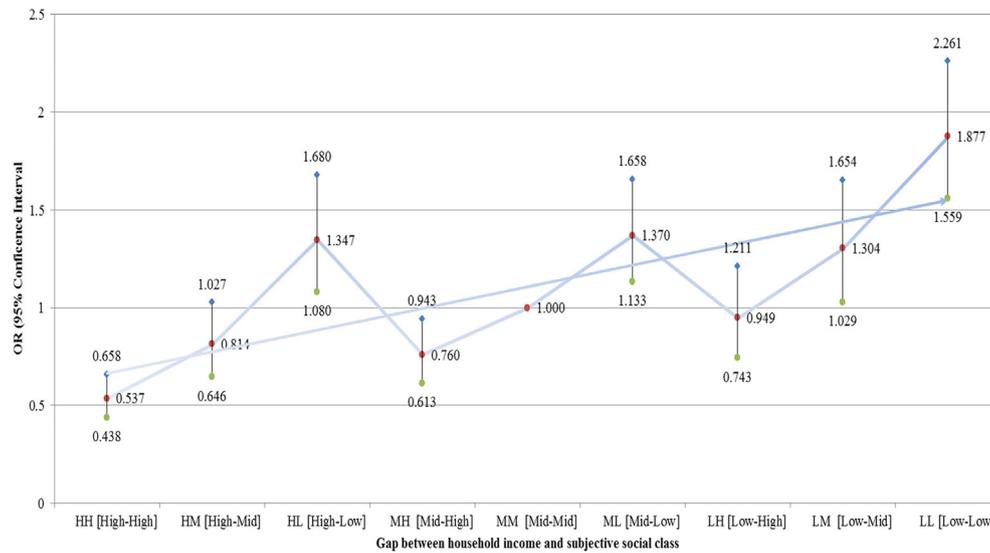


Fig. 1. Adjusted effect of the gap between household income and subjective social class on depressive symptoms.

the importance of subjective social class to health outcomes. The results shown in Table 3 suggest that the adjusted effect of the gaps between subjective social class and socioeconomic stratum on depressive symptoms is larger than the adjusted effect of subjective social class alone.

Our study has a number of strengths and limitations. The participants in the survey are representative of the overall South Korean population, because the sample size was large, so the results can be generalized to the national level. Nevertheless, there was a possible sample bias. One problem with using household income to examine the relationships between socioeconomic stratum and health outcomes is that the household members may have unequal access to the household income. A second problem is that the current household income may not adequately represent the standard of living of retired individuals, because it may not reflect the available financial resources, and it disregards the cumulative effects of a lifetime of deprivation or privilege. Moreover, because current income may be a product of recent health, associations

between income and health are subject to reverse-causation problems. A third problem is that the respondents' reports of income, subjective social class, and depressive symptom are subjective and imperfect measures and can potentially be affected by false consciousness or by the adaptation of resources. When a household experiences a reduction in income, the use of previously accumulated resources can delay subjective poverty. Therefore, socioeconomic stratum (i.e., income) and subjective social class do not overlap directly due to the lagged effect of income on living standards. Fourth, because personality characteristics are likely to be associated with both subjective social class and depressive symptoms, a failure to include them in the statistical models could lead to an exaggeration of the results. In addition to the above potential biases, which are likely to inflate the associations between the subjective social class and some of the health variables, we recognize that our estimates may understate the potential effects of all of the factors on depressive symptoms because of the short follow-up period in our analysis. Finally, although we estimated longitudinal

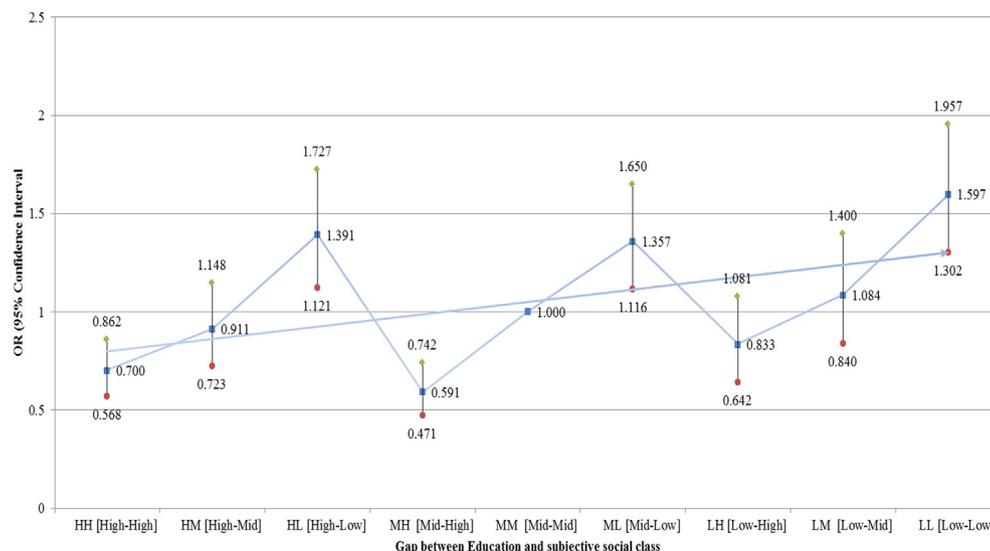


Fig. 2. Adjusted effect of the gap between education level and subjective social class on depressive symptoms.

Table 6
Adjusted effect of the gap between socioeconomic stratum and subjective social class on depressive symptoms.

	Depressive symptoms			p-value
	Or	95% CI		
Income				
Low	2.057	1.812	2.336	<0.0001
Middle	1.429	1.271	1.607	<0.0001
High	1.000			
Education				
Low	1.628	1.389	1.908	<0.0001
Middle	1.159	1.023	1.311	0.019
High	1.000			
Subjective social class				
Low	2.336	2.092	2.610	<0.0001
Middle	1.504	1.322	1.712	<0.0001
High	1.000			

Adjusted for gender, age, residential region, marital status, economic activity status, alcohol consumption, smoking status, exercise, chronic disease, and year.

data, the results possibly reflect reverse causality and bidirectional relations in the association between depressive symptoms and the gap between socioeconomic stratum and subjective social class.

5. Conclusions

Unlike the simple measures that have previously been used to estimate associations between income and health outcomes or between subjective social class and health outcomes, our study provides evidence that gaps between socioeconomic stratum and perceived position in the social hierarchy could have important health implications.

Conflicts of interest

No author has any financial or other conflict of interest to declare.

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