Differentiation of direct and indirect socioeconomic effects on suicide attempts in South Korea

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Abstract

Despite the wide recognition of the inverse association between socioeconomic position (SEP) and suicidal behaviors, its underlying process and potential mediators are little known. This study investigated the pathway from SEP to suicide attempts with attention to potential mediators.

From the Korean Health and Nutrition Examination Survey 2007–2013, which is a nationwide cross-sectional survey of the health and nutritional status, a total of 34,565 participants ($\geq$30 years) were included in the analysis. To unfold the pathways linking SEP to suicide attempts, the direct and indirect effects of 3 SEP measures (educational attainment, household income, and occupational group) and 3 mediators (physical illness, mental health problems, and problematic drinking) were differentiated using structured equation model (SEM).

Most of direct and indirect effects of educational attainment, household income, and occupational group on suicide attempts were significant; Nonemployment status had the largest total ($\beta = 0.291$, $P < .01$) and direct effects ($\beta = 0.212$, $P < .01$), while educational attainment had the largest indirect effect ($\beta = -0.124$, $P < .01$). Educational attainment was mainly mediated by physical illness and problem drinking, whereas household income and occupational group were mainly mediated by anxious or depressed mood and problem drinking. Physical illness played a major role in explaining suicide attempts, compared to mental health problem and problem drinking.

Overall, experience of socioeconomic disadvantage increased suicide attempts independently of mental and physical problems. An extension of suicide prevention program is required for comprehensively targeting people with general problems such as physical illness and low SEP, complemented to narrowly targeting high risk group with, such as mental health problem.

Abbreviations: AUDIT = alcohol use disorders identification test, CFI = comparative fit index, KNHANES = Korean National Health and Nutrition Examination Survey, OECD = Organization for Economic Co-operation and Development, RMSEA = root mean square error of approximation, SEM = structural equation modeling, SEP = socioeconomic position, TLI = Tucker–Lewis index .

Keywords: mediating effect, physical illness, socioeconomic position, suicide attempts

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1. Introduction

Suicide has been a priority public health issue in South Korea (hereafter referred to as Korea) and in the world. The suicide rate in Korea has increased at an unprecedented rate during the past 2 decades, and Korea has had the highest suicide rate of Organization for Economic Co-operation and Development (OECD) countries since 2003. In Korea, improving fragmented and insufficient mental health services has been a central interest as a prevention target, but involving multiple pathways has not yet materialized. Indeed, a range of risk factors involved in the progression of suicidal behaviors includes individual (e.g., demographic characteristics, adverse life events, mental, and physical health problem), social (e.g., unemployment rate, economic recession, or boom) and cultural (e.g., family value and religious tradition) factors.[1,2] Among these factors, socioeconomic factors primarily measured by income level, educational attainment, and occupational status have been principal predictors of suicidal behavior and a higher risk of suicidal behavior has been observed among those with a lower socioeconomic position (SEP), both worldwide[3,4] and in Korea.[1,5] This evidence is consistent with the extensive literatures on inequalities in health,[6–11] and more generally in areas of economics, education, and other domains.[12] Despite the widespread recognition of the inverse association between SEP

and suicidal behaviors, little is known about the underlying process, particularly the indirect path through the mediation. Although SEP can affect suicidal behavior both directly and indirectly, previous studies have mostly focused on its direct impact. Thus, uncertainty remains about the simultaneous direct and indirect influence of SEP and the degree to which the link between SEP and suicidal behavior is attributable to mediators.

It is well known that mental health problem is an important independent risk factor of suicidal behaviors.[13] Furthermore, mental health problem indirectly plays a mediating role in the pathway to suicidal behavior.[14] Likewise, according to previous studies, physical illness is an independent risk factor for suicidality, even after adjusting for mental health problems.[15,16] However, evidence on the role of physical illness as a mediator between predisposing factors including SEP and suicidal behaviors remains unavailable, despite the common explanation that SEP affects health indirectly through psychosocial, behavioral, and biomedical factors.[17] Additionally, firm foundation on the role of physical illness is an urgent issue, given that a growing number of people will live with multiple health problems for their lives, as the aged population and survival gains rapidly increase. In the current study, the process of linking SEP to suicidal behavior was further differentiated into direct and indirect pathways by examining 3 mediating factors (i.e. mental and physical health problems and problem drinking) concurrently. Furthermore, to gain a more detailed understanding, 3 SEP indices were used, because each SEP measure accounts for distinct aspects of socioeconomic condition. Structural equation modeling (SEM) was used to assess the magnitude of each detailed relationship and the fitness of the complex pathway.

Socioeconomic factors carry particular significance in the epidemic of suicide in the Korean context. For example, old people in Korea are leading the epidemic with incomparably high suicidal rates across all age subgroups. Then again, they are experiencing the highest rate of old age poverty among OECD countries.[18] Along with such financial stress, multiple chronic illnesses, which are common phenomena among the elderly, are major threats to the disruption of livelihood. These elements may constitute a crisis, particularly when combined with the insufficiency of national public spending, such as with respect to public transfer to the elderly and health insurance coverage. This finding suggests that suicide may not result from a single, separate cause, but may need to be understood as an outcome of interrelated process involving several mediators, such as physical illness.

This study was performed to investigate the pathway linking SEP to suicide behavior (suicide attempts), with a particular focus on potential mediators, including mental and physical health problems. Using data from a nationwide representative health survey, our goals were to ascertain direct effects of SEP measures such as educational attainment, household income, and occupational group on suicide attempts and to assess the mediating effects of mental and physical health problems, and problematic drinking on the association between SEP and suicide attempts.

2. Materials and methods

2.1. Structural model

We created the structural model shown in Figure 1 and developed the following assumptions, based on evidence from relevant studies:
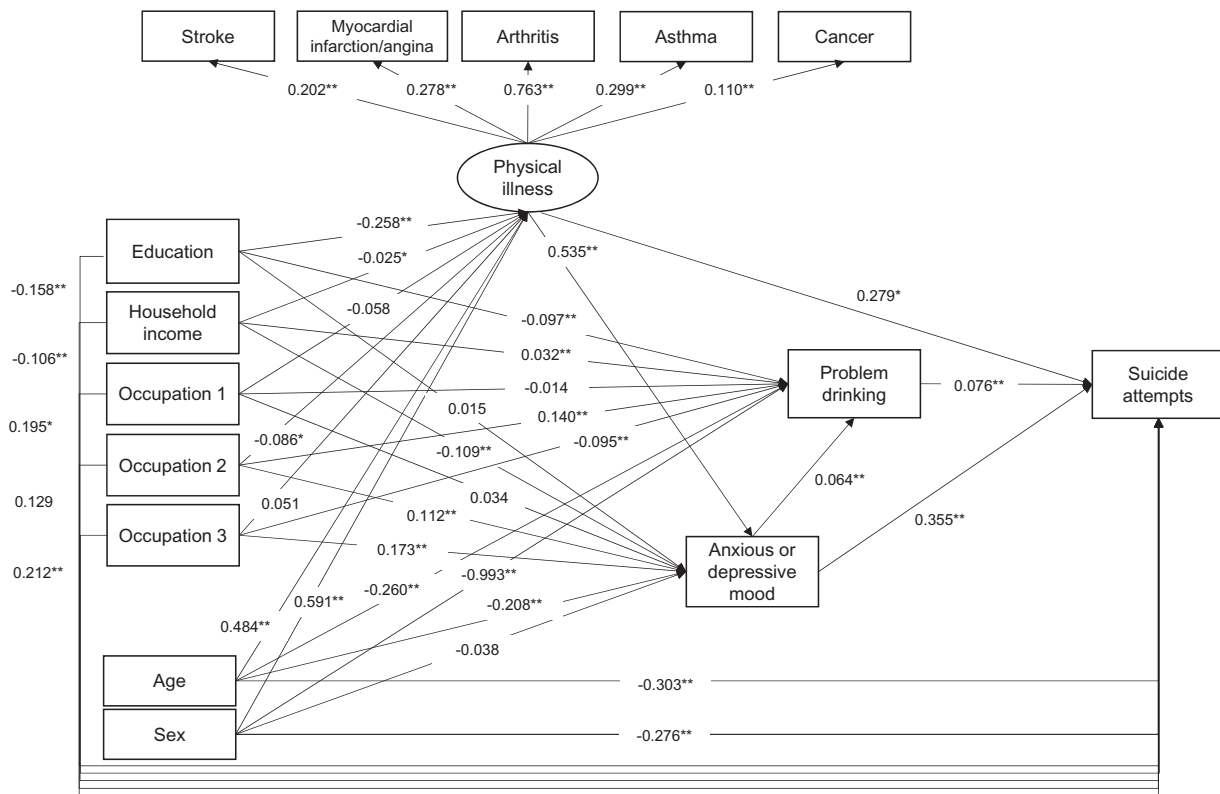
Figure 1. Standardized coefficients of socioeconomic and mediating variables for suicide attempts from the structural equation model. (occupation 1: manager or office work compared to manual work, occupation 2: service or sales compared to manual work, occupation 3: nonemployment compared to manual work, *: P < .05, **: P < .01).

Assumption 1: Suicide attempts are directly or indirectly affected by sociodemographic characteristics (e.g., SEP, age, and sex), physical illness (stroke, myocardial infarction (MI) or angina, arthritis, asthma, and cancer), anxious or depressed mood, and degree of problem drinking.[19–22]

Assumption 2: Sociodemographic characteristics affect physical illness, anxious or depressed mood, and degree of problem drinking.[23–25]

Assumption 3: Physical illness affects anxious or depressed mood.[20]

Assumption 4: Anxious or depressed mood affects degree of problem drinking.[19]

2.2. Study sample

Participants were selected from data of 7 years (2007–2013) of the Korean National Health and Nutrition Examination Survey (KNHANES), which is a nationwide cross-sectional survey of the health and nutritional status of noninstitutionalized Korean people. This survey used stratified, multistage probability sampling design based on geographic area, age, and sex for the selection of household units. Data of the survey were collected through 3 types of survey methods; a health interview, health examination, and nutritional survey. We limited the sample to those aged ≥ 30 years, because the status of education and occupation of some early career younger individuals are still changing. Among the 38,503 participants aged ≥ 30 years, 35,346 participants (91.8%) answered the question about suicide attempts. In the final analysis, total 34,565 participants were included after excluding the 3157 and the 781 participants who did not answer either to the question about suicide attempts or to independent variables. This study was approved by the Institutional Review Board of Eulji University, Korea (EUIRB2016-59).

2.3. Measurement

Suicide attempts were measured by responses ("*yes*" or "*no*") to the following question, "Have you ever attempted suicide in the last 12 months?" Socioeconomic variables included educational attainment (primary school, middle school, high school, or university); occupational group (not employed, physical work, service/sales work, or manager/office work); and level of household income (low, mid-low, mid-high, or high). Household income was calculated as total monthly household income divided by the square root of the family size, and categorized into the quartiles according to age and sex in each year of the survey.

We selected several physical illnesses associated with suicidality, including stroke, myocardial infarction/angina, osteoarthritis/rheumatic arthritis, asthma, and cancer[26–30] and assessed their current prevalence. For example, stroke was measured by responses ("*yes*" or "*no*") to the following question, "Do you currently suffer from stroke?" The degree of problem drinking was measured according to the Korean version of the Alcohol Use Disorders Identification Test (AUDIT), which is a brief screening tool for hazardous drinking.[31] Problem drinking was categorized by AUDIT-K Scores into none or low (0–7), medium (8–15), high (16–19), and very high (20–40), as recommended by the World Health Organization.[32] The level of problem drinking was used for the analysis, except for the SEM, in which the AUDIT score itself was included. Anxious or depressed mood was assessed by a question included in the EuroQol 5-dimensional questionnaire. Respondents were asked to choose

one among the following 3 options: not/moderately/extremely anxious or depressed.

2.4. Statistical analysis

Differences in the prevalence of suicide attempts according to sociodemographic characteristics, physical illness, anxious or depressed mood, and degree of problem drinking were assessed using the chi-square test. The chi-square test was conducted using SPSS version 24 (IBM, Chicago, IL).

SEM was performed using MPlus 7.4 (Muthen and Muthen, 2015) to examine the direct and indirect effects of SEP on suicide attempts while considering physical illness, anxious or depressed mood, and problem drinking as mediators. We used the weighted least square mean and variance method, which weighs the error of categorical variables, and the theta parameterization method, which uses residual variances, because the model included binary covariates.[33] The pairwise deletion method was used to handle missing data in dependent variables, as this method allows incomplete data to be used, but observations with a missing value in independent variables were excluded from the analysis (n= 781, 2.0%). Comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and chi-square test were used to assess the SEM's data fitness. Bootstrapping was used to obtain for the parameter estimates and confidence interval for the indirect effects of socioeconomic and mediating variables on suicide attempts. Results from weighted and unweighted analysis were similar and we presented unweighted results here.

3. Results

The median and range of age among the 34,565 participants were 52 and 30–101 years, respectively; 57.7% of participants were female. The annual prevalence of suicide attempts was 0.9% (n= 315). With the exception of sex, all variables related to sociodemographic characteristics, physical illness, anxious or depressed mood, and problem drinking were significantly associated with the prevalence of suicide attempts (Table 1). As the level of education and occupation (in the following order: management/office work, service/sales, physical work, and not employed), and household income increased, the prevalence of suicide attempts decreased significantly. In general, the prevalence gradually increased, as the degree of problem drinking increased to very high level (Table 1).

Figure 1 shows the standardized coefficients and the statistical significance of the pathway estimated in the SEM. The SEM model fit was considered good based on former 3 indices (RMSEA=0.023, CFI=0.931, and TLI=0.873), though the chi-square estimates were not satisfactory (X^2=12179.6, df=84). This decision was made, because the chi-square test tends to reject the null hypothesis too frequently if the sample size is large.[34]

Low levels of educational attainment (β=−0.158, P<.01) and household income (β=−0.106, P<.01), and manager or office work (β=0.195, P=.02) and nonemployment (β=0.212, P<.01) were significantly associated with a higher prevalence of suicide attempts. In general, the pathway linking educational attainment to suicide attempts was mainly mediated through physical illness and problem drinking, whereas the pathway from level of household income to suicide attempts were mainly mediated through anxious or depressed mood and problem drinking. Compared to manual work, nonemployment had a significant indirect effect on suicide attempts, mainly through anxious or

Table 1

Prevalence of suicide attempts according to sociodemographic characteristics, physical illness, anxious or depressed mood, and problem drinking.

Characteristics	N	%	Suicide attempts N	%	χ^2	P
All	34,565	100.0	315	0.9		
Sex					3.472	.06
Male	14,623	42.3	117	0.8		
Female	19,942	57.7	198	1.0		
Age					27.394	<.01
30–64	25,527	73.9	192	0.8		
65+	9038	26.1	123	1.4		
Educational attainment					117.417	<.01
Primary school graduate	10,516	30.4	173	1.7		
Middle school graduate	4223	12.2	51	1.2		
High school graduate	10,697	31.0	65	0.6		
University graduate	9129	26.4	26	0.3		
Occupational group					48.803	<.01
Manger/office work	6280	18.2	26	0.4		
Service/sales	4198	12.1	30	0.7		
Manual work	9907	28.7	72	0.7		
Not employed	14,180	41.0	187	1.3		
Household income					123.858	<.01
Low	7535	21.8	144	1.9		
Mid-low	8796	25.4	76	0.9		
Mid-high	9069	26.2	67	0.7		
High	9165	26.5	28	0.3		
Stroke					11.985	<.01
No	33,992	98.3	302	0.9		
Yes	571	1.7	13	2.3		
Myocardial infarction or angina					16.728	<.01
No	33,710	97.5	296	0.9		
Yes	854	2.5	19	2.2		
Osteoarthritis or rheumatic arthritis					65.933	<.01
No	29,186	84.4	214	0.7		
Yes	5377	15.6	101	1.9		
Asthma					17.536	<.01
No	33,791	97.8	297	0.9		
Yes	774	2.2	18	2.3		
Cancer					9.270	<.01
No	33,998	98.4	303	0.9		
Yes	567	1.6	12	2.1		
Anxious or depressive mood					869.028	<.01
None	29,973	86.7	150	0.5		
Moderate	4208	12.2	114	2.7		
Extreme	378	1.1	51	13.5		
Degree of problem drinking					18.262	<.01
None or low	25,428	73.9	218	0.9		
Medium	5568	16.2	40	0.7		
High	1735	5.0	24	1.4		
Very high	1676	4.9	28	1.7		

depressed mood and problem drinking. Also, direct effects of all 3 mediators showed statistical significance; anxious or depressed mood, physical illness, and degree of problem drinking. Among socioeconomic variables, nonemployment compared to manual work showed the largest total effect (β=0.291, $P < .01$) on suicide attempts. Among all independent variables, including socioeconomic factors and mediators, physical illness had the greatest total effect on suicide attempts (β=0.472, $P < .01$). Physical illness showed the largest direct effect (β=0.279, $P = .02$) following anxious or depressed mood; it also showed the largest indirect effect (β=0.192, $P < .01$) among all independent variables (Table 2, 3).

3.1. Discussion and conclusions

In this nation-wide cross-sectional study, significant direct and indirect effects were consistently observed across socioeconomic variables, including educational attainment, household income, and occupational group. The current study found differences in the mediating factors in linking the impacts of socioeconomic variables on suicide attempt: the effect of educational attainment was primarily mediated by physical illness and problem drinking, whereas household income and occupational group were mainly mediated by anxious or depressive mood and problem drinking. Additionally, physical illness plays a major role in explaining suicide attempts, compared to mental health problem (Table 2).

Table 2

Direct and indirect effects of socioeconomic and mediating variables on suicide attempts from the structural equation modeling analysis.

		Direct and indirect effects		Total effects	
Independent variables	Effects	β	P	β	P
Education attainment	Direct	−0.158	<.01	−0.282	<.01
	Indirect	−0.124	<.01		
Household income	Direct	−0.106	<.01	−0.154	<.01
	Indirect	−0.048	<.01		
Occupational group (reference = manual work)					
Manager or office work	Direct	0.195	.02	0.179	.04
	Indirect	−0.016	.39		
Service or sales work	Direct	0.129	.12	0.139	.08
	Indirect	0.010	.61		
Not employed	Direct	0.212	<.01	0.291	<.01
	Indirect	0.079	<.01		
Physical illness	Direct	0.279	.02	0.472	<.01
	Indirect	0.192	<.01		
Anxious or depressive mood	Direct	0.355	<.01	0.360	<.01
	Indirect	0.005	<.01		
Problem drinking	Direct	0.076	<.01	0.076	<.01
	Indirect	−	−		

Table 3

Indirect effects of independent variables through mediators on suicide attempts from the structural equation modeling analysis.

	Indirect effects through mediators		
Independent variables	Mediators	β	P
Education attainment	PI	−0.072	.02
	ADM	0.005	.60
	PD	−0.006	<.01
	PI → ADM	−0.049	<.01
	ADM → PD	0.000	.62
	PI → ADM → PD	−0.001	<.01
Household income	PI	−0.007	.13
	ADM	−0.039	<.01
	PD	0.002	<.01
	PI → ADM	−0.005	.06
	ADM → PD	−0.001	<.01
	PI → ADM → PD	0.000	.12
Occupational group (reference = manual work)			
Manager or office work	PI	−0.016	.26
	ADM	0.012	.36
	PD	−0.001	.43
	PI → ADM	−0.011	.17
	ADM → PD	0.000	.39
	PI → ADM → PD	0.000	.22
Service or sales work	PI	−0.024	.10
	ADM	0.040	<.01
	PD	0.011	<.01
	PI → ADM	−0.016	.03
	ADM → PD	0.001	.02
	PI → ADM → PD	0.000	.07
Not employed	PI	0.014	.22
	ADM	0.061	<.01
	PD	−0.007	<.01
	PI → ADM	0.010	.09
	ADM → PD	0.001	<.01
	PI → ADM → PD	0.000	.16
Physical illness	ADM	0.190	<.01
	ADM → PD	0.003	<.01
Anxious or depressive mood Problem drinking	PD	0.005	<.01

(Note: Each indirect effect of independent variables on suicide attempts through respective mediator is presented. For example, indirect effects of education attainment on suicide attempts via physical illness and through the pathway of education attainment → physical illness → anxious or depressive mood → suicide attempts were −0.072 (P=.02) and −0.049 (P<.01), respectively. ADM=anxious or depressed mood, PI= physical illness, PD=problem drinking).

3.2. Comparison with previous studies

Consistent with the previous studies,[35,36] we observed significant direct effects of SEP on suicide attempts, providing support to the hypothesis that low SEP directly increases the risk of suicide attempts without going through mediators. Given the strongest association between nonemployment status and suicide attempts, this finding may be partly attributed to work and employment-related factors such as job insecurity and job stressors[37] in rapidly industrializing East Asian societies, where the relative contribution of socioeconomic factors to suicide is more substantial, compared to Western countries.[38] The working environment in Korea has become increasingly competitive and workers marginalized to performing peripheral labour or detached from the labour market experience a reduced chance of re-entry into the labor force. Similarly, those with low income find it difficult to establish a secure standard of living, as income gap between rich and poor increases.[39] These socioeconomic hardships, along with a low level education, are likely to exhaust resources to cope with stressors[40] and increase the risk of suicidal behavior.

The current study also showed significant indirect effects of SEP on suicide attempts, though these were relatively smaller than the direct effects. This finding suggests that SEP poses an increased risk of unhealthy behavior (e.g., drinking and smoking) and unfavorable health outcomes (e.g., mental and physical illness), all of which are in turn related to suicide attempts. This accords with the life-course perspective, which holds that SEP does not act alone but works in multiple ways through numerous indirect pathways in the course of accumulation of adversity, leading to further declines in SEP and health. Likewise, this study supports the notion that the effects of early disadvantage, including lower SEP, precede and may be amplified by mediating events, such as physical and mental illness that serve as additional risk factors for later suicide.

The strengths of the associations between SEP and suicide attempts differed by measures and nonemployment status had the largest total and direct effects, while educational attainment had the largest indirect effect. In addition, our finding suggests that, in mediating socioeconomic influences to suicidal attempts, the

relative contribution of involving mediators also differed and educational attainment was more attributed to biomedical (e.g., physical illness) and behavioral (e.g., problem drinking) pathway, while household income and occupational group were more attributed to psychosocial (e.g., mental health problem) and behavioral (e.g., problem drinking) pathway. Previous studies, including a review, mostly supported the inverse associations linking nonemployment to suicide attempts and suicides, but they were inconsistent with regard to the strength of association. In general, the differences in findings can be explained by the way of identification of subtypes of employment status. As shown in the current study, the effect size became larger, when the dichotomy between employed and nonemployed was further refined; for example, when unemployment was defined as those who are actively seeking a job,[41] or when specific types of employment, such as part-time job or precarious work were differentiated.[42] The differences in the magnitude of the association were also related to other factors, such as duration of unemployment (increases until 5 years),[43] availability of unemployment benefits, and economic fluctuations.[44] The stronger indirect effects of educational attainment may arise because of time gap between the completion of one's education, which typically occurs in early adulthood, and later suicide attempts. Why the effect size of household income is smaller than that of unemployment or education, is not entirely clear. One explanation is that household income may not accurately represent material status and fail to capture socioeconomic variation in this population, particularly among older people, because of the insufficiency of information on diverse income sources.[45] If under-reporting of income sources was more associated with the respondents with higher income level, this may have resulted in underestimation of the effect size.

Our study adds supports to the recent evidence that physical illness plays a major role as a mediator of the association between SEP and suicide attempts. One study that considered the prevalence of overall physical illness, rather than an individual illness found that a quarter of all suicides were attributed to the occurrence of physical illnesses.[46] Our finding regarding the total effects of multiple and overall physical illnesses complements and extends previous researches that focused on the effects of an individual physical illness on suicidal behavior, in which results have been mixed and sometimes reported absent or opposite associations for diseases such as diabetes and breast cancer.[47] This finding may be relevant to the Korean context, where, those, particularly older people, who suffer multiple physical illnesses, are frequently the most socioeconomically vulnerable group and thus are possibly directed to suicide without referring to mental health services. The policy implication of this finding underscore the importance of a balanced and comprehensive approach, targeting both the high risk population having mental health problems with low prevalence and also general population having physical illness and lower SEP with relatively high prevalence, as suggested by an earlier review.

In conclusion, both the direct and indirect effects of SEP on suicide attempts were significant, but the former was larger than the latter. Physical illness played a major role in explaining suicide attempts, compared to mental health problem and problem drinking. This carries particular policy implication to the suicide prevention program in Korea, which is fragmented largely around high risk group with mental health problem. The Korean suicide prevention program needs to be widened to encompass population with general problems such as physical illness and lower SEP, consistent with the traditional[48,49] and recent public health perspectives.[50,51]

3.3. Methodological strengths and limitations

This study had some limitations. First, the ability to draw causal inferences from our results is limited due to the cross-sectional nature of the study and explanations relying on reverse causation are also possible, in which physical or mental health problems can cause low SEP. For example, some of not employed respondents may have decided early retirement because of long-term illnesses. As such, the association might be in part, the result of illness, but this influence may not have been strong enough to change the direction of the association. One advantage of measuring educational attainment is related to the fact that education is completed by early adulthood. As a consequence, reverse causation may be less likely to intervene the association. The second limitation concerns the lack of available data. Suicide attempts instead of completed suicide were used as a main outcome, because the former were not observed. Thus, our results may have underestimated the actual association between SEP and suicide, as the effect of SEP on completed suicide would be expected to be higher than that on suicide attempts.[1] Similarly, we examined a limited range of mediating factors, and the role of mental disorders were not fully assessed due to a lack of available information in the KNHANES. Additional studies that cover a complete suicide and a wide range of mediating variables would be important for developing more accurate estimates of associations.

A major strength of this study is that the association between SEP and suicidal behavior was further clarified by examining both direct and indirect pathways and 3 mediating factors concurrently. The use of 3 SEP measures may help to extend the span of conceptual domain of each SEP indicator. This is the first study to undertake a detailed examination of the mediating variables, including physical illness, related to suicide attempts in the context of 3 SEP indicators using nationally representative data.

References

[1] Kim M-H, Jung-Choi K, Jun H-J, et al. Socioeconomic inequalities in suicidal ideation, parasuicides, and completed suicides in South Korea. Social Sci Med 2010;70:1254–61.

[2] WHO. Preventing suicide: a global imperative. 2014. http://www.who.int/mental_health/suicide-prevention/world_report_2014/en/.

[3] Milner A, Page A, LaMontagne AD. Long-term unemployment and suicide: a systematic review and meta-analysis. PloS One 2013;8:e51333.

[4] Qin P, Agerbo E, Mortensen PB. Suicide risk in relation to socioeconomic, demographic, psychiatric, and familial factors: a national register-based study of all suicides in Denmark, 1981–1997. Am J Psychiatr 2003;160:765–72.

[5] Lee WY, Khang YH, Noh M, et al. Trends in educational differentials in suicide mortality between 1993–2006 in Korea. Yonsei Med J 2009;50:482–92.

[6] Deaton A. On death and money: history, facts, and explanations. JAMA 2016;315:1703–5.

[7] Demakakos P, Biddulph JP, Bobak M, et al. Wealth and mortality at older ages: a prospective cohort study. J Epidemiol Community Health 2016;70:346–53.

[8] Leischik R, Dworrak B, Strauss M, et al. Plasticity of health. German J Med 2016;1:1–7.

[9] Mackenbach JP, Stirbu I, Roskam AJ, et al. Socioeconomic inequalities in health in 22 European countries. N Engl J Med 2008;358:2468–81.

[10] Fuchs VR. Social determinants of health: caveats and nuances. JAMA 2017;317:25–6.

[11] Wilkinson RG. Unhealthy Societies: The Afflictions of Inequality. 2002; Routledge, Abingdon, UK:255.

[12] Neckerman KM, Torche F. Inequality: causes and consequences. Ann Rev Sociol 2007;33:335–57.

[13] Chesney E, Goodwin GM, Fazel S. Risks of all-cause and suicide mortality in mental disorders: a meta-review. World Psychiatr 2014;13:153–60.

[14] Shim E-J, Song YW, Park S-H, et al. Examining the relationship between pain catastrophizing and suicide risk in patients with rheumatic disease:

the mediating role of depression, perceived social support, and perceived burdensomeness. Int J Behav Med 2017;24:1–2.

[15] Bolton JM, Walld R, Chateau D, et al. Risk of suicide and suicide attempts associated with physical disorders: a population-based, balancing score-matched analysis. Psychol Med 2015;45:495–504.

[16] MacLean J, Kinley DJ, Jacobi F, et al. The relationship between physical conditions and suicidal behavior among those with mood disorders. J Affect Disord 2011;130:245–50.

[17] Skalicka V, van Lenthe F, Bambra C, et al. Material, psychosocial, behavioural and biomedical factors in the explanation of relative socio-economic inequalities in mortality: evidence from the HUNT study. Int J Epidemiol 2009;38:1272–84.

[18] OECDOECD Labour Force Statistics. OECD Publishing, Cedex, France: 2015.

[19] Ganz D, Sher L. Suicidal behavior in adolescents with comorbid depression and alcohol abuse. Minerva Pediatr 2009;61:333–47.

[20] Goodwin RD, Kroenke K, Hoven CW, et al. Major depression, physical illness, and suicidal ideation in primary care. Psychosom Med 2003;65:501–5.

[21] Li Z, Page A, Martin G, et al. Attributable risk of psychiatric and socio-economic factors for suicide from individual-level, population-based studies: a systematic review. Soc Sci Med 2011;72:608–16.

[22] Minkoff K, Bergman E, Beck AT, et al. Hopelessness, depression, and attempted suicide. Am J Psychiatry 1973;130:455–9.

[23] Everson SA, Maty SC, Lynch JW, et al. Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. J Psychosom Res 2002;53:891–5.

[24] Pratt L. The relationship of socioeconomic status to health. Am J Public Health 1971;61:281–91.

[25] Van Oers J, Bongers I, Van de Goor L, et al. Alcohol consumption, alcohol-related problems, problem drinking, and socioeconomic status. Alcohol Alcohol 1999;34:78–88.

[26] Ahn E, Shin DW, Cho S-I, et al. Suicide rates and risk factors among Korean cancer patients. Cancer Epidemiol Biomarkers Prev 2010;19:2097–105.

[27] Goodwin RD, Demmer RT, Galea S, et al. Asthma and suicide behaviors: results from the Third National Health and Nutrition Examination Survey (NHANES III). J Psychiatr Res 2012;46:1002–7.

[28] Placido A, Sposito AC. Association between suicide and cardiovascular disease: time series of 27 years. Int J Cardiol 2009;135:261–2.

[29] Pompili M, Venturini P, Campi S, et al. Do stroke patients have an increased risk of developing suicidal ideation or dying by suicide? An overview of the current literature. CNS Neurosci Ther 2012;18:711–21.

[30] Timonen M, Viilo K, Hakko H, et al. Suicides in persons suffering from rheumatoid arthritis. Rheumatology 2003;42:287–91.

[31] Bush K, Kivlahan DR, McDonell MB, et al. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Arch Int Med 1998;158:1789–95.

[32] Kim SS, Gulick EE, Nam KA, et al. Psychometric properties of the alcohol use disorders identification test: a Korean version. Arch Psychiatr Nurs 2008;22:190–9.

[33] Hye-Jeong Choi MRB. Monte Carlo study for comparison of weighted least square mean and variance (WLSMV) and maximum likelihood (ML) on the latent growth modeling with categorical repeated measures. J Educ Eval 2007;20:213–32.

[34] Browne MW, Cudeck R. Alternative ways of assessing model fit. Sociol Methods Res 1992;21:230–58.

[35] Aschan L, Goodwin L, Cross S, et al. Suicidal behaviours in South East London: prevalence, risk factors and the role of socio-economic status. J Affect Disord 2013;150:441–9.

[36] Gong Y, Zhang L, Wang Z, et al. Pathway analysis of risk factors for severe suicidal ideation: a survey in rural China. Canadian J Public Health 2011;102:472–5.

[37] Milner A, Witt K, LaMontagne AD, et al. Psychosocial job stressors and suicidality: a meta-analysis and systematic review. Occup Environ Med 2017;[Epub ahead of print].

[38] Phillips MR, Liu H, Zhang Y. Suicide and social change in China. Cult Med Psychiatry 1999;23:25–50.

[39] Koh YS. Scholz JK, Moon HP, Lee SH. The social safety net in Korea: from welfare to workfare. Social Policies in an Age of Austerity: A Comparative Analysis of the US and Korea: 2015;Edward Elgar Publishing, 44–80.

[40] Antonovsky A. Health, Stress and Coping. Jossey-Bass, San Francisco: 1979.

[41] Taylor R, Page A, Morrell S, et al. Socio-economic differentials in mental disorders and suicide attempts in Australia. Br J Psychiatry 2004;185:486–93.

[42] Min KB, Park SG, Hwang SH, et al. Precarious employment and the risk of suicidal ideation and suicide attempts. Prev Med 2015;71:72–6.

[43] Kolves K, Milner A, Varnik P. Suicide rates and socioeconomic factors in Eastern European countries after the collapse of the Soviet Union: trends between 1990 and 2008. Sociol Health Illn 2013;35:956–70.

[44] Cylus J, Glymour MM, Avendano M. Do generous unemployment benefit programs reduce suicide rates? A state fixed-effect analysis covering 1968–2008. Am J Epidemiol 2014;180:45–52.

[45] Guilley E, Bopp M, Faeh D, et al. Socioeconomic gradients in mortality in the oldest old: a review. Arch Gerontol Geriatr 2010;51:e37–40.

[46] Qin P, Hawton K, Mortensen PB, et al. Combined effects of physical illness and comorbid psychiatric disorder on risk of suicide in a national population study. Br J Psychiatry 2014;204:430–5.

[47] Juurlink DN, Herrmann N, Szalai JP, et al. Medical illness and the risk of suicide in the elderly. Arch Intern Med 2004;164:1179–84.

[48] Lalonde M. A New Perspective on the Health of Canadians—A Working Document. Ottawa: Government of Canada; 1974.

[49] WHO. The Ottawa Charter for Health Promotion. New York: New York: World Health Organization; 1986.

[50] Kickbusch I. Healthy Societies: Addressing 21st Century Health Challenges. Department of the Premier and Cabinet, Government of South Australia, Adelaide, Australia:2008.

[51] WHOPreventing Suicide: A Global Imperative. New York: World Health Organization; 2014.