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Positive and negative social support and depressive symptoms according to economic status among adults in Korea: A multilevel regression analysis

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Positive and negative social support and depressive symptoms according to economic status among adults in Korea? A multilevel regression analysis results from the Health Examinees Study

ABSTRACT

Objectives: Associations between positive and negative social support and risk of depression according to economic status have not been explored. We aimed to examine the associations of positive and negative social support with the risk of depressive symptoms among urban-dwelling adults in Korea, focusing on interactions with socioeconomic status.

Design: We used the first wave of a large-scale cohort study called The Health Examinees Study. Positive and negative support scores each ranged between 0–6; the variables were then categorized into low, medium, and high groups. A two-level random intercept linear regression model was used, where the first level is individual and the second is the community. We further tested for interactions between household income and types of social support.

Setting: A survey conducted at 38 health examination centers and training hospitals in major Korean cities and metropolitan areas during 2004-2013.

Participants: 21,208 adult men and women.

Outcome measures: Depressive symptoms score measured by Epidemiologic Studies-Depression Scale, with scores ranging from 0 to 60.

Results: Level of positive social support was significantly negatively associated with

depressive symptom score, whereas level of negative support was significantly positively associated with depressive symptoms. Tests for interaction terms showed that these associations were stronger in individuals with lower income, compared with their more affluent counterparts.

Conclusions: Our findings highlight the benefits of positive support and the risk of exposure to negative support for the mental health of Korean adults with low income. Strategies for encouraging positive social support and discouraging negative social support for disadvantaged individuals might be reasonable ways of reducing depression in that group.

Keywords: Depressive symptoms, multi-level regression, social capital, social support.

Strengths and limitations of this study

- To the best of our knowledge, this is the first study to explore the difference in association between positive and negative social support and depressive symptom according to economic status.
- The article is based on large study involving 21,208 Korean adults.
- The study design is cross-sectional, and hence can only reveal associations between social support and depressive symptom.
- We used health examination centers where respondents were recruited as a proxy for community, which is not an accurate geographical classification.

INTRODUCTION

Depression has been proven to be associated with adverse health outcomes including increased susceptibility to disease through multiple mechanisms, such as disrupted immune functioning[1-3] and altered health-related behavioral patterns (e.g., excessive alcohol use, smoking, poor diet).[4 5] Socioeconomically disadvantaged people disproportionately experience conditions that elevate the risk of depression, such as precarious work, job loss, financial insecurity, or disadvantaged living environment.[6-9] Urban dwellers, especially those in developed countries such as Canada and the United Kingdom, are usually more vulnerable to depression than those living in rural areas, owing to several possible factors, including more frequent encounters with uneven distribution of socioeconomic status (SES), stress from work, higher rate of separated or divorced marital status, high rate of suffering from crime, and poor social cohesion.[10-13]

Positive social support has been shown to be protective against risk of depression by buffering the effects of stress.[4 14-17] Specifically, instrumental support, such as tangible assistance (labor, in kind) and financial support (e.g., cash loans), has been demonstrated to lower the risk of depression by assisting individuals in coping with everyday hardships and facilitating their socioeconomic mobility.[18 19] Emotional support such as companionship and intimacy can also buffer the individual from the harmful effects of stress.[20 21] However, social support does not always give rise to positive experiences, however well-meaning the intentions of the support giver may be. Social support can be negative when it is unwanted, at odds with the needs of the

recipient, or when it makes the recipient uncomfortable, which could unintentionally serve as a potential source of stress.[22-25] Thus, positive and negative supports represent two separate domains of social experience and may have independent effects on depression via different mechanisms.[22 26 27] In addition, there is a high chance that a low level of positive support or high level of negative support is associated with a higher risk of depressive symptoms when combined with conditions of low SES. For example, better educated people may have the capacity to obtain information for coping with depressive moods from various sources other than their social networks. Similarly, better-off people can afford to hire people or purchase things that can help them avoid depressive situations.

To date, only a handful of studies have investigated the separate effects of positive and negative social support on depressive symptoms. Moreover, studies on whether the effects of social support vary by SES are even rarer. Most studies have focused only on the relationships between financial deprivation and depressive symptoms[28-30] or on the protective influence of social support on depression.[14-17]

To address this research gap, the current study sought to address the following two research aims. The first was to examine the association between positive and negative social support and depressive symptoms. The second aim was to explore the interaction between the two domains of social support and economic status.

METHODS

Data source

Our data came from a large-scale genomic cohort study called The Health Examinees-Gem (HEXA-G), which was established to investigate the epidemiologic characteristics of major chronic diseases in Korean adults living in urban areas. Target participants, adult males and females aged 40–69, were recruited prospectively at 38 health examination centers or training hospitals located in 8 regions in Korea when they visited for their government-subsidized health examinations (n = 173,357). The baseline survey was conducted by trained research staff using a standardized questionnaire, which included information on sociodemographic characteristics, medical history, medication usage, lifestyles, dietary habits, and social capital. Written informed consent was obtained from all participants. The study protocol was approved by the Ethics Committee of the Korean Health and Genomic Study of the Korean National Institute of Health, as well as by the institutional review boards of all participating hospitals.[31]

Although the recruitment occurred in two phases (first-phase survey: 2004–2008, second-phase survey: 2009–2013), this study utilized data collected between March, 2009, and March, 2010, because of availability of information on depressive symptoms. More detailed information about the study can be found elsewhere.[32]

Outcome variable

Depressive symptoms were measured using the 20-item version of the Centers for Epidemiologic Studies-Depression Scale (CES-D).[33] Respondents were asked to rate how often, over the preceding week, they experienced symptoms associated with depression, such as restless sleep, poor appetite, and feelings of loneliness. Possible scores ranged

between 0 and 3 for each item (0 = less than one day per week, 1 = 1–2 days per week, 2 = 3–4 days per week, and 3 = more than 6 days per week). The overall score, obtained by summation of the individual items, has a possible range of 0–60, with higher scores indicating more severe depressive symptoms (Supplemental table 1).

Social support

Positive and negative social supports were measured by 6 items each. Whereas most previous studies have investigated the functional characteristics of social support by measuring positive and negative experiences of social supports (such as appreciation of relationships with others) using the Social Experiences Checklist, the HEXA-G study investigated structural characteristics of social support, such as the presence around the respondent of people who provide certain kinds of positive or negative support in certain situations.Questions about positive social support in our study include both instrumental and emotional dimensions. Questions about negative support also have two dimensions: aggressive types of negative support (causing active harm to the respondent) and passive forms of negative support (such as indifference and neglect) (Supplemental table 2).

Respondents were asked to answer “yes” or “no” to each question. The number of “yes” responses to each of the six questions was summed to create three ordinal groups: low positive/negative support (scores of 0–2 for positive support and 0–1 for negative support), medium positive/negative support (scores of 3–4 for positive support and 2–3 for negative support), and high positive/negative support (scores of 5–6 for positive support and 4–6 for negative support). The cutoff values were determined based on

frequency distribution.

Other explanatory factors

Marital status was categorized into five categories: married or cohabiting, never married, divorced or separated, widowed, and others. Age was divided into ten-year interval groups, starting at 40 years old. The socioeconomic factors of occupational status, education level, and income level were measured. Specifically, respondents were asked to provide their occupational status by choosing among 14 kinds of job categorized by the Korean Standard Classification of Occupation. We grouped these into 7 categories: non-manual (legislators, senior officials, managers, professionals, technicians and associate professionals, clerical support workers), service and sales workers, manual (skilled agricultural, forestry and fishery workers, craft and related trades workers, plant and machine operators and assemblers, elementary occupations), armed forces, housewives, unemployed, and others. Educational attainment was grouped into four levels: primary school or below, high school graduate or below, college degree, and graduate school or higher. Household monthly income was categorized into four levels: < 100, 100 to < 300, 300 to < 600, and ≥ 600 (unit: Korean Won).

We controlled for several community-level SES variables: average income, average educational level, and the employment rate in the community. These were aggregated from their individual-level analogues.

Patient and public involvement

This study did not involve patients. Participants were urban dwellers aged 40–69 who visited hospitals for their government-subsidized health examinations. The findings from this study will be disseminated to the wider public via local media and civil society organizations.

Statistical analyses

We constructed random intercept multi-level models to estimate the association between negative and positive social support and the risk of depressive symptoms while accounting for the clustering of observations at the community level. Because there is no residential address information in our dataset, we used the 38 health examination centers or training hospitals where survey population was recruited as a proxy for communities, assuming that people would visit the nearest centers to their residence for their medical check-ups.

In model 1, we adjusted only for individual-level demographic variables: marital status, age, and gender. Then, individual-level SES variables were added to model 1 to create model 2: occupational status, educational level, and monthly income. The reason for this sequential entering of group of variables was that we wanted to explore whether adjusting for SES would attenuate the association between positive or negative social supports and the outcome variable, assuming that SES might confound association between social supports and depressive symptoms. Model 3 included interaction terms between each domain of social support and household income level.

Finally, we controlled for community-level SES variables in model 4. All statistical tests were two-sided, and statistical significance was determined at $p < 0.05$. Data were analyzed using SAS 9.3 software package.

RESULTS

The total number of respondents who participated in the survey between March, 2009, and March, 2010, was 25,712 in 15 communities. After list-wise deletion of participants with missing data in the independent and outcome variables, the final number of respondents for analysis was 21,208 (Figure 1).

Table 1 shows the descriptive statistics of the sample. The married or cohabiting group, which accounted for almost 90% of the sample, showed the lowest level of depressive symptoms, whereas the separated or divorced category showed the highest level. The difference in depressive symptom scores across age groups was less than 0.3. Men scored lower on depressive symptoms compared with women, on average. Depressive symptoms diminished as education level and monthly income level increased. Among occupations, the group working in the armed forces had the lowest average depressive symptoms score. There was a large difference in average depressive symptom scores across low, medium, and high levels of positive and negative social support groups in the study sample.

Table 1. Descriptive statistics of a study sample of urban adults in Korea.

	n	Proportion (%)	Mean depressive symptom score
Marriage			
Currently married/cohabiting	19,037	89.76	4.25

Never married	514	2.42	5.11
Separated/divorced	671	3.16	8.07
Widowed	957	4.51	6.2
Others	29	0.14	5.59
Age(yrs)			
40≤age<50	8,387	39.55	4.44
50≤age<60	8,098	38.18	4.61
60≤age<70	4,723	22.27	4.34
Gender			
Male	7,978	37.62	3.62
Female	13,230	62.38	5.01
Education			
Primary school or below	3,242	15.29	5.67
High school graduate	12,830	60.50	4.46
College degree	4,277	20.17	3.9
Graduate school or higher	859	4.05	3.31
Job			
Non-manual	3,776	17.80	3.72
Service and sales workers	3,983	18.78	4.22
Manual	4,324	20.39	4.21
Armed forces occupation	24	0.11	2.21
Housewives	7,106	33.51	5.33
Unemployed	1,895	8.94	4
Others	100	0.47	5.37
Income(Korean Won)†			
<100	2,636	12.43	7.08
100 ≤income <300	9,715	45.81	4.42
300 ≤income <600	7,285	34.35	3.86
600 < income	1,572	7.41	3.4
Level of positive social support			
Low	833	3.93	11.51
Medium	1,778	8.38	9.07
High	18,597	87.69	3.73
Level of negative social support			
Low	18,856	88.91	3.66
Medium	1,724	8.13	10
High	628	2.96	14.16

†1 US $ ≒ 1,128 Korea Won

Models 1 and 2 in Table 2 show the linear coefficients and 95% confidence intervals for depressive symptoms according to level of positive social support when only individual-level variables were controlled. Respondents with medium and high

positive social support were more likely to have lower depressive symptom scores compared with the low positive social support group, even when adjusting for individual-level SES characteristics (b = -2.51, p < 0.001 in medium group; b = -6.32, p < 0.001 in high group). There was not much difference in coefficients between models 1 and 2, meaning that positive social capital is inversely associated with depressive symptoms independently of SES.

The interaction term between positive social support and individual income was significantly positive, indicating that the negative association between positive social support and depressive symptoms is stronger at lower income levels (b = 0.52, p < 0.001) (Figure 2). This interaction term remained statistically significant after adjusting for community-level SES (p < 0.001).

Table 2. Association between positive social supports and depressive symptom scores in Korean urban adults.

	Model 1		Model 2		Model 3		Model 4	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Individual level								
Currently married/co-residing								
Never married	*0.64	0.30	0.47	0.30	0.46	0.30	0.46	0.30
Separated/divorced	***3.67	0.26	***2.12	0.26	***2.09	0.26	***2.09	0.26
Widowed	***1.38	0.22	***0.80	0.23	***0.79	0.23	***0.79	0.23
Others	0.54	1.22	0.09	1.21	0.08	1.21	0.08	1.21
40≤age<50(yrs)								
50≤age<60	0.21	0.10	-0.16	0.11	-0.16	0.11	-0.16	0.11
60≤age<70	0.05	0.13	***-0.96	0.14	***-0.95	0.14	***-0.95	0.14
Male								
Female	***1.23	0.10	***0.69	0.12	***0.69	0.12	***0.69	0.12
Non-manual								
Service and sales workers			0.26	0.16	0.26	0.16	0.26	0.16
Manual			-0.16	0.17	-0.15	0.17	-0.15	0.17
Armed forces occupation			-1.83	1.33	-1.83	1.33	-1.83	1.33
Housewives			***0.67	0.16	***0.67	0.16	***0.67	0.16
Unemployed			0.36	0.20	0.37	0.20	0.38	0.20

Others			-0.69	0.66	-0.72	0.66	-0.72	0.66
Primary school or below								
High school graduate			***-0.59	0.14	***-0.58	0.14	***-0.58	0.14
College degree			***-0.82	0.18	***-0.81	0.18	***-0.82	0.18
Graduate school or higher			***-1.15	0.28	***-1.16	0.28	***-1.16	0.28
<100(Korean Won)†								
100 ≤income <300			***-1.57	0.16	***-2.98	0.35	***-2.98	0.35
300 ≤income <600			***-2.16	0.17	***-5.07	0.68	***-5.08	0.67
600 < income			***-2.61	0.23	***-7.03	1.02	***-7.03	1.02
Positive social support(Low level)								
Medium	***-2.73	0.28	***-2.51	0.27	***-3.49	0.35	***-3.50	0.35
High	***-6.69	0.23	***-6.32	0.23	***-8.50	0.54	***-8.50	0.54
Positive social support x income					***0.52	0.12	***0.53	0.12
Community-level								
Share of the employed							9.69	7.50
Mean income level							-4.67	5.41
Mean education level							7.52	4.78

(* $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$) †1 US $ ≒ 1,128 Korea Won

Negative social support was also a strong predictor of depressive symptoms when adjusting for demographics and socioeconomic characteristics at the individual level ($b = 5.08$, $p < 0.001$ in the medium group; $b = 9.06$, $p < 0.001$ in the high group) (Table 3). We also found a significant negative interaction between negative social support and income, indicating that the positive association between negative social support and depressive symptom score was stronger in the lower income group ($b = -0.66$, $p < 0.001$) (Figure 3).

Table 3. Association between negative social support and depressive symptom score in Korean urban adults.

	Model 1		Model 2		Model 3		Model 4	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Individual level								
Currently married/co-residing								
Never married	**0.96	0.29	**0.77	0.29	**0.78	0.29	**0.78	0.29
Separated/divorced	***3.10	0.25	***2.48	0.26	***2.47	0.26	***2.47	0.26
Widowed	***1.83	0.22	***1.19	0.22	***1.23	0.22	***1.23	0.22

Others	-0.41	1.20	-0.87	1.19	-0.96	1.19	-0.96	1.19
40≤age<50(yrs)								
50≤age<60	*0.26	0.10	-0.15	0.11	-0.15	0.11	-0.15	0.11
60≤age<70	*0.27	0.12	***-0.83	0.14	***-0.81	0.14	***-0.82	0.14
Male								
Female	***1.36	0.10	***0.76	0.12	***0.76	0.12	***0.76	0.12
Non-manual								
Service and sales workers			0.27	0.16	0.27	0.16	0.27	0.16
Manual			-0.22	0.16	-0.20	0.16	-0.20	0.16
Armed forces occupation			-2.23	1.31	-2.20	1.31	-2.19	1.31
Housewives			***0.70	0.16	***0.70	0.16	***0.70	0.16
Unemployed			0.33	0.20	0.34	0.20	0.34	0.20
Others			-0.28	0.66	-0.27	0.66	-0.27	0.65
Primary school or below								
High school graduate			***-0.66	0.14	***-0.66	0.14	***-0.66	0.14
College degree			***-0.94	0.18	***-0.94	0.18	***-0.95	0.18
Graduate school or higher			***-1.37	0.28	***-1.39	0.28	***-1.39	0.28
<100(Korean Won)†								
100 ≤income <300			***-1.72	0.15	***-0.92	0.22	***-0.92	0.22
300 ≤income <600			***-2.33	0.17	*-0.78	0.35	*-0.79	0.35
600 < income			***-2.73	0.23	-0.45	0.50	-0.45	0.50
negative social support(Low level)								
Medium	***5.14	0.17	***5.08	0.16	***6.63	0.34	***6.63	0.34
High	***9.29	0.26	***9.06	0.26	***11.98	0.63	***11.98	0.63
Negative social support x income					***-0.66	0.13	***-0.66	0.13
Community-level								
Share of the employed							8.46	6.89
Mean income level							-5.03	4.97
Mean education level							7.71	4.39

(*:p <0.05, **: p<0.01, *** :p<0.001) †1 US $ ≒ 1,128 Korea Won

Regarding the relevance of the other independent variables, being separated or divorced was associated with a higher depressive symptom score, whereas female gender, housewife occupational status, higher education level, and higher income were associated with lower depressive symptom scores compared with their counterparts. No community-level SES variable was significant in both positive and negative social support models.

DISCUSSION

This study, conducted among a sample of urban dwellers in South Korea, showed that a low level of positive social support and a high level of negative social support at the individual level were significantly associated with higher depressive symptom scores. Moreover, it was found that those associations were magnified in the group with low household income.

Our results on the association between positive social support and depressive symptoms are consistent with many previous findings, although there are slight differences in target groups and definition of social support across studies.[14 16 34-36] Generally, a low level of positive social support is associated with higher prevalence or incidence of depressive disorder.

Although the exact pathways through which positive social support acts on mental health outcomes remains unclear, it has been posited generally to occur through two different processes that are not necessarily mutually exclusive. Stated briefly, positive social support may influence psychological wellbeing by buffering the adverse effects of emotional or financial stress (termed the "buffering model"); or it may have a "direct" or "main" effect on mental health by fulfilling a person's need for respect, social recognition, affection, or nurturance, irrespective of stress status (termed the "main effect model").[37]

The effect of negative social support on mental health in adults has been less explored in previous studies than that of positive social support. However, findings related to negative social support from the present study are also in line with previous

similar studies. Two previous studies reported a positive association between negative social exchanges and suicidal behavior in adolescents and college students, respectively.[38 39] Croezen et al. demonstrated that negatively experienced supports are significantly associated with higher prevalence and incidence of poor mental health.[40] Newsom et al. also reported that higher levels of stable negative social exchanges were significantly predictive of lower self-rated health, greater functional limitations, and a higher number of health problems, including mental health, over 2 years after controlling for initial levels of health and sociodemographic variables.[41] The specific process that may account for the association between negative social support and poor mental health has not been explored yet.

A notable finding from the present study is that those with low economic status may receive greater benefits from positive social support or greater damage from negative social supports than those of high economic status. Whereas low economic capacity can be linked to stress, low self-esteem, stigma, feelings of helplessness and hopelessness,[42] and risk for marginalization and social exclusion,[43] these can be counterbalanced by positive social support. Specifically, emotional support, such as understanding, dialogue, appreciation, or getting assistance with problem solving, can provide marginalized poor people with the feeling that they are cared for, esteemed, and valued. Tangible benefits bestowed by another aspect of positive support, named instrumental supports such as help in housework or exchange of material resources, may also assist in coping with materially deprived circumstances.[43] Conversely, negative supports such as perception of arguing, being criticized, feelings of undue demand, or too much intervention may serve as an additional source of stress for poor people who are already psychologically vulnerable due to financial stress.[39]

A similar effect of positive social support on depressive symptoms among the poor has been described in one previous study, where suicide rates of African American teens were lower than those of Whites, despite the fact that their parents were poorer and less employed. It was assumed that the result was probably due to their religiosity, environmental factors, or positive social capital.[44]

The result of the current study may provide important implications in the Korean context. Since the country's economic crisis in late 1990, socioeconomic inequality has deepened, resulting in worsening social polarization, which, in turn, caused a rising prevalence of depression.[45] A downward trend in the suicide rate, from 11.2 in 1985 to 8.8 in 1990, subsequently reversed, increasing from 8.4 in 1991 to 28.5 in 2013 (per 100,000 persons). As a result, South Korea has had the highest suicide rate among Organization for Economy Cooperation and Development countries since 2002.[46] Despite these trends, only a minority of people with depressive disorder seek professional consultation, for fear of the cultural stigma attached to mental illness.[47] Because economic disadvantage has been well recognized as a determinant of depression in Korea,[48] the results of our study provide supporting evidence for interventions encouraging positive social support or discouraging negative social support in underprivileged populations.

Although the poor are more affected by social support than the better off, they also tend to have more limited capacity to control social support on their own by generating positive support or avoiding negative support. For example, people with economic capacity have more access to or opportunities to receive positive emotional support because they can afford private psychologists or clinical counselors. Similary, they have more access to instrumental positive support by hiring private caregivers or

housekeepers when they cannot find those supports among close people around them. Therefore, interventions to mobilize positive social support or prevent negative support for those with limited economic means might be effective for lowering depressive symptoms in society.

Strength and limitations

Although this study is unique in separately analyzing the effects of positive and negative social supports on depressive symptoms according to income level in a large sample, it also has a few limitations to be noted when interpreting the results. First, there is a possibility of reverse causation, given the cross-sectional nature of the study. For example, people with depressive symptoms may become less sociable and less engaged in social networks, thereby eventually reducing social support.[49] Second, we used the 38 health examination centers or training hospitals where target populations were recruited as a proxy for communities. Although this is not geographical classification based on respondents' residential address, equating it with community is assumed to be reasonable; most of people are likely to go to the hospitals nearest to their residence for their government-subsidized medical check-ups, because there is no much difference in quality between hospitals designated for government-subsidized health examination. Third, because no cutoff points for high or low levels of social support were available, we classified sum scores into three ordinal groups considering the number of people belonging to each group. To test the sensitivity of the result to the categorization of social support level, we reran the analyses using the score as a continuous variable. These different ways of categorization produced the almost same results.

CONCLUSION

The present study showed that, at the individual level, both positive and negative social support were associated with depressive symptoms, and these associations were found to be stronger in economically disadvantaged people when adjusting for various control variables at multiple levels. Reducing inequality is always challenging, although most pursue social equality as an ideal. The results of this study suggest that strategies for adjusting positive and negative support among disadvantaged populations might be effective in reducing depressive symptoms in those populations.

Further study is required to reveal the mechanisms by which different types of individual social support operate on depressive symptoms in each economic group in the context of South Korea.

Contributors: HYL and JO conceived the study. HYL led the statistical analysis and drafted the manuscript. JO provided supervision throughout the data analysis and interpretation. IK provided overall guidance and helped to edit language. JH, SK, JL, and DK helped to interpret the data. All authors read and approved the final manuscript.

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Data sharing statement: Data are available from the Korea Centers for Disease Control and Prevention for researchers who meet the criteria for access to the data. Researchers may contact Dr. Yeonjung Kim, Division of Epidemiology and Health Index, Center for Genome Science, Korea.

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Figure Legends

[Figure 1] Derivation process of study sample

[Figure 2] Differential effect of positive support according to income group

[Figure 3] Differential effect of negative support according to income group

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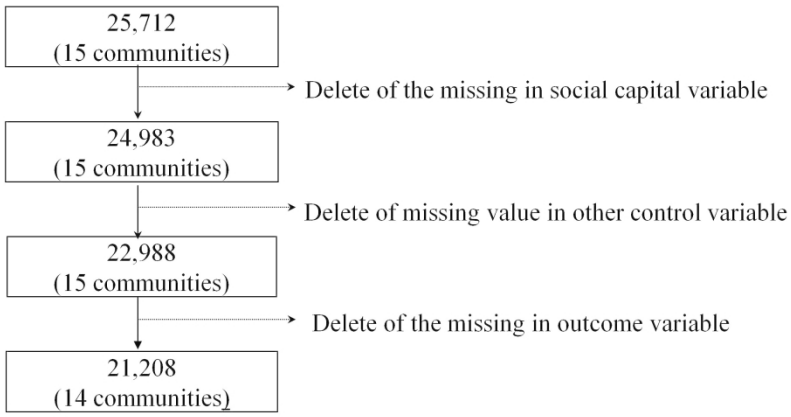

Figure 1. Derivation process of study sample

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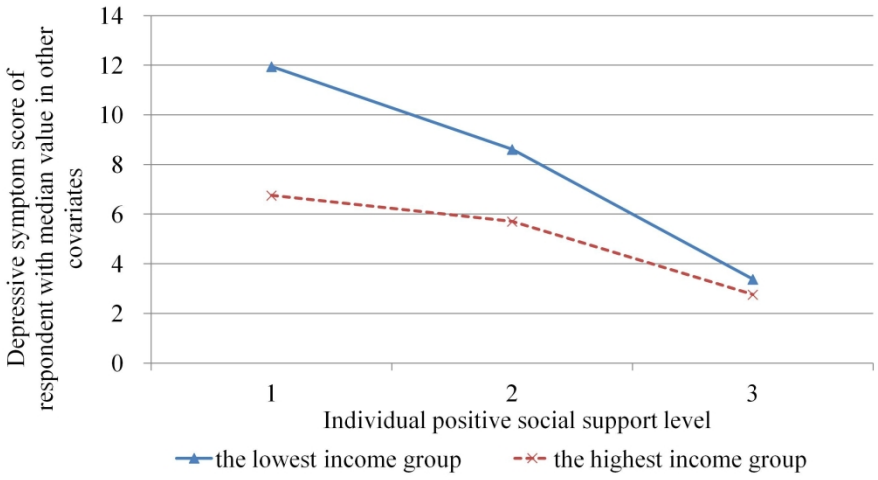

Figure 2. Differential effect of positive support according to income group

Figure 2. Differential effect of positive support according to income group

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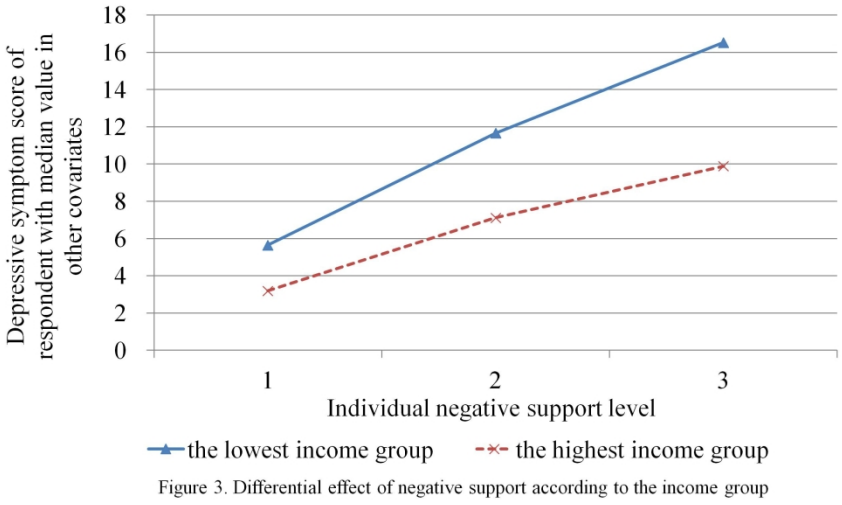

Figure 3. Differential effect of negative support according to the income group

Figure 3. Differential effect of negative support according to income group

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Supplemental Table 1. 20-items of the Centers for Epidemiologic Studies-Depression Scale (CES-D)

1. I was bothered by things that usually don't bother me.
2. I did not feel like eating; my appetite was poor
3. I felt that I could not shake off the blues even with help from my family or friends.
4. I had trouble keeping my mind on what I was doing.
5. I was happy.
6. I felt depressed.
7. I felt that everything I did was an effort.
8. I felt hopeful about the future.
9. I thought my life had been a failure.
10. I felt I was just as good as other people
11. My sleep was restless. I had a lot of trouble getting to sleep.
12. I felt fearful.
13. I talked less than usual.
14. I felt lonely.
15. I enjoyed life.
16. People were unfriendly.
17. I had crying spells.
18. I felt sad.
19. I felt that people disliked me.
20. I could not get going.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-8
Bias	9	Describe any efforts to address potential sources of bias	*9*
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	10
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10(Figure1)
		(b) Give reasons for non-participation at each stage	10(Figure1)
		(c) Consider use of a flow diagram	10(Figure1)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10-11(Table 1)
		(b) Indicate number of participants with missing data for each variable of interest	10(Figure1)
Outcome data	15*	Report numbers of outcome events or summary measures	10-11(Table 1)
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-14(Table 2 & 3)
		(*b*) Report category boundaries when continuous variables were categorized	7-8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Positive and negative social support and depressive symptoms according to economic status among adults in Korea: A multilevel regression analysis from the Health Examinees-Gem Study

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Positive and negative social support and depressive symptoms according to economic status among adults in Korea: A multilevel regression analysis from the Health Examinees-Gem Study

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Positive and negative social support and depressive symptoms according to economic status among adults in Korea: A multilevel regression analysis from the Health Examinees-Gem Study

ABSTRACT

Objectives: The interaction between positive and negative social support as well as between each domain of social support and income on depressive symptom have not been much explored. We aimed to examine the associations of positive and negative social support with the risk of depressive symptoms among urban-dwelling adults in Korea, focusing on those interaction effects.

Design: We used the first wave of a large-scale cohort study called The Health Examinees-Gem Study. Positive and negative support scores each ranged between 0–6; the variables were then categorized into low, medium, and high groups. A two-level random intercept linear regression model was used, where the first level is individual and the second is the community. We further tested for interactions between each domain of social supports and household income.

Setting: A survey conducted at 38 health examination centers and training hospitals in major Korean cities and metropolitan areas during 2009-2010.

Participants: 21,208 adult men and women in Korea.

Outcome measures: Depressive symptoms score measured by Epidemiologic Studies-Depression Scale, with scores ranging from 0 to 60.

Results: Level of positive social support was significantly negatively associated with depressive symptom, whereas the level of negative support was significantly positively associated with depressive symptoms. These associations were proved to be stronger in lower income group in tests for interaction terms of household income and each domain of social supports. The interaction between positive and negative social supports revealed that one domain of social support mediates the effect of the other domain of social support on depressive symptom.

Conclusions: Our findings suggest that strategies for encouraging positive social support and discouraging negative social support for disadvantaged individuals might be effective in reducing depression in Korea.

Keywords: Depressive symptoms, multi-level regression, social capital, social support.

Strengths and limitations of this study

- To the best of our knowledge, this is the first study to explore the difference in the association between positive and negative social support and depressive symptom according to a different level of social support and economic status.
- The article is based on a large study involving 21,208 Korean adults.
- The study design is a cross-sectional, and hence can only reveal associations between social support and depressive symptom.
- We used health examination centers where respondents were recruited as a proxy for the community, which is not an accurate geographical classification.

INTRODUCTION

Depression has been proven to be associated with adverse health outcomes including increased susceptibility to disease through multiple mechanisms, such as disrupted immune functioning[1-3] and altered health-related behavioral patterns (e.g., excessive alcohol use, smoking, poor diet).[4 5] In addition, depression is linked to suicide. Suicide is considered to be a sequel of depression.[6 7] Positive social support has been shown to be protective against risk of depression by buffering the effects of stress.[4 8-11] Specifically, instrumental support, such as tangible assistance (labor, in kind) and financial support (e.g., cash loans), has been demonstrated to lower the risk of depression by assisting individuals in coping with everyday hardships and facilitating their socioeconomic mobility.[12 13] Emotional support such as companionship and intimacy can also buffer the individual from the harmful effects of stress.[14 15] On the other hand, social support does not always give rise to positive experiences, however well-meaning the intentions of the support giver may be. Social support can be negative when it is unwanted, at odds with the needs of the recipient, or when it makes the recipient uncomfortable, which could unintentionally serve as a potential source of stress.[16-19] Thus, positive and negative supports represent two separate domains of social experience and may have independent effects on depression via different mechanisms.[16 20 21]

Socioeconomically disadvantaged people disproportionately experience conditions that elevate the risk of depression, such as precarious work, job loss, financial insecurity,

or disadvantaged living environment.[22-25] In addition, urban dwellers, especially those in developed countries such as Canada and the United Kingdom, are usually more vulnerable to depression than those living in rural areas, owing to stresses from more frequent encounters with uneven distribution of socioeconomic status (SES), competitive work environment, higher rate of separated or divorced marital status, high rate of suffering from crime, and poor social cohesion.[26-29] These findings give rise to the question whether positive or negative social support might benefit or harm more in financially distressed people living in urban area. For example, better -off people may have the capacity to obtain information for coping with depressive moods from various sources other than their social networks. Similarly, they can afford to hire people or purchase things that can help them avoid depressive situations. However, to our knowledge, there were no studies that have investigated on this to date. Most studies have focused only on the relationships between financial deprivation and depressive symptoms[30-32] or on the protective influence of social support on depression.[8-11]

Moreover, while the interaction between positive and negative social supports on psychological depression is also possible, considering the 'buffering effect model' that positive social support cushions the adverse effect of the stressor on mental health, there are only a handful of studies on this and even outdated.

To address these research gaps, the current study sought to address the following research questions. The first, are positive and negative support independently associated with depressive symptoms? Second, do two domains of social support mediate the effect on depressive symptom each other? Finally, is the effect of positive or negative support more pronounced for less affluent individuals?

METHODS

Data source

Our data came from a large-scale genomic cohort study called The Health Examinees-Gem (HEXA-G), which was established to investigate the epidemiologic characteristics of major chronic diseases in Korean adults living in urban areas. Target participants which are adult males and females aged 40–69, were recruited prospectively at 38 health examination centers or training hospitals located in 8 regions in Korea (Seoul/Incheon/Gyeonggi-do, Gangwon-Do, Daejeon/Chungcheongnam-do, Chungcheongbuk-do, Daegu/ Gyeongsangbuk-do, Busan/ Gyeongsangnam-do,Jeollabuk-do,Gwangju/ Jeollanam-do) when they visited for their government-subsidized health examinations provided for free by National Health Insurance Service biennially to all Korean adults aged over 40 for the purpose of effective health promotion and disease prevention. This way of recruiting provides the advantages of longitudinal repeated measurements, and a pool of subjects that are representative of the majority of the Korean population.

The baseline survey was conducted by trained research staff using a standardized questionnaire, which included information on sociodemographic characteristics, medical history, medication usage, lifestyles, dietary habits, and social capital. Written informed consent was obtained from all participants. The study protocol was approved by the Ethics Committee of the Korean Health and Genomic Study of the Korean National Institute of Health, as well as by the institutional review boards of all participating hospitals.

Although the recruitment occurred in two phases (first-phase survey: 2004–2008, second-phase survey: 2009–2013), this study utilized data collected between March 2009, and March

2010, because of availability of information on depressive symptoms. More detailed information about the study design can be found elsewhere.[33]

Outcome variable

Depressive symptoms were measured using the 20-item version of the Centers for Epidemiologic Studies-Depression Scale (CES-D) which was developed for use in the epidemiologic studies of depressive symptom in the general population[34]. CES-D has been proved to be reliable and valid across a wide variety of demographic characteristics in the general population samples in previous studies.[34 35] Respondents were asked to rate how often, over the preceding week, they experienced symptoms associated with depression, such as restless sleep, poor appetite, and feelings of loneliness. Possible scores ranged between 0 and 3 for each item (0 = less than one day per week, 1 = 1–2 days per week, 2 = 3–4 days per week, and 3 = more than 6 days per week). The overall score, obtained by summation of the individual items, has a possible range of 0–60, with higher scores indicating more severe depressive symptoms (Supplemental table 1).

Social support

Positive and negative social supports were measured by 6 items each. Whereas most previous studies have investigated the functional characteristics of social support based on the Social Experiences Checklist which measures positive and negative experiences of social supports (such as appreciation of relationships with others), the

HEXA-G study investigated structural characteristics of social support, such as the presence of people around the respondent who provide certain kinds of positive or negative support in certain situations. Questions about positive social support in our study include both instrumental(e.g., giving or lending it when I need something) and emotional dimensions(e.g., caring or worrying about me). Questions about negative support also have two dimensions: aggressive type of negative support (e.g., causing active harm to the respondent) and passive type of negative support (e.g., indifference and neglect) (Supplemental table 2).

Respondents were asked to answer "yes" or "no" to each question. We referred to previous study in operating social support variables where structural social support was coded into absolute levels of social capital (for example, number of individuals or groups respondents received support from) and then categorized into groups.[36] We avoided using social support variable as continuous one because our interest is a relationship between the overall level of social support and depressive symptom rather than focusing on how much effect having one more people who can give social support would have on the depressive symptom.

To construct the variable reflecting level of positive and negative social support, the number of "yes" responses to each of the six questions was summed first to create three ordinal groups. Since there is no objective or agreed-upon criteria used for determining level of social support, we chose the cutoff values considering frequency distribution : low positive/negative support (scores of 0–2 for positive support and 0–1 for negative support), medium positive/negative support (scores of 3–4 for positive support and 2–3 for negative support), and high positive/negative support (scores of 5–6 for positive support and 4–6 for negative support).

Other explanatory factors

Marital status was categorized into five categories: married or cohabiting, never married, divorced or separated, widowed, and others. Age was divided into ten-year interval groups, starting at 40 years old. The SES factors included occupational status, education level, and household income level. Specifically, respondents were asked to provide their occupational status by choosing among 14 kinds of job categorized by the Korean Standard Classification of Occupation. We grouped these into 7 categories: non-manual (legislators, senior officials, managers, professionals, technicians and associate professionals, clerical support workers), service and sales workers, manual (skilled agricultural, forestry and fishery workers, craft and related trades workers, plant and machine operators and assemblers, elementary occupations), armed forces, housewives, unemployed, and others. Educational attainment was grouped into four levels: primary school or below, high school graduate or below, college degree, and graduate school or higher. Household monthly income was asked into four levels (unit: 10,000 Korean Won): < 100 (≒ 887 US$), 100 to < 300 (≒ 2,660 US$), 300 to < 600 (≒ 5,319 US$), and ≥ 600.

We controlled for several community-level SES variables: average income, average educational level, and the employment rate in the community. These were aggregated from their individual-level analogues.

Patient and public involvement

This study did not involve patients. Participants were urban dwellers aged 40–69

who visited hospitals for their government-subsidized health examinations. The findings from this study will be disseminated to the wider public via local media and civil society organizations.

Statistical analyses

We constructed linear random intercept multi-level models to estimate the association between negative and positive social support and the risk of depressive symptoms while accounting for the clustering of observations at the community level. Because there is no residential address information in our dataset, we used the 38 health examination centers or training hospitals where survey population was recruited as a proxy for communities, assuming that people would visit the nearest centers to their residence for their medical check-ups.

We started by including positive and negative social supports alternately in the model with adjustment only for individual-level demographic variables: marital status, age, and gender (model 1 and 2). From checking the correlation, we found weak negative correlation between positive and negative social support(refer to the supplemental table 3 for phi coefficients from Chi-square analyses). Testing of Variance Inflation Factor (VIF) revealed no multi-collinearity between two (VIF=1.06 and 1.5 for the level of positive social support and negative social support respectively). Therefore, we tried to run a model including both domains of social supports simultaneously with adjustment for only demographic characteristics first(model 3), and then additional adjustment for SES variables: occupational status, educational level, and monthly income(model 4). This will enable us to test whether the association between one

domain of social support and depressive symptom is not due to confounding effect of the other domain of support. The reason for sequential entering of groups of demographic and SES variables was that we wanted to explore whether adjusting for SES would attenuate the association between positive or negative social supports and the outcome variable, assuming that SES might confound the association between social supports and depressive symptoms. All potential two-way and three-way interaction terms between income and each domain of supports were explored (model 5). Finally, we tried to control for community-level SES variables(model 6). All statistical tests were two-sided, and statistical significance was determined at $p < 0.05$. Data were analyzed using SAS 9.3 software package.

RESULTS

The total number of respondents who participated in the survey between March 2009 and March 2010, was 25,712 in 15 communities. After list-wise deletion of participants with missing data in the independent and outcome variables, the final number of respondents for analysis was 21,208 in 14 communities (Figure 1).

Insert figure 1

Table 1 shows the descriptive statistics of the sample. The married or cohabiting group, which accounted for almost 90% of the sample, showed the lowest level of depressive symptoms, whereas the separated or divorced category showed the highest level, ranging from 4.25 to 8.07. The difference in depressive symptom scores across

age groups was less than 0.3. Men scored lower on depressive symptoms compared with women, on average. Depressive symptoms diminished as education level and monthly income level increased. Among occupations, the group working in the armed forces had the lowest average depressive symptoms score. There was a large difference in average depressive symptom scores across low, medium, and high levels of positive and negative social support groups in the study sample.

Table 1. Descriptive statistics of a study sample of urban adults in Korea.

	n	Proportion (%)	Mean depressive symptom score
Marriage			
Currently married/cohabiting	19,037	89.76	4.25
Never married	514	2.42	5.11
Separated/divorced	671	3.16	8.07
Widowed	957	4.51	6.2
Others	29	0.14	5.59
Age(yrs)			
40≤age<50	8,387	39.55	4.44
50≤age<60	8,098	38.18	4.61
60≤age<70	4,723	22.27	4.34
Gender			
Male	7,978	37.62	3.62
Female	13,230	62.38	5.01
Education			
Primary school or below	3,242	15.29	5.67
High school graduate	12,830	60.50	4.46
College degree	4,277	20.17	3.9
Graduate school or higher	859	4.05	3.31
Job			
Non-manual	3,776	17.80	3.72
Service and sales workers	3,983	18.78	4.22
Manual	4,324	20.39	4.21
Armed forces occupation	24	0.11	2.21
Housewives	7,106	33.51	5.33
Unemployed	1,895	8.94	4
Others	100	0.47	5.37
Income(Korean 10,000 Won)†			
<100	2,636	12.43	7.08
100 ≤income <300	9,715	45.81	4.42

300 ≤income <600	7,285	34.35	3.86
600 < income	1,572	7.41	3.4
Level of positive social support			
Low	833	3.93	11.51
Medium	1,778	8.38	9.07
High	18,597	87.69	3.73
Level of negative social support			
Low	18,856	88.91	3.66
Medium	1,724	8.13	10
High	628	2.96	14.16

†1 US $ ≒ 1,128 Korea Won

Models 1 and 2 in Table 2 show the linear coefficients and 95% confidence intervals for depressive symptoms according to the level of positive and negative social support respectively when only individual-level demographic variables were controlled. We found clear inverse gradient of positive social support and positive gradient of negative social support with depressive symptom(for positive social support, b = -2.73, p<0.001 in medium group; b = -6.69, p<0.001 in high group / for negative social supports, b=5.14, p<0.001 in medium group; b=9.29, p<0.001 in high group). When two domains of social support were run together in one model(model 3), negative support(or positive support) did not cancel out the benefits of positive support(or harm of negative support), indicating each domain of social support may operate independently(for positive social support, b = -2.38, p<0.001 in medium group; b = -5.54, p<0.001 in high group / for negative social supports, b=4.67, p<0.001 in medium group; b=8.18, p<0.001 in high group). Adjusting for SES variables did not attenuate the strength of association between social support and depressive symptom as shown in models 4(for positive social support, b = -2.18, p<0.001 in medium group; b = -5.21, p< 0.001 in high group / for negative social supports, b=4.63, p<0.001 in medium group; b=8.03,p<0.001 in high group).

Since the level of income, level of positive and negative social support was linearly related with depressive symptom in the main effect of model 4, interaction terms were constructed by multiplying each of these variables as a continuous one to simplify the model.

All the two-way interactions were found to be significant(model 5). Association between positive social support and the depressive symptom was different according to the level of negative social support as well as income level. Specifically, the negative association between the level of positive support and depressive symptoms score was stronger for individuals with a higher level of negative support and lower income level as shown in Figure 2. Equivalently, the association between negative social support and depressive symptom depended on the level of positive social support and income. Negative social support had a stronger positive association with depressive symptom score in a group with the lower level of positive social support or lower income(Figure 3). That is, high level of negative support had a similar effect as low income while a high level of positive support had a similar effect as high income in mediating associations with the depressive symptoms. In Figure 2 and 3, we presented only the highest and lowest groups in the level of social support and in the level of income to show the differential effect in maximized way. A three-way interaction term between positive, negative social support and income level was not significant(not presented). None of the community level SES variable was significant(model 6).

Insert Figure 2 and Figure 3

Regarding the relevance of the other independent variables, marital status of being

separated or divorced and being widowed, female gender, and occupational status of housewife were associated with higher depressive symptom scores compared with their counterparts while older groups and people with higher education level were likely to have lower depressive symptom score(Supplemental table 4).

Table 2. Results from multilevel regression of positive and negative social supports and income on depressive symptom score in Korean urban adults

	Null		Model 1∫		Model 2∫		Model 3∫		Model 4∫∫		Model 5∫∫		Model 6∫∫	
	Coeff	S.E.	Coeff	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Individual level variables														
<100(Korean 10,000 Won)††														
100 ≤income <300									-1.46***	0.15	-2.25***	0.35	-2.26***	0.40
300 ≤income <600									-1.98***	0.17	-3.69***	0.68	-3.70***	0.78
600 < income									-2.40***	0.23	-5.04***	1.02	-5.05***	1.18
Positive social support(Low level)														
Medium			-2.73***	0.28			-2.38***	0.27	-2.18***	0.26	-1.72***	0.35	-1.72***	0.41
High			-6.69***	0.23			-5.54***	0.23	-5.21***	0.23	-4.66***	0.54	-4.66***	0.67
negative social support(Low level)														
Medium					5.14***	0.17	4.67***	0.16	4.63***	0.16	8.02***	0.16	8.02***	0.51
High					9.29***	0.26	8.18***	0.26	8.04***	0.26	14.03***	0.26	14.03***	0.94
Positive social support x negative social support											-0.92***	0.15	-0.92***	0.15
Positive social support x income											0.47***	0.12	0.47***	0.12
Negative social support x income											-0.38**	0.13	-0.38**	0.13
Community-level variables														
Share of the employed													7.19	4.07
Mean income level													-4.73	4.61
Mean education level													6.98	6.39
Community level variance	4.84***		3.48**	1.33	3.00**	1.15	2.45**	0.93	2.61**	0.10	2.59**	1.03	1.90**	0.73
ICC	0.09*		0.08*		0.07*		0.06*		0.06*		0.06*		0.05*	
R-squared$^{\phi}$ (level 1/level 2)	-		0.09/0.23		0.13/0.33		0.17/0.46		0.18/0.42		0.18/0.40		0.19/0.58	

Number of observations are 21, 208 in all models/∫: adjusted for only demographic variales including marital status, age and gender /∫∫: adjusted for both demographic and SES variables including marital status, age, gender, job status, and education level /*:p <0.05, **: p<0.01, *** :p<0.001 / ††1 US $ ≒ 1,128 Korea Won /$^{\phi}$: R-squared proposed by Snijders and Bosker)

DISCUSSION

This study, conducted among a sample of urban dwellers in South Korea, showed that low level of positive and high level negative supports at the individual level was significantly associated with higher depressive symptom scores holding the effect of the negative and positive social support constant respectively, meaning that positive and negative support have their own independent effect. We also found that negative association of positive social support and positive association of negative social support with depressive symptom were magnified when the level of the other domain of social support was unfavorable or income level was low.

Our results on the association between positive social support and depressive symptoms are consistent with many previous findings, although there are slight differences in target groups and definition of social support across studies.[8-10 37-39] Generally, a low level of positive social support is associated with higher prevalence and incidence of the depressive symptom (or depressive disorder) in previous studies.

Although the exact pathways through which positive social support acts on mental health outcomes remains unclear, it has been posited generally to occur through two different processes that are not necessarily mutually exclusive. Stated briefly, positive social support may influence psychological wellbeing by buffering the adverse effects of emotional or financial stress (termed the 'buffering effect model'); or it may have a 'direct or main' effect on mental health by fulfilling a person's need for respect, social recognition, affection, or nurturance, irrespective of stress status (termed the 'main effect model')[40].

The effect of negative social support on mental health in adults has been less

explored in previous studies than that of positive social support. However, finding related to negative social support from the present study are also in line with finding in previous study performed in Netherland that reported that negatively experienced supports are significantly associated with higher prevalence and incidence of poor mental health in men and women aged 26-65 years.[41]

Most previous articles focused on only positive or negative social support without considering the other and studies which have examined the simultaneous effect of two domains of social supports are rare and outdated. Among them, Ingersoll-Dayton(1997) has identified four models framing the effect of each domain of social exchange; 'Positivity effect model' meaning that only positive exchange affect health outcome whether it's positive or negative outcomes, 'Negativity effect model' arguing that only negative exchange affect outcome, again whether positive or not, 'Domain specific effect model' meaning that positive and negative exchange affect only positive and negative outcome respectively, and lastly, 'Combined positivity and negativity effects model' arguing that positive exchange and negative exchange affect both positive and negative outcome simultaneously.[42] The result from our study supports the 'Combined positivity and negativity effect model'. A few other existing studies also support this model. For example, Golding and Burnam(1990) demonstrated that both social support and social conflict were significant predictors of depression among Mexican American adults when they were run together in a model.[43] More recently, Croezen et al(2012) showed that low level of positive support and high level of negative support were associated with high odds of poor mental health at the same time in Dutch men and women.[41]

More notable findings from the present study are significant interactions among positive, negative social support and income on the depressive symptom. Those with

lower income and higher level of negative support may receive greater benefits from positive social support and those with lower income and lower level of positive support may have greater damage from negative social supports compared to their counterparts. These findings may suggest that social supports play a similar role to income. Specifically, a high level of negative supports mediates the association between positive social support and depressive symptom in the same way as low income and low level of positive supports operated in the same manner as low income for mediating the association between negative social support and depressive symptoms.

Low economic capacity can be linked to stress, low self-esteem, stigma, feelings of helplessness and hopelessness,[38] and risk for marginalization and social exclusion.[39] However, these can be counterbalanced by positive social support. Negative social support also serves as a type of stressor similar to low income, for which positive social support also can compensate for.[44] Thus, the effect of positive support on reducing depressive symptom was stronger in a group with lower income and a higher level of negative social support. Emotional positive support, such as understanding, dialogue, appreciation, or getting assistance with problem solving, can provide marginalized poor or people hurt by negative social support with the feeling that they are cared for, esteemed, and valued. Tangible benefits bestowed by another aspect of positive support, named instrumental supports such as help in housework or exchange of material resources, may also assist in coping with materially deprived circumstances or feeling of unprotectedness or isolation from negative social support.[39] Conversely, negative supports such as perception of arguing, being criticized, feelings of undue demand, or too much intervention may serve as an additional source of stress for poor people who are already psychologically vulnerable due to financial stress.[35] While people with a

high level of positive support have the capacity to buffer harmful effect of negative support on the depressive symptoms, those without positive support may suffer from damage from negative support.

There are several studies which examined the interaction of positive and negative social support. While some have not found any evidence of interaction,[32 45] others have observed a buffering effect of positive social support on the association between negative social support and mental health across different outcomes and population group.[46 47] No previous studies have examined on the interaction between social supports and income on mental health to our knowledge.

The result of the current study may provide important implications in the Korean context. Since the country's economic crisis in late 1990, socioeconomic inequality has deepened, resulting in worsening social polarization, which, in turn, caused a rising prevalence of depression.[48] A downward trend in the suicide rate, from 11.2 in 1985 to 8.8 in 1990, subsequently reversed, increasing from 8.4 in 1991 to 28.5 in 2013 (per 100,000 persons). As a result, South Korea has had the highest suicide rate among Organization for Economy Cooperation and Development countries since 2002.[49] Despite these trends, only a minority of people with depressive symptoms seek professional consultation, for fear of the cultural stigma attached to mental illness.[50] Because economic disadvantage has been well recognized as a determinant of depression in Korea,[51] the results of our study provide supporting evidence for interventions encouraging positive social support or discouraging negative social support in underprivileged populations.

Although the poor are more affected by social support than the better off, they also tend to have more limited capacity to control social support on their own by generating

positive support or avoiding negative support. For example, people with economic capacity have more access to receive positive emotional support because they can afford private psychologists or clinical counselors. Similarly, they have more access to instrumental positive support by hiring private caregivers or housekeepers when they cannot find those supports among close people around them. Therefore, interventions to mobilize positive social support or prevent negative support for those with limited economic means might be effective for lowering depressive symptoms in society.

Strength and limitations

Although this study is unique in separately analyzing the effects of positive and negative social supports on depressive symptoms according to income level in a large sample, it also has a few limitations to be noted when interpreting the results. First, there is a possibility of reverse causation, given the cross-sectional nature of the study. For example, people with depressive symptoms may become less sociable and less engaged in social networks, thereby eventually reducing social support.[52] Second, we used the 38 health examination centers or training hospitals where target populations were recruited as a proxy for communities. Although this is not a geographical classification based on respondents' residential address, equating it with community is assumed to be reasonable; most people are likely to go to the hospitals nearest to their residence for their government-subsidized medical check-ups, because there is no much difference in quality between hospitals designated for government-subsidized health examination. Third, because no agreed upon cutoff points for high or low levels of social support were available, we classified sum scores into three ordinal groups considering

the number of people belonging to each group. To test the sensitivity of the result to the categorization of social support level, we reran the analyses using the score as a continuous variable. These different ways of categorization produced the almost same results.

CONCLUSION

The present study showed that, at the individual level, both positive and negative social support were associated with depressive symptoms, and these associations were found to be stronger in economically disadvantaged people when adjusting for various control variables at multiple levels. In addition, positive and negative social support mediated the association of negative and positive social support with depressive symptoms, respectively. Reducing inequality is always challenging, although most pursue social equality as an ideal. The results of this study suggest that strategies for adjusting positive and negative support among low income populations might be effective in reducing depressive symptoms in those populations.

Further study is required to reveal the mechanisms by which different types of individual social support operate on depressive symptoms in each economic group in the context of South Korea.

Contributors: HYL and JO conceived the study. HYL led the statistical analysis and drafted the manuscript. JO provided supervision throughout the data analysis and interpretation. IK provided overall guidance and helped to edit language. JH, SK, JL, and DK helped to interpret the data. All authors read and approved the final manuscript.

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Data sharing statement: Data are available from the Korea Centers for Disease Control and Prevention for researchers who meet the criteria for access to the data. Researchers may contact Dr. Yeonjung Kim, Division of Epidemiology and Health Index, Center for Genome Science, Korea.

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Figure Legends

[Figure 1] Derivation process of study sample

[Figure 2] Differential effect of positive support according to level of negative support and income level on depressive symptom

[Figure 3] Differential effect of negative support according to the level of positive support and income level on depressive symptom

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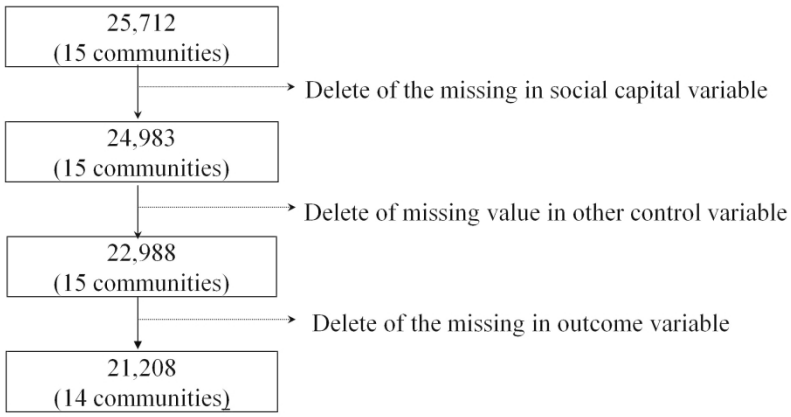

Figure 1. Derivation process of study sample

[Figure 1] Derivation process of study sample

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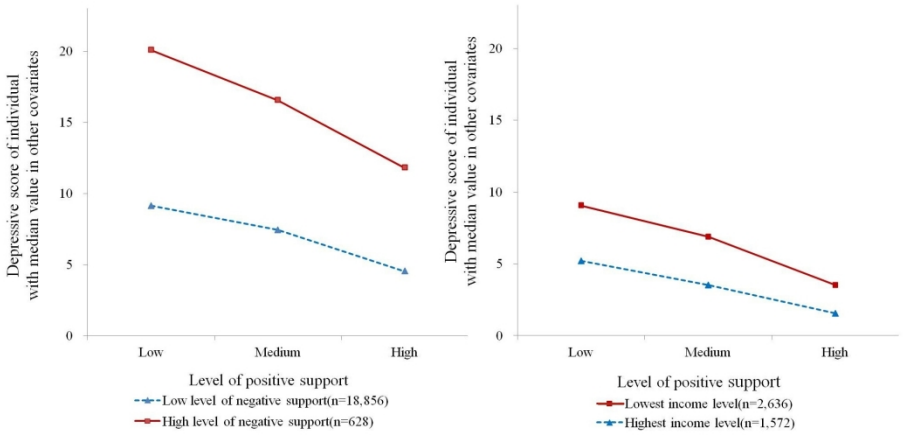
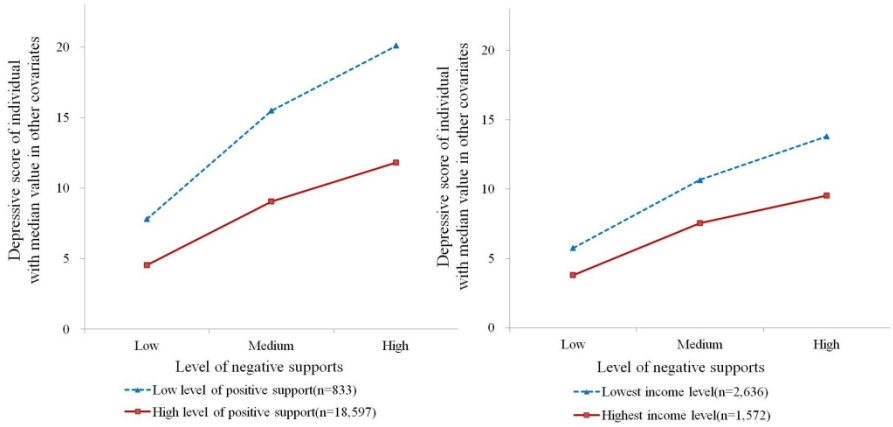


[Figure 2] Differential effect of positive support according to level of negative support and income level on depressive symptom

185x93mm (300 x 300 DPI)



[Figure 3] Differential effect of negative support according to the level of positive support and income level on depressive symptom

187x95mm (300 x 300 DPI)

Supplemental Table 1. 20-items of the Centers for Epidemiologic Studies-Depression Scale (CES-D)

1. I was bothered by things that usually don't bother me.
2. I did not feel like eating; my appetite was poor
3. I felt that I could not shake off the blues even with help from my family or friends.
4. I had trouble keeping my mind on what I was doing.
5. I was happy.
6. I felt depressed.
7. I felt that everything I did was an effort.
8. I felt hopeful about the future.
9. I thought my life had been a failure.
10. I felt I was just as good as other people
11. My sleep was restless. I had a lot of trouble getting to sleep.
12. I felt fearful.
13. I talked less than usual.
14. I felt lonely.
15. I enjoyed life.
16. People were unfriendly.
17. I had crying spells.
18. I felt sad.
19. I felt that people disliked me.
20. I could not get going.

Supplemental Table 2. Questions for measuring positive and negative social support

Ask to the following questions on feeling about the people around you.

<Positive social support>

1. There is a person whom I can confide in
2. There is a person who always care or worry about me
3. There is a person whom I can discuss with when I have important or difficult matters
4. There is a person who nurses me and give a help in housework when I am ill
5. There is a person who gives or lends it when I need something
6. There is a person who takes a time for me and help with housework whenever I request

<Negative social support>

1. There is a person who object to or meddle with what I do
2. There is a person who blames me for all the problems I have
3. There is a person who forgets or ignores me
4. There is a person who gives you unwanted help and make me uncomfortable
5. There is a person who is indifferent to me and my affair
6. There is a person who turns down most of the time when I ask help

Supplemental table 3. Chi-square correlation test between positive and negative social support

		Positive support					
		Level 1		Level 2		Level 3	
		χ^2 (P)	Phi	χ^2 (P)	Phi	χ^2 (P)	Phi
Negative support	Level 1	299.1(p<0.001)	-0.12	92.3(p<0.001)	0.07	273.7(p<0.001)	0.11
	Level 2	443.2(p<0.001)	-0.15	236.1(p<0.001)	0.11	202.5(p<0.001)	0.10
	Level 3	783.0(p<0.001)	0.19	347.5(p<0.001)	-0.13	474.5(p<0.001)	-0.15

Supplemental table 4. Association of other covariates and depressive symptom score from Mode 8 in Table 2)

	Coeff.	S.E.
Currently married/co-residing		
Never married	0.46	0.29
Separated/divorced	2.09***	0.25
Widowed	1.11***	0.22
Others	-0.90	1.16
40≤age<50(yrs)		
50≤age<60	-0.20*	0.10
60≤age<70	-0.84***	0.14
Male		
Female	0.74***	0.11
Non-manual		
Service and sales workers	0.24	0.15
Manual	-0.18	0.16
Armed forces occupation	-1.98	1.28
Housewives	0.63***	0.15
Unemployed	0.32	0.20
Others	-0.50	0.64
Primary school or below		
High school graduate	-0.56***	0.13
College degree	-0.80***	0.18
Graduate school or higher	-1.17***	0.27

*:p <0.05, **: p<0.01, *** :p<0.001

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-8
Bias	9	Describe any efforts to address potential sources of bias	*9*
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	10
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10(Figure1)
		(b) Give reasons for non-participation at each stage	10(Figure1)
		(c) Consider use of a flow diagram	10(Figure1)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10-11(Table 1)
		(b) Indicate number of participants with missing data for each variable of interest	10(Figure1)
Outcome data	15*	Report numbers of outcome events or summary measures	10-11(Table 1)
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-14(Table 2 & 3)
		(*b*) Report category boundaries when continuous variables were categorized	7-8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Positive and negative social support and depressive symptoms according to economic status among adults in Korea: Cross-sectional results from the Health Examinees-Gem Study

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Positive and negative social support and depressive symptoms according to economic status among adults in Korea: Cross-sectional results from the Health Examinees-Gem Study

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Positive and negative social support and depressive symptoms according to economic status among adults in Korea: Cross-sectional results from the Health Examinees-Gem Study

ABSTRACT

Objectives: The interaction between positive and negative social support as well as each domain of social support and income on depressive symptom have not been much explored. We aimed to examine the associations of positive and negative social support with the risk of depressive symptoms among urban-dwelling adults in Korea, focusing on those interaction effects.

Design: We used the first wave of a large-scale cohort study called The Health Examinees-Gem Study. Positive and negative support scores ranged between 0–6; the variables were then categorized into low, medium, and high groups. A two-level random intercept linear regression model was used, where the first level is individual and the second is the community. We further tested for interactions between each domain of social supports and household income.

Setting: A survey conducted at 38 health examination centers and training hospitals in major Korean cities and metropolitan areas during 2009-2010.

Participants: 21,208 adult men and women aged between 40 and 69 in Korea (mean age : 52.6, standard deviation: 8.0).

Outcome measures: Depressive symptoms score measured by Epidemiologic Studies-Depression Scale, with scores ranging from 0 to 60.

Results: Level of positive and negative social support showed negative and positive association with depressive symptom score with statistical significance at $p<0.05$ respectively. When the interaction terms among household income and social supports were examined, negative association between level of positive social support and depressive symptom score was more pronounced as income was lower and level of negative social support was higher. Similarly, positive association between level of negative social support and depressive symptom score was more pronounced as income was lower and level of positive social support was lower.

Conclusions: Our findings suggest that strategies for encouraging positive social support and discouraging negative social support for disadvantaged individuals might be effective in reducing depression in Korea.

Keywords: Depressive symptoms, multi-level regression, social capital, social support.

Strengths and limitations of this study

- To the best of our knowledge, this is the first study to explore the difference in the association between positive and negative social support and depressive symptom according to a different level of social support and economic status.
- The article is based on a large study involving 21,208 Korean adults.
- The study design is cross-sectional, and hence can only reveal associations between social support and depressive symptom.
- We used health examination centers where respondents were recruited as a proxy for the community, which is not an accurate geographical classification.

INTRODUCTION

Depression has been proven to be associated with adverse health outcomes including increased susceptibility to disease through multiple mechanisms, such as disrupted immune functioning[1-3] and altered health-related behavioral patterns (e.g., excessive alcohol use, smoking, poor diet).[4 5] In addition, depression is linked to suicide. Not only suicide ideation studies but also psychological autopsy studies have proved the strong association between depression and suicide.[6 7]

Positive social support has been shown to be protective against risk of depression by buffering the effects of stress.[4 8-11] Specifically, instrumental support, such as tangible assistance (labor, in kind) and financial support (e.g., cash loans), has been demonstrated to lower the risk of depression by assisting individuals in coping with everyday hardships and facilitating their socioeconomic mobility.[12 13] Emotional support such as companionship and intimacy can also buffer the individual from the harmful effects of stress.[14 15] On the other hand, social support does not always give rise to positive experiences, however well-meaning the intentions of the support giver may be. Social support can be negative when it is unwanted, at odds with the needs of the recipient, or when it makes the recipient uncomfortable, which could unintentionally serve as a potential source of stress.[16-19] Thus, positive and negative supports represent two separate domains of social experience and may have independent effects on depression via different mechanisms.[16 20 21]

In addition, these two domains of social supports might interfere the effect on psychological depression each other when they co-exist According to the “buffering effect model”,. Those with high level of negative support may receive more benefit

from the positive support in reducing depressive symptom. Conversely, high level of positive support may cushion the adverse effect of the stressor from negative supports on mental health[22] Only a handful of studies have explored on this and have not been updated for a long time.[23-25]

Socioeconomically disadvantaged people disproportionately experience conditions that elevate the risk of depression, such as precarious work, job loss, financial insecurity, or disadvantaged living environment.[26-29] In addition, urban dwellers, especially those in developed countries such as Canada and the United Kingdom, are usually more vulnerable to depression than those living in rural areas, owing to stresses from more frequent encounters with uneven distribution of socioeconomic status (SES), competitive work environment, higher rate of separated or divorced marital status, high rate of suffering from crime, and poor social cohesion.[30-33] These findings give rise to the question whether positive or negative social support might benefit or harm more in financially distressed people living in urban area. For example, better -off people may have the capacity to obtain information for coping with depressive moods from various sources other than their social networks. Similarly, they can afford to hire people or purchase things that can help them avoid depressive situations. However, to our knowledge, there was no study that has investigated on this to date. Most studies have focused only on the relationships between financial deprivation and depressive symptoms[34-36] or on the protective influence of social support on depression.[8-11]

Korea is facing the continuous increase in depression. One-year prevalence of depression, the proportion of adults who had experienced depressive disorder more than once during recent 12 months from the survey time, increased from 1.8 % in 2001 to 3.1 % in 2011.[37]

The current study sought to address the following research questions in Korean context while addressing the research gaps that exist in previous studies. The first, are positive and negative support independently associated with depressive symptoms? Second, do positive social support moderate the effect of negative social support on depressive symptom or vice versa? Finally, are the effects of positive and negative support more pronounced for less affluent individuals?

METHODS

Data source

Our data came from a large-scale genomic cohort study called The Health Examinees-Gem (HEXA-G), which was established to investigate the epidemiologic characteristics of major chronic diseases in Korean adults living in urban areas. Target participants which are adult males and females aged 40–69, were recruited prospectively at 38 health examination centers or training hospitals located in 8 regions in Korea (Seoul/Incheon/Gyeonggi-do, Gangwon-Do, Daejeon/Chungcheongnam-do, Chungcheongbuk-do, Daegu/ Gyeongsangbuk-do, Busan/ Gyeongsangnam-do,Jeollabuk-do,Gwangju/ Jeollanam-do) when they visited for their government-subsidized health examinations provided for free by the National Health Insurance Service biennially to all Korean adults aged over 40 for the purpose of effective health promotion and disease prevention. This way of recruiting can provide the advantages of longitudinal repeated measurements, and a pool of subjects that are representative of the majority of the Korean population.

The baseline survey was conducted by trained research staff using a standardized questionnaire, which included information on sociodemographic characteristics, medical history, medication usage, lifestyles, dietary habits, and social capital. Written informed consent was obtained from all participants. The study protocol was approved by the Ethics Committee of the Korean Health and Genomic Study of the Korean National Institute of Health, as well as by the institutional review boards of all participating hospitals.

Although the recruitment occurred in two phases (first-phase survey: 2004–2008, second-phase survey: 2009–2013), this study utilized data collected between March 2009, and March 2010, because of availability of information on depressive symptoms. More detailed information about the study design can be found elsewhere.[38]

Outcome variable

Depressive symptoms were measured using the 20-item version of the Centers for Epidemiologic Studies-Depression Scale (CES-D) which was developed for use in the epidemiologic studies of depressive symptom in the general population[39]. CES-D has been proved to be reliable in previous studies with a Cronbach's alpha of 0.84 ~ 0.90 depending on the ethnic groups.[39 40] Respondents were asked to rate how often, over the preceding week, they experienced symptoms associated with depression, such as restless sleep, poor appetite, and feelings of loneliness. Possible scores ranged between 0 and 3 for each item (0 = less than one day per week, 1 = 1–2 days per week, 2 = 3–4 days per week, and 3 = more than 6 days per week). The overall score, obtained by summation of the individual items, has a possible range of 0–60, with higher scores

indicating more severe depressive symptoms (Supplemental table 1).

Social support

Positive and negative social supports were measured by 6 items each. Whereas most previous studies have investigated the functional characteristics of social support based on the Social Experiences Checklist which measures positive and negative experiences of social supports (such as appreciation of relationships with others), the HEXA-G study investigated structural characteristics of social support, such as the presence of people around the respondent who provide certain kinds of positive or negative support in certain situations. Questions about positive social support in our study include both instrumental(e.g., giving or lending it when I need something) and emotional dimensions(e.g., caring or worrying about me). Questions about negative support also have two dimensions: aggressive type of negative support (e.g., causing active harm to the respondent) and passive type of negative support (e.g., indifference and neglect) (Supplemental table 2).

Respondents were asked to answer “yes” or “no” to each question. We referred to previous study in operating social support variables where structural social support was coded into absolute levels of social capital (for example, number of individuals or groups respondents received support from) and then categorized into groups.[41] We avoided using social support variable as continuous one because our interest is a relationship between the overall level of social support and depressive symptom rather than focusing on how much effect having one more people who can give social support would have on the depressive symptom.

To construct the variable reflecting level of positive and negative social support, the number of "yes" responses to each of the six questions was summed first to create three ordinal groups. Since there is no objective or agreed-upon criteria used for determining level of social support, we chose the cutoff values considering frequency distribution: low positive/negative support (scores of 0–2 for positive support and 0–1 for negative support), medium positive/negative support (scores of 3–4 for positive support and 2–3 for negative support), and high positive/negative support (scores of 5–6 for positive support and 4–6 for negative support).

Other explanatory factors

Marital status was categorized into five categories: married or cohabiting, never married, divorced or separated, widowed, and others. Age was divided into ten-year interval groups, starting at 40 years old. The SES factors included occupational status, education level, and household income level. Specifically, respondents were asked to provide their occupational status by choosing among 14 kinds of job categorized by the Korean Standard Classification of Occupation. We grouped these into 7 categories: non-manual (legislators, senior officials, managers, professionals, technicians and associate professionals, clerical support workers), service and sales workers, manual (skilled agricultural, forestry and fishery workers, craft and related trades workers, plant and machine operators and assemblers, elementary occupations), armed forces, housewives, unemployed, and others. Educational attainment was grouped into four levels: primary school or below, high school graduate or below, college degree, and graduate school or higher. Household monthly income was asked into four levels (unit: 10,000 Korean

Won): < 100 (≒ 887 US$), 100 to < 300 (≒ 2,660 US$), 300 to < 600 (≒ 5,319 US$), and ≥ 600.

We controlled for several community-level SES variables such as average income, average educational level, and the employment rate in the community, which were created from aggregation of their individual-level analogues. The purpose of this was to adjust for the SES-contextual effect of people living together in the community based on assumption that people may feel a different level of depressive symptom depending on the level of socioeconomic status of their neighborhood even if their individual socioeconomic status are equal.

Patient and public involvement

This study did not involve patients. Participants were urban dwellers aged 40–69 who visited hospitals for their government-subsidized health examinations. The findings from this study will be disseminated to the wider public via local media and civil society organizations.

Statistical analyses

We constructed linear random intercept multi-level models to estimate the association between negative and positive social support and the risk of depressive symptoms while accounting for the clustering of observations at the community level. Because there is no residential address information in our dataset, we used the 38 health examination centers or training hospitals where survey population was recruited

as a proxy for communities, assuming that people would visit the nearest centers to their residence for their medical check-ups.

We started by including positive and negative social supports alternately in the model with adjustment only for individual-level demographic variables: marital status, age, and gender (model 1 and 2). From checking the correlation, we found weak negative correlation between positive and negative social support(refer to the supplemental table 3 for phi coefficients from Chi-square analyses). Testing of Variance Inflation Factor (VIF) revealed no multi-collinearity between two (VIF=1.06 and 1.5 for the level of positive social support and negative social support respectively). Therefore, we tried to run a model including both domains of social supports simultaneously with adjustment for only demographic characteristics first(model 3), and then additional adjustment for SES variables: occupational status, educational level, and monthly income(model 4). This will enable us to test whether the association between one domain of social support and depressive symptom is not due to confounding effect of the other domain of support. The reason for sequential entering of groups of demographic and SES variables was that we wanted to explore whether adjusting for SES would attenuate the association between positive or negative social supports and the outcome variable, assuming that SES might confound the association between social supports and depressive symptoms. All potential two-way and three-way interaction terms between income and each domain of supports were explored (model 5). Finally, we tried to control for community-level SES variables(model 6). All statistical tests were two-sided, and statistical significance was determined at $p < 0.05$. Data were analyzed using SAS 9.3 software package.

RESULTS

The total number of respondents who participated in the survey between March 2009 and March 2010, was 25,712 in 15 communities. After list-wise deletion of participants with missing data in the independent and outcome variables, the final number of respondents for analysis was 21,208 in 14 communities (Figure 1).

Insert figure 1

Table 1 shows the descriptive statistics of the sample. The married or cohabiting group, which accounted for almost 90% of the sample, showed the lowest level of depressive symptoms, whereas the separated or divorced category showed the highest level, ranging from 4.25 to 8.07. The difference in depressive symptom scores across age groups was less than 0.3. Men scored lower on depressive symptoms compared with women, on average. Depressive symptoms diminished as education level and monthly income level increased. Among occupations, the group working in the armed forces had the lowest average depressive symptoms score. There was a large difference in average depressive symptom scores across low, medium, and high levels of positive and negative social support groups in the study sample.

Table 1. Descriptive statistics of a study sample of urban adults in Korea.

	n	Proportion (%)	Mean depressive symptom score
Marriage			
Currently married/cohabiting	19,037	89.76	4.25

Never married	514	2.42	5.11
Separated/divorced	671	3.16	8.07
Widowed	957	4.51	6.20
Others	29	0.14	5.59
Age(yrs)			
40≤age<50	8,387	39.55	4.44
50≤age<60	8,098	38.18	4.61
60≤age<70	4,723	22.27	4.34
Gender			
Male	7,978	37.62	3.62
Female	13,230	62.38	5.01
Education			
Primary school or below	3,242	15.29	5.67
High school graduate	12,830	60.50	4.46
College degree	4,277	20.17	3.90
Graduate school or higher	859	4.05	3.31
Job			
Non-manual	3,776	17.80	3.72
Service and sales workers	3,983	18.78	4.22
Manual	4,324	20.39	4.21
Armed forces occupation	24	0.11	2.21
Housewives	7,106	33.51	5.33
Unemployed	1,895	8.94	4.00
Others	100	0.47	5.37
Income(Korean 10,000 Won)†			
<100	2,636	12.43	7.08
100 ≤income <300	9,715	45.81	4.42
300 ≤income <600	7,285	34.35	3.86
600 < income	1,572	7.41	3.40
Level of positive social support			
Low	833	3.93	11.51
Medium	1,778	8.38	9.07
High	18,597	87.69	3.73
Level of negative social support			
Low	18,856	88.91	3.66
Medium	1,724	8.13	10.00
High	628	2.96	14.16

†1 US $ ≒ 1,128 Korea Won

Models 1 and 2 in Table 2 show the linear coefficients and 95% confidence intervals for depressive symptoms according to the level of positive and negative social support respectively when only individual-level demographic variables were controlled.

We found clear inverse gradient of positive social support and positive gradient of negative social support with depressive symptom(for positive social support, *b* = -2.73, *p*<0.001 in medium group; *b* = -6.69, *p*<0.001 in high group / for negative social supports, b=5.14, *p*<0.001 in medium group; b=9.29, *p*<0.001 in high group). When two domains of social support were run together in one model(model 3), negative support(or positive support) did not cancel out the benefits of positive support(or harm of negative support), indicating each domain of social support may operate independently(for positive social support, *b* = -2.38, *p*<0.001 in medium group; *b* = -5.54, *p*<0.001 in high group / for negative social supports, b=4.67, *p*<0.001 in medium group; b=8.18, *p*<0.001 in high group). Adjusting for SES variables did not attenuate the strength of association between social support and depressive symptom as shown in models 4(for positive social support, *b* = -2.18, *p*<0.001 in medium group; *b* = -5.21, *p*< 0.001 in high group / for negative social supports, b=4.63, p<0.001 in medium group; b=8.03,p<0.001 in high group).

Since the level of income, level of positive and negative social support was linearly related with depressive symptom in the main effect of model 4, interaction terms were constructed by multiplying each of these variables as a continuous one to simplify the model.

All the two-way interactions were found to be significant(model 5). Association between positive social support and the depressive symptom was different according to the level of negative social support as well as income level. Specifically, the negative association between the level of positive support and depressive symptoms score was stronger for individuals with a higher level of negative support and lower income level as shown in Figure 2. Equivalently, the association between negative social support and

depressive symptom depended on the level of positive social support and income. Negative social support had a stronger positive association with depressive symptom score in a group with the lower level of positive social support or lower income(Figure 3). That is, high level of negative support had a similar effect as low income while a high level of positive support had a similar effect as high income in moderating associations with the depressive symptoms. In Figure 2 and 3, we presented only the highest and lowest groups in the level of social support and in the level of income to show the differential effect in maximized way. A three-way interaction term between positive, negative social support and income level was not significant(not presented). None of the community level SES variable was significant(model 6).

Insert Figure 2 and Figure 3

Regarding the relevance of the other independent variables, marital status of being separated or divorced and being widowed, female gender, and occupational status of housewife were associated with higher depressive symptom scores compared with their counterparts while older groups and people with higher education level were likely to have lower depressive symptom score(Supplemental table 4).

Table 2. Results from multilevel regression of positive and negative social supports and income on depressive symptom score in Korean urban adults

	Null		Model 1∫		Model 2∫		Model 3∫		Model 4∫∫		Model 5∫∫		Model 6∫∫	
	Coeff	S.E.	Coeff	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Individual level variables														
<100(Korean 10,000 Won)††														
100 ≤income <300									-1.46***	0.15	-2.25***	0.35	-2.26***	0.40
300 ≤income <600									-1.98***	0.17	-3.69***	0.68	-3.70***	0.78
600 < income									-2.40***	0.23	-5.04***	1.02	-5.05***	1.18
Positive social support(Low level)														
Medium			-2.73***	0.28			-2.38***	0.27	-2.18***	0.26	-1.72***	0.35	-1.72***	0.41
High			-6.69***	0.23			-5.54***	0.23	-5.21***	0.23	-4.66***	0.54	-4.66***	0.67
negative social support(Low level)														
Medium					5.14***	0.17	4.67***	0.16	4.63***	0.16	8.02***	0.16	8.02***	0.51
High					9.29***	0.26	8.18***	0.26	8.04***	0.26	14.03***	0.26	14.03***	0.94
Positive social support x negative social support											-0.92***	0.15	-0.92***	0.15
Positive social support x income											0.47***	0.12	0.47***	0.12
Negative social support x income											-0.38**	0.13	-0.38**	0.13
Community-level variables														
Share of the employed													7.19	4.07
Mean income level													-4.73	4.61
Mean education level													6.98	6.39
Community level variance	4.84***		3.48**	1.33	3.00**	1.15	2.45**	0.93	2.61**	0.10	2.59**	1.03	1.90**	0.73
ICC	0.09*		0.08*		0.07*		0.06*		0.06*		0.06*		0.05*	
R-squared$ (level 1/level 2)	-		0.09/0.23		0.13/0.33		0.17/0.46		0.18/0.42		0.18/0.40		0.19/0.58	

Number of observations are 21, 208 in all models/∫: adjusted for only demographic variales including marital status, age and gender /∫∫: adjusted for both demographic and SES variables including marital status, age, gender, job status, and education level /*:p <0.05, **: p<0.01, *** :p<0.001 / ††1 US $ ≒ 1,128 Korea Won /$: R-squared proposed by Snijders and Bosker)

DISCUSSION

This study, conducted among a sample of urban dwellers in South Korea, showed that low level of positive and high level negative supports at the individual level was significantly associated with higher depressive symptom scores holding the effect of the negative and positive social support constant respectively, meaning that positive and negative support have their own independent effect. We also found that negative association of positive social support and positive association of negative social support with depressive symptom were magnified when the level of the other domain of social support was unfavorable or income level was low.

Our results on the association between positive social support and depressive symptoms are consistent with many previous findings, although there are slight differences in target groups and definition of social support across studies.[8-10 22 42 43] Generally, a low level of positive social support is associated with higher prevalence and incidence of the depressive symptom (or depressive disorder) in previous studies.

Although the exact pathways through which positive social support acts on mental health outcomes remains unclear, it has been posited generally to occur through two different processes that are not necessarily mutually exclusive. Stated briefly, positive social support may influence psychological wellbeing by buffering the adverse effects of emotional or financial stress (termed the 'buffering effect model'); or it may have a 'direct or main' effect on mental health by fulfilling a person's need for respect, social recognition, affection, or nurturance, irrespective of stress status (termed the 'main effect model')[44].

The effect of negative social support on mental health in adults has been less

explored in previous studies than that of positive social support. However, finding related to negative social support from the present study are also in line with finding in previous study performed in Netherland that reported that negatively experienced supports are significantly associated with higher prevalence and incidence of poor mental health in men and women aged 26-65 years.[45]

Most previous articles focused on only positive or negative social support without considering the other and studies which have examined the simultaneous effect of two domains of social supports are rare and outdated. Among them, Ingersoll-Dayton(1997) has identified four models framing the effect of each domain of social exchange; 'Positivity effect model' meaning that only positive exchange affect health outcome whether it's positive or negative outcomes, 'Negativity effect model' arguing that only negative exchange affect outcome, again whether positive or not, 'Domain specific effect model' meaning that positive and negative exchange affect only positive and negative outcome respectively, and lastly, 'Combined positivity and negativity effects model' arguing that positive exchange and negative exchange affect both positive and negative outcome simultaneously.[46] The result from our study supports the 'Combined positivity and negativity effect model'. A few other existing studies also support this model. For example, Golding and Burnam(1990) demonstrated that both social support and social conflict were significant predictors of depression among Mexican American adults when they were run together in a model.[47] More recently, Croezen et al(2012) showed that low level of positive support and high level of negative support were associated with high odds of poor mental health at the same time in Dutch men and women.[45]

More notable findings from the present study are significant interactions among positive, negative social support and income on the depressive symptom. Those with

lower income and higher level of negative support may receive greater benefits from positive social support and those with lower income and lower level of positive support may have greater damage from negative social supports compared to their counterparts. These findings may suggest that social supports play a similar role to income. Specifically, a high level of negative supports operated in the same way as low income in moderating the association between positive social support and depressive symptom as depicted in Figure 2. Similarly, low level of positive supports operated in the same manner as low income in moderating the association between negative social support and depressive symptoms as shown in Figure 3.

Low economic capacity can be linked to stress, low self-esteem, stigma, feelings of helplessness and hopelessness,[43] and risk for marginalization and social exclusion.[22] However, these can be counterbalanced by positive social support. Negative social support serves as a type of stressor similar to low income, for which positive social support also can compensate for.[48] Thus, the effect of positive support on reducing depressive symptom was stronger in a group with lower income and a higher level of negative social support. Emotional positive support, such as understanding, dialogue, appreciation, or getting assistance with problem solving, can provide marginalized poor or people hurt by negative social support with the feeling that they are cared for, esteemed, and valued. Tangible benefits bestowed by another aspect of positive support, named instrumental supports such as help in housework or exchange of material resources, may also assist in coping with materially deprived circumstances or feeling of being unprotected or being isolated caused by negative social support.[22] Conversely, negative supports such as perception of arguing, being criticized, feelings of undue demand, or too much intervention may serve as an additional source of stress for poor

people who are already psychologically vulnerable due to financial stress.[40] While people with a high level of positive support have the capacity to buffer harmful effect of negative support on the depressive symptoms, those without positive support may suffer from damage from negative support.

There are several studies which examined the interaction of positive and negative social support. While some have not found any evidence of interaction,[25 36] others have observed a buffering effect of positive social support on the association between negative social support and mental health across different outcomes and population group.[23 24] No previous studies have examined on the interaction between social supports and income on mental health to our knowledge.

The result of the current study may provide important implications in the Korean context. Since the country's economic crisis in late 1990, socioeconomic inequality has deepened, resulting in worsening social polarization, which, in turn, caused a rising prevalence of depression.[49] Suicide rate, for which depression has been blamed as a strong driver in Korea[50 51], also increased continuously from 8.4 in 1991 to 28.5 in 2013 (per 100,000 persons), ranking South Korea as the first in suicide rate among Organization for Economy Cooperation and Development countries since 2002.[52] Despite these concerning trends, only a minority of people with depressive symptoms seek professional consultation, for fear of the cultural stigma attached to mental illness.[53] Because economic disadvantage has been well recognized as a determinant of depression in Korea,[54] the results of our study provide supporting evidence for interventions encouraging positive social support or discouraging negative social support in underprivileged populations.

Although the poor are more affected by social support than the better off, they also

tend to have more limited capacity to control social support on their own by generating positive support or avoiding negative support. For example, people with economic capacity have more access to receive positive emotional support because they can afford private psychologists or clinical counselors. Similarly, they have more access to instrumental positive support by hiring private caregivers or housekeepers when they cannot find those supports among close people around them. Therefore, interventions to mobilize positive social support or prevent negative support for those with limited economic means might be effective for lowering depressive symptoms in society.

Strength and limitations

Although this study is unique in separately analyzing the effects of positive and negative social supports on depressive symptoms according to income level in a large sample, it also has a few limitations to be noted when interpreting the results. First, there is a possibility of reverse causation, given the cross-sectional nature of the study. For example, people with depressive symptoms may become less sociable and less engaged in social networks, thereby eventually reducing social support.[55] Second, we used the 38 health examination centers or training hospitals where target populations were recruited as a proxy for communities. Although this is not a geographical classification based on respondents' residential address, equating it with community is assumed to be reasonable; most people are likely to go to the hospitals nearest to their residence for their government-subsidized medical check-ups, because there is no much difference in quality between hospitals designated for government-subsidized health examination. Third, because no agreed upon cutoff points for high or low levels of social

support were available, we classified sum scores into three ordinal groups considering the number of people belonging to each group. To test the sensitivity of the result to the categorization of social support level, we reran the analyses using the score as a continuous variable. These different ways of categorization produced the almost same results.

CONCLUSION

The present study showed that, at the individual level, both positive and negative social support were associated with depressive symptoms, and these associations were found to be stronger in economically disadvantaged people when adjusting for various control variables at multiple levels. In addition, positive and negative social support moderated the association of negative and positive social support with depressive symptoms, respectively. Reducing inequality is always challenging, although most pursue social equality as an ideal. The results of this study suggest that strategies for adjusting positive and negative support among low income populations might be effective in reducing depressive symptoms in those populations.

Further study is required to reveal the mechanisms by which different types of individual social support operate on depressive symptoms in each economic group in the context of South Korea.

Contributors: HYL and JO conceived the study. HYL led the statistical analysis and drafted the manuscript. JO provided supervision throughout the data analysis and interpretation. IK provided overall guidance and helped to edit language. JH, SK, JL, and DK helped to interpret the

data. All authors read and approved the final manuscript.

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Data sharing statement: Data are available from the Korea Centers for Disease Control and Prevention for researchers who meet the criteria for access to the data. Researchers may contact Dr. Yeonjung Kim, Division of Epidemiology and Health Index, Center for Genome Science, Korea.

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Figure Legends

Figure 1 Derivation process of study sample

Figure 2 Differential effect of positive support according to level of negative support and income level on depressive symptom

Figure 3 Differential effect of negative support according to the level of positive support and income level on depressive symptom

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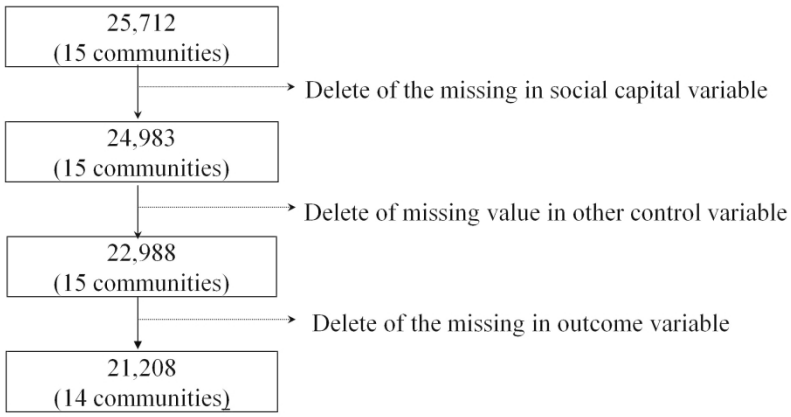
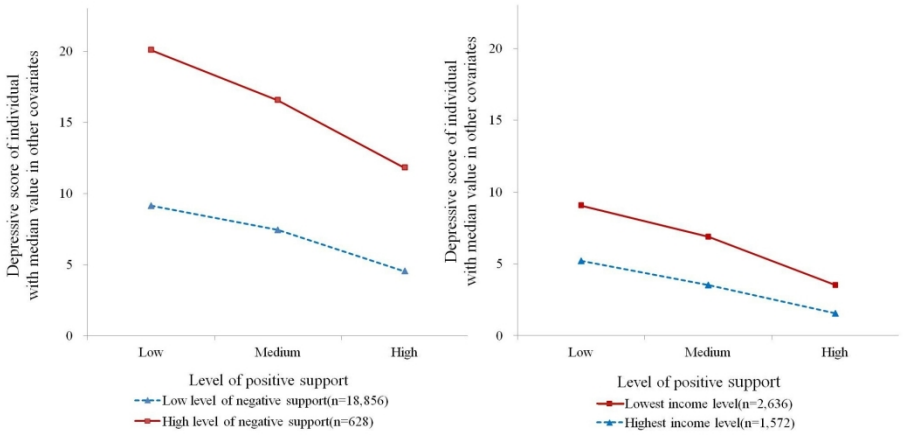


Figure 1. Derivation process of study sample

[Figure 1] Derivation process of study sample

254x190mm (300 x 300 DPI)



[Figure 2] Differential effect of positive support according to level of negative support and income level on depressive symptom

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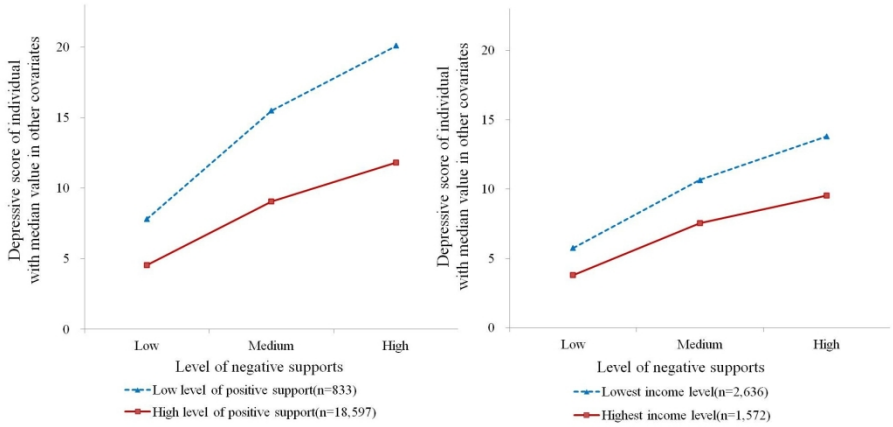

[Figure 3] Differential effect of negative support according to the level of positive support and income level on depressive symptom

187x95mm (300 x 300 DPI)

Supplemental Table 1. 20-items of the Centers for Epidemiologic Studies-Depression Scale (CES-D)

1. I was bothered by things that usually don't bother me.
2. I did not feel like eating; my appetite was poor
3. I felt that I could not shake off the blues even with help from my family or friends.
4. I had trouble keeping my mind on what I was doing.
5. I was happy.
6. I felt depressed.
7. I felt that everything I did was an effort.
8. I felt hopeful about the future.
9. I thought my life had been a failure.
10. I felt I was just as good as other people
11. My sleep was restless. I had a lot of trouble getting to sleep.
12. I felt fearful.
13. I talked less than usual.
14. I felt lonely.
15. I enjoyed life.
16. People were unfriendly.
17. I had crying spells.
18. I felt sad.
19. I felt that people disliked me.
20. I could not get going.

Supplemental Table 2. Questions for measuring positive and negative social support

Ask to the following questions on feeling about the people around you.

<Positive social support>

1. There is a person whom I can confide in
2. There is a person who always care or worry about me
3. There is a person whom I can discuss with when I have important or difficult matters
4. There is a person who nurses me and give a help in housework when I am ill
5. There is a person who gives or lends it when I need something
6. There is a person who takes a time for me and help with housework whenever I request

<Negative social support>

1. There is a person who object to or meddle with what I do
2. There is a person who blames me for all the problems I have
3. There is a person who forgets or ignores me
4. There is a person who gives you unwanted help and make me uncomfortable
5. There is a person who is indifferent to me and my affair
6. There is a person who turns down most of the time when I ask help

Supplemental table 3. Chi-square correlation test between positive and negative social support

		Positive support					
		Level 1		Level 2		Level 3	
		χ^2 (P)	Phi	χ^2 (P)	Phi	χ^2 (P)	Phi
Negative support	Level 1	299.1(p<0.001)	-0.12	92.3(p<0.001)	0.07	273.7(p<0.001)	0.11
	Level 2	443.2(p<0.001)	-0.15	236.1(p<0.001)	0.11	202.5(p<0.001)	0.10
	Level 3	783.0(p<0.001)	0.19	347.5(p<0.001)	-0.13	474.5(p<0.001)	-0.15

Supplemental table 4. Association of other covariates and depressive symptom score (from Model 6 in Table 2)

	Coeff.	S.E.
Currently married/co-residing		
Never married	0.46	0.29
Separated/divorced	2.09***	0.25
Widowed	1.11***	0.22
Others	-0.90	1.16
40≤age<50(yrs)		
50≤age<60	-0.20*	0.10
60≤age<70	-0.84***	0.14
Male		
Female	0.74***	0.11
Non-manual		
Service and sales workers	0.24	0.15
Manual	-0.18	0.16
Armed forces occupation	-1.98	1.28
Housewives	0.63***	0.15
Unemployed	0.32	0.20
Others	-0.50	0.64
Primary school or below		
High school graduate	-0.56***	0.13
College degree	-0.80***	0.18
Graduate school or higher	-1.17***	0.27

*:p <0.05, **: p<0.01, *** :p<0.001

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-8
Bias	9	Describe any efforts to address potential sources of bias	*9*
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	10
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10(Figure1)
		(b) Give reasons for non-participation at each stage	10(Figure1)
		(c) Consider use of a flow diagram	10(Figure1)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10-11(Table 1)
		(b) Indicate number of participants with missing data for each variable of interest	10(Figure1)
Outcome data	15*	Report numbers of outcome events or summary measures	10-11(Table 1)
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-14(Table 2 & 3)
		(*b*) Report category boundaries when continuous variables were categorized	7-8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Positive and negative social support and depressive symptoms according to economic status among adults in Korea: Cross-sectional results from the Health Examinees-Gem Study

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Primary Subject Heading:	Mental health
Secondary Subject Heading:	Public health
Keywords:	Depressive symptom, multi-level regression, social capital, social support

Note: The following files were submitted by the author for peer review, but cannot be converted to PDF. You must view these files (e.g. movies) online.

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Positive and negative social support and depressive symptoms according to economic status among adults in Korea: Cross-sectional results from the Health Examinees-Gem Study

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Positive and negative social support and depressive symptoms according to economic status among adults in Korea: Cross-sectional results from the Health Examinees-Gem Study

ABSTRACT

Objectives: The interaction between positive and negative social support as well as each domain of social support and income on depressive symptom have not been much explored. We aimed to examine the associations of positive and negative social support with the risk of depressive symptoms among urban-dwelling adults in Korea, focusing on those interaction effects.

Design: We used the first wave of a large-scale cohort study called The Health Examinees-Gem Study. Positive and negative support scores ranged between 0–6; the variables were then categorized into low, medium, and high groups. A two-level random intercept linear regression model was used, where the first level is individual and the second is the community. We further tested for interactions between each domain of social supports and household income.

Setting: A survey conducted at 38 health examination centers and training hospitals in major Korean cities and metropolitan areas during 2009-2010.

Participants: 21,208 adult men and women aged between 40 and 69 in Korea (mean age: 52.6, standard deviation: 8.0).

Outcome measures: Depressive symptoms score measured by Epidemiologic Studies-

Depression Scale, with scores ranging from 0 to 60.

Results: Level of positive and negative social support showed a negative and positive association with depressive symptom score with statistical significance at $p<0.05$ respectively. When the interaction terms among household income and social supports were examined, a negative association between level of positive social support and depressive symptom score was more pronounced as income was lower and level of negative social support was higher. Similarly, positive association between level of negative social support and depressive symptom score was more pronounced as income was lower and level of positive social support was lower.

Conclusions: Our findings suggest that strategies for encouraging positive social support and discouraging negative social support for disadvantaged individuals might be effective in reducing depression in Korea.

Keywords: Depressive symptoms, multi-level regression, social capital, social support.

Strengths and limitations of this study

- To the best of our knowledge, this is the first study to explore the difference in the association between positive and negative social support and depressive symptom according to a different level of social support and economic status.
- The article is based on a large study involving 21,208 Korean adults.
- The study design is cross-sectional and hence can only reveal associations between social support and depressive symptom.
- We used health examination centers where respondents were recruited as a proxy for the community, which is not an accurate geographical classification.

INTRODUCTION

Depression has been proven to be associated with adverse health outcomes including increased susceptibility to disease through multiple mechanisms, such as disrupted immune functioning[1-3] and altered health-related behavioral patterns (e.g., excessive alcohol use, smoking, poor diet).[4 5] In addition, depression is linked to suicide. Not only suicide ideation studies but also psychological autopsy studies have proved the strong association between depression and suicide.[6 7]

Positive social support has been shown to be protective against risk of depression by buffering the effects of stress.[4 8-11] Specifically, instrumental support, such as tangible assistance (labor, in kind) and financial support (e.g., cash loans), has been demonstrated to lower the risk of depression by assisting individuals in coping with everyday hardships and facilitating their socioeconomic mobility.[12 13] Emotional support such as companionship and intimacy can also buffer the individual from the harmful effects of stress.[14 15] On the other hand, social support does not always give rise to positive experiences, however well-meaning the intentions of the support giver may be. Social support can be negative when it is unwanted, at odds with the needs of the recipient, or when it makes the recipient uncomfortable, which could unintentionally serve as a potential source of stress.[16-19] Thus, positive and negative supports represent two separate domains of social experience and may have independent effects on depression via different mechanisms.[16 20 21]

In addition, these two domains of social supports might interfere in the effect on psychological depression each other when they co-exist. According to the "buffering effect model", those with a high level of negative support may receive more benefit from the positive support in reducing depressive symptom. Conversely, high level of positive support may cushion the adverse effect of the stressor from negative supports

on mental health.[22] Only a handful of studies have explored on this and have not been updated for a long time.[23-25]

Socioeconomically disadvantaged people disproportionately experience conditions that elevate the risk of depression, such as precarious work, job loss, financial insecurity, or disadvantaged living environment.[26-29] In addition, urban dwellers, especially those in developed countries such as Canada and the United Kingdom, are usually more vulnerable to depression than those living in rural areas, owing to stresses from more frequent encounters with uneven distribution of socioeconomic status (SES), competitive work environment, higher rate of separated or divorced marital status, high rate of suffering from crime, and poor social cohesion.[30-33] These findings give rise to the question of whether positive or negative social support might benefit or harm more in financially distressed people living in an urban area. For example, better -off people may have the capacity to obtain information for coping with depressive moods from various sources other than their social networks. Similarly, they can afford to hire people or purchase things that can help them avoid depressive situations. However, to our knowledge, there was no study that has investigated on this to date. Most studies have focused only on the relationships between financial deprivation and depressive symptoms[34-36] or on the protective influence of social support on depression.[8-11]

Korea is facing a continuous increase in depression. One-year prevalence of depression, the proportion of adults who had experienced depressive disorder more than once during the recent 12 months from the survey time, increased from 1.8 % in 2001 to 3.1 % in 2011.[37]

The current study sought to address the following research questions in Korean context while addressing the research gaps that exist in previous studies. The first, are

positive and negative support independently associated with depressive symptoms? Second, do positive social support moderate the effect of negative social support on depressive symptom or vice versa? Finally, are the effects of positive and negative support more pronounced for less affluent individuals?

METHODS

Data source

Our data came from a large-scale genomic cohort study called The Health Examinees-Gem (HEXA-G), which was established to investigate the epidemiologic characteristics of major chronic diseases in Korean adults living in urban areas. Target participants which are adult males and females aged 40–69, were recruited prospectively at 38 health examination centers or training hospitals located in 8 regions in Korea (Seoul/Incheon/Gyeonggi-do, Gangwon-Do, Daejeon/Chungcheongnam-do, Chungcheongbuk-do, Daegu/ Gyeongsangbuk-do, Busan/ Gyeongsangnam-do,Jeollabuk-do,Gwangju/ Jeollanam-do) when they visited for their government-subsidized health examinations provided for free by the National Health Insurance Service biennially to all Korean adults aged over 40 for the purpose of effective health promotion and disease prevention. This way of recruiting can provide the advantages of longitudinal repeated measurements, and a pool of subjects that are representative of the majority of the Korean population.

The baseline survey was conducted by trained research staff using a standardized questionnaire, which included information on sociodemographic characteristics,

medical history, medication usage, lifestyles, dietary habits, and social capital. Written informed consent was obtained from all participants. The study protocol was approved by the Ethics Committee of the Korean Health and Genomic Study of the Korean National Institute of Health, as well as by the institutional review boards of all participating hospitals.

Although the recruitment occurred in two phases (first-phase survey: 2004–2008, second-phase survey: 2009–2013), this study utilized data collected between March 2009, and March 2010, because of availability of information on depressive symptoms. More detailed information about the study design can be found elsewhere.[38]

Outcome variable

Depressive symptoms were measured using the 20-item version of the Centers for Epidemiologic Studies-Depression Scale (CES-D) which was developed for use in the epidemiologic studies of depressive symptom in the general population.[39] CES-D has been proved to be reliable in previous studies with a Cronbach's alpha of 0.84 ~ 0.90 depending on the ethnic groups.[39 40] Respondents were asked to rate how often, over the preceding week, they experienced symptoms associated with depression, such as restless sleep, poor appetite, and feelings of loneliness. Possible scores ranged between 0 and 3 for each item (0 = less than one day per week, 1 = 1–2 days per week, 2 = 3–4 days per week, and 3 = more than 6 days per week). The overall score, obtained by summation of the individual items, has a possible range of 0–60, with higher scores indicating more severe depressive symptoms (Supplemental table 1).

Social support

Positive and negative social supports were measured by 6 items each. Whereas most previous studies have investigated the functional characteristics of social support based on the Social Experiences Checklist which measures positive and negative experiences of social supports (such as appreciation of relationships with others), the HEXA-G study investigated structural characteristics of social support, such as the presence of people around the respondent who provide certain kinds of positive or negative support in certain situations. Questions about positive social support in our study include both instrumental (e.g., giving or lending it when I need something) and emotional dimensions (e.g., caring or worrying about me). Questions about negative support also have two dimensions: aggressive type of negative support (e.g., causing active harm to the respondent) and passive type of negative support (e.g., indifference and neglect) (Supplemental table 2).

Respondents were asked to answer "yes" or "no" to each question. We referred to a previous study in operating social support variables where structural social support was coded into absolute levels of social capital (for example, number of individuals or groups respondents received support from) and then categorized into groups.[41] We avoided using social support variable as continuous one because our interest is a relationship between the overall level of social support and depressive symptom rather than focusing on how much effect having one more people who can give social support would have on the depressive symptom.

To construct the variable reflecting level of positive and negative social support, the number of "yes" responses to each of the six questions was summed first to create

three ordinal groups. Since there is no objective or agreed-upon criteria used for determining level of social support, we chose the cutoff values considering frequency distribution: low positive/negative support (scores of 0–2 for positive support and 0–1 for negative support), medium positive/negative support (scores of 3–4 for positive support and 2–3 for negative support), and high positive/negative support (scores of 5–6 for positive support and 4–6 for negative support).

Other explanatory factors

Marital status was categorized into five categories: married or cohabiting, never married, divorced or separated, widowed, and others. Age was divided into ten-year interval groups, starting at 40 years old. The SES factors included occupational status, education level, and household income level. Specifically, respondents were asked to provide their occupational status by choosing among 14 kinds of job categorized by the Korean Standard Classification of Occupation. We grouped these into 7 categories: non-manual (legislators, senior officials, managers, professionals, technicians and associate professionals, clerical support workers), service and sales workers, manual (skilled agricultural, forestry and fishery workers, craft and related trades workers, plant and machine operators and assemblers, elementary occupations), armed forces, housewives, unemployed, and others. Educational attainment was grouped into four levels: primary school or below, high school graduate or below, college degree, and graduate school or higher. Household monthly income was asked into four levels (unit: 10,000 Korean Won): < 100 (≒ 887 US$), 100 to < 300 (≒ 2,660 US$), 300 to < 600 (≒ 5,319 US$), and ≥ 600.

We controlled for several community-level SES variables such as average income, average educational level, and the employment rate in the community, which were created from aggregation of their individual-level analogues. The purpose of this was to adjust for the SES-contextual effect of people living together in the community based on assumption that people may feel a different level of depressive symptom depending on the level of socioeconomic status of their neighborhood even if their individual socioeconomic status are equal.

Patient and public involvement

This study did not involve patients. Participants were urban dwellers aged 40–69 who visited hospitals for their government-subsidized health examinations. The findings from this study will be disseminated to the wider public via local media and civil society organizations.

Statistical analyses

We constructed linear random intercept multi-level models to estimate the association between negative and positive social support and the risk of depressive symptoms while accounting for the clustering of observations at the community level. Because there is no residential address information in our dataset, we used the 38 health examination centers or training hospitals where survey population was recruited as a proxy for communities, assuming that people would visit the nearest centers to their residence for their medical check-ups.

We started by including positive and negative social supports alternately in the model with adjustment only for individual-level demographic variables: marital status, age, and gender (model 1 and 2). From checking the correlation, we found a weak negative correlation between positive and negative social support (refer to the supplemental table 3 for phi coefficients from Chi-square analyses). Testing of Variance Inflation Factor (VIF) revealed no multicollinearity between two (VIF=1.06 and 1.5 for the level of positive social support and negative social support respectively). Therefore, we tried to run a model including both domains of social supports simultaneously with adjustment for only demographic characteristics first (model 3), and then additional adjustment for SES variables: occupational status, educational level, and monthly income (model 4). This will enable us to test whether the association between one domain of social support and depressive symptom is not due to the confounding effect of the other domain of support. The reason for sequential entering of groups of demographic and SES variables was that we wanted to explore whether adjusting for SES would attenuate the association between positive or negative social supports and the outcome variable, assuming that SES might confound the association between social support and depressive symptoms. All potential two-way and three-way interaction terms between income and each domain of supports were explored (model 5). Finally, we tried to control for community-level SES variables (model 6). All statistical tests were two-sided, and statistical significance was determined at $p < 0.05$. Data were analyzed using SAS 9.3 software package.

RESULTS

The total number of respondents who participated in the survey between March 2009 and March 2010, was 25,712 in 15 communities. After list-wise deletion of participants with missing data in the independent and outcome variables, the final number of respondents for analysis was 21,208 in 14 communities (Figure 1).

Insert figure 1

Table 1 shows the descriptive statistics of the sample. The married or cohabiting group, which accounted for almost 90% of the sample, showed the lowest level of depressive symptoms, whereas the separated or divorced category showed the highest level, ranging from 4.25 to 8.07. The difference in depressive symptom scores across age groups was less than 0.3. Men scored lower on depressive symptoms compared with women, on average. Depressive symptoms diminished as education level and monthly income level increased. Among occupations, the group working in the armed forces had the lowest average depressive symptoms score. There was a large difference in average depressive symptom scores across low, medium, and high levels of positive and negative social support groups in the study sample.

Table 1. Descriptive statistics of a study sample of urban adults in Korea.

	n	Proportion (%)	Mean depressive symptom score
Marriage			
Currently married/cohabiting	19,037	89.76	4.25
Never married	514	2.42	5.11
Separated/divorced	671	3.16	8.07
Widowed	957	4.51	6.20
Others	29	0.14	5.59

Age(yrs)			
40≤age<50	8,387	39.55	4.44
50≤age<60	8,098	38.18	4.61
60≤age<70	4,723	22.27	4.34
Gender			
Male	7,978	37.62	3.62
Female	13,230	62.38	5.01
Education			
Primary school or below	3,242	15.29	5.67
High school graduate	12,830	60.50	4.46
College degree	4,277	20.17	3.90
Graduate school or higher	859	4.05	3.31
Job			
Non-manual	3,776	17.80	3.72
Service and sales workers	3,983	18.78	4.22
Manual	4,324	20.39	4.21
Armed forces occupation	24	0.11	2.21
Housewives	7,106	33.51	5.33
Unemployed	1,895	8.94	4.00
Others	100	0.47	5.37
Income(Korean 10,000 Won)†			
<100	2,636	12.43	7.08
100 ≤income <300	9,715	45.81	4.42
300 ≤income <600	7,285	34.35	3.86
600 < income	1,572	7.41	3.40
Level of positive social support			
Low	833	3.93	11.51
Medium	1,778	8.38	9.07
High	18,597	87.69	3.73
Level of negative social support			
Low	18,856	88.91	3.66
Medium	1,724	8.13	10.00
High	628	2.96	14.16

†1 US $ ≒ 1,128 Korea Won

Models 1 and 2 in Table 2 show the linear coefficients and 95% confidence intervals for depressive symptoms according to the level of positive and negative social support respectively when only individual-level demographic variables were controlled. We found clear inverse gradient of positive social support and positive gradient of negative social support with depressive symptom (for positive social support, b = -2.73,

p<0.001 in medium group; *b* = -6.69, *p*<0.001 in high group / for negative social supports, b=5.14, *p*<0.001 in medium group; b=9.29, *p*<0.001 in high group). When two domains of social support were run together in one model (model 3), negative support (or positive support) did not cancel out the benefits of positive support (or harm of negative support), indicating each domain of social support may operate independently (for positive social support, *b* = -2.38, *p*<0.001 in medium group; *b* = -5.54, *p*<0.001 in high group / for negative social supports, b=4.67, *p*<0.001 in medium group; b=8.18, *p*<0.001 in high group). Adjusting for SES variables did not attenuate the strength of association between social support and depressive symptom as shown in models 4(for positive social support, *b* = -2.18, *p*<0.001 in medium group; *b* = -5.21, *p*< 0.001 in high group / for negative social supports, b=4.63, p<0.001 in medium group; b=8.03, p<0.001 in high group).

Since the level of income, level of positive and negative social support was linearly related with depressive symptom in the main effect of model 4, interaction terms were constructed by multiplying each of these variables as a continuous one to simplify the model.

All the two-way interactions were found to be significant (model 5). Association between positive social support and the depressive symptom was different according to the level of negative social support as well as income level. Specifically, the negative association between the level of positive support and depressive symptoms score was stronger for individuals with a higher level of negative support and lower income level as shown in Figure 2. Equivalently, the association between negative social support and depressive symptom depended on the level of positive social support and income. Negative social support had a stronger positive association with depressive symptom

score in a group with a lower level of positive social support or lower income (Figure 3). That is, high level of negative support had a similar effect as low income while a high level of positive support had a similar effect as high income in moderating associations with the depressive symptoms. In Figure 2 and 3, we presented only the highest and lowest groups in the level of social support and in the level of income to show the differential effect in a maximized way. A three-way interaction term between positive, negative social support and income level was not significant (not presented). None of the community level SES variable was significant (model 6).

Insert Figure 2 and Figure 3

Regarding the relevance of the other independent variables, marital status of being separated or divorced and being widowed, female gender, and occupational status of housewife were associated with higher depressive symptom scores compared with their counterparts while older groups and people with higher education level were likely to have lower depressive symptom score (Supplemental table 4).

Table 2. Results from multilevel regression of positive and negative social supports and income on depressive symptom score in Korean urban adults

	Null		Model 1∫		Model 2∫		Model 3∫		Model 4∫∫		Model 5∫∫		Model 6∫∫	
	Coeff	S.E.	Coeff	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Individual level variables														
<100(Korean 10,000 Won)††														
100 ≤income <300									-1.46***	0.15	-2.25***	0.35	-2.26***	0.40
300 ≤income <600									-1.98***	0.17	-3.69***	0.68	-3.70***	0.78
600 < income									-2.40***	0.23	-5.04***	1.02	-5.05***	1.18
Positive social support(Low level)														
Medium			-2.73***	0.28			-2.38***	0.27	-2.18***	0.26	-1.72***	0.35	-1.72***	0.41
High			-6.69***	0.23			-5.54***	0.23	-5.21***	0.23	-4.66***	0.54	-4.66***	0.67
negative social support(Low level)														
Medium					5.14***	0.17	4.67***	0.16	4.63***	0.16	8.02***	0.16	8.02***	0.51
High					9.29***	0.26	8.18***	0.26	8.04***	0.26	14.03***	0.26	14.03***	0.94
Positive social support x negative social support											-0.92***	0.15	-0.92***	0.15
Positive social support x income											0.47***	0.12	0.47***	0.12
Negative social support x income											-0.38**	0.13	-0.38**	0.13
Community-level variables														
The share of the employed													7.19	4.07
Mean income level													-4.73	4.61
Mean education level													6.98	6.39
Community level variance	4.84***		3.48**	1.33	3.00**	1.15	2.45**	0.93	2.61**	0.10	2.59**	1.03	1.90**	0.73
ICC	0.09*		0.08*		0.07*		0.06*		0.06*		0.06*		0.05*	
R-squared$ (level 1/level 2)	-		0.09/0.23		0.13/0.33		0.17/0.46		0.18/0.42		0.18/0.40		0.19/0.58	

Number of observations are 21, 208 in all models/∫: adjusted for only demographic variables including marital status, age and gender /∫∫: adjusted for both demographic and SES variables including marital status, age, gender, job status, and education level /*:p <0.05, **: p<0.01, *** :p<0.001 / ††1 US $ ≒ 1,128 Korea Won /$: R-squared proposed by Snijders and Bosker)

DISCUSSION

This study, conducted among a sample of urban dwellers in South Korea, showed that low level of positive and high level negative supports at the individual level was significantly associated with higher depressive symptom scores holding the effect of the negative and positive social support constant respectively, meaning that positive and negative support have their own independent effect. We also found that negative association of positive social support and positive association of negative social support with depressive symptom were magnified when the level of the other domain of social support was unfavorable or income level was low.

Our results on the association between positive social support and depressive symptoms are consistent with many previous findings, although there are slight differences in target groups and the definition of social support across studies.[8-10 22 42 43] Generally, a low level of positive social support is associated with higher prevalence and incidence of the depressive symptom (or depressive disorder) in previous studies.

Although the exact pathways through which positive social support acts on mental health outcomes remains unclear, it has been posited generally to occur through two different processes that are not necessarily mutually exclusive. Stated briefly, positive social support may influence psychological wellbeing by buffering the adverse effects of emotional or financial stress (termed the 'buffering effect model'); or it may have a 'direct or main' effect on mental health by fulfilling a person's need for respect, social recognition, affection, or nurturance, irrespective of stress status (termed the 'main effect model').[44]

The effect of negative social support on mental health in adults has been less

explored in previous studies than that of positive social support. However, finding related to negative social support from the present study are also in line with finding in the previous study performed in Netherland that reported that negatively experienced supports are significantly associated with higher prevalence and incidence of poor mental health in men and women aged 26-65 years.[45]

Most previous articles focused on only positive or negative social support without considering the other and studies which have examined the simultaneous effect of two domains of social supports are rare and outdated. Among them, Ingersoll-Dayton (1997) has identified four models framing the effect of each domain of social exchange; 'Positivity effect model' meaning that only positive exchange affect health outcome whether it's positive or negative outcomes, 'Negativity effect model' arguing that only negative exchange affect outcome, again whether positive or not, 'Domain specific effect model' meaning that positive and negative exchange affect only positive and negative outcome respectively, and lastly, 'Combined positivity and negativity effects model' arguing that positive exchange and negative exchange affect both positive and negative outcome simultaneously.[46] The result from our study supports the 'Combined positivity and negativity effect model'. A few other existing studies also support this model. For example, Golding and Burnam (1990) demonstrated that both social support and social conflict were significant predictors of depression among Mexican American adults when they were run together in a model.[47] More recently, Croezen et al(2012) showed that low level of positive support and high level of negative support were associated with high odds of poor mental health at the same time in Dutch men and women.[45]

More notable findings from the present study are significant interactions among positive, negative social support and income on the depressive symptom. Those with a

lower income and a higher level of negative support may receive greater benefits from positive social support and those with lower income and lower level of positive support may have greater damage from negative social supports compared to their counterparts. These findings may suggest that social supports play a similar role to income. Specifically, a high level of negative supports operated in the same way as low income in moderating the association between positive social support and depressive symptom as depicted in Figure 2. Similarly, low level of positive supports operated in the same manner as low income in moderating the association between negative social support and depressive symptoms as shown in Figure 3.

Low economic capacity can be linked to stress, low self-esteem, stigma, feelings of helplessness and hopelessness,[43] and risk for marginalization and social exclusion.[22] However, these can be counterbalanced by positive social support. Negative social support serves as a type of stressor similar to low income, for which positive social support also can compensate for.[48] Thus, the effect of positive support on reducing depressive symptom was stronger in a group with lower income and a higher level of negative social support. Emotional positive support, such as understanding, dialogue, appreciation, or getting assistance with problem-solving, can provide marginalized poor or people hurt by negative social support with the feeling that they are cared for, esteemed, and valued. Tangible benefits bestowed by another aspect of positive support, named "instrumental supports" such as help in housework or exchange of material resources, may also assist in coping with materially deprived circumstances or feeling of being unprotected or being isolated caused by negative social support.[22] Conversely, negative supports such as perception of arguing, being criticized, feelings of undue demand, or too much intervention may serve as an additional source of stress for poor

people who are already psychologically vulnerable due to financial stress.[40] While people with a high level of positive support have the capacity to buffer the harmful effect of negative support on the depressive symptoms, those without positive support may suffer from damage from negative support.

There are several studies which examined the interaction of positive and negative social support. While some have not found any evidence of interaction,[25 36] others have observed a buffering effect of positive social support on the association between negative social support and mental health across different outcomes and population group.[23 24] No previous studies have examined the interaction between social supports and income on mental health to our knowledge.

The result of the current study may provide important implications in the Korean context. Since the country's economic crisis in late 1990, socioeconomic inequality has deepened, resulting in worsening social polarization, which, in turn, caused a rising prevalence of depression.[49] Suicide rate, for which depression has been blamed as a strong driver in Korea,[50 51] also increased continuously from 8.4 in 1991 to 28.5 in 2013 (per 100,000 persons), ranking South Korea as the first in suicide rate among Organization for Economy Cooperation and Development countries since 2002.[52] Despite these concerning trends, only a minority of people with depressive symptoms seek professional consultation, for fear of the cultural stigma attached to mental illness.[53] Because economic disadvantage has been well recognized as a determinant of depression in Korea,[54] the results of our study provide supporting evidence for interventions encouraging positive social support or discouraging negative social support in underprivileged populations.

Although the poor are more affected by social support than the better off, they also

tend to have more limited capacity to control social support on their own by generating positive support or avoiding negative support. For example, people with economic capacity have more access to receive positive emotional support because they can afford private psychologists or clinical counselors. Similarly, they have more access to instrumental positive support by hiring private caregivers or housekeepers when they cannot find those supports among close people around them. Therefore, interventions to mobilize positive social support or prevent negative support for those with limited economic means might be effective for lowering depressive symptoms in society.

Strength and limitations

Although this study is unique in separately analyzing the effects of positive and negative social support on depressive symptoms according to income level in a large sample, it also has a few limitations to be noted when interpreting the results. First, there is a possibility of reverse causation, given the cross-sectional nature of the study. For example, people with depressive symptoms may become less sociable and less engaged in social networks, thereby eventually reducing social support.[55] Second, we used the 38 health examination centers or training hospitals where target populations were recruited as a proxy for communities. Although this is not a geographical classification based on respondents' residential address, equating it with a community is assumed to be reasonable; most people are likely to go to the hospitals nearest to their residence for their government-subsidized medical check-ups because there is no much difference in quality between hospitals designated for government-subsidized health examination. Third, because no agreed-upon cutoff points for high or low levels

of social support were available, we classified sum scores into three ordinal groups considering the number of people belonging to each group. To test the sensitivity of the result to the categorization of social support level, we reran the analyses using the score as a continuous variable. These different ways of categorization produced the almost same results.

CONCLUSION

The present study showed that, at the individual level, both positive and negative social support were associated with depressive symptoms, and these associations were found to be stronger in economically disadvantaged people when adjusting for various control variables at multiple levels. In addition, positive and negative social support moderated the association of negative and positive social support with depressive symptoms, respectively. Reducing inequality is always challenging, although most pursue social equality as an ideal. The results of this study suggest that strategies for adjusting positive and negative support among low-income populations might be effective in reducing depressive symptoms in those populations.

Further study is required to reveal the mechanisms by which different types of individual social support operate on depressive symptoms in each economic group in the context of South Korea.

Contributors: HYL and JO conceived the study. HYL led the statistical analysis and drafted the manuscript. JO provided supervision throughout the data analysis and interpretation. IK provided overall guidance and helped to edit language. JH, SK, JL, and DK helped to interpret the

data. All authors read and approved the final manuscript.

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Competing interests: None declared.

Ethics approval: The HEXA-G study was approved by the Ethics Committee of the Korean Health and Genomic Study of the Korean National Institute of Health

Data sharing statement: Data are available from the Korea Centers for Disease Control and Prevention for researchers who meet the criteria for access to the data. Researchers may contact Dr. Yeonjung Kim, Division of Epidemiology and Health Index, Center for Genome Science, Korea.

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Figure Legends

Figure 1 Derivation process of the study sample

Figure 2 Differential effect of positive support according to the level of negative support and income level on depressive symptom

Figure 3 Differential effect of negative support according to the level of positive support and income level on depressive symptom

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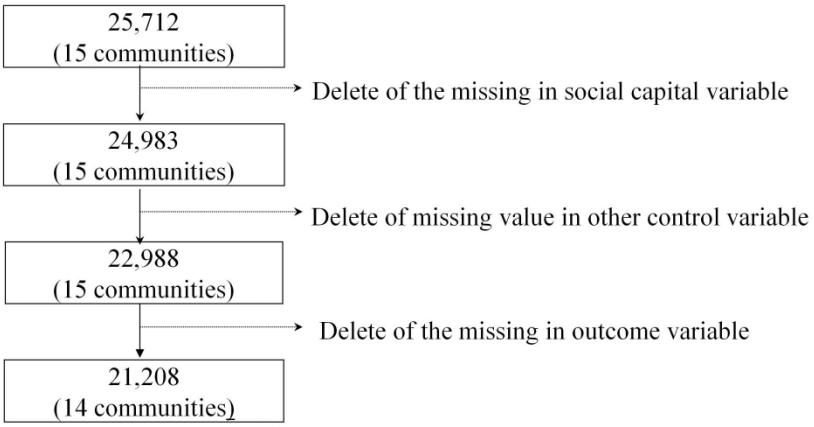
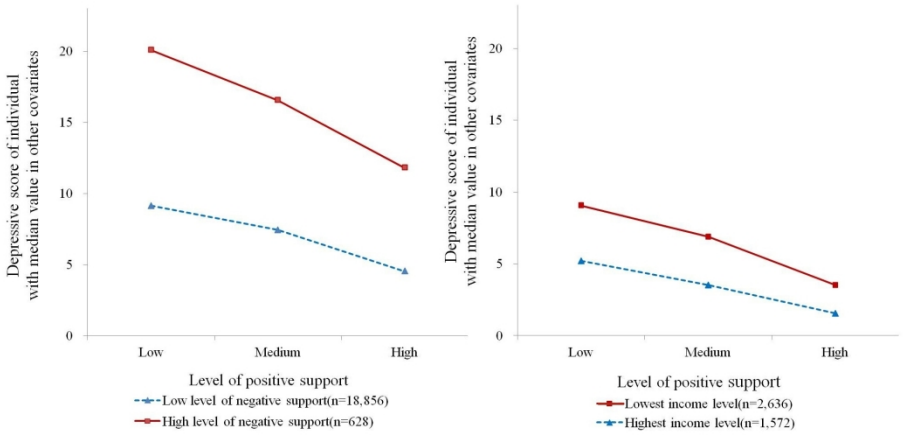


[Figure 1] Derivation process of the study sample

246x139mm (300 x 300 DPI)



[Figure 2] Differential effect of positive support according to the level of negative support and income level on depressive symptom

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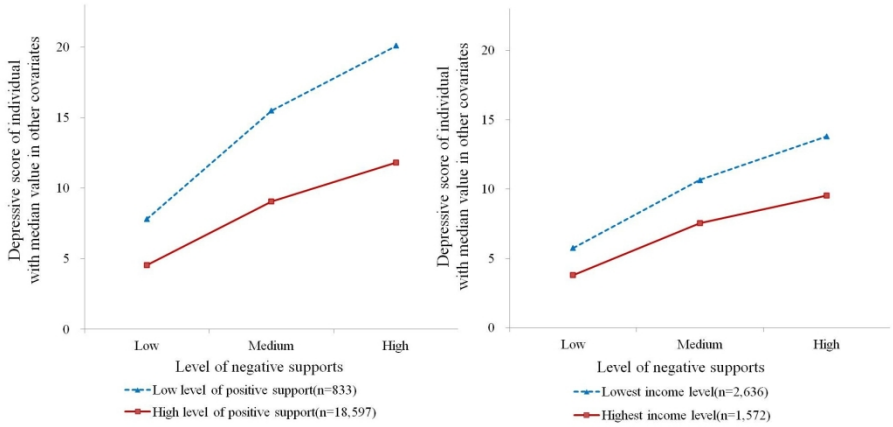

[Figure 3] Differential effect of negative support according to the level of positive support and income level on depressive symptom

187x95mm (300 x 300 DPI)

Supplemental Table 1. 20-items of the Centers for Epidemiologic Studies-Depression Scale (CES-D)

1. I was bothered by things that usually don't bother me.
2. I did not feel like eating; my appetite was poor
3. I felt that I could not shake off the blues even with help from my family or friends.
4. I had trouble keeping my mind on what I was doing.
5. I was happy.
6. I felt depressed.
7. I felt that everything I did was an effort.
8. I felt hopeful about the future.
9. I thought my life had been a failure.
10. I felt I was just as good as other people
11. My sleep was restless. I had a lot of trouble getting to sleep.
12. I felt fearful.
13. I talked less than usual.
14. I felt lonely.
15. I enjoyed life.
16. People were unfriendly.
17. I had crying spells.
18. I felt sad.
19. I felt that people disliked me.
20. I could not get going.

Supplemental Table 2. Questions for measuring positive and negative social support

Ask to the following questions on feeling about the people around you.

<Positive social support>

1. There is a person whom I can confide in
2. There is a person who always care or worry about me
3. There is a person whom I can discuss with when I have important or difficult matters
4. There is a person who nurses me and give a help in housework when I am ill
5. There is a person who gives or lends it when I need something
6. There is a person who takes a time for me and help with housework whenever I request

<Negative social support>

1. There is a person who object to or meddle with what I do
2. There is a person who blames me for all the problems I have
3. There is a person who forgets or ignores me
4. There is a person who gives you unwanted help and make me uncomfortable
5. There is a person who is indifferent to me and my affair
6. There is a person who turns down most of the time when I ask help

Supplemental table 3. Chi-square correlation test between positive and negative social support

		Positive support					
		Level 1		Level 2		Level 3	
		χ^2 (P)	Phi	χ^2 (P)	Phi	χ^2 (P)	Phi
Negative support	Level 1	299.1(p<0.001)	-0.12	92.3(p<0.001)	0.07	273.7(p<0.001)	0.11
	Level 2	443.2(p<0.001)	-0.15	236.1(p<0.001)	0.11	202.5(p<0.001)	0.10
	Level 3	783.0(p<0.001)	0.19	347.5(p<0.001)	-0.13	474.5(p<0.001)	-0.15

Supplemental table 4. Association of other covariates and depressive symptom score (from Model 6 in Table 2)

	Coeff.	S.E.
Currently married/co-residing		
Never married	0.46	0.29
Separated/divorced	2.09***	0.25
Widowed	1.11***	0.22
Others	-0.90	1.16
40≤age<50(yrs)		
50≤age<60	-0.20*	0.10
60≤age<70	-0.84***	0.14
Male		
Female	0.74***	0.11
Non-manual		
Service and sales workers	0.24	0.15
Manual	-0.18	0.16
Armed forces occupation	-1.98	1.28
Housewives	0.63***	0.15
Unemployed	0.32	0.20
Others	-0.50	0.64
Primary school or below		
High school graduate	-0.56***	0.13
College degree	-0.80***	0.18
Graduate school or higher	-1.17***	0.27

*:p <0.05, **: p<0.01, *** :p<0.001

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-8
Bias	9	Describe any efforts to address potential sources of bias	*9*
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	10
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10(Figure1)
		(b) Give reasons for non-participation at each stage	10(Figure1)
		(c) Consider use of a flow diagram	10(Figure1)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10-11(Table 1)
		(b) Indicate number of participants with missing data for each variable of interest	10(Figure1)
Outcome data	15*	Report numbers of outcome events or summary measures	10-11(Table 1)
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-14(Table 2 & 3)
		(*b*) Report category boundaries when continuous variables were categorized	7-8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.