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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-023036
Article Type:	Research
Date Submitted by the Author:	27-Mar-2018
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Keywords:	Depressive symptom, multi-level regression, social capital

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4 **Positive and negative social support and depressive**  
5 **symptoms according to economic status among adults in**  
6 **Korea: A multilevel regression analysis**  
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51  
52 Word count: 3,079; number of tables: 3; number of figures: 3; number of references: 49  
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4 **Positive and negative social support and depressive**  
5 **symptoms according to economic status among adults in**  
6 **Korea? A multilevel regression analysis results from the**  
7 **Health Examinees Study**  
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18 **ABSTRACT**

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20 **Objectives:** Associations between positive and negative social support and risk of  
21 depression according to economic status have not been explored. We aimed to examine  
22 the associations of positive and negative social support with the risk of depressive  
23 symptoms among urban-dwelling adults in Korea, focusing on interactions with  
24 socioeconomic status.  
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31 **Design:** We used the first wave of a large-scale cohort study called The Health  
32 Examinees Study. Positive and negative support scores each ranged between 0–6; the  
33 variables were then categorized into low, medium, and high groups. A two-level random  
34 intercept linear regression model was used, where the first level is individual and the  
35 second is the community. We further tested for interactions between household income  
36 and types of social support.  
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44 **Setting:** A survey conducted at 38 health examination centers and training hospitals in major  
45 Korean cities and metropolitan areas during 2004-2013.  
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48 **Participants:** 21,208 adult men and women.  
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50 **Outcome measures:** Depressive symptoms score measured by Epidemiologic Studies-  
51 Depression Scale, with scores ranging from 0 to 60.  
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54 **Results:** Level of positive social support was significantly negatively associated with  
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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<sup>1-3</sup> and altered health-related behavioral patterns (e.g., excessive alcohol use, smoking, poor diet).<sup>4,5</sup> Socioeconomically disadvantaged people disproportionately experience conditions that elevate the risk of depression, such as precarious work, job loss, financial insecurity, or disadvantaged living environment.<sup>6-9</sup> 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.<sup>10-13</sup>

Positive social support has been shown to be protective against risk of depression by buffering the effects of stress.<sup>4, 14-17</sup> 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.<sup>18, 19</sup> Emotional support such as companionship and intimacy can also buffer the individual from the harmful effects of stress.<sup>20, 21</sup> 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

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4 recipient, or when it makes the recipient uncomfortable, which could unintentionally  
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6 serve as a potential source of stress.<sup>22-25</sup> Thus, positive and negative supports represent  
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8 two separate domains of social experience and may have independent effects on  
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10 depression via different mechanisms.<sup>22 26 27</sup> In addition, there is a high chance that a low  
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12 level of positive support or high level of negative support is associated with a higher  
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14 risk of depressive symptoms when combined with conditions of low SES. For example,  
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16 better educated people may have the capacity to obtain information for coping with  
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18 depressive moods from various sources other than their social networks. Similarly,  
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20 better-off people can afford to hire people or purchase things that can help them avoid  
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22 depressive situations.  
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25  
26 To date, only a handful of studies have investigated the separate effects of positive  
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28 and negative social support on depressive symptoms. Moreover, studies on whether the  
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30 effects of social support vary by SES are even rarer. Most studies have focused only on  
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32 the relationships between financial deprivation and depressive symptoms<sup>28-30</sup> or on the  
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34 protective influence of social support on depression.<sup>14-17</sup>  
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37 To address this research gap, the current study sought to address the following two  
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39 research aims. The first was to examine the association between positive and negative  
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41 social support and depressive symptoms. The second aim was to explore the interaction  
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43 between the two domains of social support and economic status.  
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## 46 47 **METHODS**

### 48 49 **Data source**

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

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32 Although the recruitment occurred in two phases (first-phase survey: 2004–2008,  
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34 second-phase survey: 2009–2013), this study utilized data collected between March,  
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36 2009, and March, 2010, because of availability of information on depressive symptoms.  
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38 More detailed information about the study can be found elsewhere.<sup>32</sup>

### 43 **Outcome variable**

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



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4 between 0 and 3 for each item (0 = less than one day per week, 1 = 1–2 days per week, 2  
5 = 3–4 days per week, and 3 = more than 6 days per week). The overall score, obtained  
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7 by summation of the individual items, has a possible range of 0–60, with higher scores  
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9 indicating more severe depressive symptoms (Supplemental table 1).  
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## 14 **Social support**

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19 Positive and negative social supports were measured by 6 items each. Whereas  
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21 most previous studies have investigated the functional characteristics of social support  
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23 by measuring positive and negative experiences of social supports (such as appreciation  
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25 of relationships with others) using the Social Experiences Checklist, the HEXA-G study  
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27 investigated structural characteristics of social support, such as the presence around  
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29 the respondent of people who provide certain kinds of positive or negative support in  
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31 certain situations. Questions about positive social support in our study include both  
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33 instrumental and emotional dimensions. Questions about negative support also have  
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35 two dimensions: aggressive types of negative support (causing active harm to the  
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37 respondent) and passive forms of negative support (such as indifference and neglect)  
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39 (Supplemental table 2).  
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44 Respondents were asked to answer “yes” or “no” to each question. The number of  
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46 “yes” responses to each of the six questions was summed to create three ordinal groups:  
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48 low positive/negative support (scores of 0–2 for positive support and 0–1 for negative  
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50 support), medium positive/negative support (scores of 3–4 for positive support and 2–  
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52 3 for negative support), and high positive/negative support (scores of 5–6 for positive  
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54 support and 4–6 for negative support). The cutoff values were determined based on  
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4 frequency distribution.  
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## 8 **Other explanatory factors** 9

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12 Marital status was categorized into five categories: married or cohabiting, never  
13 married, divorced or separated, widowed, and others. Age was divided into ten-year  
14 interval groups, starting at 40 years old. The socioeconomic factors of occupational  
15 status, education level, and income level were measured. Specifically, respondents were  
16 asked to provide their occupational status by choosing among 14 kinds of job  
17 categorized by the Korean Standard Classification of Occupation. We grouped these into  
18 7 categories: non-manual (legislators, senior officials, managers, professionals,  
19 technicians and associate professionals, clerical support workers), service and sales  
20 workers, manual (skilled agricultural, forestry and fishery workers, craft and related  
21 trades workers, plant and machine operators and assemblers, elementary occupations),  
22 armed forces, housewives, unemployed, and others. Educational attainment was  
23 grouped into four levels: primary school or below, high school graduate or below,  
24 college degree, and graduate school or higher. Household monthly income was  
25 categorized into four levels: < 100, 100 to < 300, 300 to < 600, and  $\geq$  600 (unit: Korean  
26 Won).  
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45 We controlled for several community-level SES variables: average income, average  
46 educational level, and the employment rate in the community. These were aggregated  
47 from their individual-level analogues.  
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## 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.

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4 Finally, we controlled for community-level SES variables in model 4. All statistical tests  
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6 were two-sided, and statistical significance was determined at  $p < 0.05$ . Data were  
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8 analyzed using SAS 9.3 software package.  
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## 10 11 12 **RESULTS** 13

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17 The total number of respondents who participated in the survey between March,  
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19 2009, and March, 2010, was 25,712 in 15 communities. After list-wise deletion of  
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21 participants with missing data in the independent and outcome variables, the final  
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23 number of respondents for analysis was 21,208 (Figure 1).  
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25  
26 Table 1 shows the descriptive statistics of the sample. The married or cohabiting  
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28 group, which accounted for almost 90% of the sample, showed the lowest level of  
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30 depressive symptoms, whereas the separated or divorced category showed the highest  
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32 level. The difference in depressive symptom scores across age groups was less than 0.3.  
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34 Men scored lower on depressive symptoms compared with women, on average.  
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36 Depressive symptoms diminished as education level and monthly income level  
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38 increased. Among occupations, the group working in the armed forces had the lowest  
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40 average depressive symptoms score. There was a large difference in average depressive  
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42 symptom scores across low, medium, and high levels of positive and negative social  
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44 support groups in the study sample.  
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50 Table 1. Descriptive statistics of a study sample of urban adults in Korea.

	<i>n</i>	Proportion (%)	Mean depressive symptom score
<b>Marriage</b>			
Currently married/cohabiting	19,037	89.76	4.25
	10		

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
<b>Age(yrs)</b>			
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
<b>Gender</b>			
Male	7,978	37.62	3.62
Female	13,230	62.38	5.01
<b>Education</b>			
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
<b>Job</b>			
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
<b>Income(Korean Won)†</b>			
<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
<b>Level of positive social support</b>			
Low	833	3.93	11.51
Medium	1,778	8.38	9.07
High	18,597	87.69	3.73
<b>Level of negative social support</b>			
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.
<b>Individual level</b>								
<b>Currently married/co-residing</b>								
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
<b>40≤age&lt;50(yrs)</b>								
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
<b>Male</b>								
Female	***1.23	0.10	***0.69	0.12	***0.69	0.12	***0.69	0.12
<b>Non-manual</b>								
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
<b>Primary school or below</b>								
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
<b>&lt;100(Korean Won)†</b>								
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
<b>Positive social support(Low level)</b>								
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
<b>Positive social support x income</b>					***0.52	0.12	***0.53	0.12
<b>Community-level</b>								
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.
<b>Individual level</b>								
<b>Currently married/co-residing</b>								
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
<b>40≤age&lt;50(yrs)</b>								
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
<b>Male</b>								
Female	***1.36	0.10	***0.76	0.12	***0.76	0.12	***0.76	0.12
<b>Non-manual</b>								
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
<b>Primary school or below</b>								
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
<b>&lt;100(Korean Won)†</b>								
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
<b>negative social support(Low level)</b>								
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
<b>Negative social support x income</b>					***-0.66	0.13	***-0.66	0.13
<b>Community-level</b>								
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.<sup>14 16 34-36</sup> 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”).<sup>37</sup>

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

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4 similar studies. Two previous studies reported a positive association between negative  
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6 social exchanges and suicidal behavior in adolescents and college students,  
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8 respectively.<sup>38 39</sup> Croezen et al. demonstrated that negatively experienced supports are  
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10 significantly associated with higher prevalence and incidence of poor mental health.<sup>40</sup>  
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12 Newsom et al. also reported that higher levels of stable negative social exchanges were  
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14 significantly predictive of lower self-rated health, greater functional limitations, and a  
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16 higher number of health problems, including mental health, over 2 years after  
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18 controlling for initial levels of health and sociodemographic variables.<sup>41</sup> The specific  
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20 process that may account for the association between negative social support and poor  
21  
22 mental health has not been explored yet.  
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26 A notable finding from the present study is that those with low economic status  
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28 may receive greater benefits from positive social support or greater damage from  
29  
30 negative social supports than those of high economic status. Whereas low economic  
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32 capacity can be linked to stress, low self-esteem, stigma, feelings of helplessness and  
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34 hopelessness,<sup>42</sup> and risk for marginalization and social exclusion,<sup>43</sup> these can be  
35  
36 counterbalanced by positive social support. Specifically, emotional support, such as  
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38 understanding, dialogue, appreciation, or getting assistance with problem solving, can  
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40 provide marginalized poor people with the feeling that they are cared for, esteemed,  
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42 and valued. Tangible benefits bestowed by another aspect of positive support, named  
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44 instrumental supports such as help in housework or exchange of material resources,  
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46 may also assist in coping with materially deprived circumstances.<sup>43</sup> Conversely,  
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48 negative supports such as perception of arguing, being criticized, feelings of undue  
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50 demand, or too much intervention may serve as an additional source of stress for poor  
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52 people who are already psychologically vulnerable due to financial stress.<sup>39</sup>  
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4 A similar effect of positive social support on depressive symptoms among the poor  
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6 has been described in one previous study, where suicide rates of African American  
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8 teens were lower than those of Whites, despite the fact that their parents were poorer  
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10 and less employed. It was assumed that the result was probably due to their religiosity,  
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12 environmental factors, or positive social capital.<sup>44</sup>  
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15 The result of the current study may provide important implications in the Korean  
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17 context. Since the country's economic crisis in late 1990, socioeconomic inequality has  
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19 deepened, resulting in worsening social polarization, which, in turn, caused a rising  
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21 prevalence of depression.<sup>45</sup> A downward trend in the suicide rate, from 11.2 in 1985 to  
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23 8.8 in 1990, subsequently reversed, increasing from 8.4 in 1991 to 28.5 in 2013 (per  
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25 100,000 persons). As a result, South Korea has had the highest suicide rate among  
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27 Organization for Economy Cooperation and Development countries since 2002.<sup>46</sup>  
28  
29 Despite these trends, only a minority of people with depressive disorder seek  
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31 professional consultation, for fear of the cultural stigma attached to mental illness.<sup>47</sup>  
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33 Because economic disadvantage has been well recognized as a determinant of  
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35 depression in Korea,<sup>48</sup> the results of our study provide supporting evidence for  
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37 interventions encouraging positive social support or discouraging negative social  
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39 support in underprivileged populations.  
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44 Although the poor are more affected by social support than the better off, they also  
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46 tend to have more limited capacity to control social support on their own by generating  
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48 positive support or avoiding negative support. For example, people with economic  
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50 capacity have more access to or opportunities to receive positive emotional support  
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52 because they can afford private psychologists or clinical counselors. Similarly, they have  
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54 more access to instrumental positive support by hiring private caregivers or  
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4 housekeepers when they cannot find those supports among close people around them.

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6 Therefore, interventions to mobilize positive social support or prevent negative support  
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8 for those with limited economic means might be effective for lowering depressive  
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10 symptoms in society.  
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### 14 15 **Strength and limitations**

16  
17 Although this study is unique in separately analyzing the effects of positive and  
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19 negative social supports on depressive symptoms according to income level in a large  
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21 sample, it also has a few limitations to be noted when interpreting the results. First,  
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23 there is a possibility of reverse causation, given the cross-sectional nature of the study.  
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25 For example, people with depressive symptoms may become less sociable and less  
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27 engaged in social networks, thereby eventually reducing social support.<sup>49</sup> Second, we  
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29 used the 38 health examination centers or training hospitals where target populations  
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31 were recruited as a proxy for communities. Although this is not geographical  
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33 classification based on respondents' residential address, equating it with community is  
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35 assumed to be reasonable; most of people are likely to go to the hospitals nearest to  
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37 their residence for their government-subsidized medical check-ups, because there is no  
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39 much difference in quality between hospitals designated for government-subsidized  
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41 health examination. Third, because no cutoff points for high or low levels of social  
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43 support were available, we classified sum scores into three ordinal groups considering  
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45 the number of people belonging to each group. To test the sensitivity of the result to the  
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47 categorization of social support level, we reran the analyses using the score as a  
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49 continuous variable. These different ways of categorization produced the almost same  
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51 results.  
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## 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.

**Funding:** This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests:** No potential conflicts of interest relevant to this article are reported for any of the authors.

**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

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4 **Data sharing statement:** Data are available from the Korea Centers for Disease Control and  
5  
6 Prevention for researchers who meet the criteria for access to the data. Researchers may  
7  
8 contact Dr. Yeonjung Kim, Division of Epidemiology and Health Index, Center for Genome  
9  
10 Science, Korea.

11  
12 **Acknowledgement:** We thank Ellen Daldoss from Edanz Group ([www.edanzediting.com/ac](http://www.edanzediting.com/ac))  
13  
14 for editing a draft of this manuscript  
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### 16 17 18 Figure Legends

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21 [Figure 1] Derivation process of study sample

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

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

1. Irwin M, Daniels M, Bloom ET, et al. Life events, depressive symptoms, and immune function. *Am J Psychiatry* 1987;**411**:437–41.
2. Schleifer SJ, Keller SE, Siris SG, et al. Depression and immunity: lymphocyte function in ambulatory depressed patients, hospitalized schizophrenic patients, and patients hospitalized for herniorrhaphy. *Arch Gen Psychiatry* 1985;**42**:129–33.
3. Schleifer SJ, Keller SE, Bartlett JA. Depression and immunity: clinical factors and therapeutic course. *Psychiatry Res* 1999;**85**:63–9.
4. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychol Bull* 1985;**98**:310.
5. Morris P, Raphael B, Robinson RG. Clinical depression is associated with impaired recovery from stroke. *Med J Aust* 1992;**157**:239–42.
6. Takeuchi DT, Williams DR. Race, ethnicity and mental health: Introduction to the special issue. *J Health Soc Behav* 2003;**44**:233–36.
7. Smedley BD, Syme SL. Promoting health: Intervention strategies from social and behavioral research. *Am J Health Promot* 2001;**15**:149–66.
8. Pickett KE, Pearl M. Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *J Epidemiol Community Health* 2001;**55**:111–22.
9. Silver E, Mulvey EP, Swanson JW. Neighborhood structural characteristics and mental disorder: Faris and Dunham revisited. *Soc Sci Med* 2002;**55**:1457–70.
10. Wang J. Rural–urban differences in the prevalence of major depression and associated impairment. *Soc Psychiatry Psychiatr Epidemiol* 2004;**39**:19–25.

11. Paykel E, Abbott R, Jenkins R, et al. Urban–rural mental health differences in Great Britain: findings from the National Morbidity Survey. *Psychol Med* 2000;**30**:269–80.
12. Andrade L, Caraveo-anduaga JJ, Berglund P, et al. The epidemiology of major depressive episodes: results from the International Consortium of Psychiatric Epidemiology (ICPE) Surveys. *Int J Methods Psychiatr Res* 2003;**12**:3–21.
13. Weich S, Twigg L, Lewis G. Rural/non-rural differences in rates of common mental disorders in Britain. *Br J Psychiatry Suppl* 2006;**188**:51–7.
14. Wade TD, Kendler KS. The relationship between social support and major depression: cross-sectional, longitudinal, and genetic perspectives. *J Nerv Ment Dis* 2000;**188**:251–8.
15. Stice E, Ragan J, Randall P. Prospective relations between social support and depression: Differential direction of effects for parent and peer support? *J Abnorm Psychol* 2004;**113**:155.
16. Moak Z, Agrawal A. The association between perceived interpersonal social support and physical and mental health: results from the National Epidemiological Survey on Alcohol and Related Conditions. *J Public Health* 2009:fdp093.
17. Israel BA, Farquhar SA, Schulz AJ, et al. The relationship between social support, stress, and health among women on Detroit’s East Side. *Health Educ Behav* 2002;**29**:342–60.
18. de Souza Briggs X. Brown kids in white suburbs: Housing mobility and the many faces of social capital. *Hous Policy Debate* 1998;**9**:177–221.
19. Henly JR, Danziger SK, Offer S. The contribution of social support to the material well-being of low-income families. *J Marriage Fam* 2005;**67**:122–40.
20. Cooper PJ, Tomlinson M, Swartz L, et al. Improving quality of mother-infant



1  
2  
3  
4 relationship and infant attachment in socioeconomically deprived community in  
5 South Africa: randomised controlled trial. *BMJ* 2009;**338**:b974.

6  
7  
8 21. Campbell SB, Morgan-Lopez AA, Cox MJ, et al. A latent class analysis of maternal  
9 depressive symptoms over 12 years and offspring adjustment in adolescence. *J*  
10 *Abnorm Psychol* 2009;**118**:479.

11  
12  
13 22. Croezen S, Haveman-Nies A, Picavet H, et al. Positive and negative experiences of  
14 social support and long-term mortality among middle-aged Dutch people. *Am J*  
15 *Epidemiol* 2010;**172**:173-9.

16  
17  
18 23. Oxman TE, Hull JG. Social support, depression, and activities of daily living in  
19 older heart surgery patients. *Gerontol B Psychol Sci Soc Sci* 1997;**52**:P1-P14.

20  
21  
22 24. Oxman TE, Berkman LF, Kasl S, et al. Social support and depressive symptoms in  
23 the elderly. *Am J Epidemiol* 1992;**135**:356-68.

24  
25  
26 25. Hays JC, Krishnan KRR, George LK, et al. Psychosocial and physical correlates of  
27 chronic depression. *Psychiatry Res* 1997;**72**:149-59.

28  
29  
30 26. Newsom JT, Rook KS, Nishishiba M, et al. Understanding the relative importance  
31 of positive and negative social exchanges: Examining specific domains and  
32 appraisals. *Gerontol B Psychol Sci Soc Sci* 2005;**60**:P304-P12.

33  
34  
35 27. Pagel MD, Erdly WW, Becker J. Social networks: we get by with (and in spite of) a  
36 little help from our friends. *J Pers Soc Psychol* 1987;**53**:793.

37  
38  
39 28. Lorant V, Croux C, Weich S, et al. Depression and socio-economic risk factors: 7-  
40 year longitudinal population study. *Br J Psychiatry* 2007;**190**:293-8.

41  
42  
43 29. Belle Doucet D. Poverty, inequality, and discrimination as sources of depression  
44 among US women. *Psychol Women Q* 2003;**27**:101-13.

45  
46  
47 30. Costello EJ, Compton SN, Keeler G, et al. Relationships between poverty and

- 1  
2  
3  
4 psychopathology: A natural experiment. *Jama* 2003;**290**:2023–9.  
5  
6 31. Shin S, Lee H-W, Kim CE, et al. Egg Consumption and Risk of Metabolic Syndrome  
7  
8 in Korean Adults: Results from the Health Examinees Study. *Nutrients* 2017;**9**:687.  
9  
10 32. Group HES. The Health Examinees (HEXA) Study: Rationale, Study Design and  
11  
12 Baseline Characteristics. *Asian Pac J Cancer Prev: APJCP* 2014;**16**:1591–7.  
13  
14 33. Carpenter J, Andrykowski M, Wilson J, et al. Psychometrics for two short forms of  
15  
16 the Center for Epidemiologic Studies-Depression Scale. *Issues Ment Health Nurs*  
17  
18 1998;**19**:481–94.  
19  
20 34. Aneshensel CS, Frerichs RR. Stress, support, and depression: A longitudinal  
21  
22 causal model. *J Community Psychol* 1982;**10**:363–76.  
23  
24 35. Manuel JI, Martinson ML, Bledsoe-Mansori SE, et al. The influence of stress and  
25  
26 social support on depressive symptoms in mothers with young children. *Soc Sci Med*  
27  
28 2012;**75**:2013–20.  
29  
30 36. Neugebauer A, Katz PP. Impact of social support on valued activity disability and  
31  
32 depressive symptoms in patients with rheumatoid arthritis. *Arthritis Care Res*  
33  
34 2004;**51**:586–92.  
35  
36 37. Aneshensel CS, Stone JD. Stress and depression: A test of the buffering model of  
37  
38 social support. *Arch Gen Psychiatry* 1982;**39**:1392.  
39  
40 38. Hirsch JK, Barton AL. Positive social support, negative social exchanges, and  
41  
42 suicidal behavior in college students. *J Am Coll Health* 2011;**59**:393–8.  
43  
44 39. Bertera EM. The role of positive and negative social exchanges between  
45  
46 adolescents, their peers and family as predictors of suicide ideation. *Child Adolesc*  
47  
48 *Social Work J* 2007;**24**:523–38.  
49  
50 40. Croezen S, Picavet HSJ, Haveman-Nies A, et al. Do positive or negative  
51  
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4 experiences of social support relate to current and future health? Results from the  
5  
6 Doetinchem Cohort Study. *BMC Public Health* 2012;**12**:65.  
7  
8 41. Newsom JT, Mahan TL, Rook KS, et al. Stable negative social exchanges and health.  
9  
10 *Health Psychol* 2008;**27**:78–86.  
11  
12 42. Cohen R, Coxall J, Craig G, et al. Hardship Britain: Being Poor in the 1990s.  
13  
14 London: CPAG 1992.  
15  
16 43. Cattell V. Poor people, poor places, and poor health: the mediating role of social  
17  
18 networks and social capital. *Soc Sci Med* 2001;**52**:1501–16.  
19  
20 44. Blum RW, Beuhring T, Shew ML, et al. The effects of race/ethnicity, income, and  
21  
22 family structure on adolescent risk behaviors. *Am J Public Health* 2000;**90**:1879.  
23  
24 45. Cho MJ, Kim J-K, Jeon HJ, et al. Lifetime and 12-month prevalence of DSM-IV  
25  
26 psychiatric disorders among Korean adults. *J Nerv Ment Dis* 2007;**195**:203–10.  
27  
28 46. OECD, Economic, Environmental and Social Statistics. France: OECD Publication  
29  
30 Service 2013 <http://dx.doi.org/10.1787/factbook-2013-en>.  
31  
32 47. Cho SJ, Lee JY, Hong JP, et al. Mental health service use in a nationwide sample of  
33  
34 Korean adults. *Soc Psychiatry Psychiatr Epidemiol* 2009;**44**:943–51.  
35  
36 48. Park JH, Kim KW, Kim M-H, et al. A nationwide survey on the prevalence and risk  
37  
38 factors of late life depression in South Korea. *J Affect Disord* 2012;**138**:34–40.  
39  
40 49. Monroe SM, Steiner SC. Social support and psychopathology: interrelations with  
41  
42 preexisting disorder, stress, and personality. *J Abnorm Psychol* 1986;**95**:29.  
43  
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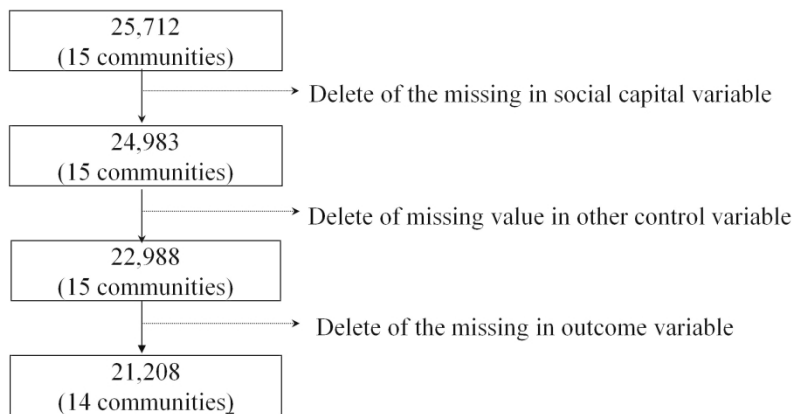


Figure 1. Derivation process of study sample

Figure 1. Derivation process of study sample

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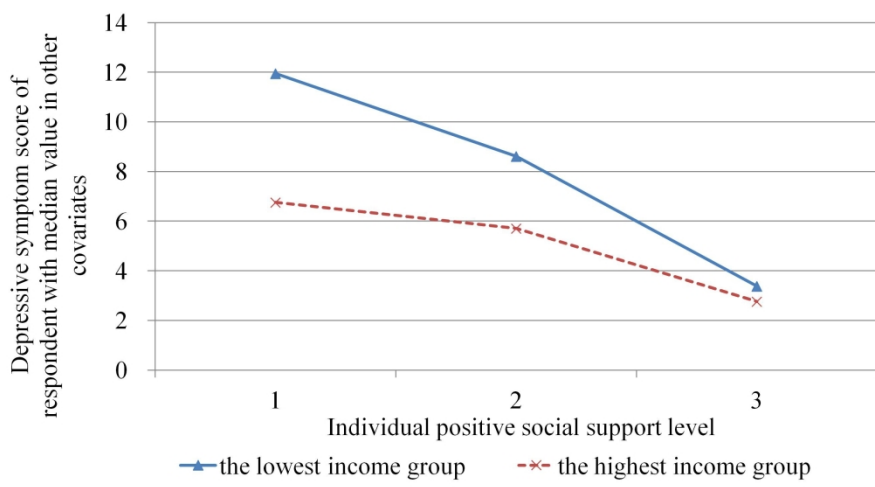


Figure 2. Differential effect of positive support according to income group

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

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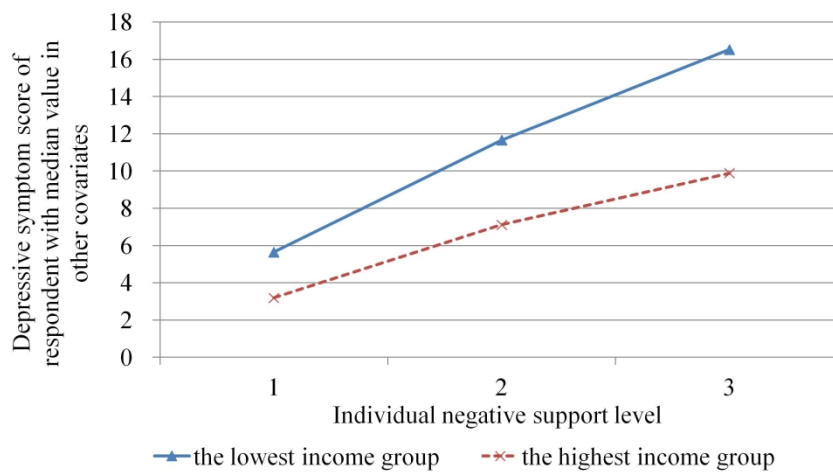


Figure 3. Differential effect of negative support according to the income group

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
<b>Introduction</b>			
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
<b>Methods</b>			
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	-
<b>Results</b>			



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	-
<b>Discussion</b>			
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
<b>Other information</b>			
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](http://www.strobe-statement.org).

# BMJ Open

## 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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-023036.R1
Article Type:	Research
Date Submitted by the Author:	10-Jul-2018
Complete List of Authors:	Lee, Hwa-Young; Seoul National University College of Medicine, JW LEE Center for Global Medicine Oh, Juhwan; Seoul National University, JW LEE Center for Global Medicine Kawachi, Ichiro; Harvard School of Public Health, Department of Society Human Development and Heo, Jongho; San Diego State University & University of California, San Diego, Public Health Joint Doctoral Program Kim, Sujin; Harvard T.H. Chan School of Public Health, Lee, Jong-Koo; Seoul National University College of Medicine, Department of Family Medicine; Seoul National University Hospital, Policy and Development Kang, Daehee; College of Medicine Seoul National University, Department of Preventive Medicine
<b>Primary Subject Heading</b>:	Mental health
Secondary Subject Heading:	Public health
Keywords:	Depressive symptom, multi-level regression, social capital, social support

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Manuscripts

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4 **Positive and negative social support and depressive**  
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7 **Examinees-Gem Study**  
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55 Word count: 3,079; number of tables: 3; number of figures: 3; number of references: 49  
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4 **Positive and negative social support and depressive**  
5 **symptoms according to economic status among adults in**  
6 **Korea: A multilevel regression analysis from the Health**  
7 **Examinees-Gem Study**  
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18 **ABSTRACT**

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20 **Objectives:** The interaction between positive and negative social support as well as  
21 between each domain of social support and income on depressive symptom have not  
22 been much explored. We aimed to examine the associations of positive and negative  
23 social support with the risk of depressive symptoms among urban-dwelling adults in  
24 Korea, focusing on those interaction effects.  
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31 **Design:** We used the first wave of a large-scale cohort study called The Health  
32 Examinees-Gem Study. Positive and negative support scores each ranged between 0–6;  
33 the variables were then categorized into low, medium, and high groups. A two-level  
34 random intercept linear regression model was used, where the first level is individual  
35 and the second is the community. We further tested for interactions between each  
36 domain of social supports and household income.  
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44 **Setting:** A survey conducted at 38 health examination centers and training hospitals in  
45 major Korean cities and metropolitan areas during 2009-2010.  
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48 **Participants:** 21,208 adult men and women in Korea.  
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51 **Outcome measures:** Depressive symptoms score measured by Epidemiologic Studies-  
52 Depression Scale, with scores ranging from 0 to 60.  
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4 **Results:** Level of positive social support was significantly negatively associated with  
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6 depressive symptom, whereas the level of negative support was significantly positively  
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8 associated with depressive symptoms. These associations were proved to be stronger in  
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10 lower income group in tests for interaction terms of household income and each domain  
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12 of social supports. The interaction between positive and negative social supports  
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14 revealed that one domain of social support mediates the effect of the other domain of  
15  
16 social support on depressive symptom.  
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19 **Conclusions:** Our findings suggest that strategies for encouraging positive social  
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21 support and discouraging negative social support for disadvantaged individuals might  
22  
23 be effective in reducing depression in Korea.  
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26 **Keywords:** Depressive symptoms, multi-level regression, social capital, social support.  
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### 30 **Strengths and limitations of this study**

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33 ▶ To the best of our knowledge, this is the first study to explore the difference in  
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35 the association between positive and negative social support and depressive  
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37 symptom according to a different level of social support and economic status.  
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40 ▶ The article is based on a large study involving 21,208 Korean adults.  
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44 ▶ The study design is a cross-sectional, and hence can only reveal associations  
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46 between social support and depressive symptom.  
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49 ▶ We used health examination centers where respondents were recruited as a  
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51 proxy for the community, which is not an accurate geographical classification.  
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## 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<sup>1-3</sup> and altered health-related behavioral patterns (e.g., excessive alcohol use, smoking, poor diet).<sup>4,5</sup> In addition, depression is linked to suicide. Suicide is considered to be a sequel of depression.<sup>6,7</sup> Positive social support has been shown to be protective against risk of depression by buffering the effects of stress.<sup>4,8-11</sup> 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.<sup>12,13</sup> Emotional support such as companionship and intimacy can also buffer the individual from the harmful effects of stress.<sup>14,15</sup> 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.<sup>16-19</sup> Thus, positive and negative supports represent two separate domains of social experience and may have independent effects on depression via different mechanisms.<sup>16,20,21</sup>

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

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4 or disadvantaged living environment.<sup>22-25</sup> In addition, urban dwellers, especially those  
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6 in developed countries such as Canada and the United Kingdom, are usually more  
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8 vulnerable to depression than those living in rural areas, owing to stresses from more  
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10 frequent encounters with uneven distribution of socioeconomic status (SES),  
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12 competitive work environment, higher rate of separated or divorced marital status, high  
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14 rate of suffering from crime, and poor social cohesion.<sup>26-29</sup> These findings give rise to the  
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16 question whether positive or negative social support might benefit or harm more in  
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18 financially distressed people living in urban area. For example, better -off people may  
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20 have the capacity to obtain information for coping with depressive moods from various  
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22 sources other than their social networks. Similarly, they can afford to hire people or  
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24 purchase things that can help them avoid depressive situations. However, to our  
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26 knowledge, there were no studies that have investigated on this to date. Most studies  
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28 have focused only on the relationships between financial deprivation and depressive  
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30 symptoms<sup>30-32</sup> or on the protective influence of social support on depression.<sup>8-11</sup>  
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35 Moreover, while the interaction between positive and negative social supports on  
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37 psychological depression is also possible, considering the 'buffering effect model' that  
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39 positive social support cushions the adverse effect of the stressor on mental health,  
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41 there are only a handful of studies on this and even outdated.  
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44 To address these research gaps, the current study sought to address the following  
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46 research questions. The first, are positive and negative support independently  
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48 associated with depressive symptoms? Second, do two domains of social support  
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50 mediate the effect on depressive symptom each other? Finally, is the effect of positive or  
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52 negative support more pronounced for less affluent individuals?  
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## 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.<sup>33</sup>

### **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<sup>34</sup>. 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.<sup>34 35</sup> 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

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4 HEXA-G study investigated structural characteristics of social support, such as the  
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6 presence of people around the respondent who provide certain kinds of positive or  
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8 negative support in certain situations. Questions about positive social support in our  
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10 study include both instrumental (e.g., giving or lending it when I need something) and  
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12 emotional dimensions (e.g., caring or worrying about me). Questions about negative  
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14 support also have two dimensions: aggressive type of negative support (e.g., causing  
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16 active harm to the respondent) and passive type of negative support (e.g., indifference  
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18 and neglect) (Supplemental table 2).  
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21 Respondents were asked to answer “yes” or “no” to each question. We referred to  
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23 previous study in operating social support variables where structural social support  
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25 was coded into absolute levels of social capital (for example, number of individuals or  
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27 groups respondents received support from) and then categorized into groups.<sup>36</sup> We  
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29 avoided using social support variable as continuous one because our interest is a  
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31 relationship between the overall level of social support and depressive symptom rather  
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33 than focusing on how much effect having one more people who can give social support  
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35 would have on the depressive symptom.  
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39 To construct the variable reflecting level of positive and negative social support,  
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41 the number of “yes” responses to each of the six questions was summed first to create  
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43 three ordinal groups. Since there is no objective or agreed-upon criteria used for  
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45 determining level of social support, we chose the cutoff values considering frequency  
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47 distribution : low positive/negative support (scores of 0–2 for positive support and 0–1  
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49 for negative support), medium positive/negative support (scores of 3–4 for positive  
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51 support and 2–3 for negative support), and high positive/negative support (scores of 5–  
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53 6 for positive support and 4–6 for negative support).  
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## 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 ( $\cong$  887 US\$), 100 to < 300 ( $\cong$  2,660 US\$), 300 to < 600 ( $\cong$  5,319 US\$), and  $\geq$  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

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4 who visited hospitals for their government-subsidized health examinations. The  
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6 findings from this study will be disseminated to the wider public via local media and  
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8 civil society organizations.  
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## 10 11 12 **Statistical analyses** 13

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17 We constructed linear random intercept multi-level models to estimate the  
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19 association between negative and positive social support and the risk of depressive  
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21 symptoms while accounting for the clustering of observations at the community level.  
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23 Because there is no residential address information in our dataset, we used the 38  
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25 health examination centers or training hospitals where survey population was recruited  
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27 as a proxy for communities, assuming that people would visit the nearest centers to  
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29 their residence for their medical check-ups.  
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33 We started by including positive and negative social supports alternately in the  
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35 model with adjustment only for individual-level demographic variables: marital status,  
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37 age, and gender (model 1 and 2). From checking the correlation, we found weak  
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39 negative correlation between positive and negative social support (refer to the  
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41 supplemental table 3 for phi coefficients from Chi-square analyses). Testing of Variance  
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43 Inflation Factor (VIF) revealed no multi-collinearity between two (VIF=1.06 and 1.5 for  
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45 the level of positive social support and negative social support respectively). Therefore,  
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47 we tried to run a model including both domains of social supports simultaneously with  
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49 adjustment for only demographic characteristics first (model 3), and then additional  
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51 adjustment for SES variables: occupational status, educational level, and monthly  
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53 income (model 4). This will enable us to test whether the association between one  
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4 domain of social support and depressive symptom is not due to confounding effect of  
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6 the other domain of support. The reason for sequential entering of groups of  
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8 demographic and SES variables was that we wanted to explore whether adjusting for  
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10 SES would attenuate the association between positive or negative social supports and  
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12 the outcome variable, assuming that SES might confound the association between social  
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14 supports and depressive symptoms. All potential two-way and three-way interaction  
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16 terms between income and each domain of supports were explored (model 5). Finally,  
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18 we tried to control for community-level SES variables(model 6). All statistical tests were  
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20 two-sided, and statistical significance was determined at  $p < 0.05$ . Data were analyzed  
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22 using SAS 9.3 software package.  
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## 28 **RESULTS**

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32 The total number of respondents who participated in the survey between March  
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34 2009 and March 2010, was 25,712 in 15 communities. After list-wise deletion of  
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36 participants with missing data in the independent and outcome variables, the final  
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38 number of respondents for analysis was 21,208 in 14 communities (Figure 1).  
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48 Table 1 shows the descriptive statistics of the sample. The married or cohabiting  
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50 group, which accounted for almost 90% of the sample, showed the lowest level of  
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52 depressive symptoms, whereas the separated or divorced category showed the highest  
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54 level, ranging from 4.25 to 8.07. The difference in depressive symptom scores across  
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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.

	<i>n</i>	Proportion (%)	Mean depressive symptom score
<b>Marriage</b>			
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
<b>Age(yrs)</b>			
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
<b>Gender</b>			
Male	7,978	37.62	3.62
Female	13,230	62.38	5.01
<b>Education</b>			
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
<b>Job</b>			
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
<b>Income(Korean 10,000 Won)†</b>			
<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
<b>Level of positive social support</b>			
Low	833	3.93	11.51
Medium	1,778	8.38	9.07
High	18,597	87.69	3.73
<b>Level of negative social support</b>			
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).

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4 Since the level of income, level of positive and negative social support was linearly  
5 related with depressive symptom in the main effect of model 4, interaction terms were  
6 constructed by multiplying each of these variables as a continuous one to simplify the  
7 model.  
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12 All the two-way interactions were found to be significant(model 5). Association  
13 between positive social support and the depressive symptom was different according to  
14 the level of negative social support as well as income level. Specifically, the negative  
15 association between the level of positive support and depressive symptoms score was  
16 stronger for individuals with a higher level of negative support and lower income level  
17 as shown in Figure 2. Equivalently, the association between negative social support and  
18 depressive symptom depended on the level of positive social support and income.  
19 Negative social support had a stronger positive association with depressive symptom  
20 score in a group with the lower level of positive social support or lower income(Figure  
21 3). That is, high level of negative support had a similar effect as low income while a high  
22 level of positive support had a similar effect as high income in mediating associations  
23 with the depressive symptoms. In Figure 2 and 3, we presented only the highest and  
24 lowest groups in the level of social support and in the level of income to show the  
25 differential effect in maximized way. A three-way interaction term between positive,  
26 negative social support and income level was not significant(not presented). None of the  
27 community level SES variable was significant(model 6).  
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54 Regarding the relevance of the other independent variables, marital status of being  
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4 separated or divorced and being widowed, female gender, and occupational status of  
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6 housewife were associated with higher depressive symptom scores compared with  
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8 their counterparts while older groups and people with higher education level were  
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10 likely to have lower depressive symptom score(Supplemental table 4).  
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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 <sup>J</sup>		Model 2 <sup>J</sup>		Model 3 <sup>J</sup>		Model 4 <sup>JJ</sup>		Model 5 <sup>JJ</sup>		Model 6 <sup>JJ</sup>	
	Coeff	S.E.	Coeff	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
<b>Individual level variables</b>														
<b>&lt;100(Korean 10,000 Won)<sup>††</sup></b>														
100 ≤ income < 300									-1.46 <sup>***</sup>	0.15	-2.25 <sup>***</sup>	0.35	-2.26 <sup>***</sup>	0.40
300 ≤ income < 600									-1.98 <sup>***</sup>	0.17	-3.69 <sup>***</sup>	0.68	-3.70 <sup>***</sup>	0.78
600 < income									-2.40 <sup>***</sup>	0.23	-5.04 <sup>***</sup>	1.02	-5.05 <sup>***</sup>	1.18
<b>Positive social support(Low level)</b>														
Medium			-2.73 <sup>***</sup>	0.28			-2.38 <sup>***</sup>	0.27	-2.18 <sup>***</sup>	0.26	-1.72 <sup>***</sup>	0.35	-1.72 <sup>***</sup>	0.41
High			-6.69 <sup>***</sup>	0.23			-5.54 <sup>***</sup>	0.23	-5.21 <sup>***</sup>	0.23	-4.66 <sup>***</sup>	0.54	-4.66 <sup>***</sup>	0.67
<b>negative social support(Low level)</b>														
Medium					5.14 <sup>***</sup>	0.17	4.67 <sup>***</sup>	0.16	4.63 <sup>***</sup>	0.16	8.02 <sup>***</sup>	0.16	8.02 <sup>***</sup>	0.51
High					9.29 <sup>***</sup>	0.26	8.18 <sup>***</sup>	0.26	8.04 <sup>***</sup>	0.26	14.03 <sup>***</sup>	0.26	14.03 <sup>***</sup>	0.94
<b>Positive social support x negative social support</b>														
											-0.92 <sup>***</sup>	0.15	-0.92 <sup>***</sup>	0.15
<b>Positive social support x income</b>														
											0.47 <sup>***</sup>	0.12	0.47 <sup>***</sup>	0.12
<b>Negative social support x income</b>														
											-0.38 <sup>**</sup>	0.13	-0.38 <sup>**</sup>	0.13
<b>Community-level variables</b>														
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 <sup>***</sup>		3.48 <sup>**</sup>	1.33	3.00 <sup>**</sup>	1.15	2.45 <sup>**</sup>	0.93	2.61 <sup>**</sup>	0.10	2.59 <sup>**</sup>	1.03	1.90 <sup>**</sup>	0.73
ICC	0.09 <sup>*</sup>		0.08 <sup>*</sup>		0.07 <sup>*</sup>		0.06 <sup>*</sup>		0.06 <sup>*</sup>		0.06 <sup>*</sup>		0.05 <sup>*</sup>	
R-squared <sup>§</sup> (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 /<sup>J</sup>: adjusted for only demographic variables including marital status, age and gender /<sup>JJ</sup>: adjusted for both demographic and SES variables including marital status, age, gender, job status, and education level /<sup>\*</sup>: p < 0.05, /<sup>\*\*</sup>: p < 0.01, /<sup>\*\*\*</sup>: p < 0.001 / <sup>††</sup>1 US \$ = 1,128 Korea Won /<sup>§</sup>: 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.<sup>8-10 37-39</sup> 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')<sup>40</sup>.

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

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4 explored in previous studies than that of positive social support. However, finding  
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6 related to negative social support from the present study are also in line with finding in  
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8 previous study performed in Netherland that reported that negatively experienced  
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10 supports are significantly associated with higher prevalence and incidence of poor  
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12 mental health in men and women aged 26-65 years.<sup>41</sup>  
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14  
15 Most previous articles focused on only positive or negative social support without  
16  
17 considering the other and studies which have examined the simultaneous effect of two  
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19 domains of social supports are rare and outdated. Among them, Ingersoll-Dayton(1997)  
20  
21 has identified four models framing the effect of each domain of social exchange;  
22  
23 'Positivity effect model' meaning that only positive exchange affect health outcome  
24  
25 whether it's positive or negative outcomes, 'Negativity effect model' arguing that only  
26  
27 negative exchange affect outcome, again whether positive or not, 'Domain specific effect  
28  
29 model' meaning that positive and negative exchange affect only positive and negative  
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31 outcome respectively, and lastly, 'Combined positivity and negativity effects model'  
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33 arguing that positive exchange and negative exchange affect both positive and negative  
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35 outcome simultaneously.<sup>42</sup> The result from our study supports the 'Combined positivity  
36  
37 and negativity effect model'. A few other existing studies also support this model. For  
38  
39 example, Golding and Burnam(1990) demonstrated that both social support and social  
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41 conflict were significant predictors of depression among Mexican American adults when  
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43 they were run together in a model.<sup>43</sup> More recently, Croezen et al(2012) showed that  
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45 low level of positive support and high level of negative support were associated with  
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47 high odds of poor mental health at the same time in Dutch men and women.<sup>41</sup>  
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52 More notable findings from the present study are significant interactions among  
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54 positive, negative social support and income on the depressive symptom. Those with  
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4 lower income and higher level of negative support may receive greater benefits from  
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6 positive social support and those with lower income and lower level of positive support  
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8 may have greater damage from negative social supports compared to their counterparts.  
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10 These findings may suggest that social supports play a similar role to income.  
11  
12 Specifically, a high level of negative supports mediates the association between positive  
13  
14 social support and depressive symptom in the same way as low income and low level of  
15  
16 positive supports operated in the same manner as low income for mediating the  
17  
18 association between negative social support and depressive symptoms.  
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21 Low economic capacity can be linked to stress, low self-esteem, stigma, feelings of  
22  
23 helplessness and hopelessness,<sup>38</sup> and risk for marginalization and social exclusion.<sup>39</sup>  
24  
25 However, these can be counterbalanced by positive social support. Negative social  
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27 support also serves as a type of stressor similar to low income, for which positive social  
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29 support also can compensate for.<sup>44</sup> Thus, the effect of positive support on reducing  
30  
31 depressive symptom was stronger in a group with lower income and a higher level of  
32  
33 negative social support. Emotional positive support, such as understanding, dialogue,  
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35 appreciation, or getting assistance with problem solving, can provide marginalized poor  
36  
37 or people hurt by negative social support with the feeling that they are cared for,  
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39 esteemed, and valued. Tangible benefits bestowed by another aspect of positive support,  
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41 named instrumental supports such as help in housework or exchange of material  
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43 resources, may also assist in coping with materially deprived circumstances or feeling of  
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45 unprotectedness or isolation from negative social support.<sup>39</sup> Conversely, negative  
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47 supports such as perception of arguing, being criticized, feelings of undue demand, or  
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49 too much intervention may serve as an additional source of stress for poor people who  
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51 are already psychologically vulnerable due to financial stress.<sup>35</sup> While people with a  
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4 high level of positive support have the capacity to buffer harmful effect of negative  
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6 support on the depressive symptoms, those without positive support may suffer from  
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8 damage from negative support.  
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11 There are several studies which examined the interaction of positive and negative  
12  
13 social support. While some have not found any evidence of interaction,<sup>32 45</sup> others have  
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15 observed a buffering effect of positive social support on the association between  
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17 negative social support and mental health across different outcomes and population  
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19 group.<sup>46 47</sup> No previous studies have examined on the interaction between social  
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21 supports and income on mental health to our knowledge.  
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23  
24 The result of the current study may provide important implications in the Korean  
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26 context. Since the country's economic crisis in late 1990, socioeconomic inequality has  
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28 deepened, resulting in worsening social polarization, which, in turn, caused a rising  
29  
30 prevalence of depression.<sup>48</sup> A downward trend in the suicide rate, from 11.2 in 1985 to  
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32 8.8 in 1990, subsequently reversed, increasing from 8.4 in 1991 to 28.5 in 2013 (per  
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34 100,000 persons). As a result, South Korea has had the highest suicide rate among  
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36 Organization for Economy Cooperation and Development countries since 2002.<sup>49</sup>  
37  
38 Despite these trends, only a minority of people with depressive symptoms seek  
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40 professional consultation, for fear of the cultural stigma attached to mental illness.<sup>50</sup>  
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42 Because economic disadvantage has been well recognized as a determinant of  
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44 depression in Korea,<sup>51</sup> the results of our study provide supporting evidence for  
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46 interventions encouraging positive social support or discouraging negative social  
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48 support in underprivileged populations.  
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53 Although the poor are more affected by social support than the better off, they also  
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55 tend to have more limited capacity to control social support on their own by generating  
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4 positive support or avoiding negative support. For example, people with economic  
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6 capacity have more access to receive positive emotional support because they can  
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8 afford private psychologists or clinical counselors. Similarly, they have more access to  
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10 instrumental positive support by hiring private caregivers or housekeepers when they  
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12 cannot find those supports among close people around them. Therefore, interventions  
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14 to mobilize positive social support or prevent negative support for those with limited  
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16 economic means might be effective for lowering depressive symptoms in society.  
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### 21 **Strength and limitations**

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26 Although this study is unique in separately analyzing the effects of positive and  
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28 negative social supports on depressive symptoms according to income level in a large  
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30 sample, it also has a few limitations to be noted when interpreting the results. First,  
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32 there is a possibility of reverse causation, given the cross-sectional nature of the study.  
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34 For example, people with depressive symptoms may become less sociable and less  
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36 engaged in social networks, thereby eventually reducing social support.<sup>52</sup> Second, we  
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38 used the 38 health examination centers or training hospitals where target populations  
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40 were recruited as a proxy for communities. Although this is not a geographical  
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42 classification based on respondents' residential address, equating it with community is  
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44 assumed to be reasonable; most people are likely to go to the hospitals nearest to their  
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46 residence for their government-subsidized medical check-ups, because there is no much  
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48 difference in quality between hospitals designated for government-subsidized health  
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50 examination. Third, because no agreed upon cutoff points for high or low levels of social  
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52 support were available, we classified sum scores into three ordinal groups considering  
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4 the number of people belonging to each group. To test the sensitivity of the result to the  
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6 categorization of social support level, we reran the analyses using the score as a  
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8 continuous variable. These different ways of categorization produced the almost same  
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10 results.  
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## 12 13 14 15 **CONCLUSION**

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19 The present study showed that, at the individual level, both positive and negative  
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21 social support were associated with depressive symptoms, and these associations were  
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23 found to be stronger in economically disadvantaged people when adjusting for various  
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25 control variables at multiple levels. In addition, positive and negative social support  
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27 mediated the association of negative and positive social support with depressive  
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29 symptoms, respectively. Reducing inequality is always challenging, although most  
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31 pursue social equality as an ideal. The results of this study suggest that strategies for  
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33 adjusting positive and negative support among low income populations might be  
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35 effective in reducing depressive symptoms in those populations.  
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39 Further study is required to reveal the mechanisms by which different types of  
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41 individual social support operate on depressive symptoms in each economic group in  
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43 the context of South Korea.  
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48 **Contributors:** HYL and JO conceived the study. HYL led the statistical analysis and drafted  
49  
50 the manuscript. JO provided supervision throughout the data analysis and interpretation. IK  
51  
52 provided overall guidance and helped to edit language. JH, SK, JL, and DK helped to interpret the  
53  
54 data. All authors read and approved the final manuscript.  
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56  
57 **Funding:** This research received no specific grant from any funding agency in the public,  
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4 commercial or not-for-profit sectors.

5  
6 **Competing interests:** No potential conflicts of interest relevant to this article are  
7  
8 reported for any of the authors.  
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10 **Ethics approval:** The HEXA-G study was approved by the Ethics Committee of the Korean  
11  
12 Health and Genomic Study of the Korean National Institute of Health  
13

14 **Data sharing statement:** Data are available from the Korea Centers for Disease Control and  
15  
16 Prevention for researchers who meet the criteria for access to the data. Researchers may  
17  
18 contact Dr. Yeonjung Kim, Division of Epidemiology and Health Index, Center for Genome  
19  
20 Science, Korea.  
21

22 **Acknowledgement:** We thank Ellen Daldoss from Edanz Group ([www.edanzediting.com/ac](http://www.edanzediting.com/ac))  
23  
24 for editing a draft of this manuscript  
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## 29 Figure Legends

30  
31 [Figure 1] Derivation process of study sample  
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33  
34 [Figure 2] Differential effect of positive support according to level of negative support  
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36 and income level on depressive symptom  
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39 [Figure 3] Differential effect of negative support according to the level of positive  
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41 support and income level on depressive symptom  
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## REFERENCES

1. Irwin M, Daniels M, Bloom ET, et al. Life events, depressive symptoms, and immune function. *The American journal of psychiatry* 1987
2. Schleifer SJ, Keller SE, Siris SG, et al. Depression and immunity: lymphocyte function in ambulatory depressed patients, hospitalized schizophrenic patients, and patients hospitalized for herniorrhaphy. *Archives of General Psychiatry* 1985;42(2):129-33.
3. Schleifer SJ, Keller SE, Bartlett JA. Depression and immunity: clinical factors and therapeutic course. *Psychiatry Research* 1999;85(1):63-69.
4. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychological bulletin* 1985;98(2):310.
5. Morris P, Raphael B, Robinson RG. Clinical depression is associated with impaired recovery from stroke. *The Medical Journal of Australia* 1992;157(4):239-42.
6. Vahia V, Sonavane S, Gandhi A, et al. Suicide and depression. *Journal of the Indian Medical Association* 2000;98(5):232-36.
7. De Leo D, San Too L. Suicide and depression. *Essentials of Global Mental Health* 2014:367.
8. Wade TD, Kendler KS. The relationship between social support and major depression: cross-sectional, longitudinal, and genetic perspectives. *The Journal of nervous and mental disease* 2000;188(5):251-58.
9. Stice E, Ragan J, Randall P. Prospective relations between social support and depression: Differential direction of effects for parent and peer support? *Journal of abnormal psychology* 2004;113(1):155.
10. Moak Z, Agrawal A. The association between perceived interpersonal social support and physical and mental health: results from the National Epidemiological Survey on Alcohol and Related Conditions. *Journal of Public Health* 2009:fdp093.
11. Israel BA, Farquhar SA, Schulz AJ, et al. The relationship between social support, stress, and health among women on Detroit's East Side. *Health Education & Behavior* 2002;29(3):342-60.
12. Henly JR, Danziger SK, Offer S. The contribution of social support to the material well-being of low-income families. *Journal of Marriage and Family* 2005;67(1):122-40.
13. de Souza Briggs X. Brown kids in white suburbs: Housing mobility and the many faces of social capital. *Housing policy debate* 1998;9(1):177-221.
14. Cooper PJ, Tomlinson M, Swartz L, et al. Improving quality of mother-infant relationship and infant attachment in socioeconomically deprived community in South Africa: randomised controlled trial. *Bmj* 2009;338:b974.
15. Campbell SB, Morgan-Lopez AA, Cox MJ, et al. A latent class analysis of maternal depressive symptoms over 12 years and offspring adjustment in adolescence. *Journal of abnormal psychology* 2009;118(3):479.
16. Croezen S, Haveman-Nies A, Picavet H, et al. Positive and negative experiences of social support and long-term mortality among middle-aged Dutch people. *American journal of epidemiology* 2010;172(2):173-79.
17. Oxman TE, Hull JG. Social support, depression, and activities of daily living in older heart surgery patients. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 1997;52(1):P1-P14.
18. Oxman TE, Berkman LF, Kasl S, et al. Social support and depressive symptoms in the elderly. *American Journal of Epidemiology* 1992;135(4):356-68.
19. Hays JC, Krishnan KRR, George LK, et al. Psychosocial and physical correlates of chronic depression. *Psychiatry research* 1997;72(3):149-59.
20. Newsom JT, Rook KS, Nishishiba M, et al. Understanding the relative importance of

- positive and negative social exchanges: Examining specific domains and appraisals. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 2005;60(6):P304-P12.
21. Pagel MD, Erdly WW, Becker J. Social networks: we get by with (and in spite of) a little help from our friends. *Journal of personality and social psychology* 1987;53(4):793.
  22. Takeuchi DT, Williams DR. Race, ethnicity and mental health: Introduction to the special issue. *Journal of Health and Social Behavior* 2003;44(3):233-36.
  23. Smedley BD, Syme SL. Promoting health: Intervention strategies from social and behavioral research. *American Journal of Health Promotion* 2001;15(3):149-66.
  24. Pickett KE, Pearl M. Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *Journal of epidemiology and community health* 2001;55(2):111-22.
  25. Silver E, Mulvey EP, Swanson JW. Neighborhood structural characteristics and mental disorder: Faris and Dunham revisited. *Social science & medicine* 2002;55(8):1457-70.
  26. Wang J. Rural-urban differences in the prevalence of major depression and associated impairment. *Social psychiatry and psychiatric epidemiology* 2004;39(1):19-25.
  27. Paykel E, Abbott R, Jenkins R, et al. Urban-rural mental health differences in Great Britain: findings from the National Morbidity Survey. *Psychological medicine* 2000;30(02):269-80.
  28. Andrade L, Caraveo-anduaga JJ, Berglund P, et al. The epidemiology of major depressive episodes: results from the International Consortium of Psychiatric Epidemiology (ICPE) Surveys. *International journal of methods in psychiatric research* 2003;12(1):3-21.
  29. Weich S, Twigg L, Lewis G. Rural/non-rural differences in rates of common mental disorders in Britain. *The British Journal of Psychiatry* 2006;188(1):51-57.
  30. Lorant V, Croux C, Weich S, et al. Depression and socio-economic risk factors: 7-year longitudinal population study. *The British Journal of Psychiatry* 2007;190(4):293-98.
  31. Belle Doucet D. Poverty, inequality, and discrimination as sources of depression among US women. *Psychology of Women Quarterly* 2003;27(2):101-13.
  32. Rhodes JE, Ebert L, Fischer K. Natural mentors: An overlooked resource in the social networks of young, African American mothers. *American Journal of Community Psychology* 1992;20(4):445-61.
  33. Group HES. The Health Examinees (HEXA) Study: Rationale, Study Design and Baseline Characteristics. *Asian Pacific journal of cancer prevention: APJCP* 2014;16(4):1591-97.
  34. Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied psychological measurement* 1977;1(3):385-401.
  35. Roberts RE. Reliability of the CES-D scale in different ethnic contexts. *Psychiatry research* 1980;2(2):125-34.
  36. De Silva MJ, Harpham T. Maternal social capital and child nutritional status in four developing countries. *Health & place* 2007;13(2):341-55.
  37. Manuel JI, Martinson ML, Bledsoe-Mansori SE, et al. The influence of stress and social support on depressive symptoms in mothers with young children. *Social science & medicine* 2012;75(11):2013-20.
  38. Neugebauer A, Katz PP. Impact of social support on valued activity disability and depressive symptoms in patients with rheumatoid arthritis. *Arthritis Care & Research* 2004;51(4):586-92.
  39. Aneshensel CS, Frerichs RR. Stress, support, and depression: A longitudinal causal model. *Journal of Community Psychology* 1982;10(4):363-76.
  40. Aneshensel CS, Stone JD. Stress and depression: A test of the buffering model of social support. *Archives of General Psychiatry* 1982;39(12):1392.
  41. Croezen S, Picavet HSJ, Haveman-Nies A, et al. Do positive or negative experiences of

- 1  
2  
3  
4 social support relate to current and future health? Results from the Doetinchem  
5 Cohort Study. *BMC Public Health* 2012;12(1):65.
- 6 42. Ingersoll-Dayton B, Morgan D, Antonucci T. The effects of positive and negative social  
7 exchanges on aging adults. *J Gerontol B Psychol Sci Soc Sci* 1997;52(4):S190-9.
- 8 43. Golding JM, Burnam MA. Immigration, stress, and depressive symptoms in a Mexican-  
9 American community. *Journal of Nervous and Mental Disease* 1990;178(3):161-71.
- 10 44. Lepore SJ. Social conflict, social support, and psychological distress: Evidence of cross-  
11 domain buffering effects. *Journal of personality and social psychology*  
12 1992;63(5):857.
- 13 45. Okun MA, Keith VM. Effects of positive and negative social exchanges with various  
14 sources on depressive symptoms in younger and older adults. *The Journals of*  
15 *Gerontology Series B: Psychological Sciences and Social Sciences* 1998;53(1):P4-P20.
- 16 46. Rhodes JE, Woods M. Comfort and conflict in the relationships of pregnant, minority  
17 adolescents: Social support as a moderator of social strain. *Journal of Conununuy*  
18 *Psychology* 1995;23
- 19 47. Revenson TA, Schiaffino KM, Majerovitz SD, et al. Social support as a double-edged  
20 sword: The relation of positive and problematic support to depression among  
21 rheumatoid arthritis patients. *Social science & medicine* 1991;33(7):807-13.
- 22 48. Cho MJ, Kim J-K, Jeon HJ, et al. Lifetime and 12-month prevalence of DSM-IV psychiatric  
23 disorders among Korean adults. *The Journal of nervous and mental disease*  
24 2007;195(3):203-10.
- 25 49. Economic O. Environmental and Social Statistics. *France: OECD Publication Service* 2013
- 26 50. Cho SJ, Lee JY, Hong JP, et al. Mental health service use in a nationwide sample of Korean  
27 adults. *Social psychiatry and psychiatric epidemiology* 2009;44(11):943-51.
- 28 51. Park JH, Kim KW, Kim M-H, et al. A nationwide survey on the prevalence and risk factors  
29 of late life depression in South Korea. *Journal of affective disorders* 2012;138(1):34-  
30 40.
- 31 52. Monroe SM, Steiner SC. Social support and psychopathology: interrelations with  
32 preexisting disorder, stress, and personality. *Journal of abnormal psychology*  
33 1986;95(1):29.
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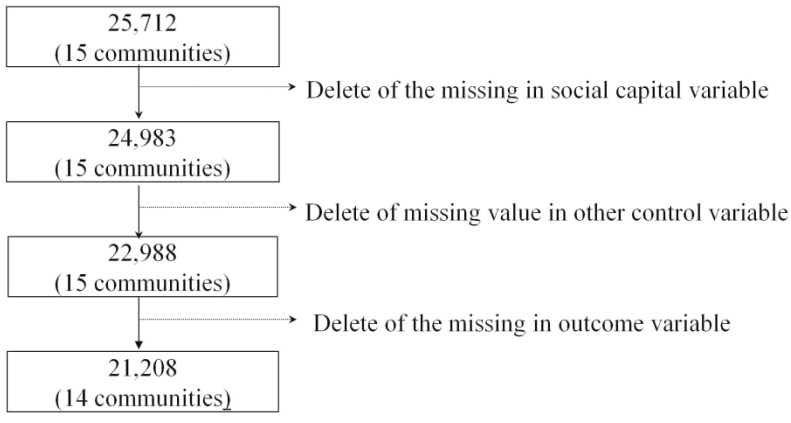
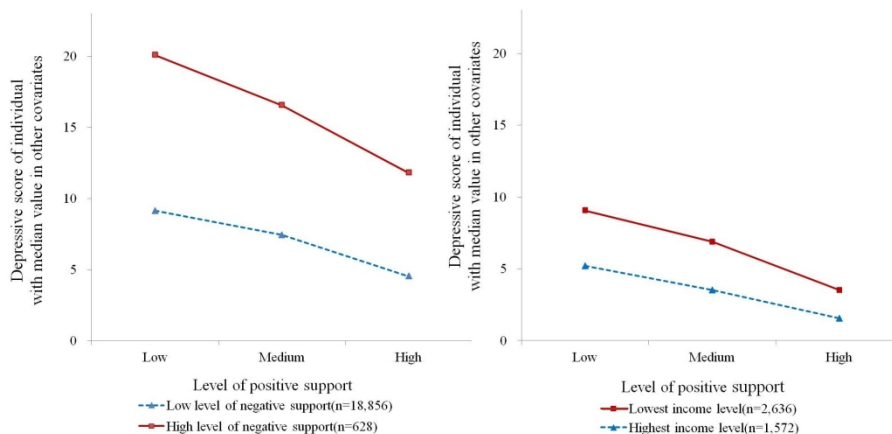


Figure 1. Derivation process of study sample

[Figure 1] Derivation process of study sample

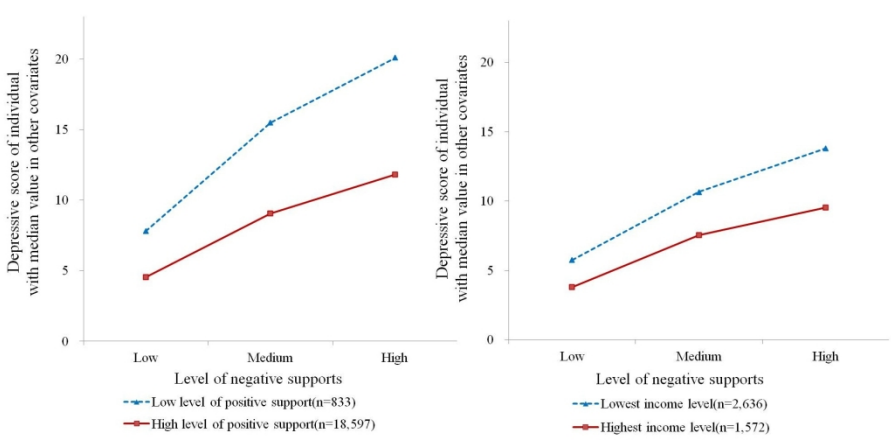
254x190mm (300 x 300 DPI)



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

185x93mm (300 x 300 DPI)

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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.



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4 Supplemental Table 2. Questions for measuring positive and negative social support  
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8 Ask to the following questions on feeling about the people around you.  
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11 <Positive social support>  
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- 13 1. There is a person whom I can confide in  
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15 2. There is a person who always care or worry about me  
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17 3. There is a person whom I can discuss with when I have important or difficult  
18 matters  
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20 4. There is a person who nurses me and give a help in housework when I am ill  
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22 5. There is a person who gives or lends it when I need something  
23  
24 6. There is a person who takes a time for me and help with housework whenever I  
25 request  
26

27  
28  
29 <Negative social support>  
30

- 31 1. There is a person who object to or meddle with what I do  
32  
33 2. There is a person who blames me for all the problems I have  
34  
35 3. There is a person who forgets or ignores me  
36  
37 4. There is a person who gives you unwanted help and make me uncomfortable  
38  
39 5. There is a person who is indifferent to me and my affair  
40  
41 6. There is a person who turns down most of the time when I ask help  
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Supplemental table 3. Chi-square correlation test between positive and negative social support

		Positive support					
		Level 1		Level 2		Level 3	
		$\chi^2$ (P)	Phi	$\chi^2$ (P)	Phi	$\chi^2$ (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

For peer review only

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

	<b>Coeff.</b>	<b>S.E.</b>
<b>Currently married/co-residing</b>		
Never married	0.46	0.29
Separated/divorced	2.09***	0.25
Widowed	1.11***	0.22
Others	-0.90	1.16
<b>40≤age&lt;50(yrs)</b>		
50≤age<60	-0.20*	0.10
60≤age<70	-0.84**	0.14
<b>Male</b>		
Female	0.74***	0.11
<b>Non-manual</b>		
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
<b>Primary school or below</b>		
High school graduate	-0.56**	0.13
College degree	-0.80***	0.18
Graduate school or higher	-1.17***	0.27

\*:p &lt;0.05, \*\*: p&lt;0.01, \*\*\*:p&lt;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
<b>Introduction</b>			
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
<b>Methods</b>			
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	-
<b>Results</b>			

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	-
<b>Discussion</b>			
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
<b>Other information</b>			
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](http://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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-023036.R2
Article Type:	Research
Date Submitted by the Author:	14-Nov-2018
Complete List of Authors:	Lee, Hwa-Young; Seoul National University College of Medicine, JW LEE Center for Global Medicine Oh, Juhwan; Seoul National University, JW LEE Center for Global Medicine Kawachi, Ichiro; Harvard School of Public Health, Department of Society Human Development and Heo, Jongho; San Diego State University & University of California, San Diego, Public Health Joint Doctoral Program Kim, Sujin; Harvard T.H. Chan School of Public Health, Lee, Jong-Koo; Seoul National University College of Medicine, Department of Family Medicine; Seoul National University Hospital, Policy and Development Kang, Daehee; College of Medicine Seoul National University, Department of Preventive Medicine
<b>Primary Subject Heading</b>:	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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Word count: 3,079; number of tables: 3; number of figures: 3; number of references: 49

## **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**

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8 Depression has been proven to be associated with adverse health outcomes  
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10 including increased susceptibility to disease through multiple mechanisms, such as  
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12 disrupted immune functioning<sup>1-3</sup> and altered health-related behavioral patterns (e.g.,  
13  
14 excessive alcohol use, smoking, poor diet).<sup>4 5</sup> In addition, depression is linked to suicide.  
15  
16 Not only suicide ideation studies but also psychological autopsy studies have proved the  
17  
18 strong association between depression and suicide.<sup>6 7</sup>  
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20

21  
22 Positive social support has been shown to be protective against risk of depression  
23  
24 by buffering the effects of stress.<sup>4 8-11</sup> Specifically, instrumental support, such as tangible  
25  
26 assistance (labor, in kind) and financial support (e.g., cash loans), has been  
27  
28 demonstrated to lower the risk of depression by assisting individuals in coping with  
29  
30 everyday hardships and facilitating their socioeconomic mobility.<sup>12 13</sup> Emotional  
31  
32 support such as companionship and intimacy can also buffer the individual from the  
33  
34 harmful effects of stress.<sup>14 15</sup> On the other hand, social support does not always give rise  
35  
36 to positive experiences, however well-meaning the intentions of the support giver may  
37  
38 be. Social support can be negative when it is unwanted, at odds with the needs of the  
39  
40 recipient, or when it makes the recipient uncomfortable, which could unintentionally  
41  
42 serve as a potential source of stress.<sup>16-19</sup> Thus, positive and negative supports represent  
43  
44 two separate domains of social experience and may have independent effects on  
45  
46 depression via different mechanisms.<sup>16 20 21</sup>  
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52 In addition, these two domains of social supports might interfere the effect on  
53  
54 psychological depression each other when they co-exist According to the “buffering  
55  
56 effect model”,. Those with high level of negative support may receive more benefit  
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4 from the positive support in reducing depressive symptom. Conversely, high level of  
5  
6 positive support may cushion the adverse effect of the stressor from negative supports  
7  
8 on mental health<sup>22</sup> Only a handful of studies have explored on this and have not been  
9  
10 updated for a long time.<sup>23-25</sup>  
11  
12

13  
14 Socioeconomically disadvantaged people disproportionately experience conditions  
15  
16 that elevate the risk of depression, such as precarious work, job loss, financial insecurity,  
17  
18 or disadvantaged living environment.<sup>26-29</sup> In addition, urban dwellers, especially those  
19  
20 in developed countries such as Canada and the United Kingdom, are usually more  
21  
22 vulnerable to depression than those living in rural areas, owing to stresses from more  
23  
24 frequent encounters with uneven distribution of socioeconomic status (SES),  
25  
26 competitive work environment, higher rate of separated or divorced marital status, high  
27  
28 rate of suffering from crime, and poor social cohesion.<sup>30-33</sup> These findings give rise to the  
29  
30 question whether positive or negative social support might benefit or harm more in  
31  
32 financially distressed people living in urban area. For example, better -off people may  
33  
34 have the capacity to obtain information for coping with depressive moods from various  
35  
36 sources other than their social networks. Similarly, they can afford to hire people or  
37  
38 purchase things that can help them avoid depressive situations. However, to our  
39  
40 knowledge, there was no study that has investigated on this to date. Most studies have  
41  
42 focused only on the relationships between financial deprivation and depressive  
43  
44 symptoms<sup>34-36</sup> or on the protective influence of social support on depression.<sup>8-11</sup>  
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51  
52 Korea is facing the continuous increase in depression. One-year prevalence of  
53  
54 depression, the proportion of adults who had experienced depressive disorder more  
55  
56 than once during recent 12 months from the survey time, increased from 1.8 % in 2001  
57  
58 to 3.1 % in 2011.<sup>37</sup>  
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4 The current study sought to address the following research questions in Korean  
5 context while addressing the research gaps that exist in previous studies. The first, are  
6 positive and negative support independently associated with depressive symptoms?  
7  
8 Second, do positive social support moderate the effect of negative social support on  
9 depressive symptom or vice versa? Finally, are the effects of positive and negative  
10 support more pronounced for less affluent individuals?  
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## 20 **METHODS**

### 21 **Data source**

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28 Our data came from a large-scale genomic cohort study called The Health Examinees-  
29 Gem (HEXA-G), which was established to investigate the epidemiologic characteristics  
30 of major chronic diseases in Korean adults living in urban areas. Target participants  
31 which are adult males and females aged 40–69, were recruited prospectively at 38  
32 health examination centers or training hospitals located in 8 regions in Korea  
33 (Seoul/Incheon/Gyeonggi-do, Gangwon-Do, Daejeon/Chungcheongnam-do,  
34 Chungcheongbuk-do, Daegu/ Gyeongsangbuk-do, Busan/ Gyeongsangnam-do, Jeollabuk-  
35 do, Gwangju/ Jeollanam-do) when they visited for their government-subsidized health  
36 examinations provided for free by the National Health Insurance Service biennially to all  
37 Korean adults aged over 40 for the purpose of effective health promotion and disease  
38 prevention. This way of recruiting can provide the advantages of longitudinal repeated  
39 measurements, and a pool of subjects that are representative of the majority of the  
40 Korean population.  
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4 The baseline survey was conducted by trained research staff using a standardized  
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6 questionnaire, which included information on sociodemographic characteristics,  
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8 medical history, medication usage, lifestyles, dietary habits, and social capital. Written  
9  
10 informed consent was obtained from all participants. The study protocol was approved  
11  
12 by the Ethics Committee of the Korean Health and Genomic Study of the Korean  
13  
14 National Institute of Health, as well as by the institutional review boards of all  
15  
16 participating hospitals.  
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20  
21 Although the recruitment occurred in two phases (first-phase survey: 2004–2008,  
22  
23 second-phase survey: 2009–2013), this study utilized data collected between March  
24  
25 2009, and March 2010, because of availability of information on depressive symptoms.  
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27 More detailed information about the study design can be found elsewhere.<sup>38</sup>  
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### 31 32 **Outcome variable** 33 34 35 36

37 Depressive symptoms were measured using the 20-item version of the Centers for  
38  
39 Epidemiologic Studies-Depression Scale (CES-D) which was developed for use in the  
40  
41 epidemiologic studies of depressive symptom in the general population<sup>39</sup>. CES-D has  
42  
43 been proved to be reliable in previous studies with a Cronbach's alpha of 0.84 ~ 0.90  
44  
45 depending on the ethnic groups.<sup>39 40</sup> Respondents were asked to rate how often, over  
46  
47 the preceding week, they experienced symptoms associated with depression, such as  
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49 restless sleep, poor appetite, and feelings of loneliness. Possible scores ranged between  
50  
51 0 and 3 for each item (0 = less than one day per week, 1 = 1–2 days per week, 2 = 3–4  
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53 days per week, and 3 = more than 6 days per week). The overall score, obtained by  
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55 summation of the individual items, has a possible range of 0–60, with higher scores  
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4 indicating more severe depressive symptoms (Supplemental table 1).  
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## 8 9 **Social support**

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14 Positive and negative social supports were measured by 6 items each. Whereas  
15  
16 most previous studies have investigated the functional characteristics of social support  
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18 based on the Social Experiences Checklist which measures positive and negative  
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20 experiences of social supports (such as appreciation of relationships with others), the  
21  
22 HEXA-G study investigated structural characteristics of social support, such as the  
23  
24 presence of people around the respondent who provide certain kinds of positive or  
25  
26 negative support in certain situations. Questions about positive social support in our  
27  
28 study include both instrumental(e.g., giving or lending it when I need something) and  
29  
30 emotional dimensions(e.g., caring or worrying about me). Questions about negative  
31  
32 support also have two dimensions: aggressive type of negative support (e.g., causing  
33  
34 active harm to the respondent) and passive type of negative support (e.g., indifference  
35  
36 and neglect) (Supplemental table 2).  
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41  
42 Respondents were asked to answer “yes” or “no” to each question. We referred to  
43  
44 previous study in operating social support variables where structural social support  
45  
46 was coded into absolute levels of social capital (for example, number of individuals or  
47  
48 groups respondents received support from) and then categorized into groups.<sup>41</sup> We  
49  
50 avoided using social support variable as continuous one because our interest is a  
51  
52 relationship between the overall level of social support and depressive symptom rather  
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54 than focusing on how much effect having one more people who can give social support  
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56 would have on the depressive symptom.  
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4 To construct the variable reflecting level of positive and negative social support,  
5 the number of “yes” responses to each of the six questions was summed first to create  
6 three ordinal groups. Since there is no objective or agreed-upon criteria used for  
7 determining level of social support, we chose the cutoff values considering frequency  
8 distribution: low positive/negative support (scores of 0–2 for positive support and 0–1  
9 for negative support), medium positive/negative support (scores of 3–4 for positive  
10 support and 2–3 for negative support), and high positive/negative support (scores of 5–  
11 6 for positive support and 4–6 for negative support).  
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### 25 **Other explanatory factors**

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30 Marital status was categorized into five categories: married or cohabiting, never  
31 married, divorced or separated, widowed, and others. Age was divided into ten-year  
32 interval groups, starting at 40 years old. The SES factors included occupational status,  
33 education level, and household income level. Specifically, respondents were asked to  
34 provide their occupational status by choosing among 14 kinds of job categorized by the  
35 Korean Standard Classification of Occupation. We grouped these into 7 categories: non-  
36 manual (legislators, senior officials, managers, professionals, technicians and associate  
37 professionals, clerical support workers), service and sales workers, manual (skilled  
38 agricultural, forestry and fishery workers, craft and related trades workers, plant and  
39 machine operators and assemblers, elementary occupations), armed forces, housewives,  
40 unemployed, and others. Educational attainment was grouped into four levels: primary  
41 school or below, high school graduate or below, college degree, and graduate school or  
42 higher. Household monthly income was asked into four levels (unit: 10,000 Korean  
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4 Won): < 100 (≡ 887 US\$), 100 to < 300 (≡ 2,660 US\$), 300 to < 600 (≡ 5,319 US\$), and  
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6 ≥ 600.  
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8  
9 We controlled for several community-level SES variables such as average income,  
10  
11 average educational level, and the employment rate in the community, which were  
12  
13 created from aggregation of their individual-level analogues. The purpose of this was to  
14  
15 adjust for the SES-contextual effect of people living together in the community based on  
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17 assumption that people may feel a different level of depressive symptom depending on  
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19 the level of socioeconomic status of their neighborhood even if their individual  
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21 socioeconomic status are equal.  
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## 28 **Patient and public involvement**

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

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47 We constructed linear random intercept multi-level models to estimate the  
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49 association between negative and positive social support and the risk of depressive  
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51 symptoms while accounting for the clustering of observations at the community level.  
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53 Because there is no residential address information in our dataset, we used the 38  
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55 health examination centers or training hospitals where survey population was recruited  
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4 as a proxy for communities, assuming that people would visit the nearest centers to  
5  
6 their residence for their medical check-ups.  
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8  
9 We started by including positive and negative social supports alternately in the  
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11 model with adjustment only for individual-level demographic variables: marital status,  
12  
13 age, and gender (model 1 and 2). From checking the correlation, we found weak  
14  
15 negative correlation between positive and negative social support(refer to the  
16  
17 supplemental table 3 for phi coefficients from Chi-square analyses). Testing of Variance  
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19 Inflation Factor (VIF) revealed no multi-collinearity between two (VIF=1.06 and 1.5 for  
20  
21 the level of positive social support and negative social support respectively). Therefore,  
22  
23 we tried to run a model including both domains of social supports simultaneously with  
24  
25 adjustment for only demographic characteristics first(model 3), and then additional  
26  
27 adjustment for SES variables: occupational status, educational level, and monthly  
28  
29 income(model 4). This will enable us to test whether the association between one  
30  
31 domain of social support and depressive symptom is not due to confounding effect of  
32  
33 the other domain of support. The reason for sequential entering of groups of  
34  
35 demographic and SES variables was that we wanted to explore whether adjusting for  
36  
37 SES would attenuate the association between positive or negative social supports and  
38  
39 the outcome variable, assuming that SES might confound the association between social  
40  
41 supports and depressive symptoms. All potential two-way and three-way interaction  
42  
43 terms between income and each domain of supports were explored (model 5). Finally,  
44  
45 we tried to control for community-level SES variables(model 6). All statistical tests were  
46  
47 two-sided, and statistical significance was determined at  $p < 0.05$ . Data were analyzed  
48  
49 using SAS 9.3 software package.  
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## 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.

	<i>n</i>	Proportion (%)	Mean depressive symptom score
<b>Marriage</b>			
Currently married/cohabiting	19,037	89.76	4.25
	12		

4	Never married	514	2.42	5.11
5	Separated/divorced	671	3.16	8.07
6	Widowed	957	4.51	6.20
7	Others	29	0.14	5.59
9	<b>Age(yrs)</b>			
10	40≤age<50	8,387	39.55	4.44
11	50≤age<60	8,098	38.18	4.61
12	60≤age<70	4,723	22.27	4.34
14	<b>Gender</b>			
15	Male	7,978	37.62	3.62
16	Female	13,230	62.38	5.01
18	<b>Education</b>			
19	Primary school or below	3,242	15.29	5.67
20	High school graduate	12,830	60.50	4.46
21	College degree	4,277	20.17	3.90
22	Graduate school or higher	859	4.05	3.31
24	<b>Job</b>			
25	Non-manual	3,776	17.80	3.72
26	Service and sales workers	3,983	18.78	4.22
27	Manual	4,324	20.39	4.21
28	Armed forces occupation	24	0.11	2.21
29	Housewives	7,106	33.51	5.33
30	Unemployed	1,895	8.94	4.00
31	Others	100	0.47	5.37
33	<b>Income(Korean 10,000 Won)†</b>			
34	<100	2,636	12.43	7.08
35	100 ≤income <300	9,715	45.81	4.42
36	300 ≤income <600	7,285	34.35	3.86
37	600 < income	1,572	7.41	3.40
38	<b>Level of positive social support</b>			
39	Low	833	3.93	11.51
40	Medium	1,778	8.38	9.07
41	High	18,597	87.69	3.73
42	<b>Level of negative social support</b>			
43	Low	18,856	88.91	3.66
44	Medium	1,724	8.13	10.00
45	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.

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4 We found clear inverse gradient of positive social support and positive gradient of  
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6 negative social support with depressive symptom(for positive social support,  $b = -2.73$ ,  
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8  $p < 0.001$  in medium group;  $b = -6.69$ ,  $p < 0.001$  in high group / for negative social  
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10 supports,  $b = 5.14$ ,  $p < 0.001$  in medium group;  $b = 9.29$ ,  $p < 0.001$  in high group). When two  
11  
12 domains of social support were run together in one model(model 3), negative  
13  
14 support(or positive support) did not cancel out the benefits of positive support(or harm  
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16 of negative support), indicating each domain of social support may operate  
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18 independently(for positive social support,  $b = -2.38$ ,  $p < 0.001$  in medium group;  $b = -5.54$ ,  
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20  $p < 0.001$  in high group / for negative social supports,  $b = 4.67$ ,  $p < 0.001$  in medium group;  
21  
22  $b = 8.18$ ,  $p < 0.001$  in high group). Adjusting for SES variables did not attenuate the  
23  
24 strength of association between social support and depressive symptom as shown in  
25  
26 models 4(for positive social support,  $b = -2.18$ ,  $p < 0.001$  in medium group;  $b = -5.21$ ,  $p <$   
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28  $0.001$  in high group / for negative social supports,  $b = 4.63$ ,  $p < 0.001$  in medium group;  
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30  $b = 8.03$ ,  $p < 0.001$  in high group).

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

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46 All the two-way interactions were found to be significant(model 5). Association  
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48 between positive social support and the depressive symptom was different according to  
49  
50 the level of negative social support as well as income level. Specifically, the negative  
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52 association between the level of positive support and depressive symptoms score was  
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54 stronger for individuals with a higher level of negative support and lower income level  
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56 as shown in Figure 2. Equivalently, the association between negative social support and  
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4 depressive symptom depended on the level of positive social support and income.  
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6 Negative social support had a stronger positive association with depressive symptom  
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8 score in a group with the lower level of positive social support or lower income(Figure  
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10 3). That is, high level of negative support had a similar effect as low income while a high  
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12 level of positive support had a similar effect as high income in moderating associations  
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14 with the depressive symptoms. In Figure 2 and 3, we presented only the highest and  
15  
16 lowest groups in the level of social support and in the level of income to show the  
17  
18 differential effect in maximized way. A three-way interaction term between positive,  
19  
20 negative social support and income level was not significant(not presented). None of the  
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22 community level SES variable was significant(model 6).  
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30 Insert Figure 2 and Figure 3  
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35 Regarding the relevance of the other independent variables, marital status of being  
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37 separated or divorced and being widowed, female gender, and occupational status of  
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39 housewife were associated with higher depressive symptom scores compared with  
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41 their counterparts while older groups and people with higher education level were  
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43 likely to have lower depressive symptom score(Supplemental table 4).  
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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 <sup>f</sup>		Model 2 <sup>f</sup>		Model 3 <sup>f</sup>		Model 4 <sup>fj</sup>		Model 5 <sup>fj</sup>		Model 6 <sup>fj</sup>	
	Coeff	S.E.	Coeff	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
<b>Individual level variables</b>														
<b>&lt;100(Korean 10,000 Won)<sup>††</sup></b>														
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
<b>Positive social support(Low level)</b>														
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
<b>negative social support(Low level)</b>														
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
<b>Positive social support x negative social support</b>														
											-0.92***	0.15	-0.92***	0.15
<b>Positive social support x income</b>														
											0.47***	0.12	0.47***	0.12
<b>Negative social support x income</b>														
											-0.38**	0.13	-0.38**	0.13
<b>Community-level variables</b>														
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 <sup>§</sup> (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 /<sup>f</sup>: adjusted for only demographic variables including marital status, age and gender /<sup>fj</sup>: adjusted for both demographic and SES variables including marital status, age, gender, job status, and education level /<sup>\*</sup>: p < 0.05, /<sup>\*\*</sup>: p < 0.01, /<sup>\*\*\*</sup>: p < 0.001 /<sup>††</sup> US \$ ≅ 1,128 Korea Won /<sup>§</sup>: 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.<sup>8-10 22 42 43</sup> 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')<sup>44</sup>.

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

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4 explored in previous studies than that of positive social support. However, finding  
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6 related to negative social support from the present study are also in line with finding in  
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8 previous study performed in Netherland that reported that negatively experienced  
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10 supports are significantly associated with higher prevalence and incidence of poor  
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12 mental health in men and women aged 26-65 years.<sup>45</sup>  
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16 Most previous articles focused on only positive or negative social support without  
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18 considering the other and studies which have examined the simultaneous effect of two  
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20 domains of social supports are rare and outdated. Among them, Ingersoll-Dayton(1997)  
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22 has identified four models framing the effect of each domain of social exchange;  
23  
24 'Positivity effect model' meaning that only positive exchange affect health outcome  
25  
26 whether it's positive or negative outcomes, 'Negativity effect model' arguing that only  
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28 negative exchange affect outcome, again whether positive or not, 'Domain specific effect  
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30 model' meaning that positive and negative exchange affect only positive and negative  
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32 outcome respectively, and lastly, 'Combined positivity and negativity effects model'  
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34 arguing that positive exchange and negative exchange affect both positive and negative  
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36 outcome simultaneously.<sup>46</sup> The result from our study supports the 'Combined positivity  
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38 and negativity effect model'. A few other existing studies also support this model. For  
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40 example, Golding and Burnam(1990) demonstrated that both social support and social  
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42 conflict were significant predictors of depression among Mexican American adults when  
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44 they were run together in a model.<sup>47</sup> More recently, Croezen et al(2012) showed that  
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46 low level of positive support and high level of negative support were associated with  
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48 high odds of poor mental health at the same time in Dutch men and women.<sup>45</sup>  
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55 More notable findings from the present study are significant interactions among  
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57 positive, negative social support and income on the depressive symptom. Those with  
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4 lower income and higher level of negative support may receive greater benefits from  
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6 positive social support and those with lower income and lower level of positive support  
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8 may have greater damage from negative social supports compared to their counterparts.  
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10 These findings may suggest that social supports play a similar role to income.  
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12 Specifically, a high level of negative supports operated in the same way as low income in  
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14 moderating the association between positive social support and depressive symptom  
15  
16 as depicted in Figure 2. Similarly, low level of positive supports operated in the same  
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18 manner as low income in moderating the association between negative social support  
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20 and depressive symptoms as shown in Figure 3.  
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25 Low economic capacity can be linked to stress, low self-esteem, stigma, feelings of  
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27 helplessness and hopelessness,<sup>43</sup> and risk for marginalization and social exclusion.<sup>22</sup>  
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29 However, these can be counterbalanced by positive social support. Negative social  
30  
31 support serves as a type of stressor similar to low income, for which positive social  
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33 support also can compensate for.<sup>48</sup> Thus, the effect of positive support on reducing  
34  
35 depressive symptom was stronger in a group with lower income and a higher level of  
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37 negative social support. Emotional positive support, such as understanding, dialogue,  
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39 appreciation, or getting assistance with problem solving, can provide marginalized poor  
40  
41 or people hurt by negative social support with the feeling that they are cared for,  
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43 esteemed, and valued. Tangible benefits bestowed by another aspect of positive support,  
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45 named instrumental supports such as help in housework or exchange of material  
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47 resources, may also assist in coping with materially deprived circumstances or feeling of  
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49 being unprotected or being isolated caused by negative social support.<sup>22</sup> Conversely,  
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51 negative supports such as perception of arguing, being criticized, feelings of undue  
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53 demand, or too much intervention may serve as an additional source of stress for poor  
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4 people who are already psychologically vulnerable due to financial stress.<sup>40</sup> While  
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6 people with a high level of positive support have the capacity to buffer harmful effect of  
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8 negative support on the depressive symptoms, those without positive support may  
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10 suffer from damage from negative support.  
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14 There are several studies which examined the interaction of positive and negative  
15  
16 social support. While some have not found any evidence of interaction,<sup>25 36</sup> others have  
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18 observed a buffering effect of positive social support on the association between  
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20 negative social support and mental health across different outcomes and population  
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22 group.<sup>23 24</sup> No previous studies have examined on the interaction between social  
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24 supports and income on mental health to our knowledge.  
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28 The result of the current study may provide important implications in the Korean  
29  
30 context. Since the country's economic crisis in late 1990, socioeconomic inequality has  
31  
32 deepened, resulting in worsening social polarization, which, in turn, caused a rising  
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34 prevalence of depression.<sup>49</sup> Suicide rate, for which depression has been blamed as a  
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36 strong driver in Korea<sup>50 51</sup>, also increased continuously from 8.4 in 1991 to 28.5 in 2013  
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38 (per 100,000 persons), ranking South Korea as the first in suicide rate among  
39  
40 Organization for Economy Cooperation and Development countries since 2002.<sup>52</sup>  
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42 Despite these concerning trends, only a minority of people with depressive symptoms  
43  
44 seek professional consultation, for fear of the cultural stigma attached to mental  
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46 illness.<sup>53</sup> Because economic disadvantage has been well recognized as a determinant of  
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48 depression in Korea,<sup>54</sup> the results of our study provide supporting evidence for  
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50 interventions encouraging positive social support or discouraging negative social  
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52 support in underprivileged populations.  
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58 Although the poor are more affected by social support than the better off, they also  
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4 tend to have more limited capacity to control social support on their own by generating  
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6 positive support or avoiding negative support. For example, people with economic  
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8 capacity have more access to receive positive emotional support because they can  
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10 afford private psychologists or clinical counselors. Similarly, they have more access to  
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12 instrumental positive support by hiring private caregivers or housekeepers when they  
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14 cannot find those supports among close people around them. Therefore, interventions  
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16 to mobilize positive social support or prevent negative support for those with limited  
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18 economic means might be effective for lowering depressive symptoms in society.  
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### 25 **Strength and limitations**

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30 Although this study is unique in separately analyzing the effects of positive and  
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32 negative social supports on depressive symptoms according to income level in a large  
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34 sample, it also has a few limitations to be noted when interpreting the results. First,  
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36 there is a possibility of reverse causation, given the cross-sectional nature of the study.  
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38 For example, people with depressive symptoms may become less sociable and less  
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40 engaged in social networks, thereby eventually reducing social support.<sup>55</sup> Second, we  
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42 used the 38 health examination centers or training hospitals where target populations  
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44 were recruited as a proxy for communities. Although this is not a geographical  
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46 classification based on respondents' residential address, equating it with community is  
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48 assumed to be reasonable; most people are likely to go to the hospitals nearest to their  
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50 residence for their government-subsidized medical check-ups, because there is no much  
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52 difference in quality between hospitals designated for government-subsidized health  
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54 examination. Third, because no agreed upon cutoff points for high or low levels of social  
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4 support were available, we classified sum scores into three ordinal groups considering  
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6 the number of people belonging to each group. To test the sensitivity of the result to the  
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8 categorization of social support level, we reran the analyses using the score as a  
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10 continuous variable. These different ways of categorization produced the almost same  
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12 results.  
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## 18 **CONCLUSION**

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23 The present study showed that, at the individual level, both positive and negative  
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25 social support were associated with depressive symptoms, and these associations were  
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27 found to be stronger in economically disadvantaged people when adjusting for various  
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29 control variables at multiple levels. In addition, positive and negative social support  
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31 moderated the association of negative and positive social support with depressive  
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33 symptoms, respectively. Reducing inequality is always challenging, although most  
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35 pursue social equality as an ideal. The results of this study suggest that strategies for  
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37 adjusting positive and negative support among low income populations might be  
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39 effective in reducing depressive symptoms in those populations.  
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44 Further study is required to reveal the mechanisms by which different types of  
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46 individual social support operate on depressive symptoms in each economic group in  
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48 the context of South Korea.  
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53 **Contributors:** HYL and JO conceived the study. HYL led the statistical analysis and drafted  
54  
55 the manuscript. JO provided supervision throughout the data analysis and interpretation. IK  
56  
57 provided overall guidance and helped to edit language. JH, SK, JL, and DK helped to interpret the  
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4 data. All authors read and approved the final manuscript.  
5

6 **Funding:** This research received no specific grant from any funding agency in the public,  
7  
8 commercial or not-for-profit sectors.  
9

10  
11 **Competing interests:** No potential conflicts of interest relevant to this article are  
12  
13 reported for any of the authors.  
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16 **Ethics approval:** The HEXA-G study was approved by the Ethics Committee of the Korean  
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18 Health and Genomic Study of the Korean National Institute of Health  
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21 **Data sharing statement:** Data are available from the Korea Centers for Disease Control and  
22  
23 Prevention for researchers who meet the criteria for access to the data. Researchers may  
24  
25 contact Dr. Yeonjung Kim, Division of Epidemiology and Health Index, Center for Genome  
26  
27 Science, Korea.  
28

29  
30 **Acknowledgement:** We thank Ellen Daldoss from Edanz Group ([www.edanzediting.com/ac](http://www.edanzediting.com/ac))  
31  
32 for editing a draft of this manuscript  
33  
34  
35

### 36 Figure Legends

37  
38 Figure 1 Derivation process of study sample  
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40  
41 Figure 2 Differential effect of positive support according to level of negative support and  
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43 income level on depressive symptom  
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45  
46 Figure 3 Differential effect of negative support according to the level of positive support  
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48 and income level on depressive symptom  
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## REFERENCES

1. Irwin M, Daniels M, Bloom ET, et al. Life events, depressive symptoms, and immune function. *The American journal of psychiatry* 1987
2. Schleifer SJ, Keller SE, Siris SG, et al. Depression and immunity: lymphocyte function in ambulatory depressed patients, hospitalized schizophrenic patients, and patients hospitalized for herniorrhaphy. *Archives of General Psychiatry* 1985;42(2):129-33.
3. Schleifer SJ, Keller SE, Bartlett JA. Depression and immunity: clinical factors and therapeutic course. *Psychiatry Research* 1999;85(1):63-69.
4. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychological bulletin* 1985;98(2):310.
5. Morris P, Raphael B, Robinson RG. Clinical depression is associated with impaired recovery from stroke. *The Medical Journal of Australia* 1992;157(4):239-42.
6. De Leo D, San Too L. Suicide and depression. *Essentials of Global Mental Health* 2014:367.
7. Yoshimasu K, Kiyohara C, Miyashita K. Suicidal risk factors and completed suicide: meta-analyses based on psychological autopsy studies. *Environmental health and preventive medicine* 2008;13(5):243.
8. Wade TD, Kendler KS. The relationship between social support and major depression: cross-sectional, longitudinal, and genetic perspectives. *The Journal of nervous and mental disease* 2000;188(5):251-58.
9. Stice E, Ragan J, Randall P. Prospective relations between social support and depression: Differential direction of effects for parent and peer support? *Journal of abnormal psychology* 2004;113(1):155.
10. Moak Z, Agrawal A. The association between perceived interpersonal social support and physical and mental health: results from the National Epidemiological Survey on Alcohol and Related Conditions. *Journal of Public Health* 2009:fdp093.
11. Israel BA, Farquhar SA, Schulz AJ, et al. The relationship between social support, stress, and health among women on Detroit's East Side. *Health Education & Behavior* 2002;29(3):342-60.
12. Henly JR, Danziger SK, Offer S. The contribution of social support to the material well-being of low-income families. *Journal of Marriage and Family* 2005;67(1):122-40.
13. de Souza Briggs X. Brown kids in white suburbs: Housing mobility and the many faces of social capital. *Housing policy debate* 1998;9(1):177-221.
14. Cooper PJ, Tomlinson M, Swartz L, et al. Improving quality of mother-infant relationship and infant attachment in socioeconomically deprived community in South Africa: randomised controlled trial. *Bmj* 2009;338:b974.
15. Campbell SB, Morgan-Lopez AA, Cox MJ, et al. A latent class analysis of maternal depressive symptoms over 12 years and offspring adjustment in adolescence. *Journal of abnormal psychology* 2009;118(3):479.
16. Croezen S, Haveman-Nies A, Picavet H, et al. Positive and negative experiences of social support and long-term mortality among middle-aged Dutch people. *American journal of epidemiology* 2010;172(2):173-79.
17. Oxman TE, Hull JG. Social support, depression, and activities of daily living in older heart surgery patients. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 1997;52(1):P1-P14.
18. Oxman TE, Berkman LF, Kasl S, et al. Social support and depressive symptoms in the elderly. *American Journal of Epidemiology* 1992;135(4):356-68.
19. Hays JC, Krishnan KRR, George LK, et al. Psychosocial and physical correlates of chronic

- depression. *Psychiatry research* 1997;72(3):149-59.
20. Newsom JT, Rook KS, Nishishiba M, et al. Understanding the relative importance of positive and negative social exchanges: Examining specific domains and appraisals. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 2005;60(6):P304-P12.
  21. Pagel MD, Erdly WW, Becker J. Social networks: we get by with (and in spite of) a little help from our friends. *Journal of personality and social psychology* 1987;53(4):793.
  22. Aneshensel CS, Frerichs RR. Stress, support, and depression: A longitudinal causal model. *Journal of Community Psychology* 1982;10(4):363-76.
  23. Revenson TA, Schiaffino KM, Majerovitz SD, et al. Social support as a double-edged sword: The relation of positive and problematic support to depression among rheumatoid arthritis patients. *Social science & medicine* 1991;33(7):807-13.
  24. Rhodes JE, Woods M. Comfort and conflict in the relationships of pregnant, minority adolescents: Social support as a moderator of social strain. *Journal of Conununuy Psychology* 1995;23
  25. Okun MA, Keith VM. Effects of positive and negative social exchanges with various sources on depressive symptoms in younger and older adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 1998;53(1):P4-P20.
  26. Takeuchi DT, Williams DR. Race, ethnicity and mental health: Introduction to the special issue. *Journal of Health and Social Behavior* 2003;44(3):233-36.
  27. Smedley BD, Syme SL. Promoting health: Intervention strategies from social and behavioral research. *American Journal of Health Promotion* 2001;15(3):149-66.
  28. Pickett KE, Pearl M. Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *Journal of epidemiology and community health* 2001;55(2):111-22.
  29. Silver E, Mulvey EP, Swanson JW. Neighborhood structural characteristics and mental disorder: Faris and Dunham revisited. *Social science & medicine* 2002;55(8):1457-70.
  30. Wang J. Rural-urban differences in the prevalence of major depression and associated impairment. *Social psychiatry and psychiatric epidemiology* 2004;39(1):19-25.
  31. Paykel E, Abbott R, Jenkins R, et al. Urban-rural mental health differences in Great Britain: findings from the National Morbidity Survey. *Psychological medicine* 2000;30(02):269-80.
  32. Andrade L, Caraveo-anduaga JJ, Berglund P, et al. The epidemiology of major depressive episodes: results from the International Consortium of Psychiatric Epidemiology (ICPE) Surveys. *International journal of methods in psychiatric research* 2003;12(1):3-21.
  33. Weich S, Twigg L, Lewis G. Rural/non-rural differences in rates of common mental disorders in Britain. *The British Journal of Psychiatry* 2006;188(1):51-57.
  34. Lorant V, Croux C, Weich S, et al. Depression and socio-economic risk factors: 7-year longitudinal population study. *The British Journal of Psychiatry* 2007;190(4):293-98.
  35. Belle Doucet D. Poverty, inequality, and discrimination as sources of depression among US women. *Psychology of Women Quarterly* 2003;27(2):101-13.
  36. Rhodes JE, Ebert L, Fischer K. Natural mentors: An overlooked resource in the social networks of young, African American mothers. *American Journal of Community Psychology* 1992;20(4):445-61.
  37. JP Hong DL, BJ Ham, SH Lee, SJ Sung, Tak Y, TY Ha, SJ Sohn, JW Sohn, JC Yoo, JR Kim, JI Park, SH Kim, SJ Cho, YC Jung, MD Kim, SM Jang, BS Kim, JH Anh, BJ Kim, JS Yoon, IS Shin, HJ Chun, SW Kim. The survye of mental disorders in Korea. Seoul, Korea: Samsung Medical Center 2017:1~502 page.
  38. Group HES. The Health Examinees (HEXA) Study: Rationale, Study Design and Baseline

- Characteristics. *Asian Pacific journal of cancer prevention: APJCP* 2014;16(4):1591-97.
39. Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied psychological measurement* 1977;1(3):385-401.
40. Roberts RE. Reliability of the CES-D scale in different ethnic contexts. *Psychiatry research* 1980;2(2):125-34.
41. De Silva MJ, Harpham T. Maternal social capital and child nutritional status in four developing countries. *Health & place* 2007;13(2):341-55.
42. Manuel JI, Martinson ML, Bledsoe-Mansori SE, et al. The influence of stress and social support on depressive symptoms in mothers with young children. *Social science & medicine* 2012;75(11):2013-20.
43. Neugebauer A, Katz PP. Impact of social support on valued activity disability and depressive symptoms in patients with rheumatoid arthritis. *Arthritis Care & Research* 2004;51(4):586-92.
44. Aneshensel CS, Stone JD. Stress and depression: A test of the buffering model of social support. *Archives of General Psychiatry* 1982;39(12):1392.
45. Croezen S, Picavet HSJ, Haveman-Nies A, et al. Do positive or negative experiences of social support relate to current and future health? Results from the Doetinchem Cohort Study. *BMC Public Health* 2012;12(1):65.
46. Ingersoll-Dayton B, Morgan D, Antonucci T. The effects of positive and negative social exchanges on aging adults. *J Gerontol B Psychol Sci Soc Sci* 1997;52(4):S190-9.
47. Golding JM, Burnam MA. Immigration, stress, and depressive symptoms in a Mexican-American community. *Journal of Nervous and Mental Disease* 1990;178(3):161-71.
48. Lepore SJ. Social conflict, social support, and psychological distress: Evidence of cross-domain buffering effects. *Journal of personality and social psychology* 1992;63(5):857.
49. Cho MJ, Kim J-K, Jeon HJ, et al. Lifetime and 12-month prevalence of DSM-IV psychiatric disorders among Korean adults. *The Journal of nervous and mental disease* 2007;195(3):203-10.
50. Kim S-W, Kim S-J, Mun J-W, et al. Psychosocial factors contributing to suicidal ideation in hospitalized schizophrenia patients in Korea. *Psychiatry investigation* 2010;7(2):79-85.
51. Kim S-W, Yoon J-S. Suicide, an urgent health issue in Korea. *Journal of Korean medical science* 2013;28(3):345-47.
52. Economic O. Environmental and Social Statistics. *France: OECD Publication Service* 2013
53. Cho SJ, Lee JY, Hong JP, et al. Mental health service use in a nationwide sample of Korean adults. *Social psychiatry and psychiatric epidemiology* 2009;44(11):943-51.
54. Park JH, Kim KW, Kim M-H, et al. A nationwide survey on the prevalence and risk factors of late life depression in South Korea. *Journal of affective disorders* 2012;138(1):34-40.
55. Monroe SM, Steiner SC. Social support and psychopathology: interrelations with preexisting disorder, stress, and personality. *Journal of abnormal psychology* 1986;95(1):29.



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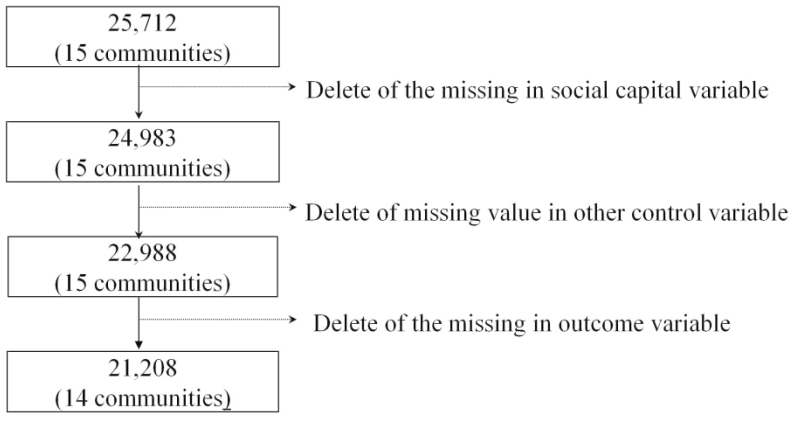
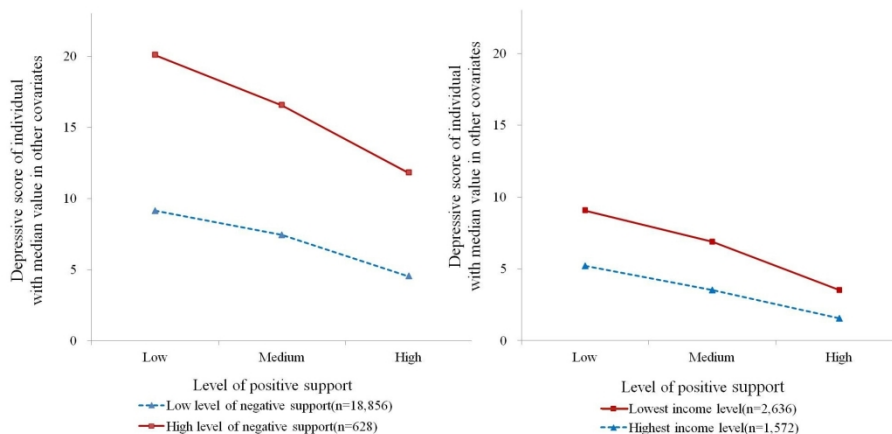


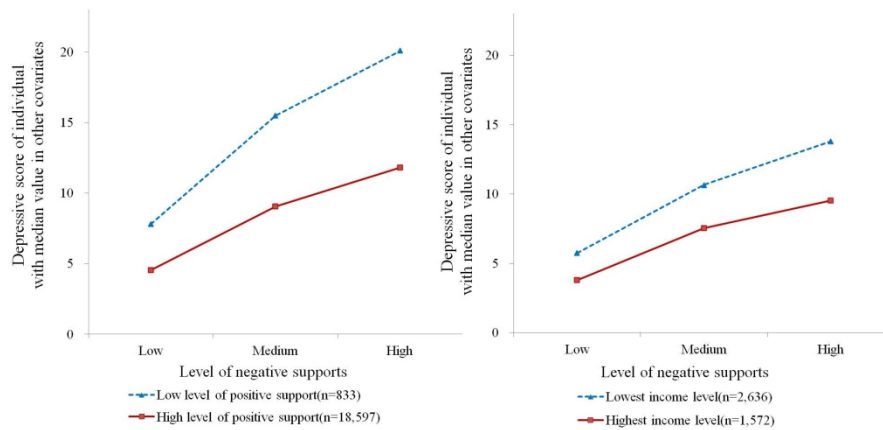
Figure 1. Derivation process of study sample

[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

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.

## &lt;Positive social support&gt;

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

## &lt;Negative social support&gt;

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	
		$\chi^2$ (P)	Phi	$\chi^2$ (P)	Phi	$\chi^2$ (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

For peer review only

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

	Coeff.	S.E.
<b>Currently married/co-residing</b>		
Never married	0.46	0.29
Separated/divorced	2.09***	0.25
Widowed	1.11***	0.22
Others	-0.90	1.16
<b>40≤age&lt;50(yrs)</b>		
50≤age<60	-0.20*	0.10
60≤age<70	-0.84***	0.14
<b>Male</b>		
Female	0.74***	0.11
<b>Non-manual</b>		
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
<b>Primary school or below</b>		
High school graduate	-0.56***	0.13
College degree	-0.80***	0.18
Graduate school or higher	-1.17***	0.27

\*:p&lt;0.05, \*\*: p&lt;0.01, \*\*\* :p&lt;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 #
<b>Title and abstract</b>	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
<b>Introduction</b>			
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
<b>Methods</b>			
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	-
<b>Results</b>			



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	-
<b>Discussion</b>			
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
<b>Other information</b>			
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](http://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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-023036.R3
Article Type:	Research
Date Submitted by the Author:	31-Jan-2019
Complete List of Authors:	Lee, Hwa-Young; Seoul National University College of Medicine, JW LEE Center for Global Medicine Oh, Juhwan; Seoul National University, JW LEE Center for Global Medicine Kawachi, Ichiro; Harvard School of Public Health, Department of Society Human Development and Heo, Jongho; San Diego State University & University of California, San Diego, Public Health Joint Doctoral Program Kim, Sujin; Harvard T.H. Chan School of Public Health, Lee, Jong-Koo; Seoul National University College of Medicine, Department of Family Medicine; Seoul National University Hospital, Policy and Development Kang, Daehee; College of Medicine Seoul National University, Department of Preventive Medicine
<b>Primary Subject Heading</b>:	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**

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4 Depression has been proven to be associated with adverse health outcomes  
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6 including increased susceptibility to disease through multiple mechanisms, such as  
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8 disrupted immune functioning<sup>1-3</sup> and altered health-related behavioral patterns (e.g.,  
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10 excessive alcohol use, smoking, poor diet).<sup>4,5</sup> In addition, depression is linked to suicide.  
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12 Not only suicide ideation studies but also psychological autopsy studies have proved the  
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14 strong association between depression and suicide.<sup>6,7</sup>  
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18 Positive social support has been shown to be protective against risk of depression  
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20 by buffering the effects of stress.<sup>4,8-11</sup> Specifically, instrumental support, such as tangible  
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22 assistance (labor, in kind) and financial support (e.g., cash loans), has been  
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24 demonstrated to lower the risk of depression by assisting individuals in coping with  
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26 everyday hardships and facilitating their socioeconomic mobility.<sup>12,13</sup> Emotional  
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28 support such as companionship and intimacy can also buffer the individual from the  
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30 harmful effects of stress.<sup>14,15</sup> On the other hand, social support does not always give rise  
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32 to positive experiences, however well-meaning the intentions of the support giver may  
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34 be. Social support can be negative when it is unwanted, at odds with the needs of the  
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36 recipient, or when it makes the recipient uncomfortable, which could unintentionally  
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38 serve as a potential source of stress.<sup>16-19</sup> Thus, positive and negative supports represent  
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40 two separate domains of social experience and may have independent effects on  
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42 depression via different mechanisms.<sup>16,20,21</sup>  
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49 In addition, these two domains of social supports might interfere in the effect on  
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51 psychological depression each other when they co-exist. According to the “buffering  
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53 effect model”, those with a high level of negative support may receive more benefit  
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55 from the positive support in reducing depressive symptom. Conversely, high level of  
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57 positive support may cushion the adverse effect of the stressor from negative supports  
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4 on mental health.<sup>22</sup> Only a handful of studies have explored on this and have not been  
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6 updated for a long time.<sup>23-25</sup>  
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9 Socioeconomically disadvantaged people disproportionately experience conditions  
10 that elevate the risk of depression, such as precarious work, job loss, financial insecurity,  
11 or disadvantaged living environment.<sup>26-29</sup> In addition, urban dwellers, especially those  
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13 in developed countries such as Canada and the United Kingdom, are usually more  
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15 vulnerable to depression than those living in rural areas, owing to stresses from more  
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17 frequent encounters with uneven distribution of socioeconomic status (SES),  
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19 competitive work environment, higher rate of separated or divorced marital status, high  
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21 rate of suffering from crime, and poor social cohesion.<sup>30-33</sup> These findings give rise to the  
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23 question of whether positive or negative social support might benefit or harm more in  
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25 financially distressed people living in an urban area. For example, better -off people may  
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27 have the capacity to obtain information for coping with depressive moods from various  
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29 sources other than their social networks. Similarly, they can afford to hire people or  
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31 purchase things that can help them avoid depressive situations. However, to our  
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33 knowledge, there was no study that has investigated on this to date. Most studies have  
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35 focused only on the relationships between financial deprivation and depressive  
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37 symptoms<sup>34-36</sup> or on the protective influence of social support on depression.<sup>8-11</sup>  
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42 Korea is facing a continuous increase in depression. One-year prevalence of  
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44 depression, the proportion of adults who had experienced depressive disorder more  
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46 than once during the recent 12 months from the survey time, increased from 1.8 % in  
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48 2001 to 3.1 % in 2011.<sup>37</sup>  
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53 The current study sought to address the following research questions in Korean  
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55 context while addressing the research gaps that exist in previous studies. The first, are  
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4 positive and negative support independently associated with depressive symptoms?  
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6 Second, do positive social support moderate the effect of negative social support on  
7 depressive symptom or vice versa? Finally, are the effects of positive and negative  
8 support more pronounced for less affluent individuals?  
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## 13 14 15 **METHODS**

### 16 17 18 **Data source**

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23 Our data came from a large-scale genomic cohort study called The Health Examinees-  
24 Gem (HEXA-G), which was established to investigate the epidemiologic characteristics  
25 of major chronic diseases in Korean adults living in urban areas. Target participants  
26 which are adult males and females aged 40–69, were recruited prospectively at 38  
27 health examination centers or training hospitals located in 8 regions in Korea  
28 (Seoul/Incheon/Gyeonggi-do, Gangwon-Do, Daejeon/Chungcheongnam-do,  
29 Chungcheongbuk-do, Daegu/ Gyeongsangbuk-do, Busan/ Gyeongsangnam-do, Jeollabuk-  
30 do, Gwangju/ Jeollanam-do) when they visited for their government-subsidized health  
31 examinations provided for free by the National Health Insurance Service biennially to all  
32 Korean adults aged over 40 for the purpose of effective health promotion and disease  
33 prevention. This way of recruiting can provide the advantages of longitudinal repeated  
34 measurements, and a pool of subjects that are representative of the majority of the  
35 Korean population.  
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54 The baseline survey was conducted by trained research staff using a standardized  
55 questionnaire, which included information on sociodemographic characteristics,  
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4 medical history, medication usage, lifestyles, dietary habits, and social capital. Written  
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6 informed consent was obtained from all participants. The study protocol was approved  
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8  
9 by the Ethics Committee of the Korean Health and Genomic Study of the Korean  
10  
11 National Institute of Health, as well as by the institutional review boards of all  
12  
13 participating hospitals.  
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15  
16 Although the recruitment occurred in two phases (first-phase survey: 2004–2008,  
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18 second-phase survey: 2009–2013), this study utilized data collected between March  
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20 2009, and March 2010, because of availability of information on depressive symptoms.  
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22 More detailed information about the study design can be found elsewhere.<sup>38</sup>  
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### 28 **Outcome variable**

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32 Depressive symptoms were measured using the 20-item version of the Centers for  
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34 Epidemiologic Studies-Depression Scale (CES-D) which was developed for use in the  
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36 epidemiologic studies of depressive symptom in the general population.<sup>39</sup> CES-D has  
37  
38 been proved to be reliable in previous studies with a Cronbach's alpha of 0.84 ~ 0.90  
39  
40 depending on the ethnic groups.<sup>39 40</sup> Respondents were asked to rate how often, over  
41  
42 the preceding week, they experienced symptoms associated with depression, such as  
43  
44 restless sleep, poor appetite, and feelings of loneliness. Possible scores ranged between  
45  
46 0 and 3 for each item (0 = less than one day per week, 1 = 1–2 days per week, 2 = 3–4  
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48 days per week, and 3 = more than 6 days per week). The overall score, obtained by  
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50 summation of the individual items, has a possible range of 0–60, with higher scores  
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52 indicating more severe depressive symptoms (Supplemental table 1).  
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## 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.<sup>41</sup> 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

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4 three ordinal groups. Since there is no objective or agreed-upon criteria used for  
5  
6 determining level of social support, we chose the cutoff values considering frequency  
7  
8 distribution: low positive/negative support (scores of 0–2 for positive support and 0–1  
9  
10 for negative support), medium positive/negative support (scores of 3–4 for positive  
11  
12 support and 2–3 for negative support), and high positive/negative support (scores of 5–  
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14 6 for positive support and 4–6 for negative support).  
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### 21 **Other explanatory factors**

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25 Marital status was categorized into five categories: married or cohabiting, never  
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27 married, divorced or separated, widowed, and others. Age was divided into ten-year  
28  
29 interval groups, starting at 40 years old. The SES factors included occupational status,  
30  
31 education level, and household income level. Specifically, respondents were asked to  
32  
33 provide their occupational status by choosing among 14 kinds of job categorized by the  
34  
35 Korean Standard Classification of Occupation. We grouped these into 7 categories: non-  
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37 manual (legislators, senior officials, managers, professionals, technicians and associate  
38  
39 professionals, clerical support workers), service and sales workers, manual (skilled  
40  
41 agricultural, forestry and fishery workers, craft and related trades workers, plant and  
42  
43 machine operators and assemblers, elementary occupations), armed forces, housewives,  
44  
45 unemployed, and others. Educational attainment was grouped into four levels: primary  
46  
47 school or below, high school graduate or below, college degree, and graduate school or  
48  
49 higher. Household monthly income was asked into four levels (unit: 10,000 Korean  
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51 Won): < 100 (≐ 887 US\$), 100 to < 300 (≐ 2,660 US\$), 300 to < 600 (≐ 5,319 US\$), and  
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60 ≥ 600.

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4 We controlled for several community-level SES variables such as average income,  
5  
6 average educational level, and the employment rate in the community, which were  
7  
8 created from aggregation of their individual-level analogues. The purpose of this was to  
9  
10 adjust for the SES-contextual effect of people living together in the community based on  
11  
12 assumption that people may feel a different level of depressive symptom depending on  
13  
14 the level of socioeconomic status of their neighborhood even if their individual  
15  
16 socioeconomic status are equal.  
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### 23 **Patient and public involvement**

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27 This study did not involve patients. Participants were urban dwellers aged 40–69  
28  
29 who visited hospitals for their government-subsidized health examinations. The  
30  
31 findings from this study will be disseminated to the wider public via local media and  
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33 civil society organizations.  
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### 40 **Statistical analyses**

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43 We constructed linear random intercept multi-level models to estimate the  
44  
45 association between negative and positive social support and the risk of depressive  
46  
47 symptoms while accounting for the clustering of observations at the community level.  
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49 Because there is no residential address information in our dataset, we used the 38  
50  
51 health examination centers or training hospitals where survey population was recruited  
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53 as a proxy for communities, assuming that people would visit the nearest centers to  
54  
55 their residence for their medical check-ups.  
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4 We started by including positive and negative social supports alternately in the  
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6 model with adjustment only for individual-level demographic variables: marital status,  
7  
8 age, and gender (model 1 and 2). From checking the correlation, we found a weak  
9  
10 negative correlation between positive and negative social support (refer to the  
11  
12 supplemental table 3 for phi coefficients from Chi-square analyses). Testing of Variance  
13  
14 Inflation Factor (VIF) revealed no multicollinearity between two (VIF=1.06 and 1.5 for  
15  
16 the level of positive social support and negative social support respectively). Therefore,  
17  
18 we tried to run a model including both domains of social supports simultaneously with  
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20 adjustment for only demographic characteristics first (model 3), and then additional  
21  
22 adjustment for SES variables: occupational status, educational level, and monthly  
23  
24 income (model 4). This will enable us to test whether the association between one  
25  
26 domain of social support and depressive symptom is not due to the confounding effect  
27  
28 of the other domain of support. The reason for sequential entering of groups of  
29  
30 demographic and SES variables was that we wanted to explore whether adjusting for  
31  
32 SES would attenuate the association between positive or negative social supports and  
33  
34 the outcome variable, assuming that SES might confound the association between social  
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36 support and depressive symptoms. All potential two-way and three-way interaction  
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38 terms between income and each domain of supports were explored (model 5). Finally,  
39  
40 we tried to control for community-level SES variables (model 6). All statistical tests  
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42 were two-sided, and statistical significance was determined at  $p < 0.05$ . Data were  
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44 analyzed using SAS 9.3 software package.  
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## 55 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.

	<i>n</i>	Proportion (%)	Mean depressive symptom score
<b>Marriage</b>			
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
	12		

<b>Age(yrs)</b>			
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
<b>Gender</b>			
Male	7,978	37.62	3.62
Female	13,230	62.38	5.01
<b>Education</b>			
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
<b>Job</b>			
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
<b>Income(Korean 10,000 Won)<sup>†</sup></b>			
<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
<b>Level of positive social support</b>			
Low	833	3.93	11.51
Medium	1,778	8.38	9.07
High	18,597	87.69	3.73
<b>Level of negative social support</b>			
Low	18,856	88.91	3.66
Medium	1,724	8.13	10.00
High	628	2.96	14.16

<sup>†</sup>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,  $b = -2.73$ ,

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

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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



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4 score in a group with a lower level of positive social support or lower income (Figure 3).  
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6 That is, high level of negative support had a similar effect as low income while a high  
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8 level of positive support had a similar effect as high income in moderating associations  
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10 with the depressive symptoms. In Figure 2 and 3, we presented only the highest and  
11  
12 lowest groups in the level of social support and in the level of income to show the  
13  
14 differential effect in a maximized way. A three-way interaction term between positive,  
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16 negative social support and income level was not significant (not presented). None of  
17  
18 the community level SES variable was significant (model 6).  
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25 Insert Figure 2 and Figure 3  
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30 Regarding the relevance of the other independent variables, marital status of being  
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32 separated or divorced and being widowed, female gender, and occupational status of  
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34 housewife were associated with higher depressive symptom scores compared with  
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36 their counterparts while older groups and people with higher education level were  
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38 likely to have lower depressive symptom score (Supplemental table 4).  
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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 <sup>f</sup>		Model 2 <sup>f</sup>		Model 3 <sup>f</sup>		Model 4 <sup>fj</sup>		Model 5 <sup>fj</sup>		Model 6 <sup>fj</sup>	
	Coeff	S.E.	Coeff	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
<b>Individual level variables</b>														
<b>&lt;100(Korean 10,000 Won)<sup>††</sup></b>														
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
<b>Positive social support(Low level)</b>														
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
<b>negative social support(Low level)</b>														
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
<b>Positive social support x negative social support</b>														
											-0.92***	0.15	-0.92***	0.15
<b>Positive social support x income</b>														
											0.47***	0.12	0.47***	0.12
<b>Negative social support x income</b>														
											-0.38**	0.13	-0.38**	0.13
<b>Community-level variables</b>														
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 <sup>§</sup> (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 /<sup>f</sup>: adjusted for only demographic variables including marital status, age and gender /<sup>fj</sup>: adjusted for both demographic and SES variables including marital status, age, gender, job status, and education level /<sup>\*</sup>: p < 0.05, /<sup>\*\*</sup>: p < 0.01, /<sup>\*\*\*</sup>: p < 0.001 /<sup>††</sup> US \$ ≅ 1,128 Korea Won /<sup>§</sup>: 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.<sup>8-10 22 42 43</sup> 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').<sup>44</sup>

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

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4 explored in previous studies than that of positive social support. However, finding  
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6 related to negative social support from the present study are also in line with finding in  
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8 the previous study performed in Netherland that reported that negatively experienced  
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10 supports are significantly associated with higher prevalence and incidence of poor  
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12 mental health in men and women aged 26-65 years.<sup>45</sup>  
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16 Most previous articles focused on only positive or negative social support without  
17  
18 considering the other and studies which have examined the simultaneous effect of two  
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20 domains of social supports are rare and outdated. Among them, Ingersoll-Dayton (1997)  
21  
22 has identified four models framing the effect of each domain of social exchange;  
23  
24 'Positivity effect model' meaning that only positive exchange affect health outcome  
25  
26 whether it's positive or negative outcomes, 'Negativity effect model' arguing that only  
27  
28 negative exchange affect outcome, again whether positive or not, 'Domain specific effect  
29  
30 model' meaning that positive and negative exchange affect only positive and negative  
31  
32 outcome respectively, and lastly, 'Combined positivity and negativity effects model'  
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34 arguing that positive exchange and negative exchange affect both positive and negative  
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36 outcome simultaneously.<sup>46</sup> The result from our study supports the 'Combined positivity  
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38 and negativity effect model'. A few other existing studies also support this model. For  
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40 example, Golding and Burnam (1990) demonstrated that both social support and social  
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42 conflict were significant predictors of depression among Mexican American adults when  
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44 they were run together in a model.<sup>47</sup> More recently, Croezen et al(2012) showed that  
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46 low level of positive support and high level of negative support were associated with  
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48 high odds of poor mental health at the same time in Dutch men and women.<sup>45</sup>  
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55 More notable findings from the present study are significant interactions among  
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57 positive, negative social support and income on the depressive symptom. Those with a  
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4 lower income and a higher level of negative support may receive greater benefits from  
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6 positive social support and those with lower income and lower level of positive support  
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8 may have greater damage from negative social supports compared to their counterparts.  
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10 These findings may suggest that social supports play a similar role to income.  
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12 Specifically, a high level of negative supports operated in the same way as low income in  
13  
14 moderating the association between positive social support and depressive symptom as  
15  
16 depicted in Figure 2. Similarly, low level of positive supports operated in the same  
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18 manner as low income in moderating the association between negative social support  
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20 and depressive symptoms as shown in Figure 3.  
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25 Low economic capacity can be linked to stress, low self-esteem, stigma, feelings of  
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27 helplessness and hopelessness,<sup>43</sup> and risk for marginalization and social exclusion.<sup>22</sup>  
28  
29 However, these can be counterbalanced by positive social support. Negative social  
30  
31 support serves as a type of stressor similar to low income, for which positive social  
32  
33 support also can compensate for.<sup>48</sup> Thus, the effect of positive support on reducing  
34  
35 depressive symptom was stronger in a group with lower income and a higher level of  
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37 negative social support. Emotional positive support, such as understanding, dialogue,  
38  
39 appreciation, or getting assistance with problem-solving, can provide marginalized poor  
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41 or people hurt by negative social support with the feeling that they are cared for,  
42  
43 esteemed, and valued. Tangible benefits bestowed by another aspect of positive support,  
44  
45 named “instrumental supports” such as help in housework or exchange of material  
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47 resources, may also assist in coping with materially deprived circumstances or feeling of  
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49 being unprotected or being isolated caused by negative social support.<sup>22</sup> Conversely,  
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51 negative supports such as perception of arguing, being criticized, feelings of undue  
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53 demand, or too much intervention may serve as an additional source of stress for poor  
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4 people who are already psychologically vulnerable due to financial stress.<sup>40</sup> While  
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6 people with a high level of positive support have the capacity to buffer the harmful  
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8 effect of negative support on the depressive symptoms, those without positive support  
9  
10 may suffer from damage from negative support.  
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14 There are several studies which examined the interaction of positive and negative  
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16 social support. While some have not found any evidence of interaction,<sup>25 36</sup> others have  
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18 observed a buffering effect of positive social support on the association between  
19  
20 negative social support and mental health across different outcomes and population  
21  
22 group.<sup>23 24</sup> No previous studies have examined the interaction between social supports  
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24 and income on mental health to our knowledge.  
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28 The result of the current study may provide important implications in the Korean  
29  
30 context. Since the country's economic crisis in late 1990, socioeconomic inequality has  
31  
32 deepened, resulting in worsening social polarization, which, in turn, caused a rising  
33  
34 prevalence of depression.<sup>49</sup> Suicide rate, for which depression has been blamed as a  
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36 strong driver in Korea,<sup>50 51</sup> also increased continuously from 8.4 in 1991 to 28.5 in 2013  
37  
38 (per 100,000 persons), ranking South Korea as the first in suicide rate among  
39  
40 Organization for Economy Cooperation and Development countries since 2002.<sup>52</sup>  
41  
42 Despite these concerning trends, only a minority of people with depressive symptoms  
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44 seek professional consultation, for fear of the cultural stigma attached to mental  
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46 illness.<sup>53</sup> Because economic disadvantage has been well recognized as a determinant of  
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48 depression in Korea,<sup>54</sup> the results of our study provide supporting evidence for  
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50 interventions encouraging positive social support or discouraging negative social  
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52 support in underprivileged populations.  
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58 Although the poor are more affected by social support than the better off, they also  
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4 tend to have more limited capacity to control social support on their own by generating  
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6 positive support or avoiding negative support. For example, people with economic  
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8 capacity have more access to receive positive emotional support because they can  
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10 afford private psychologists or clinical counselors. Similarly, they have more access to  
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12 instrumental positive support by hiring private caregivers or housekeepers when they  
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14 cannot find those supports among close people around them. Therefore, interventions  
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16 to mobilize positive social support or prevent negative support for those with limited  
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18 economic means might be effective for lowering depressive symptoms in society.  
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### 25 **Strength and limitations**

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30 Although this study is unique in separately analyzing the effects of positive and  
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32 negative social support on depressive symptoms according to income level in a large  
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34 sample, it also has a few limitations to be noted when interpreting the results. First,  
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36 there is a possibility of reverse causation, given the cross-sectional nature of the study.  
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38 For example, people with depressive symptoms may become less sociable and less  
39  
40 engaged in social networks, thereby eventually reducing social support.<sup>55</sup> Second, we  
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42 used the 38 health examination centers or training hospitals where target populations  
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44 were recruited as a proxy for communities. Although this is not a geographical  
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46 classification based on respondents' residential address, equating it with a community  
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48 is assumed to be reasonable; most people are likely to go to the hospitals nearest to  
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50 their residence for their government-subsidized medical check-ups because there is no  
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52 much difference in quality between hospitals designated for government-subsidized  
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54 health examination. Third, because no agreed-upon cutoff points for high or low levels  
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4 of social support were available, we classified sum scores into three ordinal groups  
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6 considering the number of people belonging to each group. To test the sensitivity of the  
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8 result to the categorization of social support level, we reran the analyses using the score  
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10 as a continuous variable. These different ways of categorization produced the almost  
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12 same results.  
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## 18 **CONCLUSION**

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23 The present study showed that, at the individual level, both positive and negative  
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25 social support were associated with depressive symptoms, and these associations were  
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27 found to be stronger in economically disadvantaged people when adjusting for various  
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29 control variables at multiple levels. In addition, positive and negative social support  
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31 moderated the association of negative and positive social support with depressive  
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33 symptoms, respectively. Reducing inequality is always challenging, although most  
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35 pursue social equality as an ideal. The results of this study suggest that strategies for  
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37 adjusting positive and negative support among low-income populations might be  
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39 effective in reducing depressive symptoms in those populations.  
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44 Further study is required to reveal the mechanisms by which different types of  
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46 individual social support operate on depressive symptoms in each economic group in  
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48 the context of South Korea.  
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53 **Contributors:** HYL and JO conceived the study. HYL led the statistical analysis and drafted  
54  
55 the manuscript. JO provided supervision throughout the data analysis and interpretation. IK  
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57 provided overall guidance and helped to edit language. JH, SK, JL, and DK helped to interpret the  
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4 data. All authors read and approved the final manuscript.  
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6 **Funding:** This research received no specific grant from any funding agency in the public,  
7  
8 commercial or not-for-profit sectors.  
9

10 **Competing interests:** None declared.  
11

12  
13 **Ethics approval:** The HEXA-G study was approved by the Ethics Committee of the Korean  
14  
15 Health and Genomic Study of the Korean National Institute of Health  
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18 **Data sharing statement:** Data are available from the Korea Centers for Disease Control and  
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20 Prevention for researchers who meet the criteria for access to the data. Researchers may  
21  
22 contact Dr. Yeonjung Kim, Division of Epidemiology and Health Index, Center for Genome  
23  
24 Science, Korea.  
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26  
27 **Acknowledgment:** We thank Ellen Daldoss from Edanz Group ([www.edanzediting.com/ac](http://www.edanzediting.com/ac))  
28  
29 for editing a draft of this manuscript  
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### 31 32 33 Figure Legends

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36 Figure 1 Derivation process of the study sample  
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38  
39 Figure 2 Differential effect of positive support according to the level of negative support  
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41 and income level on depressive symptom  
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44 Figure 3 Differential effect of negative support according to the level of positive support  
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46 and income level on depressive symptom  
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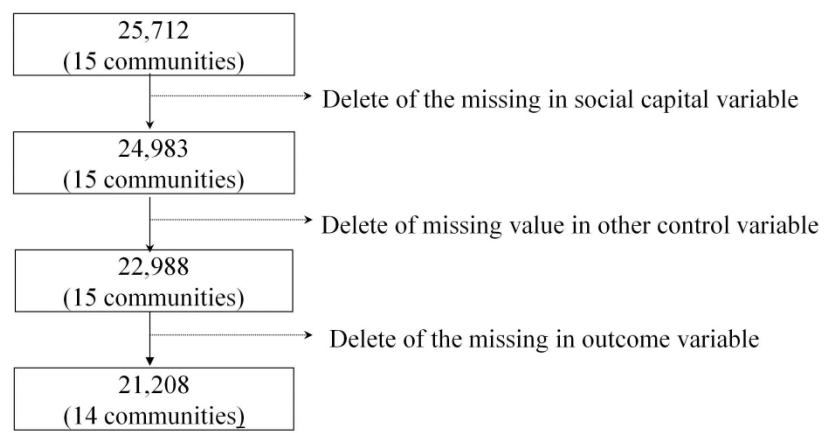
## REFERENCES

1. Irwin M, Daniels M, Bloom ET, et al. Life events, depressive symptoms, and immune function. *The American journal of psychiatry* 1987
2. Schleifer SJ, Keller SE, Siris SG, et al. Depression and immunity: lymphocyte function in ambulatory depressed patients, hospitalized schizophrenic patients, and patients hospitalized for herniorrhaphy. *Archives of General Psychiatry* 1985;42(2):129-33.
3. Schleifer SJ, Keller SE, Bartlett JA. Depression and immunity: clinical factors and therapeutic course. *Psychiatry Research* 1999;85(1):63-69.
4. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychological bulletin* 1985;98(2):310.
5. Morris P, Raphael B, Robinson RG. Clinical depression is associated with impaired recovery from stroke. *The Medical Journal of Australia* 1992;157(4):239-42.
6. De Leo D, San Too L. Suicide and depression. *Essentials of Global Mental Health* 2014:367.
7. Yoshimasu K, Kiyohara C, Miyashita K. Suicidal risk factors and completed suicide: meta-analyses based on psychological autopsy studies. *Environmental health and preventive medicine* 2008;13(5):243.
8. Wade TD, Kendler KS. The relationship between social support and major depression: cross-sectional, longitudinal, and genetic perspectives. *The Journal of nervous and mental disease* 2000;188(5):251-58.
9. Stice E, Ragan J, Randall P. Prospective relations between social support and depression: Differential direction of effects for parent and peer support? *Journal of abnormal psychology* 2004;113(1):155.
10. Moak Z, Agrawal A. The association between perceived interpersonal social support and physical and mental health: results from the National Epidemiological Survey on Alcohol and Related Conditions. *Journal of Public Health* 2009:fdp093.
11. Israel BA, Farquhar SA, Schulz AJ, et al. The relationship between social support, stress, and health among women on Detroit's East Side. *Health Education & Behavior* 2002;29(3):342-60.
12. Henly JR, Danziger SK, Offer S. The contribution of social support to the material well-being of low-income families. *Journal of Marriage and Family* 2005;67(1):122-40.
13. de Souza Briggs X. Brown kids in white suburbs: Housing mobility and the many faces of social capital. *Housing policy debate* 1998;9(1):177-221.
14. Cooper PJ, Tomlinson M, Swartz L, et al. Improving quality of mother-infant relationship and infant attachment in socioeconomically deprived community in South Africa: randomised controlled trial. *Bmj* 2009;338:b974.
15. Campbell SB, Morgan-Lopez AA, Cox MJ, et al. A latent class analysis of maternal depressive symptoms over 12 years and offspring adjustment in adolescence. *Journal of abnormal psychology* 2009;118(3):479.
16. Croezen S, Haveman-Nies A, Picavet H, et al. Positive and negative experiences of social support and long-term mortality among middle-aged Dutch people. *American journal of epidemiology* 2010;172(2):173-79.
17. Oxman TE, Hull JG. Social support, depression, and activities of daily living in older heart surgery patients. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 1997;52(1):P1-P14.
18. Oxman TE, Berkman LF, Kasl S, et al. Social support and depressive symptoms in the elderly. *American Journal of Epidemiology* 1992;135(4):356-68.
19. Hays JC, Krishnan KRR, George LK, et al. Psychosocial and physical correlates of chronic

- depression. *Psychiatry research* 1997;72(3):149-59.
20. Newsom JT, Rook KS, Nishishiba M, et al. Understanding the relative importance of positive and negative social exchanges: Examining specific domains and appraisals. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 2005;60(6):P304-P12.
  21. Pagel MD, Erdly WW, Becker J. Social networks: we get by with (and in spite of) a little help from our friends. *Journal of personality and social psychology* 1987;53(4):793.
  22. Aneshensel CS, Frerichs RR. Stress, support, and depression: A longitudinal causal model. *Journal of Community Psychology* 1982;10(4):363-76.
  23. Revenson TA, Schiaffino KM, Majerovitz SD, et al. Social support as a double-edged sword: The relation of positive and problematic support to depression among rheumatoid arthritis patients. *Social science & medicine* 1991;33(7):807-13.
  24. Rhodes JE, Woods M. Comfort and conflict in the relationships of pregnant, minority adolescents: Social support as a moderator of social strain. *Journal of Conununuy Psychology* 1995;23
  25. Okun MA, Keith VM. Effects of positive and negative social exchanges with various sources on depressive symptoms in younger and older adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 1998;53(1):P4-P20.
  26. Takeuchi DT, Williams DR. Race, ethnicity and mental health: Introduction to the special issue. *Journal of Health and Social Behavior* 2003;44(3):233-36.
  27. Smedley BD, Syme SL. Promoting health: Intervention strategies from social and behavioral research. *American Journal of Health Promotion* 2001;15(3):149-66.
  28. Pickett KE, Pearl M. Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *Journal of epidemiology and community health* 2001;55(2):111-22.
  29. Silver E, Mulvey EP, Swanson JW. Neighborhood structural characteristics and mental disorder: Faris and Dunham revisited. *Social science & medicine* 2002;55(8):1457-70.
  30. Wang J. Rural-urban differences in the prevalence of major depression and associated impairment. *Social psychiatry and psychiatric epidemiology* 2004;39(1):19-25.
  31. Paykel E, Abbott R, Jenkins R, et al. Urban-rural mental health differences in Great Britain: findings from the National Morbidity Survey. *Psychological medicine* 2000;30(02):269-80.
  32. Andrade L, Caraveo-anduaga JJ, Berglund P, et al. The epidemiology of major depressive episodes: results from the International Consortium of Psychiatric Epidemiology (ICPE) Surveys. *International journal of methods in psychiatric research* 2003;12(1):3-21.
  33. Weich S, Twigg L, Lewis G. Rural/non-rural differences in rates of common mental disorders in Britain. *The British Journal of Psychiatry* 2006;188(1):51-57.
  34. Lorant V, Croux C, Weich S, et al. Depression and socio-economic risk factors: 7-year longitudinal population study. *The British Journal of Psychiatry* 2007;190(4):293-98.
  35. Belle Doucet D. Poverty, inequality, and discrimination as sources of depression among US women. *Psychology of Women Quarterly* 2003;27(2):101-13.
  36. Rhodes JE, Ebert L, Fischer K. Natural mentors: An overlooked resource in the social networks of young, African American mothers. *American Journal of Community Psychology* 1992;20(4):445-61.
  37. JP Hong DL, BJ Ham, SH Lee, SJ Sung, Tak Y, TY Ha, SJ Sohn, JW Sohn, JC Yoo, JR Kim, JI Park, SH Kim, SJ Cho, YC Jung, MD Kim, SM Jang, BS Kim, JH Anh, BJ Kim, JS Yoon, IS Shin, HJ Chun, SW Kim. The survye of mental disorders in Korea. Seoul, Korea: Samsung Medical Center 2017:1~502 page.
  38. Group HES. The Health Examinees (HEXA) Study: Rationale, Study Design and Baseline

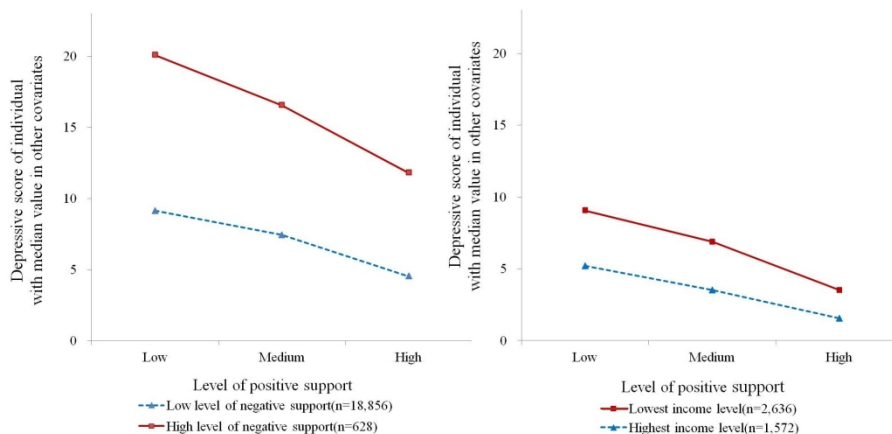
- Characteristics. *Asian Pacific journal of cancer prevention: APJCP* 2014;16(4):1591-97.
39. Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied psychological measurement* 1977;1(3):385-401.
40. Roberts RE. Reliability of the CES-D scale in different ethnic contexts. *Psychiatry research* 1980;2(2):125-34.
41. De Silva MJ, Harpham T. Maternal social capital and child nutritional status in four developing countries. *Health & place* 2007;13(2):341-55.
42. Manuel JI, Martinson ML, Bledsoe-Mansori SE, et al. The influence of stress and social support on depressive symptoms in mothers with young children. *Social science & medicine* 2012;75(11):2013-20.
43. Neugebauer A, Katz PP. Impact of social support on valued activity disability and depressive symptoms in patients with rheumatoid arthritis. *Arthritis Care & Research* 2004;51(4):586-92.
44. Aneshensel CS, Stone JD. Stress and depression: A test of the buffering model of social support. *Archives of General Psychiatry* 1982;39(12):1392.
45. Croezen S, Picavet HSJ, Haveman-Nies A, et al. Do positive or negative experiences of social support relate to current and future health? Results from the Doetinchem Cohort Study. *BMC Public Health* 2012;12(1):65.
46. Ingersoll-Dayton B, Morgan D, Antonucci T. The effects of positive and negative social exchanges on aging adults. *J Gerontol B Psychol Sci Soc Sci* 1997;52(4):S190-9.
47. Golding JM, Burnam MA. Immigration, stress, and depressive symptoms in a Mexican-American community. *Journal of Nervous and Mental Disease* 1990;178(3):161-71.
48. Lepore SJ. Social conflict, social support, and psychological distress: Evidence of cross-domain buffering effects. *Journal of personality and social psychology* 1992;63(5):857.
49. Cho MJ, Kim J-K, Jeon HJ, et al. Lifetime and 12-month prevalence of DSM-IV psychiatric disorders among Korean adults. *The Journal of nervous and mental disease* 2007;195(3):203-10.
50. Kim S-W, Kim S-J, Mun J-W, et al. Psychosocial factors contributing to suicidal ideation in hospitalized schizophrenia patients in Korea. *Psychiatry investigation* 2010;7(2):79-85.
51. Kim S-W, Yoon J-S. Suicide, an urgent health issue in Korea. *Journal of Korean medical science* 2013;28(3):345-47.
52. Economic O. Environmental and Social Statistics. *France: OECD Publication Service* 2013
53. Cho SJ, Lee JY, Hong JP, et al. Mental health service use in a nationwide sample of Korean adults. *Social psychiatry and psychiatric epidemiology* 2009;44(11):943-51.
54. Park JH, Kim KW, Kim M-H, et al. A nationwide survey on the prevalence and risk factors of late life depression in South Korea. *Journal of affective disorders* 2012;138(1):34-40.
55. Monroe SM, Steiner SC. Social support and psychopathology: interrelations with preexisting disorder, stress, and personality. *Journal of abnormal psychology* 1986;95(1):29.

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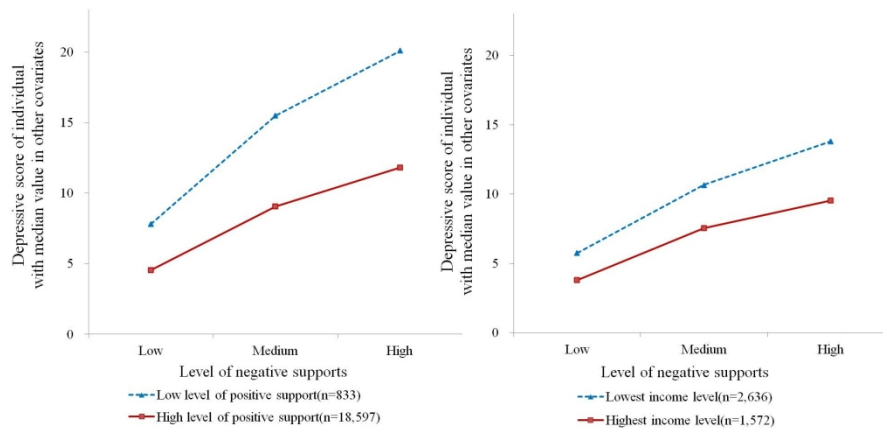
[Figure 1] Derivation process of the study sample

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

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.

## &lt;Positive social support&gt;

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

## &lt;Negative social support&gt;

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	
		$\chi^2$ (P)	Phi	$\chi^2$ (P)	Phi	$\chi^2$ (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

For peer review only

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

	Coeff.	S.E.
<b>Currently married/co-residing</b>		
Never married	0.46	0.29
Separated/divorced	2.09***	0.25
Widowed	1.11***	0.22
Others	-0.90	1.16
<b>40≤age&lt;50(yrs)</b>		
50≤age<60	-0.20*	0.10
60≤age<70	-0.84***	0.14
<b>Male</b>		
Female	0.74***	0.11
<b>Non-manual</b>		
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
<b>Primary school or below</b>		
High school graduate	-0.56***	0.13
College degree	-0.80***	0.18
Graduate school or higher	-1.17***	0.27

\*:p&lt;0.05, \*\*: p&lt;0.01, \*\*\* :p&lt;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 #
<b>Title and abstract</b>	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
<b>Introduction</b>			
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
<b>Methods</b>			
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	-
<b>Results</b>			

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	-
<b>Discussion</b>			
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
<b>Other information</b>			
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](http://www.strobe-statement.org).