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The temporal impact of excessive health expenditures on suicidal ideation in heads of households

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Abstract

Objective Excessive health expenditures (CHEs) are a global issue for households suffering from high-cost medical conditions, low incomes, and limited insurance coverage. After the international financial crisis of 2009, CHEs became a social problem in developed countries. Such economic crises might induce severe mental stress, resulting in suicide.

Methods We used the Korean Welfare Panel Study (KoWePS) from 2011 to 2013 and selected heads of households among respondents to a questionnaire; the total number of analyzed samples was 4,247 out of 5,717 households in the database. To measure the impact of economic crises accurately, we only included households that had never experienced CHEs before 2011 and never missed any annual surveys during the study period. To examine the temporal relationship between CHEs and suicidal ideation, we conducted a logistic regression analysis.

Results Among 4,247 heads of household, 146 (3.4%) experienced suicidal ideation more than once during the past year, whereas 4,101 (96.6%) did not. The heads of households who had poor perceived health status (odds ratio (OR)=1.89, 1.13–3.14) and the highest quartile group for depression score (CESD-11, OR=8.60, 4.94–14.97) were more vulnerable to suicidal ideation. Such ideation was influenced to a greater extent by a recent CHE (ORs=1.91, 1.16–3.15) than by either a remote CHE (ORs=1.37, 1.16–3.15) or CHEs in both 2011 and 2012 (ORs=1.71, 1.56) for CHEs above 10%. Results for CHEs above 20% were nearly identical to those of CHEs above 10%.

Conclusions Up to our knowledge, this is the first study to determine the association between CHEs and suicidal ideation in Korea. At the household level, more recent and higher CHEs resulted in more episodes of suicidal ideation. In conclusion, it might be suggested that to prevent suicidal ideation and improve the mental health of individuals, recent household

CHEs must be considered.

Strength and limitation of this study

Strength

- We used the representative national data 'Korea Welfare Panel Study(KoWePS)' from the national research institute, "Korea Institute for Health and Social Affairs, KIHASA".
- We divided the occurrences of CHEs into four subgroups (none, recent, remote, and both years) in an attempt to analyze temporal causality.

Limitation

- We could not determine casual relationships due to the cross-sectional nature of this study.
- Because the number of suicide attempts observed during the study period was too small to continue the analysis, we used suicidal ideation as a dependent variable.
- The number of cases of suicidal ideation may have been too small to determine all associations.

Introduction

Protection from excessive health expenditures (CHEs) is widely regarded as a desirable objective of healthcare systems and policies. However, CHEs are not always the same as high healthcare costs. For example, an expensive surgery might not be excessive if a household does not bear its full cost because the service is provided free or at a subsidized price or is covered by third-party insurance. On the other hand, even the small cost of common illnesses can be financially disastrous for poor households with no insurance.

CHEs have traditionally been household issues in undeveloped countries[1-5]. However, after the international financial crisis of 2009, CHEs became a social problem in developed countries. As these countries regard healthcare as a luxury[6], they began to cut these benefits and raise productivity in health industries[7]. The average increase in health spending across Organisation for Economic Co-operation and Development (OECD) member countries was only 0.2% between 2009 and 2011, compared to over 4% per annum after years of continuous growth. This increase resulted in a significant increase in out-of-pocket expenses for medical care and a decrease in access to the healthcare system.

According to OECD health data, patients pay the highest percentage of their medical fees (>35%) out of pocket in the Republic of Korea[7]. The low health insurance premiums for national health insurance in Korea limit the range of insurance coverage. In 2011, the national health insurance rate was 5.99% of an employee's salary. Compared to the average rate of 9.5% in OECD countries, this is quite low when we consider both the Korean economy and overall health expenditures. The percentage of coverage paid by the government is only 44.7%, which is extremely low compared to 74.4% for the average OECD country. Only three countries (Mexico, Chile, and the United States) have lower coverage rates than Korea. As the primary function of insurance is to protect the patient from harm in terms of health and

economic risk, it is critical to reduce the occurrences of CHEs. According to Korean National Statistics, the number of households experiencing CHEs in 2010 was 618,000, or 3.9% of all households. This figure was only 1% in 2002 but began to increase thereafter, reaching 3.3% by 2006[8].

These data suggest that Koreans are at risk of occurrences of CHEs. Thus, they might be vulnerable to a decline in their economic welfare in the face of ill health, especially when CHEs exist.

Additionally, the number of suicides is steeply increasing annually in Korea[8 9]. According to OECD health statistics data, the age-standardized suicide mortality rate in 2011 was 33.3 per 100,000 individuals. Among all OECD countries, this is the highest value, although the rate of increase in suicidal mortality remains constant. The most vulnerable age group is below 40 years of age, presumably because of economic crises in the household.

In this study, the compositions of health expenditures between households with and without CHEs were compared. In addition, the relationships between CHEs and suicidal ideation were assessed. Our results suggest that CHEs have an adverse effect on suicidal ideation.

Methods

Data from the Korean Welfare Panel Study (KoWePS: Korea Institute for Health & Social Affairs & Seoul National University Social Welfare Research Center, 2008) from 2011 to 2013 were obtained for this study. The KoWePS is an on-going longitudinal study of a nationally representative sample of Korean households, which collects data annually. The constituent questionnaires in this survey consisted of a household member survey for household members aged 15 years and over, a household survey, and a supplementary survey for special topics. Face-to-face interviews were used to gain information during the first year of the study.

We respect the provision of declaration of Helsinki and we obey the protocol for the research project, suitable for safe and ethical principles. As this study is a secondary opened national data for public access from Korea institute for Health and Social welfare, we do not need to get any individual informed consents. All patient records/information in this study was anonymized and de-identified prior to analysis.

We especially focused on the economic impact to households and suggest that the most vulnerable family member to an economic crisis is the head of household. Indeed, we selected heads of households among respondents to the questionnaire. The total number of analyzed samples was 4,247 out of 5,717 households in the database. To measure the impact of economic crises accurately, we only included households that had never experienced a CHE before 2011 and never missed any annual surveys during the study period.

The household questionnaire portion of the KoWePS included a set of questions that asked about the income of all household members. These questions addressed earned income, income from assets, and miscellaneous income. The present study utilized this set of income-

related questions to create a total household income and disposable income variable. To obtain the number of households experiencing CHEs, we divided the total cost of health expenditures into disposable income for each household.

Although a CHE was defined as an expense over 40% of disposable income by the World Health Organization[4], it has been defined differently by various studies[10-12]. To evaluate correlations between economic crises and health expenditures, we considered the thresholds of CHEs to be 10% and 20%.

In this study, we used several covariates to control for demographic and socioeconomic characteristics and health status. Demographic characteristics included gender, age, marital status, and socioeconomic factors. Moreover, we considered temporal factors of CHEs. In other words, we determined when a excessive event occurred: none, remote (in 2011), recent (in 2012), and in both 2011 and 2012.

To measure the level of depression, the CESD-11 scale was used, which was originally designed to measure depressive symptoms in the general population[13] and has been widely used in community- and clinically based samples[14,15]. For each year of the study period, the respondents reported symptoms experienced during the previous week using a four-point scale. Depression scores for each year were calculated by averaging across 11 items. Suicidal ideation was assessed by a questionnaire that asked about the presence of suicidal ideation during the past year.

The frequency with which CHEs occurred overall, and after stratifying by household demographics and socioeconomic status, was determined by performing a chi-square test. To examine the relationship between CHEs and suicidal ideation, we conducted a logistic regression analysis. We used the SAS 9.3 statistical package (Cary, NC, USA) for statistical

analysis.

Results

The general characteristics of households are shown in Table 1. A total of 4,247 households were enrolled in this study. Among them, 146 heads of households (3.4%) had suicidal ideation more than once during the past year, whereas 4,101 (96.6%) did not.

First, we performed chi-square tests for bivariate analyses (Tables 1 and 2). At the level of the head of household, all dependent variables, including sex ($p<0.001$), being over 65 years of age ($p=0.009$), education level ($p=0.003$), the presence of a spouse ($p<0.001$), and depression ($p<0.001$) were significantly different between those who did and did not have suicidal ideation. We also considered variables that reflect the overall household situation, such as income level, number of family members, economically active family members, presence of a disabled person in the family, and presence of a senior in the family. Among these variables, there were statistically significant differences in income level ($p<0.001$), number of family members ($p<0.001$), and economically active family members in the family ($p<0.001$). Moreover, we investigated whether a temporal relationship between the occurrence of health expenditures and suicidal ideation might exist. At different threshold settings, CHEs that were 10% and 20% above disposable income were both significantly different between those who did and did not have suicidal ideation. However, in both 2011 and 2012, CHEs over 10% had a greater impact on suicidal ideation, whereas in 2012 alone, CHEs over 20% had a greater impact.

We carried out multivariate analysis using a logistic regression model. For CHEs above 10% of disposable income, the heads of households who had poor perceived health status [odds ratio (OR)=1.89, 95% CI: 1.13–3.14] and the highest quartile group for depression score (CESD-11, OR=8.60, 95% CI: 4.94–14.97) were more vulnerable to suicidal ideation (Table 3). This ideation was influenced to a greater extent by a recent CHE than by a remote CHE or

CHEs in both years. For CHEs above 20% of disposable income, statistical differences in perceived health status (OR=1.02, 95% CI: 1.01–1.04) and the highest group for depression score (CESD-11, OR=8.43, 95% CI: 4.84–14.68) were also present at the level of head of household. At this level, the impact of the lowest quartile of income was more than double that of the highest quartile (OR=2.07, 95% CI: 1.01–4.23). Interestingly, only the recent CHE (OR=2.07, 95% CI: 1.01–4.23) had a meaningful association with suicidal ideation.

Because depression at the level of head of household had extremely high ORs in both threshold settings of CHEs, a subgroup analysis was performed for heads of households who were above average in terms of CESD-11 score (Table 4). In this subgroup analysis, the heads of households were more vulnerable to the high threshold of CHEs. In other words, when CHEs were above 20% (in 2012; OR=2.32, 95% CI: 1.40–3.87; in both 2011 and 2012; OR=1.82, 95% CI: 0.99–3.34) compared to 10% (in 2012; OR=1.66, 95% CI: 0.94–2.94; in both 2011 and 2012; OR=1.49, 95% CI: 0.86–2.57), suicidal ideation was increased (Figure 1).

Discussion

From this study, we observed that heads of households with poor perceived health status and depressive mood who experienced CHEs reported more episodes of suicidal ideation. According to measurements of the temporal influences of CHEs during 2011 and 2012, 2011 was associated with meaningful increases in ORs for suicidal ideation in both the above 10% and 20% groups. In addition, there was a greater impact in the above 20% group than in the above 10% group. We also performed a subgroup analysis for heads of households who were moderately and severely depressed. Here, there were statistical trends between income level and suicidal ideation, although the p-values did not indicate statistical significance. The temporal relationship between CHE and suicidal ideation was stronger in the more depressed groups than in the less depressed groups. Within the more depressed groups, the 20% group showed a higher OR than the 10% group.

Globally, many politicians and public health administrators have tried to make healthcare as accessible as possible[10 11]. The problem of accessibility is likely induced by both economic and spatial problems. In Korea, the amount and quality of healthcare access have improved over the last 30 years by the rapid expansion of national health insurance. However, because national reimbursement was low, fiscal asset quality could not be secured. In other words, the out-of-pocket expenses were high regardless of insurance availability, and the range of diseases covered by the insurance was limited. These problems are slow to improve because medical insurance premiums are very low. In 2009, a global economic crisis hindered the ability of patients to visit clinics due to high out-of-pocket expenses and low incomes. In addition, patients with chronic diseases and a large economic burden suffered from tremendous medical expenses.

In this sense, many researchers have tried to determine the causes and economic outcomes

of CHEs rather than their effects on health. However, these kinds of economic stresses worsen mental health and induce depressive disorders, suicidal ideation, and numbers of suicide attempts[12 13]. For example, there was a steep increase in the number of patients with major depressive disorder, suicidal ideation, and suicide attempts immediately after the international economic crisis in 2009[14-17]. The prevalence of major depressive disorder increased from 3.3% of the general population in 2008 to 8.2% in 2011, which is a statistically significant difference. In addition, suicidal ideation among men increased from 4.4% in 2009 to 7.1% in 2011[18].

In 2008, the state of Oregon in the United States initiated a limited expansion of its Medicaid program for low-income adults through a lottery drawing of approximately 30,000 names from a waiting list of almost 90,000[19]. Selected adults won the opportunity to apply for Medicaid and to enroll if they met eligibility requirements. This lottery presented an opportunity to study the effects of Medicaid with the use of random assignment. Five years after its initiation, researchers found no significant effect of Medicaid coverage on the prevalence or diagnosis of hypertension or high cholesterol levels or on the use of medication for these conditions. Medicaid coverage significantly increased the probability of a diagnosis of diabetes and the use of diabetes medications, but there were no significant effects on average glycated hemoglobin levels or on the percentage of participants with levels of 6.5% or higher. Interestingly, Medicaid coverage decreased the probability of a positive screening for depression (-9.15 percentage points; 95% confidence interval, -16.70 to -1.60; p=0.02), increased the use of many preventive services, and nearly eliminated excessive out-of-pocket medical expenditures.

Another study that observed the association between CHEs and depression was performed in India[20]. This study comprised a cross-sectional survey of 2,494 consenting women from a

randomly selected sample of 3,000 women aged 18–50 years who lived in the catchment area of a primary health center in Goa, India. CHEs, defined a priori as greater than 10% of total household income spent out of pocket on health in the previous month, was reported by 138 women (5.5%; CI: 4.7–6.5%); these women were more likely to report economic difficulties, such as having gone hungry in the past 3 months because of a lack of money (OR 1.99, CI 1.1–3.6, p=0.02). Only depressive disorder was associated with significantly higher healthcare costs, lost time costs, and risk of CHEs (OR 2.66, CI 1.6–4.4, p<0.001, after adjustment for possible demographic confounders and other physical health problems). There was a linear association between psychological morbidity scores and the risk of CHEs. From this study, the authors concluded that if economic arguments were considered a key driver of global health policy, then depressive disorder should be considered a major health priority for women in developing countries.

After examining these studies from the United States and India, we hypothesized that CHEs might increase the severity of depression and induce suicidal ideation. In addition, there are still many other studies investigating the association between CHEs and depression[21 22]. However, no research has analyzed the direct association between CHEs and suicidal events, such as ideation, attempts, and mortality cases. For this reason, we expect that this study will stimulate additional studies on the prevention of CHE occurrences and their impact on suicide and mental health problems.

There are several limitations of this study. First, we could not determine casual relationships due to the cross-sectional nature of this study. To overcome this weakness, we divided the occurrences of CHEs into four subgroups (none, recent, remote, and both years) in an attempt to analyze temporal causality. Second, the measured outcome was suicidal ideation, not suicide attempts, although there is a rough association between suicidal ideation and attempts.

Because the number of suicide attempts observed during the study period was too small to continue the analysis, we used suicidal ideation as a dependent variable. Third, the number of cases of suicidal ideation may have been too small to determine all associations. Although we observed some statistical trends among independent variables for income level and temporal factors of CHEs, these trends did not reach statistical significance. One reason may be that the KoWePS study included investigations on mental health and suicide only since 2010 despite its initiation in 2006. Hence, we could not obtain more data for analysis.

Conclusion

This is the first study to determine an association between CHEs and suicidal ideation. For heads of households, poor perceived health status and more severe depressed mood could affect suicidal ideation. For heads of households, a recent and greater CHE resulted in more episodes of suicidal ideation. Although this study has several limitations, a future study could overcome these limitations by altering the characteristics of national and panel data. We also plan to gather a larger number of suicide attempts and suicide mortality cases. In conclusion, we suggest that to prevent suicidal ideation and improve the mental health of individuals, recent household CHEs must be considered.

Contributorship statement

we clarified that the content has not been published or submitted for publication elsewhere. We respect the provision of declaration of Helsinki and we obey the protocol for the research project, suitable for safe and ethical principles. As this study is a secondary opened national data for public access, we do not need to get any individual informed consents. All authors have contributed significantly and that all authors are in agreement with the content of the manuscript. Jaeyong Shin and Jae Woo Choi designed the study as co-first authors, Young Choi carried out the statistical analysis and wrote the paper, gave important comments for this study, Sung-in Jang and Sang Gyu Lee was responsible for the statistical design, and Eun-Cheol Park suggested the direction of this study as a corresponding author.

Competing interests

There are no competing interests in all authors.

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Data sharing

As we used public and national open data, we are willing to sharing our data and results.

References

1. Brinda EM, Andres RA, Enemark U. Correlates of out-of-pocket and excessive health expenditures in Tanzania: results from a national household survey. BMC international health and human rights 2014;14:5.

2. Ilesanmi OS, Adebiyi AO, Fatiregun AA. National health insurance scheme: how protected are households in Oyo State, Nigeria from excessive health expenditure? International journal of health policy and management 2014;2(4):175-80.

3. Li Y, Wu Q, Liu C, et al. Excessive health expenditure and rural household impoverishment in China: what role does the new cooperative health insurance scheme play? PloS one 2014;9(4):e93253.

4. Xu K, Evans DB, Kawabata K, et al. Household excessive health expenditure: a multicountry analysis. Lancet 2003;362(9378):111-7.

5. Ekman B. Excessive health payments and health insurance: some counterintuitive evidence from one low-income country. Health policy (Amsterdam, Netherlands) 2007;83(2-3):304-13.

6. Getzen TE. Health care is an individual necessity and a national luxury: applying multilevel decision models to the analysis of health care expenditures. Journal of health economics 2000;19(2):259-70.

7. The Organisation for Economic Co-operation and Development(OECD). Health at a Glance 2013, OECD INDICATORS. 2013.

8. Statistics Korea. National Health Statistics, 2013.

9. Chan CH, Caine ED, You S, et al. Suicide rates among working-age adults in South Korea before and after the 2008 economic crisis. Journal of epidemiology and community health

2014;68(3):246-52.

10. Kim S, Kwon S. The effect of extension of benefit coverage for cancer patients on health care utilization across different income groups in South Korea. International journal of health care finance and economics 2014;14(2):161-77.

11. Li X, Shen JJ, Lu J, et al. Household excessive medical expenses in eastern China: determinants and policy implications. BMC health services research 2013;13:506.

12. Ahnquist J, Wamala SP, Lindstrom M. Social determinants of health--a question of social or economic capital? Interaction effects of socioeconomic factors on health outcomes. Social science & medicine (1982) 2012;74(6):930-9.

13. Economou M, Peppou L, Fousketaki S, et al. [Economic crisis and mental health: effects on the prevalence of common mental disorders]. Psychiatrike = Psychiatriki 2013;24(4):247-61.

14. Economou M, Madianos M, Peppou LE, et al. Cognitive social capital and mental illness during economic crisis: a nationwide population-based study in Greece. Social science & medicine (1982) 2014;100:141-7.

15. Economou M, Madianos M, Peppou LE, et al. Suicidal ideation and reported suicide attempts in Greece during the economic crisis. World psychiatry : official journal of the World Psychiatric Association (WPA) 2013;12(1):53-9.

16. Economou M, Madianos M, Peppou LE, et al. Major depression in the era of economic crisis: a replication of a cross-sectional study across Greece. Journal of affective disorders 2013;145(3):308-14.

17. Economou M, Madianos M, Theleritis C, et al. Increased suicidality amid economic crisis

in Greece. Lancet 2011;378(9801):1459.

18. Shafer AB. Meta-analysis of the factor structures of four depression questionnaires: Beck, CES-D, Hamilton, and Zung. Journal of clinical psychology 2006;62(1):123-46.

19. Baicker K, Taubman SL, Allen HL, et al. The Oregon experiment--effects of Medicaid on clinical outcomes. The New England journal of medicine 2013;368(18):1713-22.

20. Patel V, Chisholm D, Kirkwood BR, et al. Prioritizing health problems in women in developing countries: comparing the financial burden of reproductive tract infections, anaemia and depressive disorders in a community survey in India. Tropical medicine & international health : TM & IH 2007;12(1):130-9.

21. Bayliss EA, Ellis JL, Delate T, et al. Characteristics of Medicare Part D beneficiaries who reach the drug benefit threshold in both of the first two years of the Part D benefit. Medical care 2010;48(3):267-72.

22. Brinda EM, Rajkumar AP, Enemark U, et al. Nature and determinants of out-of-pocket health expenditure among older people in a rural Indian community. International psychogeriatrics / IPA 2012;24(10):1664-73.

Table 1. Bivariate analysis, based on the presence of suicidal ideation in heads of households

Variables	Absence of suicidal ideation		Presence of suicidal ideation		Total	*p*-value
	n	%	n	%	N	
Head of household						
Sex						<0.001
Male	3040	97.6	76	2.4	3116	
Female	1061	93.8	70	6.2	1131	
Age over 65 years						0.009
<65 years	2164	97.1	64	2.9	2228	
≥65 years	1937	95.8	85	4.2	2022	
Education						0.003
Graduation from elementary school	1376	95.5	65	4.5	1441	
Graduation from middle school	545	95.4	26	4.6	571	
Graduation from high school	1198	97.3	33	2.7	1231	
Graduation from college	982	97.8	22	2.2	1004	
The presence of a spouse						<0.001
Presence	2858	97.7	66	2.3	2924	
Absence	1243	94.0	80	6.0	1323	
Perceived health status						<0.001
Excellent	2271	98.3	40	1.7	2311	
Good	912	96.7	31	3.3	943	
Poor	918	92.4	75	7.6	993	
Depressive mood status, CESD-11						<0.001
<25%	1916	99.0	19	1.0	1935	
25–50%	581	98.1	11	1.9	592	
50–75%	741	98.5	11	1.5	752	
≥75%	863	89.2	105	10.8	968	
Head of household						
Income level						<0.001
<25%	756	93.2	55	6.8	811	
25–50%	953	96.1	39	3.9	992	
50–75%	1140	97.1	34	2.9	1174	
≥75%	1252	98.6	18	1.4	1270	

Number of family members						<0.001
One	856	93.7	58	6.3	914	
Two	1233	96.5	45	3.5	1278	
Three	767	97.3	21	2.7	788	
Four or more	1245	98.3	22	1.7	1267	
Economically active family member						<0.001
None	1001	93.5	70	6.5	1071	
One	1882	97.3	52	2.7	1934	
Two or more	1218	98.1	24	1.9	1242	
Disabled person among family members						0.102
Absence	3389	96.8	113	3.2	3502	
Presence	712	95.6	33	4.4	745	
Senior person among family members						0.062
Absence	2007	97.1	60	2.9	2067	
Presence	2094	96.1	86	3.9	2180	
Total	4101	96.6	146	3.4	4247	

Table 2. Bivariate analysis, based on the presence of suicidal ideation in heads of households and the occurrence of excessive health expenditures during the last 2 years

The occurrence of excessive health expenditure during the last 2 years	Excessive health expenditure > 10%						Excessive health expenditure > 20%					
	Absence of suicidal ideation		Presence of suicidal ideation		Total	*p*-value	Absence of suicidal ideation		Presence of suicidal ideation		Total	*p*-value
	n	%	n	%			n	%	n	%		
None	2061	98.0	43	2.0	2104	<0.001	2984	97.5	75	2.5	3059	<0.001
2011, remote	582	96.8	19	3.2	601		406	96.2	16	3.8	422	
2012, recent	632	94.8	35	5.2	667		413	92.2	35	7.8	448	
2011 and 2012	826	94.4	49	5.6	875		298	93.7	20	6.3	318	
Total	4101	96.6	146	3.4	4247		4101	96.6	146	3.4	4247	

Table 3. Multivariate analysis, based on the presence of suicidal ideation during the past year among heads of households

Variables	Excessive health expenditure > 10%				Excessive health expenditure > 20%			
	OR	95% C.I.		*p*-value	OR	95% C.I.		*p*-value
Head of household								
Sex								
Male	1.00	1.00	1.00		1.00	1.00	1.00	
Female	0.91	0.49	1.66	0.748	0.91	0.50	1.65	0.748
Age of head of household								
<65 years	1.00	1.00	1.00		1.00	1.00	1.00	
≥65 years	2.69	0.34	21.17	0.346	2.62	0.33	20.59	0.360
Education								
Graduation from elementary school	0.50	0.25	0.97	0.040	0.51	0.26	1.00	0.049
Graduation from middle school	0.94	0.49	1.83	0.864	0.94	0.48	1.83	0.850
Graduation from high school	0.86	0.48	1.55	0.618	0.87	0.49	1.57	0.649
Graduation from college	1.00	1.00	1.00		1.00	1.00	1.00	
The presence of a spouse								
Presence	1.00	1.00	1.00		1.00	1.00	1.00	
Absence	1.70	0.86	3.34	0.126	1.69	0.87	3.31	0.122
Perceived health status								
Excellent	1.00	1.00	1.00		1.00	1.00	1.00	
Good	1.20	0.70	2.04	0.504	1.20	0.71	2.04	0.503
Poor	1.89	1.13	3.14	0.015	1.90	1.15	3.15	0.012
Depressive mood status, CESD-11								
<25%	1.00	1.00	1.00		1.00	1.00	1.00	
25–50%	1.79	0.84	3.79	0.132	1.74	0.82	3.70	0.151
50–75%	1.29	0.60	2.76	0.521	1.26	0.59	2.71	0.553
≥75%	8.60	4.94	14.97	<.001	8.43	4.84	14.68	<0.001
Head of household								
Income Level								
<25%	2.75	1.34	5.63	0.064	2.07	1.01	4.23	0.047
25–50%	1.90	0.97	3.72	0.175	1.63	0.84	3.17	0.148
50–75%	1.70	0.92	3.16	0.187	1.56	0.84	2.88	0.159
≥75%	1.00	1.00	1.00		1.00	1.00	1.00	
Number of family members								
One	1.00	1.00	1.00		1.00	1.00	1.00	
Two	0.99	0.47	2.08	0.571	1.17	0.65	2.08	0.606
Three	0.90	0.39	2.08	0.972	1.01	0.48	2.12	0.979
Four or more	0.87	0.37	2.04	0.805	0.91	0.39	2.12	0.833
Economically active family member								
None	1.39	0.70	2.74	0.346	1.37	0.69	2.71	0.370
One	0.96	0.54	1.68	0.876	0.92	0.52	1.62	0.771
Two or more	1.00	1.00	1.00		1.00	1.00	1.00	

Disabled person among family members								
Absence	1.00	1.00	1.00		1.00	1.00	1.00	
Presence	1.12	0.72	1.73	0.617	1.12	0.72	1.75	0.601
Senior person among family members								
Absence	1.00	1.00	1.00		1.00	1.00	1.00	
Presence	0.16	0.02	1.21	0.075	0.16	0.02	1.24	0.080
Excessive health expenditure during the last 2 years								
None	1.00	1.00	1.00		1.00	1.00	1.00	
2011, remote	1.37	0.77	2.44	0.288	1.25	0.70	2.24	0.454
2012, recent	1.91	1.16	3.15	0.012	2.29	1.45	3.64	<0.001
2011 and 2012	1.71	1.04	2.81	0.034	1.56	0.88	2.76	0.129

Table 4. Multivariate analysis, based on the presence of suicidal ideation during the past year, among moderately and severely depressed heads of households

	Excessive health expenditure > 10%				Excessive health expenditure > 20%			
	OR	95% C.I.		*p*-value	OR	95% C.I.		*p*-value
Excessive health expenditure during the last 2 years								
None	1.00	1.00	1.00		1.00	1.00	1.00	
2011, remote	1.40	0.74	2.63	0.301	1.25	0.65	2.38	0.504
2012, recent	1.66	0.94	2.94	0.083	2.32	1.40	3.87	0.001
2011 and 2012	1.49	0.86	2.57	0.156	1.82	0.99	3.34	0.054

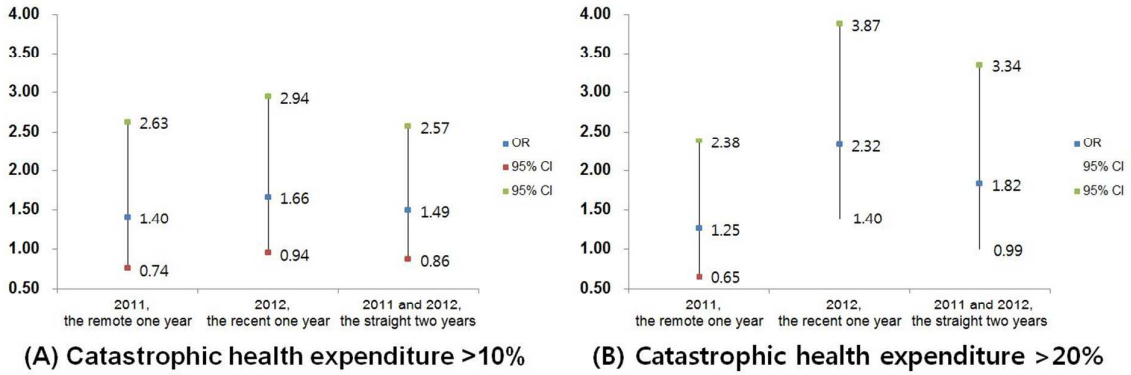

Figure 1. The heads of households were more vulnerable to the high threshold of CHEs. In other words, when CHEs were above 20% (B), compared to 10% (A), suicidal ideation was increased.

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The temporal association of excessive health expenditure with suicidal ideation among primary income earners: cross-sectional design using Korean Welfare Panel Survey (KoWePS)

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The temporal association of excessive health expenditure with suicidal ideation among primary income earners: cross-sectional design using Korean Welfare Panel Survey (KoWePS)

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Abstract

Objective Excessive health expenditure (EHE) is a global issue for households suffering from high-cost medical conditions, low incomes, and limited insurance coverage. After the international financial crisis of 2008, EHE became a social problem in developed countries. Such economic crisis might induce severe mental stress, resulting in suicidal ideation.

Methods We used the Korean Welfare Panel Study (KoWePS) from 2011 to 2013 and selected primary income earners, who were defined as practical and economic representatives of households; the total number of analyzed samples was 4,247 out of 5,717 households in the database. We only included households that had never experienced EHE before 2011. To examine the temporal relationship between EHE and suicidal ideation, we conducted a logistic regression analysis.

Results Among 4,247 subjects, 146 (3.4%) experienced suicidal ideation, whereas 4,101 (96.6%) did not. One scale of depression score (CESD-11, Odds ratio (OR)=1.28, Confidential Interval (CI); 1.23–1.34, p <0.001) was associated with increased suicidal ideation. Such ideation was influenced to a greater extent by a recent EHE above ten percent of disposable income (ORs=1.91, CI; 1.16–3.15, p=0.012) than by either a remote EHE (ORs=1.29, CI; 0.71–2.32) or one in both 2011 and 2012 (ORs=1.67, CI; 1.01-2.78, p=0.048).

Conclusions In this study, more recent EHE resulted in more suicidal ideation. In conclusion, we suggest that recent household EHE might be considered as an important factor to prevent suicidal ideation and to improve the mental health of individuals.

Strength and limitation of this study

Strength

- We used the representative national data 'Korea Welfare Panel Study(KoWePS)' from the national research institute, "Korea Institute for Health and Social Affairs, KIHASA".
- We divided the occurrences of EHE into four subgroups (none, recent, remote, and both years) in an attempt to analyze temporal causality.

Limitation

- We could not determine casual relationships due to the cross-sectional nature of this study.
- Because the number of suicide attempts observed during the study period was too small to continue the analysis, we used suicidal ideation as a dependent variable.
- The number of cases of suicidal ideation may have been too small to determine all associations.

Introduction

Protection from excessive health expenditure (EHE) is widely regarded as a desirable objective of healthcare systems and policies. However, EHE is not always the same as high healthcare cost. For example, an expensive surgery might not be excessive if a household does not bear its full cost because the service is provided free or at a subsidized price or is covered by third-party insurance. On the other hand, even the small cost of common illnesses can be financially disastrous for poor households with no insurance.

Although EHE is usually defined as catastrophic health expenditure (CHE), health-related expenses over 40% of disposable income per annum according to the World Health Organization (WHO)[1], it has often been defined differently by various studies[2-4]. Thus in this study we defined different cut-off values to enhance the effectiveness of the study design.

EHE has traditionally been chronic household issues in undeveloped countries[1 5-8]. However, after the international financial crisis of 2008, EHE became a social problem even in developed countries. As these countries began to see the healthcare as a luxury[9], they started to cut these benefits and raised productivity in health industries[10]. The average increase in health spending across Organisation for Economic Co-operation and Development (OECD) member countries was only 0.2% between 2009 and 2011, compared to recent drastic growth in total health expenditure over 4% per annum. This increase resulted in a significant rise in out-of-pocket expenses for medical care whereas a decrease in access to the healthcare benefits.

According to OECD health data, patients pay the highest percentage of their medical fees (>35%) out of pocket in the Republic of Korea[10]. The low health insurance premiums for national health insurance in Korea limit the range of insurance coverage. In 2011, the national

health insurance rate was 5.99% of an employee's salary. Compared to the average rate of 9.5% in OECD countries, this is quite low when we consider both the Korean economy and overall health expenditures. The percentage of coverage paid by the government is only 44.7%, which is extremely low compared to 74.4% for the average OECD country. Only three countries (Mexico, Chile, and the United States) have lower coverage rates than Korea. As the primary function of insurance is to protect the patient from harm in terms of health and economic risk, it is critical to reduce the occurrences of EHE. According to Korean National Statistics, the number of households experiencing EHE, more than 40% of disposable household income, in 2010 was 618,000, or 3.9% of all households. This figure was only 1% in 2002 but began to increase thereafter, reaching 3.3% by 2006[11].

These data suggest that Koreans are at risk of occurrences of EHE. Thus, they might be vulnerable to a decline in their economic welfare in the face of ill health, especially when EHE exist. Additionally, the number of suicides is steeply increasing annually in Korea[11 12]. According to OECD health statistics data, the age-standardized suicide mortality rate in 2011 was 33.3 per 100,000 individuals. Among all OECD countries, this is the highest value, while the rate of increase in suicidal mortality remains constant. Since the financial stress might be an important factor in Korea, we have to put concern on the financially vulnerable groups such as primary income earners with EHE in household.

For example, in 2008, the state of Oregon in the United States initiated a limited expansion of its Medicaid program for low-income adults[13]. Five years after its initiation, researchers found no significant effect of Medicaid coverage on the prevalence or diagnosis of hypertension or high cholesterol levels or on the use of medication for these conditions. However, interestingly, Medicaid coverage decreased the probability of a positive screening for depression (-9.15 percentage points; 95% confidence interval (CI); -16.70--1.60; p=0.02),

increased the use of many preventive services, and nearly eliminated excessive out-of-pocket medical expenditures. This study has proven that the mental health could be improved by reducing the financial burden for health.

Another study which observed the association between EHE and depression was performed in India[14]. According to this cross-sectional study in Goa, India, 138 women, whose households were spending more than 10% of their disposable income for medical cost, were more likely to report economic difficulties, such as having gone hungry in the past 3 months due to lack of money (OR 1.99, CI 1.10–3.62, p=0.021). In addition, depressive disorder was associated with significantly higher healthcare costs, lost time costs, and risk of EHE. There was a linear association between psychological morbidity scores and the risk of EHE. From this study, it could be suggested that economic arguments due to health problems were considered to be a key driver of mental health policy.

Although a few studies on EHE in Korea were published in Korea[15 16], there were insignificant to prove the relationship between excessive health expenditures and mental health.

In this study, the compositions of health expenditures between households with and without EHE were compared at first. Then we are going to focus on the analysis for the temporal association between EHE and suicidal ideation among the primary income earners in household. After the financial crisis of Korea in 1997, the primary income earners in households had great burden and financial responsibility to keep providing for family. For this reason, we would like to verify the hypothesis that the recently occurred EHE have greater relation to suicidal ideation rather than remote occurred EHE among those primary income earners and their responsibility for providing family in Asian culture.

Methods

Participants

Data from the Korean Welfare Panel Study (KoWePS: Korea Institute for Health & Social Affairs & Seoul National University Social Welfare Research Center, 2008) from 2011 to 2013 were obtained for this study. The KoWePS is an on-going longitudinal study of a nationally representative sample of Korean households, which collects data annually. The KoWePS-led survey population represents 90% of the census conducted in 2005. Statisticians of this survey determined final panel households by applying 'Stratified Double Sampling' model. The constituent questionnaires in this survey consisted of a household member survey for household members aged 15 years and over, a household survey, and a supplementary survey for special topics. Face-to-face interviews were used to gain information during the first year of the study.

We respected the provision of declaration of Helsinki and obeyed the protocol for the research project, suitable for safe and ethical principles. Since this study was a secondary opened national data for public access from Korea institute for Health and Social welfare, we did not need to get any individual informed consents. All patient records/information in this study was anonymized and de-identified prior to analysis. In addition, we were granted the approval of institutional review board at the graduate school of public health in Yonsei university (IRB approval No.: 2-1040939-AB-N-01-2015-202).

We especially focused on the suicidal ideation of household heads, who are defined as the primary income earner and practical representative in household. The study suggests that the most vulnerable family member to an economic crisis might be a primary income earner. Indeed, we selected them among respondents to the questionnaire. The total number of analyzed samples was 4,247 out of 5,717 households from the database. In Korea, there were

total 17,339,422 households enrolled in governmental system in 2010. We only included households those had never experienced EHE before 2011 and never missed any annual surveys during the study period.

The characteristics of individuals as primary income earners

In this study, we used several covariates to control for demographic and socioeconomic characteristics of individual levels. Demographic characteristics such as sex, age, educational level, presence of a spouse, perceived heath status, regular medication more than three months, and depressive mood status were included. Since the official retiring age is sixty-five years old in Korea, we divided the age groups into one under sixty-five and another on sixty-five and over. Four education categories including degree from elementary, middle, high school, and college and above were self-reported by participants. In terms of the presence of a spouse, interviewers reported whether the subjects were in social marital status with someone else. We divided perceived health status with three categories into good, normal, and bad, while the original survey questionnaire used scale with five degrees including excellent, good, normal, bad, and very bad. The question of self-rated health is as follow; “In your opinion, How do you evaluate your own general health status during the last one year?”. In terms of regular medication, interviewers asked whether the subjects were taking any medication regularly more than last three months or not. This was used as an indicator to determine presence of any kind of chronic diseases.

The characteristics of households

The household questionnaire portion of the KoWePS included a set of questions that asked

about the income of all household members. These questions addressed earned income, income from assets, and miscellaneous income. The present study utilized this set of income-related questions to create a total household income and disposable income variable. To obtain the number of households experiencing EHE, we divided the total cost of health expenditures into disposable income for each household. Moreover, we considered temporal factors of EHE. In other words, we determined when an excessive event occurred: none, remote (in 2011), recent (in 2012), and in both 2011 and 2012.

We also considered other covariates of households such as number of family members, economically active family members, disabled members, and members over sixty five years old. In terms of economically active family members, it was defined as someone who worked regularly and earned salaries during last one year. Disabled were those officially diagnosed by doctors using the standard of national guideline for disabled.

Measuring depressive symptoms and suicidal ideation

To measure the level of depression, the Center for Epidemiologic Studies Depression scale (CES-D) was used, which was originally designed to measure depressive symptoms in the general population[17] and has been widely used in community- and clinically based samples[18] [19]. For each year of the study period, the respondents reported symptoms experienced during the previous week using a four-point scale. Depression scores for each year were calculated by totaling across 11 items.

Suicidal ideation was assessed by a questionnaire regarding the occurrence of suicidal ideation during the past year as follows; “Have you ever had any serious suicidal ideation in the past year as of today?”

Statistical analysis

The frequency, with which EHE occurred overall, and after stratifying by household demographic and socioeconomic status, was determined by performing a chi-square test. To examine the relationship between EHE and suicidal ideation, we conducted a logistic regression analysis.

At the level of the primary income earners, all dependent variables regarding characteristics of individuals were used in analysis. We also considered variables that reflect the overall household situation, such as income level, number of family members, economically active family members, disabled members, and members over sixty five years old.

Moreover, we investigated whether there is a temporal relationship between the occurrence of healthcare expenditures and suicidal ideation. The EHE over 10% of disposable income, which is the standard threshold from the Ministry of Health and Welfare, South Korea, was significantly different between those who did and did not have suicidal ideation. To examine the increased relationship between EHE and suicidal ideation, we also performed another analysis using various cut-off values as 20% and 40% for EHE, the latter being the standard of WHO.

In logistic regression analysis, we only included the variables of individual level in Model 1. Furthermore, we expanded to use variables both individual and household levels in Model 2. When p-value was less than 0.05, we defined the statistical result as significance. We used the SAS 9.3 statistical package (Cary, NC, USA) for statistical analysis.

Results

The general characteristics of primary income earners and households are shown in Table 1. A total of 4,247 households are enrolled in this study. Among them, 146 heads of households (3.4%) reported suicidal ideation once or more during the past year, whereas 4,101 (96.6%) did not. A total number of 76 men (52.1%) and 70 women (47.9%) had suicidal ideation among primary income earners. Moreover, the lowest educated subjects with elementary level of education 65 subjects (44.5%) had higher proportion among the group with suicidal ideation. The average sum of CESD-11 among the subjects with suicidal ideation is 23.15, while the average score among the others is only 18.81. Only five subjects attempted suicide among all primary income earners.

Threshold of the EHE of 10% and 40% above disposable income are significantly different for those who did and did not have suicidal ideation (Table 2). Among 875 subjects whose households suffered from EHE over 10% during the last two consecutive years, 49 persons (5.6%) experience suicidal ideation. In 62 subjects with EHE above 40% during the last two consecutive years, eight persons (12.9%) reported suicidal ideation, indicating greater association with suicidal ideation.

We carried out multivariate analysis using a logistic regression model, based on the threshold of EHE above 10% of disposable income (Table 3). In model 1, the primary income earners who had poor perceived health status (odds ratio (OR)=1.78, 95% CI: 1.03–3.08) and a higher depression score (CESD-11, OR=1.29, 95% CI: 1.24–1.35) are more vulnerable to suicidal ideation. In model 2, a higher depressive score (CESD-11, OR=1.28, 95% CI: 1.23–1.34) is associated with the presence of suicidal ideation. In both model 1 and 2, EHE occurred in the recent year of 2012 (Model 1; OR=2.03, 95% CI: 1.23–3.35 / Model 2; OR=1.91, 95% CI: 1.16–3.15) and for both consecutive years in 2011 and 2012 (Model 1;

OR=1.83, 95% CI: 1.12–2.98 / Model 2; OR=1.67, 95% CI: 1.01–2.78) have statistically significant ORs for suicidal ideation. Moreover, the suicidal ideation is influenced to a greater extent by a recent EHE than by a remote EHE or EHE in both years. To compare the fitness between the models, we used -2logL methods. Through this measurement, it seems that the model 2 is more suitable for suicidal ideation because the number of -2logL is less than that of model 1.

As the official cut-off value in our study is 10%, we performed other values as threshold. The primary income earners are more vulnerable to the high threshold of EHE. When EHE is above 20%, compared to 10%, the odds ratio for suicidal ideation with the EHE in recent one year is increased. (Figure 1)

For EHE above 40% of disposable income in the Supplementary table 1, the consecutive two years with EHE is statistical meaningful to the increased odds ratio for suicidal ideation (Model 2; OR=2.67, 95% CI: 1.10–6.46).

Since the heads of households with depressive symptoms may have more correlation with suicidal ideation, a subgroup analysis was performed for the primary income earners whose sum of CESD-11 score were sixteen or more (Table 4). The sum of CESD-11 score over sixteen indicates potential risk for major depressive disorder (MDD). In this subgroup analysis, the primary income earners were more vulnerable to the higher EHE. In other words, when EHE were above 20% (in 2012; OR=2.46, 95% CI: 1.57–3.85 / in both 2011 and 2012; OR=1.89, 95% CI: 1.08–3.31) compared to 10% (in 2012; OR=1.98, 95% CI: 1.21–3.22 / in both 2011 and 2012; OR=1.86, 95% CI: 1.15–3.02), suicidal ideation was increased.

Discussion

According to measurements of the temporal association with EHE during 2011 and 2012, the recent one year in 2012 was associated with meaningful increases in ORs for suicidal ideation with the EHE above 10%. We also performed a subgroup analysis for primary income earners with potential risk to MDD. The temporal relationship between EHE and suicidal ideation is stronger in this potentially depressed group than in the others. Within this group, the subjects with the EHE over 20% showed a higher OR than one of the EHE over 10%. Interestingly, in the EHE over 40%, the recent 2012 one year is not statically associated with suicidal ideation. However, the two consecutive two years with EHE is highly associated with suicidal ideation. Since the number of households with EHE over 40 % is only 197 (4.4%), the odds ratio of the recent one year in 2012 might not show statistically increased OR for suicidal ideation. In spite of this limited condition, the consecutive occurrence of EHE have strong statically association with suicidal ideation. Thus we need to focus on the households with EHE in a long term through appropriate intervention based on social consensus.

Globally, many politicians and public health administrators have tried to make healthcare as accessible as possible[2 3]. The problem of accessibility is likely induced by both economic and spatial problems. In Korea, the amount and quality of healthcare access have improved over the last 30 years by through rapid expansion of national health insurance. However, because national reimbursement was low, fiscal asset quality in healthcare system could not be secured. Although this problem was improving gradually, a global economic crisis in 2008 hindered the ability of patients to visit clinics because of decreased incomes and heavy out-of-pocket expenses, especially for the low SES class with chronic and severe diseases with the tremendous medical expenses[20]. In this sense, many researchers have tried to determine the causes and economic outcomes of EHE rather than their effects on health. However, these

kinds of economic stresses worsen mental health and induce depressive disorders, suicidal ideation, and numbers of suicide attempts[4 17]. For example, there was a steep increase in the number of patients with MDD, suicidal ideation, and suicide attempts immediately after the international economic crisis in 2008[18 19 21]. The prevalence of MDD increased from 3.3% of the general population in 2008 to 8.2% in 2011, which is a statistically significant difference. In addition, suicidal ideation among men increased from 4.4% in 2008 to 7.1% in 2011[22].

Just as the same as these previous studies on this topic, our result also mentioned the strong association between financial burden of health and suicidal ideation. However, there were several limitations of this study.

First, we could not determine casual relationship due to the cross-sectional nature of this study. To overcome this weakness, we divided the occurrences of EHE into four subgroups (none, recent, remote, and both years) in an attempt to analyze temporal causality.

Second, we used the suicidal ideation as a dependent variable, not suicidal attempt. Because the number of suicide attempts observed during the study period was minimal to conduct the analysis, we used suicidal ideation. Although a small portion of general population with suicidal ideation eventually tried suicide attempts, suicidal ideation is still one of the powerful indicators to predict suicide attempt. According to one study in Korea, 84% of subjects with suicide attempt had previous suicidal ideation in the last two year[23]. Moreover, 'someone talking or writing about death, dying, or suicide' is well established consensus warning sign for suicide[24]. Thus, even suicidal ideation is regarded as important dependent variable for preventing the progress to suicidal attempt and suicide.

Third, the number of cases of suicidal ideation may have been too small to determine all associations. Although we observed some statistical trends among independent variables for

income level and temporal factors of EHEs, these trends did not reach statistical significance. One reason may be that the KoWePS study included investigations on mental health and suicide only since 2011 regardless of its initiation in 2006. Hence, we could not obtain more data for analysis.

Fourth, we excluded other family members except for the primary income earner in households. This panel survey tried to include as many family members as possible; surveys were mainly answered by heads of household who are practical and economic representatives of households. In addition, since family members under nineteen years old did not answer the CESD-11 scale, we could not adjust the depressive symptoms, which is one of the most important factors to suicidal ideation. In this regard, we only included the primary income earners as study population.

Fifth, we did not know what kinds of diagnosis categories, including mental and physical illness, were most significant to the occurrence of EHE. Although few researchers studied the attributable medical conditions, the range of them were so wide, defined as chronic diseases or disabled. For example, Choi et al. analyzed that cancer patients with unstable economic status were more vulnerable to EHE than those with stable economic conditions[16]. In addition, they studied that family members with chronic diseases or disabilities were powerful attributable factors to EHE on household[25]. However, none of them tried to figure out the most important kinds of disease categories. In this sense, another further study is needed to investigate the disease specific targeted to policy on EHE.

Despite of such limitations, we still believe that this study still deserves to be published for several reasons.

First, this study used national opened data representing the Republic of Korea. Through this

well-designed panel survey, this study had high external validity and is able to be expanded in the future. Furthermore, this national data could be compared to ones in other countries such as Japan and Scandinavian countries[10], those had reduced the suicidal mortality rates dramatically.

Second, this is the first study on the relationship between EHE and suicidal ideation in Korea up to our knowledge. Thus, it could draw attentions of other researchers and policy makers to the economic burden for health as an attributable factor to suicidal ideation.

Third, it is able to minimize the health disparity in society through the subsidies to EHE. Because EHE hinders the access to healthcare system, solving this problem could improve the basic human right for health and overall quality of public health. Korea already started to public subsidies for EHE last year, further studies would possibly figure out the effect of the support for EHE in the near future.

To put all things together, we still need to perform further investigation. As we are going to accumulating these Korean Data and following the trend of policy implication, we will report the effect of the policy for EHE apparently.

Conclusion

This is the first study to examine an association between EHE and suicidal ideation among primary income earners. For them, more severe depressive mood is associated with suicidal ideation. Furthermore, recently occurred and greater EHE might increase suicidal ideation. Although this study has several limitations, a future study could overcome these limitations by altering the characteristics of national and panel data. We also plan to gather a larger number of suicide attempts and suicide mortality cases. In conclusion, we suggest that in

order to prevent suicidal ideation and to improve the mental health of individuals especially for primary income earners in households, recent household EHE might be considered.

Contributorship statement

We clarified that the content has not been published or submitted for publication elsewhere. We respect the provision of declaration of Helsinki and we obey the protocol for the research project, suitable for safe and ethical principles. As this study is a secondary opened national data for public access, we do not need to get any individual informed consents. All authors have contributed significantly and that all authors are in agreement with the content of the manuscript. Jaeyong Shin and Jae Woo Choi designed the study as co-first authors and wrote the paper, Young Choi and Tae Hwan Ihm carried out the statistical analysis and gave important comments for this study, Sung-in Jang and Sang Gyu Lee was responsible for the statistical design, and Eun-Cheol Park suggested the direction of this study as a corresponding author.

Competing interests

There are no competing interests in all authors.

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Data sharing

As we used public and national open data, we are willing to sharing our data and results.

References

1. Xu K, Evans DB, Kawabata K, et al. Household catastrophic health expenditure: a multicountry analysis. Lancet 2003;**362**(9378):111-7.

2. Kim S, Kwon S. The effect of extension of benefit coverage for cancer patients on health care utilization across different income groups in South Korea. International journal of health care finance and economics 2014;**14**(2):161-77.

3. Li X, Shen JJ, Lu J, et al. Household catastrophic medical expenses in eastern China: determinants and policy implications. BMC health services research 2013;**13**:506.

4. Ahnquist J, Wamala SP, Lindstrom M. Social determinants of health--a question of social or economic capital? Interaction effects of socioeconomic factors on health outcomes. Social science & medicine (1982) 2012;**74**(6):930-9.

5. Brinda EM, Andres RA, Enemark U. Correlates of out-of-pocket and catastrophic health expenditures in Tanzania: results from a national household survey. BMC international health and human rights 2014;**14**:5.

6. Ilesanmi OS, Adebiyi AO, Fatiregun AA. National health insurance scheme: how protected are households in Oyo State, Nigeria from catastrophic health expenditure? International journal of health policy and management 2014;**2**(4):175-80.

7. Li Y, Wu Q, Liu C, et al. Catastrophic health expenditure and rural household impoverishment in China: what role does the new cooperative health insurance scheme play? PloS one 2014;**9**(4):e93253.

8. Ekman B. Catastrophic health payments and health insurance: some counterintuitive evidence from one low-income country. Health policy (Amsterdam, Netherlands) 2007;**83**(2-

3):304-13.

9. Getzen TE. Health care is an individual necessity and a national luxury: applying multilevel decision models to the analysis of health care expenditures. Journal of health economics 2000;**19**(2):259-70.

10. The Organisation for Economic Co-operation and Development(OECD). Health at a Glance 2013, OECD INDICATORS. 2013.

11. Statistics Korea. National Health Statistics, 2013.

12. Chan CH, Caine ED, You S, et al. Suicide rates among working-age adults in South Korea before and after the 2008 economic crisis. Journal of epidemiology and community health 2014;**68**(3):246-52.

13. Baicker K, Taubman SL, Allen HL, et al. The Oregon experiment--effects of Medicaid on clinical outcomes. The New England journal of medicine 2013;**368**(18):1713-22.

14. Patel V, Chisholm D, Kirkwood BR, et al. Prioritizing health problems in women in developing countries: comparing the financial burden of reproductive tract infections, anaemia and depressive disorders in a community survey in India. Tropical medicine & international health : TM & IH 2007;**12**(1):130-9.

15. Kim Y, Yang B. Relationship between catastrophic health expenditures and household incomes and expenditure patterns in South Korea. Health policy (Amsterdam, Netherlands) 2011;**100**(2-3):239-46.

16. Choi JW, Cho KH, Choi Y, et al. Changes in economic status of households associated with catastrophic health expenditures for cancer in South Korea. Asian Pacific journal of cancer prevention : APJCP 2014;**15**(6):2713-7.

17. Economou M, Peppou L, Fousketaki S, et al. [Economic crisis and mental health: effects on the prevalence of common mental disorders]. Psychiatrike = Psychiatriki 2013;**24**(4):247-61.

18. Economou M, Madianos M, Peppou LE, et al. Cognitive social capital and mental illness during economic crisis: a nationwide population-based study in Greece. Social science & medicine (1982) 2014;**100**:141-7.

19. Economou M, Madianos M, Peppou LE, et al. Suicidal ideation and reported suicide attempts in Greece during the economic crisis. World psychiatry : official journal of the World Psychiatric Association (WPA) 2013;**12**(1):53-9.

20. Lee WY, Shaw I. The impact of out-of-pocket payments on health care inequity: the case of national health insurance in South Korea. International journal of environmental research and public health 2014;**11**(7):7304-18.

21. Economou M, Madianos M, Peppou LE, et al. Major depression in the era of economic crisis: a replication of a cross-sectional study across Greece. Journal of affective disorders 2013;**145**(3):308-14.

22. Shafer AB. Meta-analysis of the factor structures of four depression questionnaires: Beck, CES-D, Hamilton, and Zung. Journal of clinical psychology 2006;**62**(1):123-46.

23. Jeon HJ, Lee JY, Lee YM, et al. Unplanned versus planned suicide attempters, precipitants, methods, and an association with mental disorders in a Korea-based community sample. Journal of affective disorders 2010;**127**(1-3):274-80.

24. Rudd MD, Berman AL, Joiner TE, Jr., et al. Warning signs for suicide: theory, research, and clinical applications. Suicide & life-threatening behavior 2006;**36**(3):255-62.

25. Choi JW, Choi JW, Kim JH, et al. Association between chronic disease and catastrophic health expenditure in Korea. BMC health services research 2015;**15**(1):26.

Table 1. Demographic characteristics among subjects, based on the presence of suicidal ideation in heads of households

Variables	Absence of suicidal ideation		Presence of suicidal ideation		Total	*p*-value
	n	%	n	%	n	
Level of individual primary income earner						
Sex						<0.001
Male	3040	74.1	76	52.1	3116	
Female	1061	25.9	70	47.9	1131	
Age, over 65 years						0.009
≥65 years	1937	47.2	85	58.2	2022	
Education						0.003
Graduation from elementary school	1376	33.6	65	44.5	1441	
Graduation from middle school	545	13.3	26	17.8	571	
Graduation from high school	1198	29.2	33	22.6	1231	
Graduation from college	982	23.9	22	15.1	1004	
The presence of a spouse						<0.001
Presence	2858	69.7	66	45.2	2924	
Perceived health status						<0.001
Excellent	2271	55.4	40	27.4	2311	
Good	912	22.2	31	21.2	943	
Poor	918	22.4	75	51.4	993	
Regular medication more than three months[『]						<0.001
Presence	2492	60.8	117	80.1	2609	
Depressive mood	**Mean**	**SD**	**Mean**	**SD**	**Mean**	<0.001
Sum of CESD-11[∫]	18.808	2.9	23.151	4.3	18.953	
Level of household						
Income level						<0.001
<25% (lowest)	756	18.4	55	37.7	811	
25–50%	953	23.2	39	26.7	992	
50–75%	1140	27.8	34	23.3	1174	
≥75% (highest)	1252	30.5	18	12.3	1270	
Number of family members						<0.001
One	856	20.9	58	39.7	914	
Two	1233	30.1	45	30.8	1278	
Three	767	18.7	21	14.4	788	
Four or more	1245	30.4	22	15.1	1267	
Economically active family member*						<0.001
None	1001	24.4	70	47.9	1071	
One	1882	45.9	52	35.6	1934	
Two or more	1218	29.7	24	16.4	1242	
Disabled person among family members**						0.102
Presence	712	17.4	33	22.6	745	
Aged over 65, among family members						0.062
Presence	2094	51.1	86	58.9	2180	
Total	4101	96.6	146	3.4	4247	

『 *"Regular medication more than three months"* indicated the presence of on-going chronic diseases.』 *"CESD-11"* means "Center for Epidemiological Studies Depression Scale". *The variable of *"Economically active family members*" is defined as someone who worked regularly and got salary during last one year. **Disabled person means persons, who are officially qualified by doctors using the standard of national guideline for disabled.

Table 2. Bivariate analysis, based on the presence of suicidal ideation in heads of households and the occurrence of excessive health expenditures during the last 2 years

The occurrence of excessive health expenditure during the last 2 years	Excessive health expenditure > 10%*						Excessive health expenditure > 40%**					
	Absence of suicidal ideation		Presence of suicidal ideation		Total	*p*-value	Absence of suicidal ideation		Presence of suicidal ideation		Total	*p*-value
	n	%	n	%			n	%	n	%		
None	2061	98.0	43	2.0	2104	<0.001	3683	97.0	115	3.0	3798	<0.001
2011, remote	582	96.8	19	3.2	601		180	94.7	10	5.3	190	
2012, recent	632	94.8	35	5.2	667		184	93.4	13	6.6	197	
2011 and 2012	826	94.4	49	5.6	875		54	87.1	8	12.9	62	
Total	4101	96.6	146	3.4	4247		4101	96.6	146	3.4	4247	

The threshold of 10%* as excessive health expenditure (EHE) is the standard from the Ministry of Health and Welfares in Korea, while the one of 40%** is from the WHO. As WHO recommended to use flexible threshold according to cultural and national background differently, we did further statistical analysis using 10% in paper, although we also performed another statistical analysis in supplementary materials.

Table 3. Multivariate analysis, based on the presence of suicidal ideation during the past year among heads of households with the threshold of excessive health expenditure as ten percent from total expenditure in household.

Variables	Model 1 (-2logL=1056.60)				Model 2 (-2logL=1032.57)			
	OR	95% C.I.		*p*-value	OR	95% C.I.		*p*-value
Excessive health expenditure* during the last 2 years								
None	1.00				1.00			
2011, remote	1.32	0.74	2.36	0.347	1.29	0.71	2.32	0.405
2012, recent	2.03	1.23	3.35	0.006	1.91	1.16	3.15	0.012
2011 and 2012	1.83	1.12	2.98	0.016	1.67	1.01	2.78	0.048
Level of individual primary income earner								
Sex								
Male	1.00				1.00			
Female	0.94	0.51	1.71	0.832	0.83	0.45	1.54	0.559
Age, over 65								
<65 years	1.00	1.00	1.00		1.00	1.00	1.00	
≥65 years	0.57	0.36	0.91	0.018	2.52	0.32	20.13	0.384
Education								
Degree from elementary school	0.60	0.31	1.15	0.124	0.53	0.27	1.06	0.073
Degree from middle school	1.03	0.54	1.98	0.930	0.96	0.49	1.89	0.899
Degree from high school	0.90	0.50	1.60	0.713	0.85	0.47	1.54	0.596
Degree from college	1.00	1.00	1.00		1.00	1.00	1.00	
The presence of a spouse								
Presence	1.00	1.00	1.00		1.00	1.00	1.00	
Absence	0.54	0.30	0.96	0.035	0.54	0.28	1.06	0.072
Perceived health status								
Excellent	1.00	1.00	1.00		1.00	1.00	1.00	
Good	1.30	0.74	2.26	0.363	1.20	0.69	2.11	0.520
Poor	1.78	1.03	3.08	0.041	1.61	0.92	2.82	0.093
Depressive mood								
Sum of CESD-11∫	1.29	1.24	1.35	<.001	1.28	1.23	1.34	<.001
『Regular medication more than three months								
Absence	1.00				1.00			
Presence	1.22	0.71	2.10	0.473	1.22	0.70	2.11	0.481
Level of household								
Income Level								
<25% (Lowest)					2.01	0.97	4.15	0.059
25–50%					1.58	0.81	3.10	0.181
50–75%					1.60	0.86	2.96	0.139
≥75% (Highest)					1.00	1.00	1.00	
Number of family members								
One					1.00	1.00	1.00	
Two					1.14	0.63	2.06	0.666
Three					1.06	0.50	2.25	0.888
Four or more					0.86	0.37	2.01	0.735
Economically active family member*								
None					1.29	0.65	2.58	0.465
One					0.87	0.49	1.54	0.642
Two or more					1.00	1.00	1.00	
Disabled person among family members**								
Absence					1.00	1.00	1.00	
Presence					1.12	0.71	1.75	0.626
Aged over 65, among family members								
Absence					1.00	1.00	1.00	
Presence					0.16	0.02	1.24	0.079

『 *"Regular medication more than three months"* indicated the presence of on-going chronic diseases.』 *"CESD-11"* means "Center for Epidemiological Studies Depression Scale". *The variable of *"Economically active family members*" is defined as someone who worked regularly and got salary during last one year. **Disabled person means persons, who are officially qualified by doctors using the standard of national guideline for disabled.

Table 4. The adjusted odds ratios for suicidal ideation among the subjects, whose CESD-11 score are sixteen or over, according to the various settings of thresholds of excessive health expenditure.

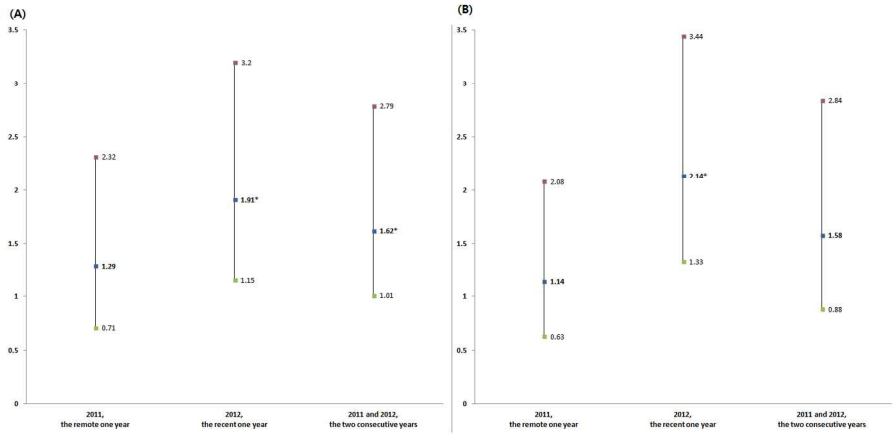
	EHE > 10%				EHE > 20%			
	OR	95% C.I.		p-value	OR	95% C.I.		p-value
Excessive health expenditure during the last two years								
None	1.00				1.00			
2011, remote	1.28	0.72	2.28	0.397	1.19	0.66	2.13	0.571
2012, recent	1.98	1.21	3.22	0.006	2.46	1.57	3.85	<0.001
2011 & 2012	1.86	1.15	3.02	0.012	1.89	1.08	3.31	0.026

We all adjusted the individual and household characteristics including sex, age, education, the presence of spouse, perceived health status, regular medication, income level, number of family members, the number of economically active family members, the presence of disabled in family, and the presence of aged over 65 in family.

"CESD-11" means "Center for Epidemiological Studies Depression Scale"

"EHE" is the excessive health expenditure, which is the proportion of health cost among disposable income of household.

Figure 1. The primary income earners were more vulnerable to the high threshold of EHE. In other words, when EHE were above 20% (B), compared to 10% (A), the odds ratio for suicidal ideation with the EHE in recent one year was increased. * *p*-value <0.05



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Supplementary table 1. Multivariate analysis, based on the presence of suicidal ideation during the past year among heads of households with the threshold of excessive health expenditure as ten percent from total expenditure in household as 40%

	Model 1 (-2logL= 1051.1)			**Model 2** (-2logL= 1035.3)			**Model 2 among depressive subjects**		
	OR	95% C.I.	*p*-value	OR	95% C.I.	*p*-value	OR	95% C.I.	*p*-value
Excessive health expenditure during the last 2 years									
None	1.00			1.00			1.00		
2011, remote	1.22	0.60 2.51	0.583	1.11	0.53 2.30	0.785	1.20	0.59 2.46	0.616
2012, recent	1.32	0.68 2.55	0.415	1.20	0.62 2.35	0.587	1.61	0.86 3.02	0.138
2011 and 2012	2.91	1.24 6.86	0.014	2.67	1.10 6.46	0.030	2.96	1.28 6.85	0.011

When we set the cut-off value as 40%, the EHE during the two consecutive years only have statistically meaningful increased odds ratios both in model 1 and 2. This might be due to the limited number of households, those spending more than 40% of disposable income as EHE.

Depressive subjects mean the primary income earners who reported depressive scales of sixteen or over, which is the cut-off value for potential major depressive disorder.

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	The temporal association of excessive health expenditure with suicidal ideation among primary income earners: cross-sectional design using Korean Welfare Panel Survey (KoWePS)
		Excessive health expenditure (EHE) is a global issue for households suffering from high-cost medical conditions, low incomes, and limited insurance coverage. After the international financial crisis of 2008, EHE became a social problem in developed countries. Such economic crisis might induce severe mental stress, resulting in suicidal ideation.
Introduction		
Background/rationale	2	Excessive health expenditure (EHE) is a global issue for households suffering from high-cost medical conditions, low incomes, and limited insurance coverage. After the international financial crisis of 2008, EHE became a social problem in developed countries. Such economic crisis might induce severe mental stress, resulting in suicidal ideation.
Objectives	3	To figure out whether recent occurred EHE is more associated with suicidal ideation
Methods		
Study design	4	Cross-sectional study design
Setting	5	the Korean Welfare Panel Study (KoWePS) from 2011 to 2013
Participants	6	*Cross-sectional study*— the Korean Welfare Panel Study (KoWePS) from 2011 to 2013. The total number of analyzed samples was 4,247 out of 5,717 households in the database. We only included households that had never experienced EHE before 2011
		Case-control study— Among 4,247 subjects, 146 (3.4%) experienced suicidal ideation, whereas 4,101 (96.6%) did not.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
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
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) we also performed another analysis using various cut-off values as 20% and 40% for EHE, the latter being the standard of WHO

Continued on next page

Results

Participants	13*	(a) Among 4,247 subjects, 146 (3.4%) experienced suicidal ideation, whereas 4,101 (96.6%) did not. One scale of depression score (CESD-11, Odds ratio (OR)=1.28, Confidential Interval (CI); 1.23–1.34, p <0.001) was associated with increased suicidal ideation. Such ideation was influenced to a greater extent by a recent EHE above ten percent of disposable income (ORs=1.91, CI; 1.16–3.15, p=0.012) than by either a remote EHE (ORs=1.29, CI; 0.71–2.32) or one in both 2011 and 2012 (ORs=1.67, CI; 1.01-2.78, p=0.048).
		(b) he total number of analyzed samples was 4,247 out of 5,717 households in the database. We only included households that had never experienced EHE before 2011
Descriptive data	14*	(a) The general characteristics of primary income earners and households are shown in Table 1. A total of 4,247 households are enrolled in this study. Among them, 146 heads of households (3.4%) reported suicidal ideation once or more during the past year, whereas 4,101 (96.6%) did not. A total number of 76 men (52.1%) and 70 women (47.9%) had suicidal ideation among primary income earners. Moreover, the lowest educated subjects with elementary level of education 65 subjects (44.5%) had higher proportion among the group with suicidal ideation. The average sum of CESD-11 among the subjects with suicidal ideation is 23.15, while the average score among the others is only 18.81. Only five subjects attempted suicide among all primary income earners.
		(b) None of them were missed, because all of them completed surveys.
		Cross-sectional study—. A total number of 76 men (52.1%) and 70 women (47.9%) had suicidal ideation among primary income earners. Moreover, the lowest educated subjects with elementary level of education 65 subjects (44.5%) had higher proportion among the group with suicidal ideation. The average sum of CESD-11 among the subjects with suicidal ideation is 23.15, while the average score among the others is only 18.81. Only five subjects attempted suicide among all primary income earners.
Main results	16	(*a*) Among 4,247 subjects, 146 (3.4%) experienced suicidal ideation, whereas 4,101 (96.6%) did not. One scale of depression score (CESD-11, Odds ratio (OR)=1.28, Confidential Interval (CI); 1.23–1.34, p <0.001) was associated with increased suicidal ideation. Such ideation was influenced to a greater extent by a recent EHE above ten percent of disposable income (ORs=1.91, CI; 1.16–3.15, p=0.012) than by either a remote EHE (ORs=1.29, CI; 0.71–2.32) or one in both 2011 and 2012 (ORs=1.67, CI; 1.01-2.78, p=0.048).
		(*b*)Based on a depressive scale of CESD , we defined the cut-off value as sixteen for potential major depressive disorder.
Other analyses	17	As the official cut-off value in our study is 10%, we performed other values as threshold. The primary income earners are more vulnerable to the high threshold of EHE. When EHE is above 20%, compared to 10%, the odds ratio for suicidal ideation with the EHE in recent one year is increased. (Figure 1) For EHE above 40% of disposable income in the Supplementary table 1, the consecutive two years with EHE is statistical meaningful to the increased odds ratio for suicidal ideation (Model 2; OR=2.67, 95% CI: 1.10–6.46). Since the heads of households with depressive symptoms may have more correlation with suicidal ideation, a subgroup analysis was performed for the primary income earners whose sum of CESD-11 score were sixteen or more (Table 4). The sum of CESD-11 score over sixteen indicates potential risk for major depressive disorder (MDD). In this subgroup analysis, the primary income earners were more vulnerable to the higher EHE. In other words, when EHE were above 20% (in 2012; OR=2.46, 95% CI: 1.57–3.85 / in both 2011 and 2012; OR=1.89, 95% CI: 1.08–3.31) compared to 10% (in 2012; OR=1.98, 95% CI: 1.21–3.22 / in

		both 2011 and 2012; OR=1.86, 95% CI: 1.15–3.02), suicidal ideation was increased.
Discussion		
Key results	18	According to measurements of the temporal association with EHE during 2011 and 2012, the recent one year in 2012 was associated with meaningful increases in ORs for suicidal ideation with the EHE above 10%.
Limitations	19	First, we could not determine casual relationship due to the cross-sectional nature of this study. To overcome this weakness, we divided the occurrences of EHE into four subgroups (none, recent, remote, and both years) in an attempt to analyze temporal causality. Second, we used the suicidal ideation as a dependent variable, not suicidal attempt. Because the number of suicide attempts observed during the study period was minimal to conduct the analysis, we used suicidal ideation. Although a small portion of general population with suicidal ideation eventually tried suicide attempts, suicidal ideation is still one of the powerful indicators to predict suicide attempt. According to one study in Korea, 84% of subjects with suicide attempt had previous suicidal ideation in the last two year23. Moreover, 'someone talking or writing about death, dying, or suicide' is well established consensus warning sign for suicide24. Thus, even suicidal ideation is regarded as important dependent variable for preventing the progress to suicidal attempt and suicide. Third, the number of cases of suicidal ideation may have been too small to determine all associations. Although we observed some statistical trends among independent variables for income level and temporal factors of EHEs, these trends did not reach statistical significance. One reason may be that the KoWePS study included investigations on mental health and suicide only since 2011 regardless of its initiation in 2006. Hence, we could not obtain more data for analysis. Fourth, we excluded other family members except for the primary income earner in households. This panel survey tried to include as many family members as possible; surveys were mainly answered by heads of household who are practical and economic representatives of households. In addition, since family members under nineteen years old did not answer the CESD-11 scale, we could not adjust the depressive symptoms, which is one of the most important factors to suicidal ideation. In this regard, we only included the primary income earners as study population. Fifth, we did not know what kinds of diagnosis categories, including mental and physical illness, were most significant to the occurrence of EHE. Although few researchers studied the attributable medical conditions, the range of them were so wide, defined as chronic diseases or disabled. For example, Choi et al. analyzed that cancer patients with unstable economic status were more vulnerable to EHE than those with stable economic conditions16. In addition, they studied that family members with chronic diseases or disabilities were powerful attributable factors to EHE on household25. However, none of them tried to figure out the most important kinds of disease categories. In this sense, another further study is needed to investigate the disease specific targeted to policy on EHE.
Interpretation	20	This is the first study to examine an association between EHE and suicidal ideation among primary income earners. For them, more severe depressive mood is associated with suicidal ideation. Furthermore, recently occurred and greater EHE might increase suicidal ideation. Although this study has several limitations, a future study could overcome these limitations by altering the characteristics of national and panel data. We also plan to gather a larger number of suicide attempts and suicide mortality cases. In conclusion, we suggest that in order to prevent suicidal ideation and to improve the mental health of individuals especially for primary income earners in households, recent household EHE might be considered
Generalisability	21	As the national stratified data was used, the external validity of the study is quite high.

		However, there are some limitations in the study, we need to do further investigation to prove the hypothesis more clearly.
Other information		
Funding	22	No funding source regarding this study

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

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

BMJ Open

The temporal association of excessive health expenditure with suicidal ideation among primary income earners: cross-sectional design using Korean Welfare Panel Survey (KoWePS)

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The temporal association of excessive health expenditure with suicidal ideation among primary income earners: cross-sectional design using Korean Welfare Panel Survey (KoWePS)

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Abstract

Objective Excessive health expenditure (EHE) is a global issue for households suffering from high-cost medical conditions, low incomes, and limited insurance coverage. After the international financial crisis of 2008, EHE became a social problem in developed countries. Such economic crisis might induce severe mental stress, resulting in suicidal ideation.

Methods We used the Korean Welfare Panel Study (KoWePS) from 2011 to 2013 and selected primary income earners, who were defined as practical and economic representatives of households; the total number of analyzed samples was 4,247 out of 5,717 households in the database. We only included households that had never experienced EHE before 2011. To examine the temporal relationship between EHE and suicidal ideation, we conducted a logistic regression analysis.

Results Among 4,247 subjects, 146 (3.4%) experienced suicidal ideation, whereas 4,101 (96.6%) did not. One scale of depression score (Odds ratio (OR)=1.28, Confidential Interval (CI); 1.23–1.34, p <0.001) was associated with increased suicidal ideation. Such ideation was influenced to a greater extent by a recent EHE above ten percent of disposable income (ORs=1.91, CI; 1.16–3.15, p=0.012) than by either a remote EHE (ORs=1.29, CI; 0.71–2.32) or one in both 2011 and 2012 (ORs=1.67, CI; 1.01-2.78, p=0.048).

Conclusions In this study, more recent EHE resulted in more suicidal ideation. In conclusion, we suggest that recent household EHE might be considered as an important factor to prevent suicidal ideation and to improve the mental health of individuals.

Strengths and limitations of this study

Strength

- We used the representative national data 'Korea Welfare Panel Study(KoWePS)' from the national research institute, "Korea Institute for Health and Social Affairs, KIHASA".
- We divided the occurrences of EHE into four subgroups (none, recent, remote, and both years) in an attempt to analyze temporal causality.

Limitation

- We could not determine casual relationships due to the cross-sectional nature of this study.
- Because the number of suicide attempts observed during the study period was too small to continue the analysis, we used suicidal ideation as a dependent variable.
- The number of cases of suicidal ideation may have been too small to determine all associations.

Introduction

According to OECD health statistics data, the age-standardized suicide mortality rate in 2011 was 33.3 per 100,000 individuals[1 2]. Among all OECD countries, this is the highest value, while the rate of increase in suicidal mortality remains constant. Since financial stress might be an important factor in Korea, we have to put concern on the financially vulnerable groups such as primary income earners with excessive health expenditure (EHE) in household.

Protection from EHE is widely regarded as a desirable objective of healthcare systems and policies[3-7]. However, EHE is not always the same as high healthcare cost. For example, an expensive surgery might not be excessive if a household does not bear its full cost because the service is provided free or at a subsidized price or is covered by third-party insurance. On the other hand, even the small cost of common illnesses can be financially disastrous for poor households with no insurance.

Although EHE is usually defined as catastrophic health expenditure (CHE), health-related expenses over 40% of disposable income per annum according to the World Health Organization (WHO)[3], it has often been defined differently by various studies[8-10]. Thus in this study we defined different cut-off values as ten, twenty, and forty percents to enhance the effectiveness of the study design.

According to OECD health data, patients pay the highest percentage of their medical fees (>35%) out of pocket in the Republic of Korea[11]. As the primary function of insurance is to protect the patient from harm in terms of health and economic risk, it is critical to reduce the occurrences of EHE. According to Korean National Statistics, the number of households experiencing EHE, more than 40% of disposable household income, in 2010 was 618,000, or

3.9% of all households. This figure was only 1% in 2002 but began to increase thereafter, reaching 3.3% by 2006[1]. These data suggest that Koreans are at risk of occurrences of EHE. Thus, they might be vulnerable to a decline in their economic welfare in the face of ill health, especially when EHE exist.

For example, in 2008, the state of Oregon in the United States initiated a limited expansion of its Medicaid program for low-income adults[12]. Medicaid coverage decreased the probability of a positive screening for depression (-9.15 percentage points; 95% confidence interval (CI); -16.70--1.60; p=0.02), increased the use of many preventive services, and nearly eliminated excessive out-of-pocket medical expenditures. This study showed that mental health could be improved by reducing the financial burden for health.

Another study which observed the association between EHE and depression was performed in India[13]. According to this cross-sectional study in Goa, India, depressive disorder was associated with significantly higher healthcare costs, lost time costs, and risk of EHE. There was a linear association between psychological morbidity scores and the risk of EHE. From this study, it could be suggested that economic arguments due to health problems were considered to be a key driver of mental health policy.

Although few studies on EHE in Korea were published in Korea[14 15], there were no appropriate study design to examine the association between excessive health expenditures and mental health.

The aims of this study were to (1) compare health expenditures between households with and without EHEs (2) examine the temporal association between EHEs and suicidal ideation among the primary income earners in household, (3) test whether recent EHEs have a greater impact on suicidal ideation than more remote EHEs.

Methods

Participants

Data from the Korean Welfare Panel Study (KoWePS: Korea Institute for Health & Social Affairs & Seoul National University Social Welfare Research Center, 2008) from 2011 to 2013 were obtained for this study. The KoWePS is an on-going longitudinal study of a nationally representative sample of Korean households, which collects data annually. The KoWePS-led survey population represents 90% of the census conducted in 2005. Statisticians of this survey determined final panel households by applying 'Stratified Double Sampling' model. The constituent questionnaires in this survey consisted of a household member survey for household members aged 15 years and over, a household survey, and a supplementary survey for special topics. Face-to-face interviews were used to gain information during the first year of the study.

This study respected the provisions of the Declaration of Helsinki for ethical medical research. Since this study used secondary data from the Korea Institute for Health and Social Welfare, we did not need to obtain individual informed consent. All patient records/information in this study were anonymized and de-identified prior to analysis. In addition, we were granted the approval of institutional review board at the graduate school of public health in Yonsei university (IRB approval No.: 2-1040939-AB-N-01-2015-202).

We especially focused on the suicidal ideation of household heads, who are defined as the primary income earner and practical representative of the household. The study suggests that the most vulnerable family member to an economic crisis might be a primary income earner. Hence, primary income earners were selected for the questionnaire. The total number of analyzed samples was 4,247 out of 5,717 households from the database. In Korea, there were total 17,339,422 households enrolled in governmental system in 2010. We only included

households those had never experienced EHE before 2011 and never missed any annual surveys during the study period.

Covariates of individual and household characteristics

In this study, we used several covariates to control for demographic and socioeconomic characteristics of individual levels. Demographic characteristics such as sex, age, educational level, marital status, perceived heath status, regular medication more than three months, and depressive mood status were included. Since the official age of retirement in Korea is sixty-five, we divided the age groups into one under sixty-five and another on sixty-five and over. Four education categories including degree from elementary, middle, high school, and college and above were self-reported by participants. We divided perceived health status with three categories into good, normal, and bad, while the original survey questionnaire used scale with five degrees including excellent, good, normal, bad, and very bad. The question of self-rated health is as follow; "How would you rate your general health during the last year?". In terms of regular medication, interviewers asked whether the subjects were taking any medication regularly more than last three months or not. This was used as an indicator to determine presence of any kind of chronic diseases.

We also considered other covariates of households such as number of family members, economically active family members, disabled members, and members over sixty-five years old. An economically active member was defined as someone who worked regularly and earned a salary during last one year. Disabled were those officially diagnosed by doctors using the standard of national guideline for disabled.

Excessive health expenditure as an interesting variable

We defined EHE as the health expenditure over 10% of disposable income, which is the standard threshold from the Ministry of Health and Welfare, South Korea. Furthermore, to examine the increased relationship between EHE and suicidal ideation, we also performed another analysis using various cut-off values as 20% and 40% for EHE, the latter being the standard of the WHO.

The household questionnaire portion of the KoWePS included a set of questions that asked about the income of all household members. These questions addressed earned income, income from assets, and miscellaneous income. The present study utilized this set of income-related questions to create total household income and disposable income variable. To obtain the number of households experiencing EHE, we divided the total cost of health expenditures into disposable income for each household. Moreover, we considered temporal factors of EHE. In other words, we determined when an excessive event occurred: none, remote (in 2011), recent (in 2012), and in both 2011 and 2012.

Measuring depressive symptoms and suicidal ideation

To measure the level of depression, the Center for Epidemiologic Studies Depression scale (CES-D) was used, which was originally designed to measure depressive symptoms in the general population[16] and has been widely used in community- and clinically based samples[17] [18]. For each year of the study period, the respondents reported symptoms experienced during the previous week using a four-point scale. Depression scores for each year were calculated by totaling across 11 items.

Suicidal ideation was assessed by a questionnaire regarding the occurrence of suicidal

ideation during the past year as follows; “Have you seriously considered suicide at any time in the past year?”.

Statistical analysis

The frequency of EHE for samples stratified by demographic and socioeconomic status was determined by performing a chi-square test. To examine the relationship between EHE and suicidal ideation, we conducted a logistic regression analysis.

In logistic regression analysis, Model 1 includes individual level variables. Furthermore, variables in Model 2 are extended to both individual and household levels. When p-value was less than 0.05, we defined the statistical result as significant. We used the SAS 9.3 statistical package (Cary, NC, USA) for statistical analysis.

Results

The general characteristics of primary income earners and households are shown in Table 1. A total of 4,247 households are enrolled in this study. Among them, 146 heads of households (3.4%) reported suicidal ideation once or more during the past year, whereas 4,101 (96.6%) did not. A total number of 76 men (52.1%) and 70 women (47.9%) had suicidal ideation among primary income earners. Moreover, the lowest educated subjects with elementary level of education 65 subjects (44.5%) had higher proportion among the group with suicidal ideation.

Threshold of EHE of 10% and 40% above disposable income are significantly different for those who did and did not have suicidal ideation (Table 2). Among 875 subjects whose households suffered from EHE over 10% during the last two consecutive years, 49 persons (5.6%) experienced suicidal ideation. In 62 subjects with EHE above 40% during the last two consecutive years, eight persons (12.9%) reported suicidal ideation.

We carried out multivariate analysis using a logistic regression model, based on the threshold of EHE above 10% of disposable income (Table 3). In Model 1, the primary income earners who had poor perceived health status (odds ratio (OR)=1.78, 95% CI: 1.03–3.08) and a higher depression score (CESD-11, OR=1.29, 95% CI: 1.24–1.35) are more vulnerable to suicidal ideation. In Model 2, a higher depressive score (CESD-11, OR=1.28, 95% CI: 1.23–1.34) is associated with the presence of suicidal ideation. In both Model 1 and 2, EHE occurred in the recent year of 2012 (Model 1; OR=2.03, 95% CI: 1.23–3.35 / Model 2; OR=1.91, 95% CI: 1.16–3.15) and for both consecutive years in 2011 and 2012 (Model 1; OR=1.83, 95% CI: 1.12–2.98 / Model 2; OR=1.67, 95% CI: 1.01–2.78) have statistically significant ORs for suicidal ideation. Moreover, the suicidal ideation is influenced to a greater extent by a recent EHE than by a remote EHE or EHE in both years. To compare the fitness

between the models, we used -2logL methods. Through this measurement, it seems that Model 2 is more suitable for suicidal ideation because it has a lower -2logL than Model 1

Although the official cut-off value in our study is 10%, we also tested with other values as cut-off thresholds. These results showed that primary income earners are more vulnerable to the high threshold of EHE. When EHE is above 20%, compared to 10%, the odds ratios of suicidal ideation associated with EHE was increased in recent year (Figure 1).

For EHE above 40% of disposable income, the consecutive two years with EHE is statistically significantly correlated with a higher rate of suicidal ideation. (Model 2; OR=2.67, 95% CI: 1.10–6.46) (Supplementary Table 1).

Since the heads of households with depressive symptoms may have more correlation with suicidal ideation, a subgroup analysis was performed for the primary income earners whose sum of CESD-11 score were sixteen or more (Table 4). A sum of CESD-11 score over sixteen indicates potential risk for major depressive disorder (MDD). In this subgroup analysis, the primary income earners were more vulnerable to the higher EHE. In other words, when EHE was above 20% (in 2012; OR=2.46, 95% CI: 1.57–3.85 / in both 2011 and 2012; OR=1.89, 95% CI: 1.08–3.31) compared to 10% (in 2012; OR=1.98, 95% CI: 1.21–3.22 / in both 2011 and 2012; OR=1.86, 95% CI: 1.15–3.02), suicidal ideation was increased.

According to subgroup analysis by sex in 2012, women primary income earners with recent EHEs are more vulnerable to suicidal ideation (EHE > 10%; OR=2.71, 95% CI: 1.25-5.86 / EHE > 20%; OR=2.66, 95% CI: 1.37–5.15) than the reference group without any EHE history (Supplementary Table 2). Although men do not have statistically meaningful odds ratios, the men subjects with EHE above ten and twenty percent above in recent one year had higher values for suicidal ideation than the reference group without any EHE history during

the last two years.

Discussion

According to measurements of the temporal association with EHE during 2011 and 2012, the recent one year in 2012 had meaningful increases in ORs for suicidal ideation among those with EHE above 10%. We also performed a subgroup analysis for primary income earners with potential risk of MDD. The temporal relationship between EHE and suicidal ideation is stronger in this potentially depressed group than in the others. Within this group, the subjects with EHE over 20% showed a higher OR than one of EHE over 10%. Interestingly, in EHE over 40%, the recent 2012 one year is not statically associated with suicidal ideation. However, the two consecutive two years with EHE is highly associated with suicidal ideation. Since the number of households with EHE over 40% is only 197 (4.4%), the odds ratio of the recent one year in 2012 might not show statistically increased OR for suicidal ideation. In spite of this limited condition, the consecutive occurrence of EHE have strong statically association with suicidal ideation. Thus we need to focus on the households with EHE in a long term through appropriate intervention based on social consensus.

In addition, when the primary income earners are women in households, EHE is more associated with suicidal ideation. Even though we need some further investigation to reveal exact mechanism of gender difference, we suggest that the job insecurity of women and surplus financial stress to caregiving might induce more suicidal ideation compared to men. According to the study in France, the people with unstable and unfavorable employment characteristics are disproportionately likely to be suicidal ideation[19]. In another similar study in Japan[20], women workers without stress reduction techniques were found to be at significantly higher risk for suicidal ideation. In this sense, it is needed that we need to initiate more careful financial support to the households with women primary income earners to prevent worsening their mental health.

Globally, many politicians and public health administrators have tried to make healthcare as accessible as possible[8 9]. The problem of accessibility is likely induced by both economic and spatial problems. In Korea, the amount and quality of healthcare access have improved over the last 30 years by through rapid expansion of national health insurance. However, because national reimbursement was low, fiscal asset security in healthcare system could not be sustainable. Although this problem was improving gradually, a global economic crisis in 2008 hindered the ability of patients to visit clinics because of decreased incomes and heavy out-of-pocket expenses, especially for the low SES class with chronic and severe diseases with the tremendous medical expenses[21]. In this sense, many researchers have tried to determine the causes and economic outcomes of EHE rather than their effects on health. However, these kinds of economic stresses worsen mental health and induce depressive disorders, suicidal ideation, and numbers of suicide attempts[10 16]. For example, there was a steep increase in the number of patients with MDD, suicidal ideation, and suicide attempts immediately after the international economic crisis in 2008[17 18 22]. The prevalence of MDD increased from 3.3% of the general population in 2008 to 8.2% in 2011, which is a statistically significant difference. In addition, suicidal ideation among men increased from 4.4% in 2008 to 7.1% in 2011[23].

Just as the same as these previous studies on this topic, our result also mentioned the strong association between financial burden of health and suicidal ideation. However, there were several limitations of this study.

First, we could not determine casual relationship due to the cross-sectional nature of this study. To overcome this weakness, we divided the occurrences of EHE into four subgroups (none, recent, remote, and both years) in an attempt to analyze temporal causality. Second, we used the suicidal ideation as a dependent variable, not suicide attempt because of the limited subjects. However, suicidal ideation is still one of the powerful indicators to predict

suicide attempts[24]. According to one study in Korea, 84% of who attempted suicide had previously seriously considered suicide within the last two years[25]. Thus, even suicidal ideation is regarded as important dependent variable for preventing the progress to suicidal attempt and suicide. Third, the number of cases of suicidal ideation may have been too small to determine all associations. Although we observed some statistical trends among independent variables for income level and temporal factors of EHEs, these trends did not reach statistical significance. One reason may be that the KoWePS study included investigations on mental health and suicide only since 2011 regardless of its initiation in 2006. Hence, we could not obtain more data for analysis. Fourth, we excluded other family members except for the primary income earner in households. Since family members under nineteen years old did not answer the CESD-11 scale, we could not adjust the depressive symptoms, which is one of the most important factors to suicidal ideation. Fifth, we did not know what kinds of diagnosis categories, including mental and physical illness, were most significant to the occurrence of EHE. Although few researchers studied the attributable medical conditions[15 26], the range of them were so wide, defined as chronic diseases or disabledIn this sense, another further study is needed to investigate the disease specific targeted to policy on EHE.

Despite of such limitations, this study has several strengths as follow.

First, this study used national opened data representing the Republic of Korea. Through this well-designed panel survey, this study had high external validity and is able to be expanded in the future. Furthermore, this national data could be compared to ones in other countries such as Japan and Scandinavian countries[11], those had reduced the suicidal mortality rates dramatically. Second, this is the first study on the relationship between EHE and suicidal ideation in Korea to our knowledge. Thus, it could draw attentions of other researchers and

policy makers to the economic burden for health as an attributable factor to suicidal ideation.

Third, it is able to minimize the health disparity in society through the subsidies to EHE. Because EHE hinders the access to healthcare system, solving this problem could improve the basic human right for health and overall quality of public health. Korea already started to Provide subsidies for families with EHE in 2014, future studies could investigate the impact this support has had.

To put all things together, we still need to perform further investigation using a longitudinal study design with a larger populations. Thorough accumulating these Korean Data and following the trend of policy implication, we will report the effect of the policy for EHE apparently. However, we possibly mention that EHE could be considered as an important factor for aggravating mental illness through this study. Furthermore, it could surge that we need to take more consider newly occurring EHEs to protect vulnerable primary income earners such as women.

Conclusion

This is the first study to examine an association between EHE and suicidal ideation among primary income earners. For this group, more severe depressive mood is associated with suicidal ideation. Furthermore, recently occurred and greater EHE might increase suicidal ideation, especially for women. In conclusion, we suggest that in order to prevent suicidal ideation and to improve the mental health of individuals, especially for primary income earners in households, recent household EHE might be considered as an important factor. Furthermore, we hope that health policy makers also take these results into account the national financial support program for EHEs in Korea and develop immediate intervention

after the onset of EHEs.

Contributorship statement

We clarified that the content has not been published or submitted for publication elsewhere. We respect the provision of declaration of Helsinki and we obey the protocol for the research project, suitable for safe and ethical principles. As this study is a secondary opened national data for public access, we do not need to get any individual informed consents. All authors have contributed significantly and that all authors are in agreement with the content of the manuscript. Jaeyong Shin and Jae Woo Choi designed the study as co-first authors and wrote the paper, Young Choi and Tae Hwan Ihm carried out the statistical analysis and gave important comments for this study, Sung-in Jang and Sang Gyu Lee was responsible for the statistical design, and Eun-Cheol Park suggested the direction of this study as a corresponding author.

Competing interests

There are no competing interests in all authors.

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Data sharing

As we used public and national open data, we are willing to sharing our data and results. It is available on 'www.koweps.re.kr'.

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References

1. Statistics Korea. National Health Statistics, 2013.
2. Chan CH, Caine ED, You S, et al. Suicide rates among working-age adults in South Korea before and after the 2008 economic crisis. Journal of epidemiology and community health 2014;**68**(3):246-52.
3. Xu K, Evans DB, Kawabata K, et al. Household catastrophic health expenditure: a multicountry analysis. Lancet 2003;**362**(9378):111-7.
4. Brinda EM, Andres RA, Enemark U. Correlates of out-of-pocket and catastrophic health expenditures in Tanzania: results from a national household survey. BMC international health and human rights 2014;**14**:5.
5. Ilesanmi OS, Adebiyi AO, Fatiregun AA. National health insurance scheme: how protected are households in Oyo State, Nigeria from catastrophic health expenditure? International journal of health policy and management 2014;**2**(4):175-80.
6. Li Y, Wu Q, Liu C, et al. Catastrophic health expenditure and rural household impoverishment in China: what role does the new cooperative health insurance scheme play? PloS one 2014;**9**(4):e93253.
7. Ekman B. Catastrophic health payments and health insurance: some counterintuitive evidence from one low-income country. Health policy (Amsterdam, Netherlands) 2007;**83**(2-3):304-13.
8. Kim S, Kwon S. The effect of extension of benefit coverage for cancer patients on health care utilization across different income groups in South Korea. International journal of health care finance and economics 2014;**14**(2):161-77.
9. Li X, Shen JJ, Lu J, et al. Household catastrophic medical expenses in eastern China: determinants and policy implications. BMC health services research 2013;**13**:506.
10. Ahnquist J, Wamala SP, Lindstrom M. Social determinants of health--a question of social or economic capital? Interaction effects of socioeconomic factors on health outcomes. Social science & medicine (1982) 2012;**74**(6):930-9.
11. The Organisation for Economic Co-operation and Development(OECD). Health at a Glance 2013, OECD INDICATORS. 2013.
12. Baicker K, Taubman SL, Allen HL, et al. The Oregon experiment--effects of Medicaid on clinical outcomes. The New England journal of medicine 2013;**368**(18):1713-22.
13. Patel V, Chisholm D, Kirkwood BR, et al. Prioritizing health problems in women in developing countries: comparing the financial burden of reproductive tract infections, anaemia and depressive disorders in a community survey in India. Tropical medicine & international health : TM & IH 2007;**12**(1):130-9.
14. Kim Y, Yang B. Relationship between catastrophic health expenditures and household incomes and expenditure patterns in South Korea. Health policy (Amsterdam, Netherlands) 2011;**100**(2-3):239-46.

15. Choi JW, Cho KH, Choi Y, et al. Changes in economic status of households associated with catastrophic health expenditures for cancer in South Korea. Asian Pacific journal of cancer prevention : APJCP 2014;**15**(6):2713-7.
16. Economou M, Peppou L, Fousketaki S, et al. [Economic crisis and mental health: effects on the prevalence of common mental disorders]. Psychiatrike = Psychiatriki 2013;**24**(4):247-61.
17. Economou M, Madianos M, Peppou LE, et al. Cognitive social capital and mental illness during economic crisis: a nationwide population-based study in Greece. Social science & medicine (1982) 2014;**100**:141-7.
18. Economou M, Madianos M, Peppou LE, et al. Suicidal ideation and reported suicide attempts in Greece during the economic crisis. World psychiatry : official journal of the World Psychiatric Association (WPA) 2013;**12**(1):53-9.
19. Dalglish SL, Melchior M, Younes N, et al. Work characteristics and suicidal ideation in young adults in France. Social psychiatry and psychiatric epidemiology 2015;**50**(4):613-20.
20. Yoon JH, Chang SJ. 0130 The combined effects of high emotional demands and low job control at work on suicidal ideation in Korean sales and service workers. Occupational and environmental medicine 2014;**71 Suppl 1**:A76-7.
21. Lee WY, Shaw I. The impact of out-of-pocket payments on health care inequity: the case of national health insurance in South Korea. International journal of environmental research and public health 2014;**11**(7):7304-18.
22. Economou M, Madianos M, Peppou LE, et al. Major depression in the era of economic crisis: a replication of a cross-sectional study across Greece. Journal of affective disorders 2013;**145**(3):308-14.
23. Shafer AB. Meta-analysis of the factor structures of four depression questionnaires: Beck, CES-D, Hamilton, and Zung. Journal of clinical psychology 2006;**62**(1):123-46.
24. Rudd MD, Berman AL, Joiner TE, Jr., et al. Warning signs for suicide: theory, research, and clinical applications. Suicide & life-threatening behavior 2006;**36**(3):255-62.
25. Jeon HJ, Lee JY, Lee YM, et al. Unplanned versus planned suicide attempters, precipitants, methods, and an association with mental disorders in a Korea-based community sample. Journal of affective disorders 2010;**127**(1-3):274-80.
26. Choi JW, Choi JW, Kim JH, et al. Association between chronic disease and catastrophic health expenditure in Korea. BMC health services research 2015;**15**(1):26.

Table 1. Demographic characteristics among subjects, based on the presence of suicidal ideation in heads of households

Variables	Absence of suicidal ideation		Presence of suicidal ideation		Total		*p*-value
	n	%	n	%	n	%	
Primary income earner characteristics							
Sex							<0.001
Male	3040	74.1	76	52.1	3116	73.4	
Female	1061	25.9	70	47.9	1131	26.6	
Age, over 65 years							0.009
≥65 years	1937	47.2	85	58.2	2022	47.6	
Education							0.003
Graduation from elementary school	1376	33.6	65	44.5	1441	33.9	
Graduation from middle school	545	13.3	26	17.8	571	13.4	
Graduation from high school	1198	29.2	33	22.6	1231	29.0	
Graduation from college	982	23.9	22	15.1	1004	23.6	
The presence of a spouse							<0.001
Presence	2858	69.7	66	45.2	2924	68.8	
Perceived health status							<0.001
Excellent	2271	55.4	40	27.4	2311	54.4	
Good	912	22.2	31	21.2	943	22.2	
Poor	918	22.4	75	51.4	993	23.4	
Regular medication more than three months ┌							<0.001
Presence	2492	60.8	117	80.1	2609	61.4	
Depressive mood	**Mean**	**SD**	**Mean**	**SD**	**Mean**		<0.001
Sum of CESD-11∫	18.808	2.9	23.151	4.3	18.953		
Household characteristics							
Income level							<0.001
<25% (lowest)	756	18.4	55	37.7	811	19.1	
25–50%	953	23.2	39	26.7	992	23.4	
50–75%	1140	27.8	34	23.3	1174	27.6	
≥75% (highest)	1252	30.5	18	12.3	1270	29.9	
Number of family members							<0.001
One	856	20.9	58	39.7	914	21.5	
Two	1233	30.1	45	30.8	1278	30.1	
Three	767	18.7	21	14.4	788	18.6	
Four or more	1245	30.4	22	15.1	1267	29.8	
Economically active family member*							<0.001
None	1001	24.4	70	47.9	1071	25.2	
One	1882	45.9	52	35.6	1934	45.5	
Two or more	1218	29.7	24	16.4	1242	29.2	
Disabled person among family members**							
Presence	712	17.4	33	22.6	745	17.5	
Aged over 65, among family members							0.062
Presence	2094	51.1	86	58.9	2180	51.3	
Total	4101	96.6	146	3.4	4247	100.0	

『 *"Regular medication more than three months"* indicated the presence of on-going chronic diseases.』 *"CESD-11"* means "Center for Epidemiological Studies Depression Scale". *The variable of *"Economically active family members*" is defined as someone who worked regularly and got salary during last one year. **Disabled person means persons, who are officially qualified by doctors using the standard of national guideline for disabled.

Table 2. Bivariate analysis, based on the presence of suicidal ideation in heads of households and the occurrence of excessive health expenditures during the last 2 years

The occurrence of excessive health expenditure during the last 2 years	Excessive health expenditure > 10%*						Excessive health expenditure > 40%**					
	Absence of suicidal ideation		Presence of suicidal ideation		Total	*p*-value	Absence of suicidal ideation		Presence of suicidal ideation		Total	*p*-value
	n	%	n	%			n	%	n	%		
None	2061	98.0	43	2.0	2104	<0.001	3683	97.0	115	3.0	3798	<0.001
2011, remote	582	96.8	19	3.2	601		180	94.7	10	5.3	190	
2012, recent	632	94.8	35	5.2	667		184	93.4	13	6.6	197	
2011 and 2012	826	94.4	49	5.6	875		54	87.1	8	12.9	62	
Total	4101	96.6	146	3.4	4247		4101	96.6	146	3.4	4247	

The threshold of 10%* as excessive health expenditure (EHE) is the standard from the Ministry of Health and Welfares in Korea, while the one of 40%** is from the WHO. As WHO recommended to use flexible threshold according to cultural and national background differently, we did further statistical analysis using 10% in paper, although we also performed another statistical analysis in supplementary materials.

Table 3. Multivariate analysis, based on the presence of suicidal ideation during the past year among heads of households with the threshold of excessive health expenditure as ten percent from total expenditure in household.

Variables	Model 1 (-2logL=1056.60)				Model 2 (-2logL=1032.57)			
	OR	95% C.I.		*p*-value	OR	95% C.I.		*p*-value
Excessive health expenditure* during the last 2 years								
None	1.00				1.00			
2011, remote	1.32	0.74	2.36	0.347	1.29	0.71	2.32	0.405
2012, recent	2.03	1.23	3.35	0.006	1.91	1.16	3.15	0.012
2011 and 2012	1.83	1.12	2.98	0.016	1.67	1.01	2.78	0.048
Level of individual primary income earner								
Sex								
Male	1.00				1.00			
Female	0.94	0.51	1.71	0.832	0.83	0.45	1.54	0.559
Age, over 65								
<65 years	1.00	1.00	1.00		1.00	1.00	1.00	
≥65 years	0.57	0.36	0.91	0.018	2.52	0.32	20.13	0.384
Education								
Degree from elementary school	0.60	0.31	1.15	0.124	0.53	0.27	1.06	0.073
Degree from middle school	1.03	0.54	1.98	0.930	0.96	0.49	1.89	0.899
Degree from high school	0.90	0.50	1.60	0.713	0.85	0.47	1.54	0.596
Degree from college	1.00	1.00	1.00		1.00	1.00	1.00	
The presence of a spouse								
Presence	1.00	1.00	1.00		1.00	1.00	1.00	
Absence	0.54	0.30	0.96	0.035	0.54	0.28	1.06	0.072
Perceived health status								
Excellent	1.00	1.00	1.00		1.00	1.00	1.00	
Good	1.30	0.74	2.26	0.363	1.20	0.69	2.11	0.520
Poor	1.78	1.03	3.08	0.041	1.61	0.92	2.82	0.093
Depressive mood								
Sum of CESD-11∫	1.29	1.24	1.35	<.001	1.28	1.23	1.34	<.001
『Regular medication more than three months								
Absence	1.00				1.00			
Presence	1.22	0.71	2.10	0.473	1.22	0.70	2.11	0.481
Level of household								
Income Level								
<25% (Lowest)					2.01	0.97	4.15	0.059
25–50%					1.58	0.81	3.10	0.181
50–75%					1.60	0.86	2.96	0.139
≥75% (Highest)					1.00	1.00	1.00	
Number of family members								
One					1.00	1.00	1.00	
Two					1.14	0.63	2.06	0.666
Three					1.06	0.50	2.25	0.888
Four or more					0.86	0.37	2.01	0.735
Economically active family member*								
None					1.29	0.65	2.58	0.465
One					0.87	0.49	1.54	0.642
Two or more					1.00	1.00	1.00	
Disabled person among family members**								
Absence					1.00	1.00	1.00	
Presence					1.12	0.71	1.75	0.626
Aged over 65, among family members								
Absence					1.00	1.00	1.00	

Presence	0.16	0.02	1.24	0.079

『 *"Regular medication more than three months"* indicated the presence of on-going chronic diseases.』 *"CESD-11"* means "Center for Epidemiological Studies Depression Scale". *The variable of *"Economically active family members*" is defined as someone who worked regularly and got salary during last one year. **Disabled person means persons, who are officially qualified by doctors using the standard of national guideline for disabled.

Table 4. The adjusted odds ratios for suicidal ideation among the subjects, whose CESD-11 score are sixteen or over, according to the various settings of thresholds of excessive health expenditure.

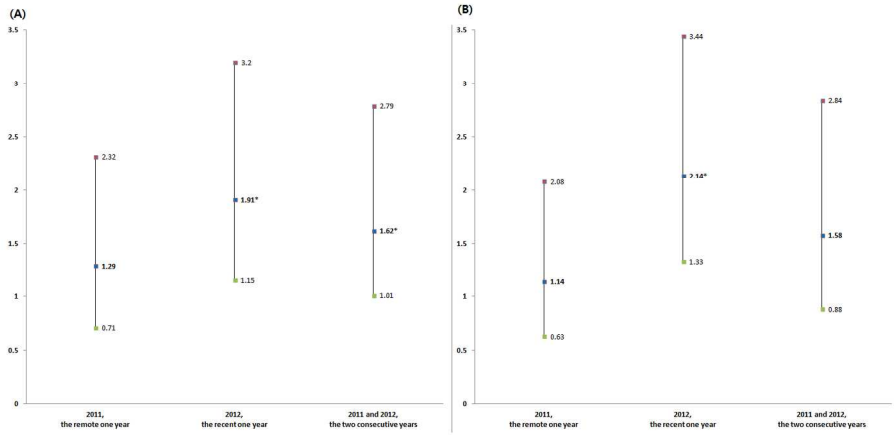
	EHE > 10%				EHE > 20%			
	OR	95% C.I.		p-value	OR	95% C.I.		p-value
Excessive health expenditure during the last two years								
None	1.00				1.00			
2011, remote	1.28	0.72	2.28	0.397	1.19	0.66	2.13	0.571
2012, recent	1.98	1.21	3.22	0.006	2.46	1.57	3.85	<0.001
2011 & 2012	1.86	1.15	3.02	0.012	1.89	1.08	3.31	0.026

We all adjusted the individual and household characteristics including sex, age, education, the presence of spouse, perceived health status, regular medication, income level, number of family members, the number of economically active family members, the presence of disabled in family, and the presence of aged over 65 in family.

"CESD-11" means "Center for Epidemiological Studies Depression Scale"

"EHE" is the excessive health expenditure, which is the proportion of health cost among disposable income of household.

Figure 1. The primary income earners were more vulnerable to the high threshold of EHE. In other words, when EHE were above 20% (B), compared to 10% (A), the odds ratio for suicidal ideation with EHE in recent one year was increased. * *p*-value <0.05



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Supplementary table 1. Multivariate analysis, based on the presence of suicidal ideation during the past year among heads of households with the threshold of excessive health expenditure as forty percent from total expenditure in household.

	Model 1 (-2logL= 1051.1)			**Model 2** (-2logL= 1035.3)			**Model 2 among depressive subjects**			
	OR	95% C.I.	*p*-value	OR	95% C.I.	*p*-value	OR	95% C.I.	*p*-value	
Excessive health expenditure during the last 2 years										
None	1.00			1.00			1.00			
2011, remote	1.22	0.60	2.51	0.583	1.11	0.53	2.30	0.785	1.20	0.59	2.46	0.616
2012, recent	1.32	0.68	2.55	0.415	1.20	0.62	2.35	0.587	1.61	0.86	3.02	0.138
2011 and 2012	2.91	1.24	6.86	0.014	2.67	1.10	6.46	0.030	2.96	1.28	6.85	0.011

When we set the cut-off value as 40%, the EHE during the two consecutive years only have statistically meaningful increased odds ratios both in model 1 and 2. This might be due to the limited number of households, those spending more than 40% of disposable income as EHE.

Depressive subjects mean the primary income earners who reported depressive scales of sixteen or over, which is the cut-off value for potential major depressive disorder.

Supplementary table 2. Subgroup analysis by sex and various thresholds of EHEs.

Excessive health expenditure during the last two years	Excessive health expenditure >10%				Excessive health expenditure >20%				Excessive health expenditure >40%			
	OR	95% C.I.		*p*-value	OR	95% C.I.		*p*-value	OR	95% C.I.		*p*-value
Men												
None	1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	
2011, the remote one year	1.28	0.58	2.83	0.546	1.15	0.49	2.72	0.753	0.73	0.22	2.43	0.611
2012, the recent one year	1.37	0.66	2.87	0.398	1.74	0.86	3.51	0.124	0.96	0.37	2.53	0.934
2011 and 2012, the straight two years	1.55	0.75	3.20	0.240	1.12	0.48	2.65	0.793	1.56	0.42	5.79	0.508
Women												
None	1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	
2011, the remote one year	1.31	0.53	3.28	0.558	1.01	0.42	2.41	0.983	1.26	0.48	3.32	0.644
2012, the recent one year	2.71	1.25	5.86	0.011	2.66	1.37	5.15	0.004	1.40	0.54	3.64	0.486
2011 and 2012, the straight two years	1.75	0.82	3.76	0.149	2.19	0.95	5.07	0.067	4.73	1.21	18.46	0.025

According to the results, women are more vulnerable to suicidal ideation by EHEs than men. Although, men do not have statistically meaningful odds ratio, the EHE with recent one year had higher values for suicidal ideation than the reference group without any EHE history during the last two years.

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	The temporal association of excessive health expenditure with suicidal ideation among primary income earners: cross-sectional design using Korean Welfare Panel Survey (KoWePS)
		Excessive health expenditure (EHE) is a global issue for households suffering from high-cost medical conditions, low incomes, and limited insurance coverage. After the international financial crisis of 2008, EHE became a social problem in developed countries. Such economic crisis might induce severe mental stress, resulting in suicidal ideation.
Introduction		
Background/rationale	2	Excessive health expenditure (EHE) is a global issue for households suffering from high-cost medical conditions, low incomes, and limited insurance coverage. After the international financial crisis of 2008, EHE became a social problem in developed countries. Such economic crisis might induce severe mental stress, resulting in suicidal ideation.
Objectives	3	To figure out whether recent occurred EHE is more associated with suicidal ideation
Methods		
Study design	4	Cross-sectional study design
Setting	5	the Korean Welfare Panel Study (KoWePS) from 2011 to 2013
Participants	6	*Cross-sectional study*— the Korean Welfare Panel Study (KoWePS) from 2011 to 2013. The total number of analyzed samples was 4,247 out of 5,717 households in the database. We only included households that had never experienced EHE before 2011
		Case-control study— Among 4,247 subjects, 146 (3.4%) experienced suicidal ideation, whereas 4,101 (96.6%) did not.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
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
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) we also performed another analysis using various cut-off values as 20% and 40% for EHE, the latter being the standard of WHO

Continued on next page

Results

Participants	13*	(a) Among 4,247 subjects, 146 (3.4%) experienced suicidal ideation, whereas 4,101 (96.6%) did not. One scale of depression score (CESD-11, Odds ratio (OR)=1.28, Confidential Interval (CI); 1.23–1.34, p <0.001) was associated with increased suicidal ideation. Such ideation was influenced to a greater extent by a recent EHE above ten percent of disposable income (ORs=1.91, CI; 1.16–3.15, p=0.012) than by either a remote EHE (ORs=1.29, CI; 0.71–2.32) or one in both 2011 and 2012 (ORs=1.67, CI; 1.01-2.78, p=0.048).
		(b) he total number of analyzed samples was 4,247 out of 5,717 households in the database. We only included households that had never experienced EHE before 2011
Descriptive data	14*	(a) The general characteristics of primary income earners and households are shown in Table 1. A total of 4,247 households are enrolled in this study. Among them, 146 heads of households (3.4%) reported suicidal ideation once or more during the past year, whereas 4,101 (96.6%) did not. A total number of 76 men (52.1%) and 70 women (47.9%) had suicidal ideation among primary income earners. Moreover, the lowest educated subjects with elementary level of education 65 subjects (44.5%) had higher proportion among the group with suicidal ideation. The average sum of CESD-11 among the subjects with suicidal ideation is 23.15, while the average score among the others is only 18.81. Only five subjects attempted suicide among all primary income earners.
		(b) None of them were missed, because all of them completed surveys.
		Cross-sectional study—. A total number of 76 men (52.1%) and 70 women (47.9%) had suicidal ideation among primary income earners. Moreover, the lowest educated subjects with elementary level of education 65 subjects (44.5%) had higher proportion among the group with suicidal ideation. The average sum of CESD-11 among the subjects with suicidal ideation is 23.15, while the average score among the others is only 18.81. Only five subjects attempted suicide among all primary income earners.
Main results	16	(*a*) Among 4,247 subjects, 146 (3.4%) experienced suicidal ideation, whereas 4,101 (96.6%) did not. One scale of depression score (CESD-11, Odds ratio (OR)=1.28, Confidential Interval (CI); 1.23–1.34, p <0.001) was associated with increased suicidal ideation. Such ideation was influenced to a greater extent by a recent EHE above ten percent of disposable income (ORs=1.91, CI; 1.16–3.15, p=0.012) than by either a remote EHE (ORs=1.29, CI; 0.71–2.32) or one in both 2011 and 2012 (ORs=1.67, CI; 1.01-2.78, p=0.048).
		(*b*)Based on a depressive scale of CESD , we defined the cut-off value as sixteen for potential major depressive disorder.
Other analyses	17	As the official cut-off value in our study is 10%, we performed other values as threshold. The primary income earners are more vulnerable to the high threshold of EHE. When EHE is above 20%, compared to 10%, the odds ratio for suicidal ideation with the EHE in recent one year is increased. (Figure 1) For EHE above 40% of disposable income in the Supplementary table 1, the consecutive two years with EHE is statistical meaningful to the increased odds ratio for suicidal ideation (Model 2; OR=2.67, 95% CI: 1.10–6.46). Since the heads of households with depressive symptoms may have more correlation with suicidal ideation, a subgroup analysis was performed for the primary income earners whose sum of CESD-11 score were sixteen or more (Table 4). The sum of CESD-11 score over sixteen indicates potential risk for major depressive disorder (MDD). In this subgroup analysis, the primary income earners were more vulnerable to the higher EHE. In other words, when EHE were above 20% (in 2012; OR=2.46, 95% CI: 1.57–3.85 / in both 2011 and 2012; OR=1.89, 95% CI: 1.08–3.31) compared to 10% (in 2012; OR=1.98, 95% CI: 1.21–3.22 / in

		both 2011 and 2012; OR=1.86, 95% CI: 1.15–3.02), suicidal ideation was increased.
Discussion		
Key results	18	According to measurements of the temporal association with EHE during 2011 and 2012, the recent one year in 2012 was associated with meaningful increases in ORs for suicidal ideation with the EHE above 10%.
Limitations	19	First, we could not determine casual relationship due to the cross-sectional nature of this study. To overcome this weakness, we divided the occurrences of EHE into four subgroups (none, recent, remote, and both years) in an attempt to analyze temporal causality. Second, we used the suicidal ideation as a dependent variable, not suicidal attempt. Because the number of suicide attempts observed during the study period was minimal to conduct the analysis, we used suicidal ideation. Although a small portion of general population with suicidal ideation eventually tried suicide attempts, suicidal ideation is still one of the powerful indicators to predict suicide attempt. According to one study in Korea, 84% of subjects with suicide attempt had previous suicidal ideation in the last two year23. Moreover, 'someone talking or writing about death, dying, or suicide' is well established consensus warning sign for suicide24. Thus, even suicidal ideation is regarded as important dependent variable for preventing the progress to suicidal attempt and suicide. Third, the number of cases of suicidal ideation may have been too small to determine all associations. Although we observed some statistical trends among independent variables for income level and temporal factors of EHEs, these trends did not reach statistical significance. One reason may be that the KoWePS study included investigations on mental health and suicide only since 2011 regardless of its initiation in 2006. Hence, we could not obtain more data for analysis. Fourth, we excluded other family members except for the primary income earner in households. This panel survey tried to include as many family members as possible; surveys were mainly answered by heads of household who are practical and economic representatives of households. In addition, since family members under nineteen years old did not answer the CESD-11 scale, we could not adjust the depressive symptoms, which is one of the most important factors to suicidal ideation. In this regard, we only included the primary income earners as study population. Fifth, we did not know what kinds of diagnosis categories, including mental and physical illness, were most significant to the occurrence of EHE. Although few researchers studied the attributable medical conditions, the range of them were so wide, defined as chronic diseases or disabled. For example, Choi et al. analyzed that cancer patients with unstable economic status were more vulnerable to EHE than those with stable economic conditions16. In addition, they studied that family members with chronic diseases or disabilities were powerful attributable factors to EHE on household25. However, none of them tried to figure out the most important kinds of disease categories. In this sense, another further study is needed to investigate the disease specific targeted to policy on EHE.
Interpretation	20	This is the first study to examine an association between EHE and suicidal ideation among primary income earners. For them, more severe depressive mood is associated with suicidal ideation. Furthermore, recently occurred and greater EHE might increase suicidal ideation. Although this study has several limitations, a future study could overcome these limitations by altering the characteristics of national and panel data. We also plan to gather a larger number of suicide attempts and suicide mortality cases. In conclusion, we suggest that in order to prevent suicidal ideation and to improve the mental health of individuals especially for primary income earners in households, recent household EHE might be considered
Generalisability	21	As the national stratified data was used, the external validity of the study is quite high.

		However, there are some limitations in the study, we need to do further investigation to prove the hypothesis more clearly.
Other information		
Funding	22	No funding source regarding this study

*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.