



스트레스와 우울증이 미충족 의료수요에 미치는 영향

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The Effect of Stress and Depression on Unmet Medical Needs

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ABSTRACT

Background: Mental health issues such as stress and depression have been regarded as major social problems in Korea. We investigated the relationship between stress and depression with unmet medical needs (UMN). **Methods:** Using the nationwide database of 2010 Korea National Health and Nutritional Examination Survey (K-NHANES), subjects aged 19 years or above were selected (n=6,055). In the K-NHANES questionnaire, subjects were asked about their UMN experience, severity of stress, and perceived depression lasting at least 2 weeks over the past year. The effects of stress and depression on UMN were analyzed in 4 models established by adding predisposing, enabling and need factors in a step-wise fashion. The risks for UMN were also assessed according to the causes of UMN. **Results:** Individuals who felt stress 'very often' (odds ratio (OR) 3.28, 95% CI=2.23-4.86) and 'often' (OR 2.53, 95% CI=1.93-3.31) and who experienced depression (OR 1.68, 95% CI=1.35-2.10) reported significantly elevated UMN rates, and these effects were substantial especially for the individuals who had UMN due to economic constraint. Females, lower education level, lower income, unemployed status, and negative perceptions about health status were found to be additional risk factors for UMN. **Conclusion:** Our results confirmed the risks of stress and depression on UMN. It is strongly advisable to create initiatives to improve mental health, particularly stress and depression, and to fulfill individuals' medical utilization needs.

KEY WORDS: Unmet medical needs, stress, depression, medical utilization

As modern society continually evolves, stress has been regarded as an inevitable byproduct and it's become one of the major social issues, especially in South Korean society.¹⁾ Socio-economic factors could be the reason of physical and psychological mental health, and there is an association with economic recession and stress.^{2,3)} Recently in South Korea, the economic recession problems including increased youth unemployment rate and non-regular employment rate workers have been regarded as typical society stress, and the long term

data support that economic recession make negative mental health outcomes in South Korea.²⁻⁴⁾

Stress can harm people by leading to various forms of emotional and cognitive symptoms such as depression, dissatisfaction, lack of willpower and the inability to make decisions.⁵⁻¹⁰⁾ In addition, depression is another serious societal issue, and has likely contributed to the high suicide rate in Korea.¹¹⁻¹⁴⁾ Previous clinical studies with regard to depression suggested that it can manifest itself in the form of

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various physical symptoms.¹⁵⁻¹⁷⁾ In Chinese study, 35.1% of type 2 diabetes mellitus (T2DM) patients had depression, and they had various physical symptoms such as myocardial infarction, and high body mass index, total cholesterol, triglyceride, and urea compared to non-depression T2DM patients.¹⁸⁾ In Saudi Arabia, more than 37% of diabetes patients were diagnosed with depression and depression was detected in 46.5% among hematological cancers patients.^{19,20)} This in turn, leads to heightened demand for medical services, and general trends show that depression leads to chronic dissatisfaction with medical treatment.^{17,21,22)} Thus, emotional and cognitive factors should be highlighted as primary reasons for increased demand in medical care for individuals experiencing symptoms of stress and depression as much as socio-economic reasons and environmental factors.²³⁻²⁵⁾

At the same time, demand for medical care must be met to result in successful utilization of medical services. Assuming the final outcome is utilization of medical services, unmet medical needs (UMN) occurs prior to the final outcome. UMN can serve as a good index to measuring and evaluating the accessibility of healthcare systems.²⁶⁻²⁸⁾

According to the data from the Korea National Health and Nutritional Examination Survey (K-NHANES) we used, 20.3% of individuals reported that they experienced UMN in 2010, a number that is substantially greater than other countries' (5.1%~13.2%) such as the United States, Canada, Germany, and France.²⁹⁾ Researchers in the United States and Canada have already examined the associations of stress and depression with UMN.^{30,31)} However there has been limited research focused on the effects of stress and depression on UMN in South Korea, even though South Korea led the OECD poll in multiple categories related to stress and depression.^{1,11,32)} This study was therefore designed to examine the impact of stress/depression level on UMN in South Korea.

METHODS

Participants and data

This study was based on the data obtained from the 2010 Korea National Health and Nutritional Examination Survey (K-NHANES) in the first year of the fifth session. K-NHANES is a national surveillance system that collects and evaluates health data from the South Korean population.³³⁾ This data is the result of a survey taken by 3,840 households that includes 8,958 individuals across South Korea from

January to December 2010. The participants involved in the study included individuals who were at least 19 years of age.

Definition of variables

In the K-NHANES, unmet medical needs (UMN) were defined as medical services that the subject was unable to utilize although they sought out. To elaborate, subjects were asked, "In the past year, did you want to utilize medical services but were unable to?" It would be a case of UMN if the subjects' answer was 'yes'. If the answer was 'yes', subjects were asked to elaborate on the cause of UMN and popular choices were the following: (1) economical reason; (2) hospital operational hours did not match with subjects' schedule; (3) mildness of subjects' illness by self-diagnosis; and (4) other reasons.

The self-perception of stress and depression were variables that were taken into account. For the self-perception of stress, subjects were asked how much stress they were feeling in their daily routine. They were asked to give a graded response on the severity of stress: very often; often; occasionally; and a few times or never. As for depression, subjects were asked, "In the past year, have you experienced depression or despair to the point where it disturbs your daily routine for 2 weeks in a row or longer?" and the subject answered 'yes' or 'no'.

Confounding variables consisted of three factors: predisposing factors, enabling factors and need factors based on the framework of the Andersen model. The predisposing factors include gender, age, marital status, and education level. The enabling factors include income level, type of health insurance, possession of private insurance, and employment status. Types of health insurance include national health insurance (NHI) for employed; NHI for unemployed citizens; and Medical aid for vulnerable social group. Private health insurance (PHI) is any additional health insurance subjects possess beyond public health insurance. The need factor consists of subjective health status, limitation to daily routine, hospitalization in the past year, and outpatient treatment in the past 2 weeks.

Analysis

Descriptive analyses for UMN, depression, stress level as well as other confounding variables were performed. The differences between characteristics in subjects that experienced UMN and those who did not was addressed using the Rao-Scott chi-square test.

The effects of stress and depression on UMN were thoroughly

assessed by establishing four models using logistic regression analyses. Model I addressed the relationship between UMN and the two variables (stress and depression) without confounding variables. Model II included predisposing factors. In Model III, enabling factors were added onto Model II. Model IV was an addition of need factors to Model III. The step-by-step additions of factors enabled us to get a better understanding about the relationship between UMN and stress and depression in detail. Lastly, the causes for UMN were divided into four different subgroups for further analysis and for each subgroup, the effect of stress and depression on UMN was analyzed.

Since the K-NHANES data were designed to represent the entire South Korean population, the Rao-Scott chi-square test and survey logistic procedure were used to evaluate the relationship

between categorical variables. C-static method and Hosmer and Lemeshow goodness of fit test were used to evaluate the discrimination and conformity of the models. Significance of the statistics were defined by $p < 0.05$ and all data analyses were performed using the program SAS version 9.2.

RESULTS

The study sample included 6,055 individuals (male: 2,620 and female: 3,435). Table 1 show the UMN, stress, and depression proportions as well as sociodemographic characteristics (predisposing factors), economic status (enabling factors) and subjective health status (need factors) of the participants. While UMN experiences were reported by 20.3% of subjects,

Table 1. Characteristics and unmet medical needs (UMN) experience proportion (%) of sample aged 19 or over from the 2010 Korea National Health and Nutritional Examination Survey (N=6,055)^a.

Characteristics/Response	% ^a	UMN experience (%)	No UMN experience (%)	χ^2 (p-value)
UMN experience		20.3%	79.7%	
Cause for UMN				
Unavailable for hospital operation hours		39.4		
Self-diagnosed as mild illness		25.9		
Economic restrains		17.3		
Others ^b		17.4		
Degree of stress severity				
Very often	4.0	39.4	60.6	148.81 (<.0001)
Often	24.0	30.8	69.2	
Occasionally	59.0	16.3	83.7	
A few times/Never	13.0	13.5	86.5	
Depression disturbed subject's daily routine				
Having depression	12.9	34.1	65.9	61.45 (<.0001)
Not having	87.1	18.3	81.7	
Predisposing Factors				
Gender				
Female	50.5	24.3	75.7	40.29 (<.0001)
Male	49.5	16.3	83.7	
Age				
19~39	40.9	20.5	79.5	1.22 (0.5422)
40~64	45.6	19.7	80.3	
>65	13.5	22.0	78.0	
Marital Status				
Single/divorced	30.7	22.9	77.1	6.03 (0.0141)
Married	69.3	19.2	80.8	
Education				
Elementary or lower	19.7	26.6	73.4	22.43 (<.0001)
Middle school	10.2	19.0	81.0	
High school	37.3	19.3	80.7	
College or higher	32.8	18.2	81.8	

Table 1. Characteristics and unmet medical needs (UMN) experience proportion (%) of sample aged 19 or over from the 2010 Korea National Health and Nutritional Examination Survey (N=6,055)^a.(continued)

Characteristics/Response	% ^a	UMN experience (%)	No UMN experience (%)	χ^2 (p-value)
Enabling Factors				
Income level				11.74 (0.0083)
Q1 (low)	23.4	22.9	83.6	
Q2 (mid-low)	24.6	21.6	80.0	
Q3 (mid-high)	25.1	20.0	78.4	
Q4 (high)	26.9	16.4	77.1	
National health insurance (NHI) ^c				12.24 (0.0022)
Medical aid	2.8	34.2	65.8	
Workplace insurance	58.8	19.8	80.2	
Community insurance	38.4	20.1	79.9	
Supplementary private health insurance (PHI)				3.90 (0.0483)
No PHI	25.1	22.5	77.5	
Having PHI	74.9	19.6	80.4	
Employment status				1.41 (0.2354)
Employed	65.4	20.8	79.2	
Unemployed	34.6	19.4	80.6	
Need Factors				
Self-perception of subjective health status				83.58 (<.0001)
Bad	19.1	32.9	67.1	
Normal	44.6	20.1	79.9	
Excellent	36.3	14.1	85.9	
Limitation to daily routine				71.86 (<.0001)
Having limitation	10.2	36.0	64.0	
No limitation	89.8	18.6	81.4	
Hospitalization in the past year				2.34 (0.1263)
No hospitalization	88.8	20.0	80.0	
Hospitalized	11.2	23.1	76.9	
Outpatient clinic visit in the past 2 weeks				8.81 (0.0030)
No visit	68.5	19.0	81.0	
Having visit	31.5	23.3	76.7	

^aWeighted sample aged 19 years or above for the multistage sampling design of 2010 KNHANES.

^bThe category 'others' include difficulty in transportation, difficulty in making reservation in the clinic, not wanting to wait at the hospital, and few other reasons.

^cWorkplace insurance meant the NHI for employed citizens and community insurance meant the NHI for citizens who are neither employed nor entitled for Medical aid program, such as self-employed citizens.

limited hospital operation time was pointed out as a major reason (39.4%), followed by mild status illness through self-diagnosis (25.9%), and economic constraint (17.3%). Regarding stress perception level, 87.1% of the subjects felt somewhat or beyond stressed in their daily routine. For depression, 12.9% of subjects experienced depression for longer than 2 weeks in the past year (Table 1).

In regards to the need factor, the vast majority of the subjects seemed to be “acceptably healthy”, which included subjects

who thought their subjective health status was ‘normal’ (44.6%) and ‘excellent’ (36.3%), while 19.1% answered ‘bad’. Among the sample, 10.2% of the subjects reported that they were limited in carrying out their daily routine, and 11.2% were hospitalized in the past year.

Table 1 also displayed the associations between UMN experience and socioeconomic factors. The more stressed subject was, the more prone to experience UMN ($p < 0.0001$). Subjects who answered ‘very often stressful’ showed the highest rate of

UMN at 39.4%, while among people who answered 'often', 'occasionally', and 'a few times or never' had UMN of 30.8%, 16.3%, and 13.5% in the order. Subjects who experienced depression for more than 2 weeks in the past year had a significantly higher rate of experiencing UMN (34.1%) versus those who did not experience depression (18.3%). Among predisposing factors, females experienced UMN significantly greater (24.3%) than males (16.3%). People who were single (22.9% vs. 19.2%; $p=0.0141$) or had lower education levels (26.6% for elementary graduate level vs. 18.2-19.3% for other groups; $p<0.0001$) experienced UMN significantly at higher rates compared to married people and those with higher education levels. Survey results for age were not significant and did not show a clear pattern.

Enabling factors such as income level, type of health insurance and having private insurance were significant risk factors affecting UMN experience (Table 1). The rate of experiencing UMN was higher as income levels decreased

($p=0.0083$). The subjects who had Medical Aid (34.3% vs. 19.8-20.1%; $p=0.0022$) and who did not possess private health insurance (22.5% vs. 19.6%; $p=0.0483$) had the highest rate of experiencing UMN in their respective categories. Employment status was not significantly correlated to UMN. .

Subjects with a bad subjective health status (32.9% vs. 14.1-20.1%; $p<0.0001$), who were limited in their daily routine (36.0% vs. 18.6%; $p<0.0001$), and had an outpatient clinic visit in the past 2 weeks (23.3% vs. 19.0%; $p<0.0030$) had significantly more UMN experiences compared to subjects in the opposite groups in their respective categories.

The UMN experiences for individuals that rate their stress as 'very often' or 'often stressful' or that experience depression were significantly higher compared to the reference groups after adjusting for other potential risk factors through Model I to Model IV (Table 2). Among predisposing factors, being female, and those with an education level at or below that of elementary school were significant risk factors associated with

Table 2. Adjusted odds ratio (and 95% confidence intervals) for unmet medical needs (UMN) experience according to risk factors among sample aged 19 years or above ($N=6,055$)^a in the 2010 Korea National Health and Nutrition Examination Survey.

Characteristics/ Response	OR (95% CI)			
	Model I	Model II	Model III	Model IV
Degree of stress severity				
Very often	3.28*** (2.23-4.86)	3.55*** (2.37-5.33)	3.35*** (2.23-5.03)	2.78*** (1.84-4.20)
Often	2.53*** (1.93-3.31)	2.72*** (2.05-3.61)	2.62*** (1.98-3.46)	2.24*** (1.67-3.01)
Occasionally	1.22 (0.96-1.54)	1.33* (1.05-1.68)	1.29 (1.02-1.64)	1.21 (0.94-1.56)
A few times/Never	1.00	1.00	1.00	1.00
Depression disturbed subject's daily routine				
Having depression	1.68*** (1.35-2.10)	1.49*** (1.18-1.88)	1.54*** (1.22-1.95)	1.40** (1.10-1.78)
Not having	1.00	1.00	1.00	1.00
Predisposing Factors				
N/A				
Gender				
Female		1.41*** (1.20-1.66)	1.52*** (1.29-1.80)	1.50*** (1.26-1.78)
Male		1.00	1.00	1.00
Age				
19~39		1.25 (0.94-1.65)	1.15 (0.85-1.57)	1.37 (1.01-1.87)
40~64		1.14 (0.89-1.45)	1.01 (0.76-1.34)	1.11 (0.84-1.47)
>65		1.00	1.00	1.00
Marital Status				
Single/ divorced		1.04 (1.00-1.09)	1.04 (0.99-1.09)	1.04 (0.99-1.09)
Married		1.00	1.00	1.00
Education				
Elementary or lower		1.72*** (1.33-2.23)	1.65*** (1.27-2.13)	1.45** (1.10-1.89)
Middle school		1.19 (0.82-1.73)	1.17 (0.81-1.70)	1.08 (0.75-1.57)
High school		1.09 (0.89-1.34)	1.08 (0.87-1.34)	1.09 (0.87-1.35)
College or higher		1.00	1.00	1.00

Table 2. Adjusted odds ratio (and 95% confidence intervals) for unmet medical needs (UMN) experience according to risk factors among sample aged 19 years or above (N=6,055)^a in the 2010 Korea National Health and Nutrition Examination Survey(continued).

Characteristics/ Response	OR (95% CI)			
	Model I	Model II	Model III	Model IV
Enabling Factors	N/A	N/A		
Income level				
Q1 (low)			1.34 [†] (1.05-1.70)	1.29 [†] (1.01-1.64)
Q2 (mid-low)			1.39 ^{**} (1.10-1.75)	1.32 [†] (1.04-1.68)
Q3 (mid-high)			1.30 (0.98-1.72)	1.27 (0.96-1.70)
Q4 (high)			1.00	1.00
National health insurance (NHI) ^b				
Medical aid			1.55 [†] (1.01-2.38)	1.23 (0.80-1.91)
Workplace insurance			1.06 (0.88-1.28)	1.05 (0.87-1.27)
Community insurance			1.00	1.00
Supplementary private health insurance (PHI)				
Having PHI			0.97 (0.77-1.21)	1.01 (0.80-1.27)
No PHI			1.00	1.00
Employment				
Employed			1.42 ^{***} (1.21-1.67)	1.55 ^{***} (1.31-1.83)
Unemployed			1.00	1.00
Need Factors	N/A	N/A	N/A	
Self-perception of subjective health status				
Bad				1.97 ^{***} (1.47-2.65)
Normal				1.35 [†] (1.09-1.67)
Excellent				1.00
Limitation to daily routine				
Having limitation				1.80 ^{***} (1.37-2.35)
No limitation				1.00
Hospitalization in the past year				
No hospitalization				1.04 (0.79-1.36)
hospitalized				1.00
Outpatient clinic visit in the past 2 weeks				
No visit				0.94 (0.78-1.15)
Having visit				1.00
C-statistic	0.63	0.67	0.68	0.70
Hosmer-Lemeshow test χ^2 (p-value)	3.96 (0.27)	6.53 (0.59)	8.46 (0.39)	5.75 (0.67)

^aWeighted sample aged 19 years or above for the multistage sampling design of 2010 KNHANES.

^bWorkplace insurance meant the NHI for employed citizens and community insurance meant the NHI for citizens who are neither employed nor entitled for Medical aid program, such as self-employed citizens.

Model I: Odds ratios (95% CI) adjusted for stress severity and depression.

Model II: Odds ratios (95% CI) adjusted for Model I + predisposing factors (gender, age, marital state, and education level).

Model III: Odds ratios (95% CI) adjusted for Model II + enabling factors (income, health insurance type, private insurance possession, and employment status).

Model IV: Odds ratios (95% CI) adjusted for Model III + need factors (subjective health status, limitation to daily routine, hospitalization, and outpatient clinic visit).

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

UMN experience in Models II through IV.

In Models III and IV, which incorporated enabling factors, associations between UMN and income level and employment

status were shown to be statistically significant (Table 2). People in the 'low' and 'mid-low' income groups had significantly increased UMN risks compared to those in the 'high' income

group. The adjusted odds ratio (OR) for UMN in employed subjects was 1.42 (95% CI: 1.21-1.67) and 1.55 (95% CI: 1.31-1.83) for Models III and IV, respectively, compared to unemployed individuals. Medical aid beneficiaries had a significantly greater UMN risk (OR: 1.55, 95% CI: 1.01-2.38) compared to other NHI beneficiaries in Model III. However, the significant effect of Medical aid on UMN disappeared in Model IV. It seemed that having supplementary private health insurance had no association with UMN risk (Table 2).

In Model IV where need factors were explained, individuals reporting subjective health status as 'normal' and 'bad' had statistically significant ORs of 1.35 (95% CI: 1.09-1.67) and 1.97 (95% CI: 1.47-2.65), respectively, for UMN needs. Subjects with limitation to daily routine had also significantly increased UMN risks with an OR of 1.80 (95% CI: 1.37-2.35).

Regarding the four subgroup analysis according to the causes of UMN, the Hosmer-Lemeshow test suggested the subgroup of 'other reasons' for UMN was not a good fit with

p-value of 0.0147. For this reason, only three main causes for UMN were considered for analyses (Table 3). Subjects experiencing frequent stress ('very often' and 'often') in their daily routine were more prone to experience UMN for three different reasons: 'unavailable for hospital operation hours', 'self-diagnosed as mild illness' and 'economic constraints' with statistical significance (Table 3). Individuals with depression for two weeks or longer in the past year with economic constraint had significantly ORs for UMN risk of 1.86 (95% CI: 1.09-3.18).

Females were more likely to experience UMN due to 'unavailable for hospital operation hours' (OR 1.65, 95% CI: 1.29-2.12) and 'economic constraints' (OR 1.73, 95% CI: 1.12-2.69). Being under 65 years old was a significant risk factor for UMN due to unavailable hospital operation hours compared to those 65 and over. Marital status and education level were not significant risk factors for UMN across individual UMN reason groups (Table 3).

Table 3. Adjusted odds ratio (and 95% confidence intervals) for unmet medical needs (UMN) experience across the reason of UMN among sample aged 19 years or above (N=6,055)^a in the 2010 Korea National Health and Nutrition Examination Survey.

Characteristics/ Response	Causes of UMN ^b		
	Unavailable for hospital operation hours	Self-diagnosed as mild illness	Economic constraints
Degree of stress severity			
Very often	2.31 (1.10-4.83)	2.94** (1.43-6.03)	4.56*** (2.03-10.25)
Often	2.16 (1.23-3.77)	2.26** (1.29-3.94)	2.85*** (1.57-5.17)
Occasionally	0.94 (0.56-1.58)	1.51 (0.93-2.45)	1.43 (0.81-2.54)
A few times/Never	1.00	1.00	1.00
Depression disturbed subject's daily routine			
Having depression	1.27 (0.89-1.82)	1.09 (0.70-1.69)	1.86* (1.09-3.18)
Not having	1.00	1.00	1.00
Predisposing Factors			
Gender			
Female	1.65*** (1.29-2.12)	0.99 (0.70-1.39)	1.73** (1.12-2.69)
Male	1.00	1.00	1.00
Age			
19~39	3.57*** (1.96-6.50)	0.71 (0.39-1.28)	0.80 (0.41-1.55)
40~64	2.37** (1.34-4.20)	0.98 (0.57-1.68)	0.82 (0.51-1.31)
>65	1.00	1.00	1.00
Marital Status			
Single/divorced	1.04 (0.97-1.11)	1.06 (0.98-1.15)	1.01 (0.90-1.15)
Married	1.00	1.00	1.00
Education			
Elementary or lower	1.10 (0.67-1.78)	1.50 (0.93-2.44)	2.83** (1.31-6.11)
Middle school	0.82 (0.48-1.41)	1.13 (0.70-1.84)	1.86 (0.81-4.31)
High school	1.06 (0.78-1.44)	1.24 (0.84-1.81)	1.41 (0.70-2.86)
College or higher	1.00	1.00	1.00

Table 3. Adjusted odds ratio (and 95% confidence intervals) for unmet medical needs (UMN) experience across the reason of UMN among sample aged 19 years or above (N=6,055)^a in the 2010 Korea National Health and Nutrition Examination Survey(continued).

Characteristics/ Response	Causes of UMN ^b		
	Unavailable for hospital operation hours	Self-diagnosed as mild illness	Economic constraints
Enabling Factors			
Income level			
Q1 (low)	1.19 (0.81-1.74)	1.40 (0.83-2.34)	2.51*** (1.45-4.32)
Q2 (mid-low)	1.14 (0.82-1.59)	1.51 (0.99-2.32)	1.67 (0.91-3.07)
Q3 (mid-high)	0.93 (0.65-1.33)	1.40 (0.90-2.18)	1.41 (0.76-2.61)
Q4 (high)	1.00	1.00	1.00
National health insurance (NHI) ^c			
Medical aid	1.44 (0.53-3.93)	0.84 (0.33-2.14)	1.23 (0.65-2.34)
Workplace insurance	1.07 (0.83-1.37)	1.09 (0.75-1.59)	0.65* (0.45-0.93)
Community insurance	1.00	1.00	1.00
Supplementary private health insurance (PHI)			
Having PHI	1.05 (0.71-1.54)	1.20 (0.77-1.88)	0.87 (0.58-1.32)
No PHI	1.00	1.00	1.00
Employment status			
Employed	4.92*** (3.28-7.37)	1.06 (0.76-1.47)	0.98 (0.60-1.59)
Unemployed	1.00	1.00	1.00
Need Factors			
Self-perception of subjective health status			
Bad	2.62*** (1.71-3.99)	1.21 (0.83-1.77)	2.37** (1.37-4.11)
Normal	1.71*** (1.27-2.31)	1.07 (0.73-1.57)	1.23 (0.73-2.07)
Excellent	1.00	1.00	1.00
Limitation to daily routine			
Having limitation	1.50 (0.97-2.31)	1.66 (1.00-2.74)	2.15*** (1.42-3.26)
No limitation	1.00	1.00	1.00
Hospitalization in the past year			
No hospitalization	1.11 (0.75-1.63)	1.32 (0.81-2.17)	1.89* (1.13-3.19)
Hospitalized	1.00	1.00	1.00
Outpatient clinic visit in the past 2 weeks			
No visit	0.88 (0.67-1.16)	1.02 (0.69-1.49)	0.82 (0.53-1.27)
Having visit	1.00	1.00	1.00
C-statistic	0.78	0.64	0.83
Hosmer-Lemeshow test χ^2 (p-value)	7.40 (0.49)	0.35 (0.90)	9.81 (0.28)

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

^aOdds ratio (95% CI) calculation using multiple logistic regression analyses among subjects aged 19 years or over weighted for the multistage sampling design of KNHANES 2010.^bThe category 'other reasons' among causes of UMN was excluded because Hosmer-Lemeshow test showed that the model was not a good fit since p-value was 0.0147^cWorkplace insurance meant the NHI for employed citizens and community insurance meant the NHI for citizens who are neither employed nor entitled for Medical aid program, such as self-employed citizens.

Among enabling factors, a low income level (OR 2.51, 95% CI: 1.45-4.32) was a significant risk factor for UMN due to 'economic constraints'. For the same subgroup, individuals with workplace-based NHI tended to report significantly less

UMN (OR 0.65, 95% CI: 0.45-0.93) compared to people with community-based NHI. On the other hand, employment status was significant risk factor (OR 4.92, 95% CI: 3.28-7.32) for UMN due to 'unavailable hospital operation hours'.

A relatively lower subjective health status tended to significantly increase the UMN risk for ‘unavailable hospital operation hours’ and ‘economic constraints’ reason (Table 3). Daily activity limitation was a significant risk factor for UMN experience in UMN groups due to ‘economic constraints’ (OR 2.15, 95% CI: 1.42-3.26). While not having a hospitalization history was a significant risk factor (OR 1.89, 95% CI: 1.13-3.19) for expecting UMN due to ‘economic reason’, an outpatient clinic visit within 2 weeks was not a significant risk factor across the three reasons for UMN.

DISCUSSION

This study revealed that stress and depression levels are significantly correlated with UMN. Furthermore, stress and depression levels proved to be important risk factors in causing UMN in models where predisposing, enabling and need factors of individuals were controlled. Subjects that responded that they ‘often’ and ‘very often’ feel stress during their daily routine had 2.24 times and 2.78 times the OR of group that answered ‘a few times or never’, respectively. Similar pattern could be observed for depression as depressed subjects had 1.4 times higher risk of OR for experiencing UMN.

Our finding that subjects who felt stressed in their daily routine were significantly more prone to experiencing UMN was consistent but slightly more drastic compared to the results of a previous Canadian study.³⁰⁾ It reported that patients who suffered from stress in the past year were 1.8 times more prone to experience UMN, and patients who experienced ‘extreme stress’ had 1.4 times the higher risk of experiencing UMN.³⁰⁾ Regarding depression, previous studies conducted in the United States indicated that depressed subjects were more likely to report UMN which supports our results.³⁴⁻³⁶⁾ For instance, a study about the survivors of World Trade Center terrorist attacks reported that one-third of people who had posttraumatic stress disorder or depression experienced UMN.³⁶⁾

We suspect that for stressed and depressed subjects, emotional and cognitive factors played a role in experiencing UMN and producing a high UMN rate. When a person is stressed or depressed, their perception of stress and depression levels may be exaggerated, causing them to seek mental healthcare services even though it is unnecessary. However, from a clinician’s perspective, the stress level was not severe enough to provide substantive medical care that the patient was expecting for successful treatment. Such subjects most

likely did not get the help they desired, which in effect substantially contributed to the rise of UMN rates.

Besides, our results revealed that specific factors explained significant associations with UMN. Among predisposing factors, being female and a lower education level were strongly linked with high UMN rates. Among enabling factors, low income level, medical aid from the NHI and being employed increased the rate of experiencing UMN. For need factors, poor self-perceived health status and limitation of daily activity were important risk factors. Among the group for whom economic constraints cause UMN, people who were not hospitalized in the past year had significantly increased UMN occurrence rate, which indicates that financial problems might lead to inadequate inpatient treatment.

While the effect of stress was not significant for the group reporting ‘unavailable hospital hours’, as a cause for UMN, its elevated risk effects persisted in the other two UMN reason groups: self-diagnosed as mild illness and economic constraints. Depressive symptoms were found to be a significant risk factor only for the individuals who had UMN due to economic constraint. These results suggest that stress and depression might not need to be given much concern in regards to UMN risk due to subjects’ busy schedule with little time to visit hospitals. However, for individuals who experienced UMN due to self-diagnosing their status as a mild illness, the severe stress levels in their daily routine might affect the results of their self-diagnosis and their decision to utilize medical services. Also, the risks of stress and depression on UMN should be especially taken into consideration for the economically impoverished.

There are several similar studies conducted in Canada with some contrasting results regarding these factors. For example, in Ontario, Canada, young age was an important risk factor in causing UMN while those in the older age group reported significantly higher rate of UMN in Atlantic Canada.^{31,37)} Age was not a significant factor related to UMN in our data and among urban residents of British Columbia.³⁰⁾ However, common factors contributing to higher UMN rate were being female, a lower income, and negative self-perception of one’s health status which highlighted the point that the source of UMN cannot be channeled into a single factor.

Although our study did not focus on the societal issues such as suicide, stress and depression are serious societal problems, which could be directly coupled with a high suicide rate.^{1,11,38)} Fierce competition and rapid growth as a nation could have

resulted in high levels of stress and depression, which eventually became strongly correlated with UMN. While economic constraints were substantially correlated with UMN, our result showed that employment status was a risk factor for people who had UMN due to unavailable hospital operational hours. Thus, the entire society needs to be improved for satisfying the medical needs of individuals in the workplace. Those with a lower income level and lower education had a higher risk of UM. In order to address the high UMN rate and to repair the mental health status of the South Korean citizens, overall quality of life must be improved in addition to developing new policies to target at-risk populations to lower stress and depression levels. Furthermore, through prolonged public efforts, the accessibility of mental health profession should be addressed in the society of South Korea.

This study was not without limitations. First, it was unclear whether subjects could be regarded as clinically depressed in practice in terms of their frequency of stress and depression. Second, the UMN subjects may have reported the ‘qualitative’ aspects of the medical care they received rather than the access ‘itself’ or ‘quantitative aspects’ of their medical needs. Third, although data from the 2010 K-NHANES had a representative sample of the South Korean population, it was difficult to state the causal relationship between UMN and the two variables (stress and depression) due to a cross-sectional study design. To elaborate, the order of time points along the past year for the occurrence of stress and depression and the experience of UMN asked to subjects in the questionnaire could be reversed due to subjects’ recall bias.

CONCLUSION

In conclusion, our research demonstrated the strong positive association between UMN and the severity of stress and depression from a substantial sample size. The risk of stress and depression was substantially prominent especially for the group who reported UMN due to economic constraints. In addition to enabling factors such as lower income level and employment, being female, a lower education level, poor self-perceived health status, and limitation to daily activities were all important risk factors linked to higher UMN rate. Considering the substantial impact of stress and depression on the UMN of individuals, policies to enhance overall quality of life in addition to specific programs designated to prevent and manage stress and depression levels should be developed.

Availability of data and material

The database we used was the nationwide database of 2010 Korea National Health and Nutritional Examination Survey (K-NHANES) which can be downloaded from the K-NHANES website <https://knhanes.cdc.go.kr/knhanes/eng/index.do>.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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