

## Original Article

J Prev Med Public Health 2013;46:147-154 • <http://dx.doi.org/10.3961/jpmph.2013.46.3.147>

pISSN 1975-8375 eISSN 2233-4521

# Medical Care Utilization During 1 Year Prior to Death in Suicides Motivated by Physical Illnesses

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**Objectives:** Many epidemiological studies have suggested that a variety of medical illnesses are associated with suicide. Investigating the time-varying pattern of medical care utilization prior to death in suicides motivated by physical illnesses would be helpful for developing suicide prevention programs for patients with physical illnesses.

**Methods:** Suicides motivated by physical illnesses were identified by the investigator's note from the National Police Agency, which was linked to the data from the Health Insurance Review and Assessment. We investigated the time-varying patterns of medical care utilization during 1 year prior to suicide using repeated-measures data analysis after adjustment for age, gender, area of residence, and socioeconomic status.

**Results:** Among 1994 suicides for physical illness, 1893 (94.9%) suicides contacted any medical care services and 445 (22.3%) suicides contacted mental health care during 1 year prior to suicide. The number of medical care visits and individual medical expenditures increased as the date of suicide approached ( $p < 0.001$ ). The number of medical care visits for psychiatric disorders prior to suicide significantly increased only in 40- to 64-year-old men ( $p = 0.002$ ), women  $< 40$  years old ( $p = 0.011$ ) and women 40 to 64 years old ( $p = 0.021$ ) after adjustment for residence, socioeconomic status, and morbidity.

**Conclusions:** Most of the suicides motivated by physical illnesses contacted medical care during 1 year prior to suicide, but many of them did not undergo psychiatric evaluation. This underscores the need for programs to provide psychosocial support to patients with physical illnesses.

**Key words:** Suicide, Medical care research, Mental disorders

## INTRODUCTION

The suicide rates of the Republic of Korea (ROK) have been

**Received:** February 25, 2013; **Accepted:** April 29, 2013

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the highest among developed countries since 2003, reaching 31.2 per 100 000 inhabitants in 2010 [1]. Many epidemiological studies have suggested that a variety of medical illnesses such as cancer [2-5], diabetes mellitus [6], and spinal cord injury [7] are associated with suicide. These physical illnesses are attributed to 25% of suicides, and the percentage increases with age [8]. A case-control study using psychological autopsy data suggested that physical illness is the most frequent life problem related to suicide and contributes to 62% of suicides in older people [9]. Considering that the suicide rates of the elderly in the ROK have been increasing [10], it is necessary to develop suicide prevention programs for patients with physi-

cal illnesses.

In line with this, investigating the time-varying pattern of medical care utilization, including mental health care, prior to suicide would be helpful. A previous study on the pattern of medical care utilization prior to suicide was conducted in the ROK [11], but the issue of suicides motivated specifically by physical illnesses has not been elucidated. Previous studies have suggested that less than 10% of the elderly contact mental health care during 1 year prior to suicide although more than 30% of all ages do [12] and 40% of older suicides are motivated by chronic physical illnesses in the ROK [13]. Collectively, suicides motivated by physical illnesses might access mental health care less frequently than other suicides, and their pattern of medical care utilization would need to be assessed, including demographic factors influencing the pattern. Thus, this study concentrated on the pattern of medical care utilization including mental health care during 1 year prior to death in suicides motivated by physical illnesses.

## METHODS

### Data Sources

To investigate medical care utilization during 1 year prior to death in suicides motivated by physical illness, we obtained data from the National Police Agency and Health Insurance Review and Assessment (HIRA). The National Police Agency provided data on 8413 suicides in 2004 identified by the investigator's notes, which included the motivation for suicide. Physicians (KT Moon and JY Park) reviewed the findings in the investigator's notes and found that 2169 suicides (25.8%) were motivated by physical illnesses such as cancer, chronic obstructive pulmonary disease (COPD), dementia, and disability [13]. Among 2169 deaths described as suicides by the investigator's notes, 1994 subjects were confirmed as suicides by the researchers of previous studies [11,14]. Information on medical care utilization during 1 year prior to suicide was obtained by linking to the data from HIRA. The data consisted of a diagnosis code according to the International Classification of Diseases, 10th revision, the date of diagnosis, medical expenditures, and health insurance premium rates. We excluded the last medical care utilization data from the analysis because suicide could be reported during the last hospital care or admission and this case could be related to a fatal suicide attempt. The institutional review board of Yonsei University Health System approved this study (approval number 4-201-0273).

### Statistical Analysis

Demographic variables such as age, gender, area of residence, and socioeconomic status were considered to be confounders related to medical care utilization [15]. The study population was categorized into three age groups: <40, 40 to 64, and  $\geq 65$  years of age. We acquired information on the area of residence classified as metropolitan, urban, or rural. Based on the health insurance premium rate, socioeconomic status was divided into quintiles and the lowest quintile (quintile 1) included Medical Aid beneficiaries. Comparisons of age, gender, residence, and socioeconomic status with the demographics of those who had not contacted medical services during the same period were conducted with chi-squared tests. We performed multiple logistic regression analysis to examine factors associated with not contacting medical care during 1 year prior to suicide. As described in a previous study [11], the time-varying patterns of medical care utilization in suicides for physical illness were analyzed across quarters during a year prior to suicide. We used repeated-measures data analysis ('proc mixed' procedure) after adjusting for age, gender, residence, and socioeconomic status. Interaction terms (quarter  $\times$  age group, quarter  $\times$  gender, quarter  $\times$  residence, and quarter  $\times$  socioeconomic status) were included in the statistical models, and none was significant. Subgroup analyses of medical care visits for any reason were conducted after stratification of disease groups: cancer (C00-C99), hypertension (I10-I15), diabetes mellitus (E10-E14), ischemic heart disease (I20-I25), and COPD including asthma (J40-J46). After stratification of age and gender, we analyzed the pattern of medical care visits for psychiatric disorders (F00-F99) after adjusting for residence, socioeconomic status, and diseases. Statistical analyses were performed using SAS version 9.2 (SAS Institute, Cary, NC, USA), and all analyses were blinded to the identity of suicides by the use of randomly generated identification numbers.

## RESULTS

Among 1994 suicides for physical illness, the number of  $\geq 65$ -year-old suicides was 1216 (61.0%), while 1893 (94.9%) suicides contacted medical care services during 1 year prior to suicide (Table 1). Comparisons between those who contacted medical care during 1 year prior to suicide and those not making any contacts showed significant differences in their age ( $p < 0.001$ ), gender ( $p = 0.006$ ), and socioeconomic status ( $p = 0.013$ ). The median values (interquartile range) in the number

**Table 1.** General characteristics of suicides motivated by physical illnesses

	Total (n = 1994)	Medical care utilization (n = 1893)	No medical care utilization (n = 101)	p-value
Age (y)				
< 40	117 (5.9)	99 (5.2)	18 (17.8)	<0.001
40-64	661 (33.2)	618 (32.6)	43 (42.6)	
≥ 65	1216 (61.0)	1176 (62.1)	40 (39.6)	
Gender				
Men	1253 (62.8)	1176 (62.1)	77 (76.2)	0.006
Women	741 (37.2)	717 (37.9)	24 (23.8)	
Residence				
Metropolitan	648 (32.5)	614 (32.4)	34 (33.7)	0.86
Urban	1053 (52.8)	999 (52.8)	54 (53.5)	
Rural	293 (14.7)	280 (14.8)	13 (12.9)	
Socioeconomic status <sup>1</sup>				
Quintile 1	701 (35.2)	663 (35.0)	38 (37.6)	0.013
Quintile 2	301 (15.1)	281 (14.8)	20 (19.8)	
Quintile 3	318 (16.0)	295 (15.6)	23 (22.8)	
Quintile 4	312 (15.7)	299 (15.8)	13 (12.9)	
Quintile 5	362 (18.2)	355 (18.8)	7 (6.9)	
Medical care utilization during 1 year prior to suicide				
No. of visits, median (IQR)	16 (8, 25)			
Total medical expenditures (in thousands of Korean won), median (IQR)	905 (231, 2664)			
Cancer (C00-C99)	291 (14.6)			
Hypertension (I10-I15)	595 (29.8)			
Diabetes mellitus (E10-E14)	374 (18.8)			
Ischemic heart disease (I20-I25)	124 (6.2)			
Chronic obstructive pulmonary disease or asthma (J40-J46)	347 (17.4)			
Psychiatric disorder (F00-F99)	445 (22.3)			

Values are expressed as number (%) unless otherwise indicated.

IQR, interquartile range.

<sup>1</sup>Based on the health insurance premium rate. Quintile 1 included Medical Aid beneficiaries.

of medical care visits and total medical expenditures during 1 year prior to suicide were 16 (17) and 904 605 won (2 433 020 won), respectively (where 1 000 000 won is approximately 1000 US dollar). The number of suicides who had medical care visits for psychiatric disorders was 445 (22.3%). In multiple logistic regression analysis, several characteristics including being <40 years old (vs. ≥ 65 years old; odds ratio [OR], 5.04; 95% confidence interval [CI], 2.76 to 9.19), men (OR, 1.75; 95% CI, 1.08 to 2.83), and the lowest socioeconomic status (vs. the highest; OR, 2.57; 95% CI, 1.12 to 5.87) were associated with not contacting medical care during 1 year prior to suicide (data not shown).

In Table 2, the number of medical care visits during a year prior to suicide showed the same median values in quarters,

but the temporal changes in the number of visits were statistically significant across quarters ( $p < 0.001$ ). Among age groups and gender, there were significant differences ( $p < 0.001$ ,  $p < 0.001$ ), but no differences for residence ( $p = 0.093$ ) or socioeconomic status ( $p = 0.087$ ).

Individual medical expenditures remarkably increased as the date of suicide approached ( $p < 0.001$ ), as shown in Table 3. The medical expenditures showed no differences by gender ( $p = 0.400$ ) or residence ( $p = 0.905$ ), but the differences among age groups ( $p < 0.001$ ) and socioeconomic status ( $p = 0.019$ ) were significant.

After stratification by disease group (Table 4), the number of medical care visits was found to have increased significantly during 1 year prior to suicide, with the exception of individuals

**Table 2.** The pattern of medical care utilization during 1 year prior to death in suicides motivated by physical illnesses

	No. of medical care visits in individuals				p-value
	12-10 mo prior to suicide	9-7 mo prior to suicide	6-4 mo prior to suicide	Last 3 mo prior to suicide	
Total subjects	4.0 (1.0, 6.0)	4.0 (1.0, 6.0)	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	<0.001 <sup>1</sup>
Age (y)					
<40	1.0 (0.0, 4.0)	1.0 (0.0, 4.0)	2.0 (0.0, 5.0)	2.0 (0.0, 5.0)	<0.001
40-64	3.0 (1.0, 6.0)	3.0 (1.0, 6.0)	3.0 (2.0, 6.0)	4.0 (1.0, 7.0)	
≥65	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	
Gender					
Men	3.0 (1.0, 6.0)	3.0 (1.0, 6.0)	4.0 (1.0, 7.0)	4.0 (2.0, 6.0)	<0.001
Women	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	5.0 (2.0, 8.0)	
Residence					
Metropolitan	4.0 (1.0, 7.0)	4.0 (1.0, 7.0)	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	0.09
Urban	3.0 (1.0, 6.0)	4.0 (1.0, 6.0)	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	
Rural	4.0 (1.0, 7.0)	4.0 (2.0, 6.0)	4.0 (2.0, 8.0)	4.0 (2.0, 8.0)	
Socioeconomic status <sup>2</sup>					
Quintile 1	4.0 (1.0, 6.0)	4.0 (2.0, 6.0)	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	0.09
Quintile 2	3.0 (1.0, 6.0)	3.0 (1.0, 6.0)	3.0 (2.0, 6.0)	3.0 (1.0, 6.0)	
Quintile 3	3.0 (1.0, 6.0)	4.0 (1.0, 6.0)	3.0 (2.0, 6.0)	4.0 (2.0, 7.0)	
Quintile 4	3.0 (1.0, 6.0)	3.0 (1.0, 6.5)	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	
Quintile 5	4.0 (2.0, 6.0)	4.0 (2.0, 7.0)	4.0 (2.0, 8.0)	5.0 (2.0, 7.0)	

Values are expressed as median (interquartile range).

<sup>1</sup>Significant difference among quarters (within-group). Other p-values refer to among subgroups (between-group); using repeated-measures data analysis after adjusting for age, gender, residence, and socioeconomic status.

<sup>2</sup>Based on the health insurance premium rate. Quintile 1 included Medical Aid beneficiaries.

with ischemic heart disease ( $p=0.391$ ). In terms of medical expenditures, individuals with cancer ( $p<0.001$ ), hypertension ( $p<0.001$ ), diabetes mellitus ( $p<0.001$ ), ischemic heart disease ( $p=0.022$ ), and COPD ( $p<0.001$ ) showed significant increases across quarters.

Among the six age/gender groups (Figure 1), the number of medical care visits for psychiatric disorders prior to suicide significantly increased in 40- to 64-year-old men ( $p=0.002$ ), <40-year-old women ( $p=0.011$ ), and 40- to 64-year-old women ( $p=0.021$ ) after adjustment for residence, socioeconomic status, and morbidity.

## DISCUSSION

Suicides motivated by physical illnesses had contact with medical care services more frequently and spent more on medical services as suicide approached. The number of medical care visits for psychiatric disorders also showed an increase during 1 year prior to suicide in underlying disease groups including cancer and COPD. As expected, more subjects accessed medical care during 1 year prior to death in suicides motivated

by physical illnesses (94.9%) than among all suicides (83.7%) [11]. However, about 5% of suicides motivated by physical illnesses did not receive medical care during 1 year prior to suicide, and they were more likely to be <65-year-old men with low socioeconomic status. Under the detailed review of the investigator's notes, it was found that suicides without medical care utilization during 1 year prior to suicide included ≥65-year-old suicides with dementia and <65-year-old suicides with disability due to stroke or spinal cord injury. The disabled are known to be at high risk of suicide [16], and in case of dementia, its association with suicide is unclear, but depression could be the prodromal symptom of dementia [17]. Disabled and dementia patients are less likely to contact medical care prior to suicide, so community support programs need to be developed and maintained for suicide prevention.

Among suicides motivated by physical illness, 22.3% accessed medical care for psychiatric disorders, and the percentage was lower than that of all suicides (25.0%) in 2004. Those who contacted mental health care included patients with hypertension (32.1%), COPD (20.7%), diabetes mellitus (20.2%), and cancer (12.6%). In Western countries, it is known that about

**Table 3.** Total medical expenditures (in thousands of Korean won) during 1 year prior to death in suicides motivated by physical illnesses

	12-10 mo prior to suicide	9-7 mo prior to suicide	6-4 mo prior to suicide	Last 3 mo prior to suicide	p-value
Total subjects	82 (18, 296)	85 (20, 311)	108 (23, 454)	153 (28, 746)	<0.001 <sup>1</sup>
Age (y)					
<40	23 (0, 155)	18 (0, 162)	48 (0, 279)	57 (0, 371)	<0.001
40-64	78 (12, 353)	75 (14, 315)	114 (23, 618)	162 (23, 914)	
≥65	89 (24, 295)	98 (28, 319)	112 (28, 406)	156 (38, 698)	
Gender					
Men	69 (11, 290)	73 (15, 285)	95 (20, 459)	128 (22, 746)	0.40
Women	106 (28, 305)	106 (28, 339)	124 (30, 450)	203 (42, 739)	
Residence					
Metropolitan	85 (19, 348)	88 (24, 349)	112 (23, 421)	156 (33, 795)	0.91
Urban	77 (17, 283)	81 (17, 285)	101 (22, 491)	141 (27, 736)	
Rural	92 (18, 266)	106 (28, 327)	122 (29, 440)	182 (32, 727)	
Socioeconomic status <sup>2</sup>					
Quintile 1	94 (18, 319)	102 (24, 353)	124 (22, 505)	161 (34, 761)	0.02
Quintile 2	60 (18, 232)	59 (14, 208)	78 (21, 349)	106 (18, 415)	
Quintile 3	76 (14, 272)	86 (17, 282)	81 (18, 368)	101 (18, 565)	
Quintile 4	80 (17, 308)	75 (18, 281)	119 (30, 559)	156 (29, 782)	
Quintile 5	80 (20, 330)	95 (26, 391)	112 (30, 429)	207 (50, 1016)	

Values are expressed as median (interquartile range).

<sup>1</sup>Significant difference among quarters (within-group). Other p-values refer to among subgroups (between-group); using repeated-measures data analysis after adjusting for age, gender, residence, and socioeconomic status.

<sup>2</sup>Based on the health insurance premium rate. Quintile 1 included Medical Aid beneficiaries.

**Table 4.** The pattern of medical care utilization during 1 year prior to death in suicides motivated by physical illnesses after stratification of disease group

	12-10 mo prior to suicide	9-7 mo prior to suicide	6-4 mo prior to suicide	Last 3 mo prior to suicide	p-value <sup>1</sup>
No. of medical care visits					
Cancer	4.0 (2.0, 7.0)	5.0 (3.0, 8.0)	6.0 (3.0, 9.0)	6.0 (4.0, 8.0)	<0.001
Hypertension	5.0 (3.0, 8.0)	5.0 (3.0, 8.0)	6.0 (3.0, 8.0)	6.0 (3.0, 8.0)	0.003
Diabetes mellitus	5.0 (3.0, 8.0)	5.0 (3.0, 8.0)	6.0 (3.0, 8.0)	6.0 (3.0, 9.0)	<0.001
Ischemic heart disease	5.0 (3.0, 8.0)	6.0 (3.0, 9.0)	6.0 (3.0, 8.0)	6.0 (3.0, 9.0)	0.39
COPD or asthma	5.0 (3.0, 8.0)	5.0 (3.0, 8.0)	6.0 (3.0, 9.0)	6.0 (4.0, 9.0)	<0.001
Medical expenditures (in thousands of Korean won)					
Cancer	168 (36, 758)	195 (59, 1005)	560 (100, 1908)	1116 (265, 2862)	<0.001
Hypertension	131 (46, 381)	136 (47, 402)	160 (48, 534)	204 (61, 736)	<0.001
Diabetes mellitus	133 (52, 486)	160 (59, 583)	235 (76, 945)	272 (68, 1333)	<0.001
Ischemic heart disease	182 (56, 580)	184 (71, 703)	240 (37, 821)	426 (74, 1412)	0.02
COPD or asthma	137 (50, 363)	162 (57, 486)	219 (71, 742)	248 (85, 1053)	<0.001

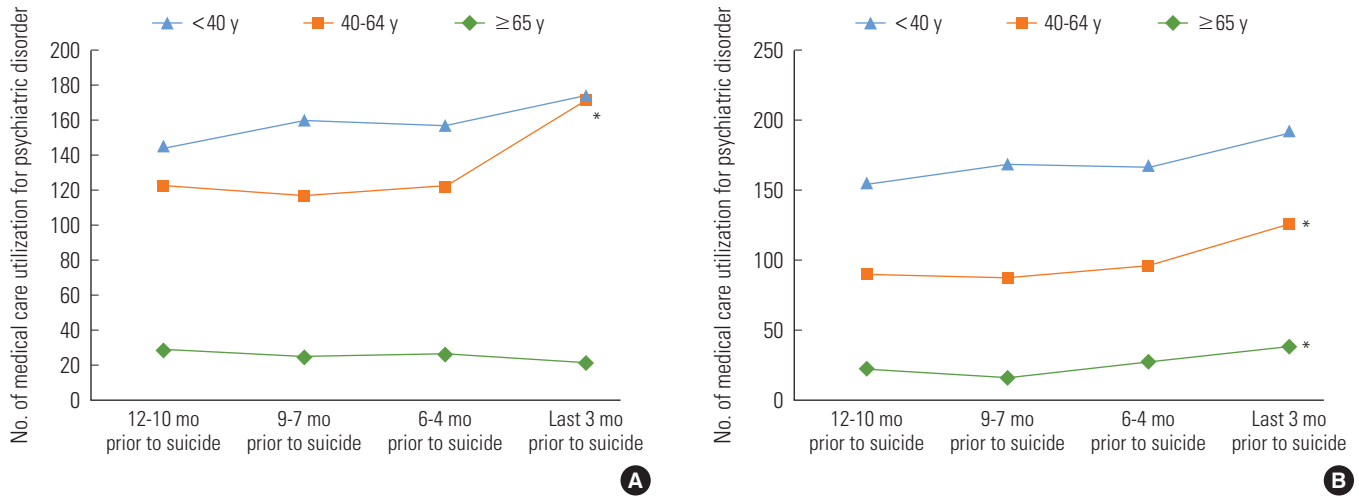
Values are expressed as median (interquartile range).

COPD, chronic obstructive pulmonary disease.

<sup>1</sup>Significant difference among quarters (within-group); using repeated-measures data analysis after adjusting for age, gender, residence, and socioeconomic status.

90% of suicides are associated with underlying psychiatric disorders [18,19], but the relationship between underlying psychiatric disorders and suicide might be weaker in Asian coun-

tries [20]. A Chinese psychological autopsy study suggested that 48% of suicides aged 15 to 34 years had underlying psychiatric disorders [21]. Comparing the present study to the



**Figure 1.** The total number of medical care utilization for psychiatric disorder (F00-F99) during 1 year prior to death in suicides motivated by physical illnesses after stratification of age and gender, separately by gender (A: men, B: women). \* $p < 0.05$ ; Significant differences among quarters (within-group); using repeated-measures data analysis after adjusting for residence, socioeconomic status, and morbidity (cancer, hypertension, diabetes mellitus, ischemic heart disease, chronic obstructive pulmonary disease or asthma).

Chinese study might be inadequate because our study subjects included all ages, but further analysis showed that 31.3% of suicides for physical illness aged 15 to 34 years accessed medical care for psychiatric disorders. In light of the findings from the Chinese study, the percentage of those who underwent psychiatric consultation might be lower than that of suicides who have suffered from underlying psychiatric disorders. That is, most of suicides motivated by physical illnesses underwent medical care during 1 year prior to suicide, but many of them did not undergo psychiatric evaluation. This underscores the need for programs to provide psychosocial support to patients with physical illnesses. In practice, for example, psychosocial interventions such as patient education and social support for cancer patients is effective for improving the quality of life [22], which is inversely associated with increased risk for suicide [23].

Among suicides with physical illness, 291 (14.6%) suicides received medical care for cancer in the present study, but previous studies showed that 649 (5.6%) cancer patients were included in all suicides in 2004 [11,14]. This suggests that every patient with cancer among suicides might not be motivated by cancer, but the discrepancy could also be derived from the fact that the number of unknown motivations for suicide was 2355 (28.0%) in the data from the National Police Agency. In addition, the remarkable increase in medical costs over time prior to suicide in the present study suggests that economic instability might contribute to the motivation toward suicide

in addition to disease severity, its treatment, or psychosocial response to progression [5].

Age and gender are well-known factors related to medical care utilization, and the frequency of medical care utilization is higher in the elderly and women [24]. In terms of the number of medical care visits, there were statistically significant differences among age groups and between men and women in the present study, with the 65-year-old or older group and women accessing medical care more frequently, as expected. Meanwhile, there was no notable difference among metropolitan, urban, and rural area of residence in either the number of visits or the medical expenditures, which is consistent with a previous study comparing health service utilization in urban and rural Korea [25]. The difference in socioeconomic status was observed only in total medical expenditures, and a notable finding was that the lowest socioeconomic level showed relatively high costs compared to the other groups throughout the whole period and the highest socioeconomic level showed a dramatic increase during the last 3 months prior to suicide. This suggests that patients with chronic physical illness requiring medical expenditures for long periods of time might fall to the lowest socioeconomic level and have severe psychosocial stress, leading to suicide motivated by chronic physical illness. Furthermore, those with the highest socioeconomic status might be newly diagnosed as having severe physical illness requiring massive treatment, followed by sudden econom-



ic instability and psychosocial stress. This highlights the need for short-term intensive intervention in addition to long-term management for suicide prevention in patients with chronic physical illnesses in health care.

The proportion of the elderly was the highest among suicides motivated by physical illnesses, which is consistent with previous studies that suggested physical illness was associated with higher suicide risk among the elderly [9,26,27]. After stratification of age and gender, 40- to 64-year-old suicides motivated by physical illnesses contacted mental health care significantly more frequently during the last quarter prior to suicide compared to the first quarter, but the difference was not observed to be significant in the elderly. According to previous studies, most depressed older patients are undiagnosed or misdiagnosed as physical illnesses [28-30]. Besides, depression tends to be manifested by physical symptoms rather than psychiatric symptoms more in the Asian elderly [31]. Therefore, strategies for suicide prevention should include early detection of suicidal thoughts and prompt intervention, and education and training in suicide prevention should be mandatory in general practitioners or other non-psychiatric physicians [32].

The present study identified suicides motivated by physical illnesses using national data. Through national record linkage, we conducted the first study, to our knowledge, on the pattern of medical care utilization in suicides motivated by physical illnesses. However, several limitations should be noted. First, the motivation toward suicide in the findings of the investigator's notes was arbitrarily classified. However, this might be inevitable because the investigator's note had no common form for its terms about the motivation for suicide. In addition, we regarded any obscurity and any discordance between two physicians' classification as unknown reasons ( $n=2355$ , 28.0%), and this might have caused the number of suicides for physical illnesses to be underestimated. Second, suicide data from the National Police Agency did not cover all suicides, so this would lead to a discrepancy with the national death statistics ( $n=11\,523$ ). The number of common suicides between suicide data from the National Police Agency and the national death statistics was 7744 (67.2%), and it was revealed that 669 subjects were not suicides by post-mortem examination. To reduce the incompleteness of data, further psychological autopsy studies including post-mortem examination and in-depth interviews with family members and close associates [33] would be needed. Nonetheless, the data from the National Police Agency is the most accessible information on the motivations

for suicides in a limited setting, so it could be a basis on which to conduct further psychological autopsy studies.

A majority of suicides motivated by physical illnesses received medical care services during 1 year prior to suicide, and medical expenditures significantly increased prior to suicide. Focusing on psychiatric disorders, suicides motivated by physical illnesses contacted psychiatrists more frequently as the date of suicide approached. However, the pattern of increase in the number of visits was significant only in the 40-to 64-year-old men and women after stratification by age and gender. The proportion of those who had contact with psychiatrists among suicides motivated by physical illnesses was lower than that of suicides overall. Suicide prevention strategies for suicides motivated by physical illnesses such as psychosocial support and education for early detection of suicidal thoughts should be implemented with consideration for these characteristics of medical care utilization including mental health care.

## ACKNOWLEDGEMENTS

This study was supported by Yonsei University College of Medicine, Seoul, Korea (grant number 6-2011-0116).

## CONFLICT OF INTEREST

The authors have no conflicts of interest with the material presented in this paper.

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