JCN Open Access ORIGINAL ARTICLE

pISSN 1738-6586 / eISSN 2005-5013 / J Clin Neurol 2017;13(1):55-61 / https://doi.org/10.3988/jcn.2017.13.1.55

Association between Stroke Status and Depression in a Community Setting: The 2014 Korea National Health and Nutrition Examination Survey

Mina Kim[a,b]
Gyung-Jae Oh[c,d]
Young-Hoon Lee[c,d]

[a]Department of Nursing, Graduate School, Chonnam National University, Gwangju, Korea
[b]Department of Counseling Psychology, Graduate School of Dongshin University, Naju, Korea
[c]Department of Preventive Medicine & Institute of Wonkwang Medical Science, Wonkwang University School of Medicine, Iksan, Korea
[d]Regional Cardiocerebrovascular Center, Wonkwang University Hospital, Iksan, Korea

Background and Purpose Previous studies have examined the risk factors for depression in stroke patients, but little information is available on the relationship between stroke status and depression in the community-dwelling general population. We evaluated the association between stroke status and depression using representative nationwide data.

Methods In total, 3,487 subjects (aged ≥40 years) who participated in version VI-2 of the sixth Korea National Health and Nutrition Examination Survey (KNHANES) performed in 2014 were included. We compared the prevalence of depression in 120 community-dwelling stroke patients and 3,367 nonstroke controls using the nine-item Patient Health Questionnaire (PHQ-9).

Results The prevalence of depression (PHQ-9 score ≥10) was 16.7% in stroke patients and 6.4% in controls. In the unadjusted model, depression was more common in stroke patients than in nonstroke controls [odds ratio (OR), 2.95; 95% confidence interval (CI), 1.79−4.86]. After adjusting for demographic characteristics, socioeconomic status, health-related behaviors, and comorbidities, stroke diagnosis was a significant risk factor for depression (OR, 1.85; 95% CI, 1.06−3.24). Specifically, a diagnosis of stroke in patients aged <60 years (OR, 3.82; 95% CI, 1.81−8.09) and the presence of stroke complications (OR, 2.77; 95% CI, 1.25−6.13) remained significant risk factors for depression even after adjusting for potential confounders.

Conclusions In a community setting, poststroke survivors had a higher prevalence of depression, and stroke was an independent risk factor for depression. Public psychosocial interventions are needed to improve the mental health care of community-dwelling stroke survivors.

Key Words stroke, depression, community, Korea National Health and Nutrition Examination Survey.

INTRODUCTION

Stroke is the third leading cause of death in Korea.[1] Although recent data have shown a gradual decreasing trend in the age-adjusted mortality rate for stroke,[2,3] the socioeconomic burden of stroke may increase rapidly due to its increasing incidence associated with the aging population of Korea.[4] Depression is the most important and prevalent neuropsychiatric complication of stroke survivors.[5,6] Poststroke depression (PSD) is associated with poor functional recovery and quality of life, reduction in daily activities, and a high mortality rates,[7,8] but it remains generally underdiagnosed and undertreated.[6]

Identifying PSD may lead to improvements in the mental and physical health of stroke survivors. The nine-item Patient Health Questionnaire (PHQ-9) is a brief and commonly recommended screening tool for depression in clinical practice and research.[9,10] The PHQ-9

Received June 29, 2016
Revised August 11, 2016
Accepted August 11, 2016

Correspondence
Young-Hoon Lee, MD, PhD
Department of Preventive Medicine & Institute of Wonkwang Medical Science, Wonkwang University School of Medicine, 460 Iksan-daero, Iksan 54538, Korea
Tel +82-63-859-1990
Fax +82-63-859-1995
E-mail lyh8275@hanmail.net

has good reliability and validity for identifying the severity of depression in stroke patients.[11,12] Early PSD detection and intervention may affect functional recovery and improve the quality of life in stroke patients and community-dwelling stroke survivors.

Previous studies have examined the risk factors for depression in stroke patients,[13-16] but little information is available on the relationship between stroke status and depression in the community-dwelling general population. Therefore, to determine whether stroke is a significant risk factor for depression in a community setting, we examined the relationship between stroke status and depression in a representative sample of the South Korean population using a screening instrument.

METHODS

Study population

Data from version VI-2 of the sixth Korea National Health and Nutrition Examination Survey (KNHANES) performed in 2014 were analyzed. The KNHANES, which is conducted every year by the Korea Centers for Disease Control and Prevention (KCDC), is a nationwide and multistage stratified survey of a representative sample of the South Korean population. Health interviews using questionnaires, health examinations, and blood and urine analyses were performed by trained interviewers, medical staff, and laboratory technicians.[17] The PHQ-9, which is a screening tool for depression, was administered to adult KNHANES participants. Among a total of 4,254 subjects aged 40 years and older, 742 who did not complete the PHQ-9 and 25 with missing data on socioeconomic status and health-related behaviors were excluded, and so 3,487 subjects were finally included in the analyses. The VI-2 version of KNHANES was approved by the KCDC Institutional Review Board (approval no. 2013-12EXP-03-5C).

Measurements

Information on stroke status (diagnosis of stroke, age at stroke diagnosis, current stroke treatment, and stroke complications) was acquired through face-to-face health interviews using a questionnaire. The presence of stroke was diagnosed by a medical doctor. The age at the diagnosis of stroke was categorized into <60 years or ≥60 years. Whether the stroke was currently being treated was also investigated. Patients with stroke complications were defined as subjects who answered "yes" to the following question: "Do you currently experience sequelae of the stroke?"

The PHQ-9, which is a brief, reliable, and valid measure of depression severity, was used to investigate depressive symptoms.[9] The PHQ-9 contains nine symptom-related items that measure the frequency of depressive symptoms over the previous 2 weeks. The response options for each item are 'not at all,' 'on several days,' 'on more than half the days,' and 'nearly every day,' which are scored 0, 1, 2, and 3, respectively. The total PHQ-9 score ranges from 0 to 27, with higher scores indicating more-severe depression. In this study, a PHQ-9 score of ≥10 was taken to indicate the presence of depression, since this tool shows a high sensitivity and specificity for major depression.[9,11]

We assessed the demographic information, socioeconomic status, health-related behaviors, and comorbidities of the participants using a health interview and health examination. The household income level was calculated by dividing the total household monthly income by the square root of the household size, with the obtained levels then grouped into quartiles. The educational level was categorized into the following four groups: ≤6 years, 7–9 years, 10–12 years, and ≥13 years. Marital status was classified as single, married, or divorced/separated/widowed. Participation in the National Basic Livelihood Security System program, which is the country's social assistance program, was grouped into none, previous, or current. Smoking status was categorized into never, former, and current. The frequency of alcohol consumption was categorized into none, ≤1 drink/month, 2 drinks/month to 3 drinks/week, and ≥4 drinks/week. Physical activity was divided into two groups based on regularity. Body mass index (BMI) was calculated as the body weight divided by the height squared, and categorized into underweight (<18.5 kg/m^2), normal (18.5–22.9 kg/m^2), overweight (23.0–24.9 kg/m^2), and obese (≥25.0 kg/m^2). All subjects were asked whether they had received a physician's diagnosis of major comorbidities such as hypertension, diabetes mellitus, dyslipidemia, ischemic heart disease, major cancers (lung, stomach, liver, colon, breast, or uterine cervical), asthma, pulmonary tuberculosis, arthritis, or chronic renal failure.

Statistical analysis

Differences in baseline characteristics according to stroke diagnosis were evaluated using the chi-square test for categorical variables and Student's *t*-test for continuous variables. To examine the association between stroke status and depression, we dichotomized the PHQ-9 scores into normal (≤9) and depressed (≥10). The prevalence of depression was compared according to stroke status (diagnosis of stroke, age at stroke diagnosis, current stroke treatment, and stroke complications) using the chi-square test. Multiple logistic regression was used to evaluate the association between stroke status and depression using four different models. Model 1 was unadjusted, while model 2 was adjusted for age, gender,

household income, education, participation in the National Basic Livelihood Security System program, and marital status. Model 3 was adjusted for the same factors as model 2 as well as smoking status, alcohol consumption, regular physical activity, and BMI. Model 4 was adjusted for the same factors as model 3 as well as comorbidities including hypertension, diabetes mellitus, dyslipidemia, ischemic heart disease, major cancer, asthma, pulmonary tuberculosis, arthritis, and chronic renal failure. All statistical analyses were performed using IBM SPSS version 22.0 (SPSS, Chicago, IL, USA). A probability value of $p<0.05$ was considered statistically significant.

RESULTS

Characteristics of the study population

Baseline characteristics of the study population according to diagnosis of stroke are presented in Table 1. Stroke was diagnosed in 120 of the 3,487 subjects (3.4%). Subjects with stroke diagnoses were older than nonstroke controls ($p<0.001$). Household income, education, marital status, participation in the National Basic Livelihood Security System program, alcohol consumption, and the prevalence rates of hypertension, diabetes mellitus, dyslipidemia, ischemic heart disease, arthritis, and chronic renal failure differed significantly between stroke patients and controls.

Prevalence of depression according to stroke status

The prevalence of depression was higher in stroke patients (16.7%) than in nonstroke controls (6.4%, $p<0.001$), and higher in patients with stroke diagnosis before 60 years of age (26.0%) than in patients who were older at stroke diagnosis (10.3%, $p=0.025$). The prevalence of depression differed significantly according to the presence of current stroke treatment and stroke complications (both $p<0.001$) (Table 2).

Association between stroke status and depression

The odds ratios (ORs) and 95% confidence intervals (CIs) for depression (PHQ-9 score ≥10) according to stroke status are listed in Table 3. According to the unadjusted model (model 1), the OR for stroke patients for depression relative to nonstroke controls was 2.95 (95% CI, 1.79−4.86). Although additional adjustments for demographic characteristics, socioeconomic status, health-related behaviors, and comorbidities attenuated this relationship, a diagnosis of stroke remained an independent predictor of depression (model 4: OR, 1.85; 95% CI, 1.06−3.24).

Stroke diagnosis before 60 years of age was associated with a higher risk of depression compared with nonstroke controls in all models (model 1: OR, 5.18; 95% CI, 2.71−9.89; model 4: OR, 3.82; 95% CI, 1.81−8.09), whereas stroke diagnosis at age 60 years or older was not a significant predictor of depression. Depression was also more common in stroke patients with an age at diagnosis of less than 60 years relative to those with an older diagnosis (fully adjusted OR, 3.88; 95% CI 1.28−11.75) (data not shown).

While the risk of depression was higher in stroke patients currently receiving treatment than in nonstroke controls in models 1, 2, and 3, this association was not significant in model 4. Compared with nonstroke controls, the presence of stroke complications resulted in a higher risk of depression in all models (model 1: OR, 4.77; 95% CI, 2.38−9.54; model 4: OR, 2.77; 95% CI, 1.25−6.13), whereas having no complications and recovering from complications were not significant predictors of depression.

DISCUSSION

The present study found that the prevalence of depression was 2.6-fold higher in stroke patients than in the nonstroke general population. Additionally, a diagnosis of stroke, an early diagnosis of stroke, and the presence of stroke complications were significant risk factors for depression in this population-based study.

Previous meta-analyses found that the incidence of depression at 5 years poststroke was 31% and that the prevalence of depression after stroke was 29%.[18,19] The prevalence of depression may have been lower in the present study due to differences in age groups, disease severity, and stroke phase, since chronic-phase stroke cases in a community setting are likely to be milder than acute-phase in-hospital stroke cases. Although PSD occurs in approximately one-third of stroke survivors, its pathogenesis is not fully understood. Multiple mechanisms involving biological, behavioral, psychological, and social factors may be involved in the development of PSD.[6,20]

Recent studies have revealed that active pharmacological treatment may improve the motor and cognition recovery and the long-term survival of patients with PSD.[21-23] Therefore, pharmacological treatments including selective serotonin-reuptake inhibitors and tricyclic antidepressants, which have significant beneficial effects on depression, are recommended for PSD.[6,24] Because effective preventive methods and beneficial treatments are available, early detection and management of PSD are important in both hospital and community settings.

Higher functional disability, longer hospitalization, worse cognition, lower quality of life, and increased mortality are associated with PSD.[18,25] Thus, periodic clinical assessments in hospitals and continuous public health programs in the

Table 1. Characteristics of the study population according to diagnosis of stroke

Variable	Stroke patients (*n*=120)	Nonstroke controls (*n*=3,367)	*p*-value
Age, years	68.7±9.5	59.2±11.7	<0.001
Male, *n* (%)	56 (46.7)	1,404 (41.7)	0.278
Household income, *n* (%)			<0.001
Low	65 (54.2)	760 (22.6)	
Low–moderate	30 (25.0)	876 (26.0)	
Moderate–high	17 (14.2)	879 (26.1)	
High	8 (6.7)	852 (25.3)	
Education level, *n* (%)			<0.001
≤6 years	68 (56.7)	1,090 (32.4)	
7–9 years	26 (21.7)	481 (14.3)	
10–12 years	19 (15.8)	1,018 (30.2)	
≥13 years	7 (5.8)	778 (23.1)	
Participation in the National Basic Livelihood Security System program, *n* (%)			<0.001
None	17 (14.2)	143 (4.2)	
Previous	6 (5.0)	103 (3.1)	
Current	97 (80.8)	3,121 (92.7)	
Marital status, *n* (%)			<0.001
Married	76 (63.3)	2,707 (80.4)	
Single	40 (33.3)	573 (17.0)	
Divorced/separated/widowed	4 (3.3)	87 (2.6)	
Smoking status, *n* (%)			0.064
Never	68 (56.7)	2,090 (62.1)	
Former	35 (29.2)	689 (20.5)	
Current	17 (14.2)	588 (17.5)	
Alcohol consumption, *n* (%)			<0.001
None	28 (23.3)	579 (17.2)	
≤1 drink/month	68 (56.7)	1,486 (44.1)	
2 drinks/month–3 drinks/week	13 (10.8)	1,030 (30.6)	
≥4 drinks/week	11 (9.2)	272 (8.1)	
Regular physical activity, *n* (%)	48 (40.0)	1,634 (48.5)	0.066
Body mass index category, *n* (%)			0.994
Underweight (<18.5)	3 (2.5)	95 (2.8)	
Normal (18.5–22.9)	45 (37.5)	1,280 (38.0)	
Overweight (23.0–24.9)	32 (26.7)	869 (25.8)	
Obese (≥25.0)	40 (33.3)	1,123 (33.4)	
Comorbidities			
Hypertension, *n* (%)	74 (61.7)	999 (29.7)	<0.001
Diabetes mellitus, *n* (%)	35 (29.2)	375 (11.1)	<0.001
Dyslipidemia, *n* (%)	37 (30.8)	623 (18.5)	0.001
Ischemic heart disease, *n* (%)	14 (11.7)	102 (3.0)	<0.001
Major cancers*, *n* (%)	5 (4.2)	132 (3.9)	0.891
Asthma, *n* (%)	4 (3.3)	101 (3.0)	0.834
Pulmonary tuberculosis, *n* (%)	9 (7.5)	173 (5.1)	0.253
Arthritis, *n* (%)	32 (26.7)	567 (16.8)	0.005
Chronic renal failure, *n* (%)	2 (1.7)	12 (0.4)	0.026

Data are presented as mean±standard deviations or number (percentage).
*Lung, stomach, liver, colon, breast, or uterine cervical cancer.

community are warranted to identify and treat depression in stroke patients. However, to our knowledge, little information is available concerning the association between stroke status and depression in the general population.

Our results demonstrate that a younger age at stroke diagnosis and the stroke severity are risk factors for depression in a community setting. A previous study found no consistent association between age and PSD among stroke survivors.[26] Although we did not investigate the relationship between age and depression after stroke diagnosis in the present study, we did find that being younger at stroke diagnosis resulted in a higher risk of depression than that observed in both the general nonstroke population and among those who were older at stroke diagnosis. Additionally, the risk of depression for those who were older at diagnosis was not significantly higher than that of the nonstroke general population. Therefore,

Table 2. Comparison of depression (PHQ-9 score ≥10) according to stroke status

Classification	PHQ-9		*p*-value	*p*-value*
	Normal (<10 points)	Depression (≥10 points)		
Diagnosis of stroke			<0.001	
Nonstroke controls (*n*=3,367)	3,153 (93.6)	214 (6.4)		
Stroke patients (*n*=120)	100 (83.3)	20 (16.7)		
Age at stroke diagnosis†			<0.001	0.025
Nonstroke controls (*n*=3,367)	3,153 (93.6)	214 (6.4)		
Diagnosis of stroke at ≥60 years (*n*=68)	61 (89.7)	7 (10.3)		
Diagnosis of stroke at <60 years (*n*=50)	37 (74.0)	13 (26.0)		
Current stroke treatment			<0.001	0.729
Nonstroke controls (*n*=3,367)	3,153 (93.6)	214 (6.4)		
No (*n*=40)	34 (85.0)	6 (15.0)		
Yes (*n*=80)	66 (82.5)	14 (17.5)		
Stroke complications			<0.001	0.077
Nonstroke controls (*n*=3,367)	3,153 (93.6)	214 (6.4)		
None or recovered (*n*=75)	66 (88.0)	9 (12.0)		
Presence of stroke complications (*n*=45)	34 (75.6)	11 (24.4)		

Data are presented as number (percentage).
*Analysis after exclusion of non-stroke controls (*n*=3,367), †Missing of age at diagnosis for 2 stroke patients.
PHQ-9: nine-item Patient Health Questionnaire.

Table 3. Associations between stroke status and depression (PHQ-9 score ≥10) using multiple logistic regression

Classification	Model 1	Model 2	Model 3	Model 4
Diagnosis of stroke				
Nonstroke controls	1.00	1.00	1.00	1.00
Stroke patients	2.95 (1.79–4.86)	1.80 (1.04–3.10)	1.88 (1.09–3.27)	1.85 (1.06–3.24)
Age at stroke diagnosis				
Nonstroke controls	1.00	1.00	1.00	1.00
Diagnosis of stroke at ≥60 years	1.69 (0.76–3.74)	0.92 (0.39–2.15)	0.93 (0.39–2.19)	0.99 (0.42–2.31)
Diagnosis of stroke at <60 years	5.18 (2.71–9.89)	3.70 (1.81–7.56)	4.02 (1.96–8.24)	3.82 (1.81–8.09)
Current stroke treatment				
Nonstroke controls	1.00	1.00	1.00	1.00
No	2.60 (1.08–6.26)	1.57 (0.61–4.05)	1.53 (0.59–3.99)	1.68 (0.64–4.42)
Yes	3.13 (1.73–5.66)	1.92 (1.01–3.66)	2.08 (1.09–4.00)	1.93 (0.99–3.76)
Stroke complications				
Nonstroke controls	1.00	1.00	1.00	1.00
None or recovered	2.01 (0.99–4.09)	1.25 (0.58–2.67)	1.34 (0.62–2.88)	1.34 (0.62–2.90)
Presence of stroke complications	4.77 (2.38–9.54)	2.81 (1.31–6.02)	2.85 (1.32–6.16)	2.77 (1.25–6.13)

Data are presented as odds ratios (95% confidence intervals). Model 1: unadjusted, Model 2: adjusted for age, gender, household income, education, participation in the National Basic Livelihood Security System program, and marital status, Model 3: adjusted for model 2 in addition to smoking status, alcohol consumption, regular physical activity, and body mass index, Model 4: adjusted for model 3 in addition to diagnosis with hypertension, diabetes mellitus, dyslipidemia, ischemic heart disease, major cancer, asthma, pulmonary tuberculosis, arthritis, and chronic renal failure.
PHQ-9: nine-item Patient Health Questionnaire.

in a community setting, more mental health policies need to be applied to stroke patients who are younger at the diagnosis.

Systematic reviews have indicated that stroke severity is consistently associated with PSD.[19,26] Additionally, functional and cognitive impairments are inversely associated with depression.[20] The stroke patients with complications in the present study had a higher risk of depression than did the nonstroke controls. However, no significant differences in depression risk were observed between stroke patients with no complications and those who had recovered from complications. Therefore, in a community setting, comprehensive rehabilitation is needed to improve both the physical and mental health of stroke patients with complications.

The present study was subject to several limitations. First, only the association—and not the causal relationship—was examined due to the cross-sectional design of the study. Second, depression was not diagnosed by a psychiatrist; however, a valid instrument was used for assessing depressed mood. Third, the diagnosis of stroke was confirmed by the respondents, rather than being medically defined by a physician or identified through medical records. Fourth, approximately half of the stroke patients in this study were diagnosed before 60 years of age, which differs from age distributions that are typical in clinical settings due to the target population of the KNHANES being designed to represent the Korean population and adjusted to the sex- and age-specific population. This may limit the generalizability of our results. Finally, only community-dwelling stroke survivors were included, in contrast to in-hospital stroke patients who constitute the typical population for acute or more-severe strokes. Therefore, we may have underestimated the effect of stroke status on depression.

Despite these limitations, this study is valuable since it analyzed data from a well-designed national survey applied to a cohort that is representative of the Korean population. Additionally, depressive symptoms were evaluated using a standardized assessment tool for depressive symptoms rather than a single self-report question on depression, as has been the case in other Korean national surveys.[27,28]

In conclusion, a higher prevalence of depression was found in community-dwelling populations who had been diagnosed with stroke, and stroke was a significant risk factor for depression. Consistent monitoring and management of PSD in both clinical and community settings may improve the functional recovery and quality of life of community-dwelling stroke survivors. Therefore, designing and implementing psychosocial interventions for the promotion of mental health in community-dwelling stroke patients is warranted.

Conflicts of Interest

The authors have no conflicts of interest.

Acknowledgements

This study was supported by Wonkwang University in 2016.

REFERENCES

1. index.go.kr [Internet]. Causes of Death in South Korea, 2014. [cited 2016 Mar 3]. Available from: http://www.index.go.kr/potal/main/EachDtlPageDetail.do?idx_cd=1012.
2. Lee SW, Kim HC, Lee HS, Suh I. Thirty-year trends in mortality from cardiovascular diseases in Korea. *Korean Circ J* 2015;45:202-209.
3. Kim HK, Ahn Y. Mortality trends of cardiovascular disease in Korea; big challenges in ischemic heart disease. *Korean Circ J* 2015;45:192-193.
4. Bang OY. Considerations when subtyping ischemic stroke in asian patients. *J Clin Neurol* 2016;12:129-136.
5. Dafer RM, Rao M, Shareef A, Sharma A. Poststroke depression. *Top Stroke Rehabil* 2008;15:13-21.
6. Espárrago Llorca G, Castilla-Guerra L, Fernández Moreno MC, Ruiz Doblado S, Jiménez Hernández MD. Post-stroke depression: an update. *Neurologia* 2015;30:23-31.
7. Pohjasvaara T, Vataja R, Leppävuori A, Kaste M, Erkinjuntti T. Depression is an independent predictor of poor long-term functional outcome post-stroke. *Eur J Neurol* 2001;8:315-319.
8. Hackett ML, Anderson CS. Predictors of depression after stroke: a systematic review of observational studies. *Stroke* 2005;36:2296-2301.
9. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001;16:606-613.
10. Gilbody S, Richards D, Brealey S, Hewitt C. Screening for depression in medical settings with the Patient Health Questionnaire (PHQ): a diagnostic meta-analysis. *J Gen Intern Med* 2007;22:1596-1602.
11. de Man-van Ginkel JM, Gooskens F, Schepers VP, Schuurmans MJ, Lindeman E, Hafsteinsdóttir TB. Screening for poststroke depression using the patient health questionnaire. *Nurs Res* 2012;61:333-341.
12. Burton LJ, Tyson S. Screening for mood disorders after stroke: a systematic review of psychometric properties and clinical utility. *Psychol Med* 2015;45:29-49.
13. Srivastava A, Taly AB, Gupta A, Murali T. Post-stroke depression: prevalence and relationship with disability in chronic stroke survivors. *Ann Indian Acad Neurol* 2010;13:123-127.
14. Carod-Artal FJ, Ferreira Coral L, Trizotto DS, Menezes Moreira C. Poststroke depression: prevalence and determinants in Brazilian stroke patients. *Cerebrovasc Dis* 2009;28:157-165.
15. Lam SC, Lee LY, To KW. Depressive symptoms among community-dwelling, post-stroke elders in Hong Kong. *Int Nurs Rev* 2010;57:269-273.
16. Sienkiewicz-Jarosz H, Milewska D, Bochyńska A, Chełmniak A, Dworek N, Kasprzyk K, et al. Predictors of depressive symptoms in patients with stroke - a three-month follow-up. *Neurol Neurochir Pol* 2010;44:13-20.
17. Kweon S, Kim Y, Jang MJ, Kim Y, Kim K, Choi S, et al. Data resource profile: the Korea National Health and Nutrition Examination Survey (KNHANES). *Int J Epidemiol* 2014;43:69-77.
18. Hackett ML, Pickles K. Part I: frequency of depression after stroke: an updated systematic review and meta-analysis of observational studies. *Int J Stroke* 2014;9:1017-1025.
19. Ayerbe L, Ayis S, Wolfe CD, Rudd AG. Natural history, predictors and outcomes of depression after stroke: systematic review and meta-analysis. *Br J Psychiatry* 2013;202:14-21.
20. Robinson RG, Jorge RE. Post-stroke depression: a review. *Am J Psychiatry* 2016;173:221-231.
21. Chollet F, Tardy J, Albucher JF, Thalamas C, Berard E, Lamy C, et al. Fluoxetine for motor recovery after acute ischaemic stroke (FLAME):

a randomised placebo-controlled trial. *Lancet Neurol* 2011;10:123-130.
22. Jorge RE, Acion L, Moser D, Adams HP Jr, Robinson RG. Escitalopram and enhancement of cognitive recovery following stroke. *Arch Gen Psychiatry* 2010;67:187-196.
23. Ried LD, Jia H, Feng H, Cameon R, Wang X, Tueth M, et al. Selective serotonin reuptake inhibitor treatment and depression are associated with poststroke mortality. *Ann Pharmacother* 2011;45:888-897.
24. Hackett ML, Köhler S, O'Brien JT, Mead GE. Neuropsychiatric outcomes of stroke. *Lancet Neurol* 2014;13:525-534.
25. Ayerbe L, Ayis S, Crichton S, Wolfe CD, Rudd AG. The long-term outcomes of depression up to 10 years after stroke; the South London Stroke Register. *J Neurol Neurosurg Psychiatry* 2014;85:514-521.
26. Kutlubaev MA, Hackett ML. Part II: predictors of depression after stroke and impact of depression on stroke outcome: an updated systematic review of observational studies. *Int J Stroke* 2014;9:1026-1036.
27. Park SJ, Jeon HJ, Kim JY, Kim S, Roh S. Sociodemographic factors associated with the use of mental health services in depressed adults: results from the Korea National Health and Nutrition Examination Survey (KNHANES). *BMC Health Serv Res* 2014;14:645.
28. Yoon JH, Won JU, Lee W, Jung PK, Roh J. Occupational noise annoyance linked to depressive symptoms and suicidal ideation: a result from nationwide survey of Korea. *PLoS One* 2014;9:e105321.