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Influence of the number and severity of somatic symptoms on the severity of depression and suicidality in community-dwelling elders

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Abstract

Introduction—Older adults commonly experience somatic symptoms, and those who do are more likely to have depressive disorders as well. Our goal in this study is to examine the influence of the number and severity of somatic symptoms on the severity of depressive symptoms, including suicidality, in elderly adults.

Methods—This study was conducted as part of the Ansan Geriatric (AGE) Study, a community-based cohort study in Ansan City, South Korea. A total of 3,210 elderly adults aged 60 years or over (1,388 males and 1,770 females) participated in this study. The Korean version of the Beck Depression Inventory (BDI) was used to measure depressive symptoms and suicidality. Somatic symptoms were assessed by the Patient Health Questionnaire-15 (PHQ-15).

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Conflict of interest

The authors have no conflict of interest to declare.

Results—Both mild and severe somatic symptoms significantly increased the risk for severe depression and high suicidality. Severe somatic symptoms doubled the risk for severe depression and suicidal intent.

Discussion—Somatic symptoms not fully explained as medical illnesses are closely associated with late-life depression, even after adjustments for comorbid physical illnesses and other confounding factors. The presence of somatic symptoms concurrent with, but not fully explained by comorbid physical illness or disability, seems to be an independent marker for predicting the severity of late-life depression and suicidality.

Keywords

Depressive Disorder; Somatoform Disorders; Suicidal Ideation

Introduction

Somatic symptoms are commonly observed in community-dwelling elderly adults, with approximately 20% of patients in the primary care setting presenting with medically unexplained somatic symptoms (Feder *et al.*, 2001; Gureje *et al.*, 1997; Kroenke, 2003). These somatic symptoms are ubiquitous across studies, although there are some geographical differences in the specific characteristics and proportions (Gureje *et al.*, 1997). These symptoms are considered to be associated with comorbid physical illnesses and disability, and are usually concomitant with aging (Sheehan and Banerjee, 1999).

Depressive symptoms are closely related to functional somatic symptoms. Patients who complain of somatic symptoms are more likely to have a depressive disorder than the general population (de Waal *et al.*, 2004; Toft *et al.*, 2005). Functional somatic complaints are more prevalent in patients with higher severity of depression, high somato-sensory amplification, and less alexithymia (Chakraborty *et al.*, 2012). Somatic symptoms, particularly chronic pain (Fishbain, 1999), have been found to predict not only suicidal ideation and mortality from suicide but also nonsuicidal death (Fishbain, 1999; Nakao *et al.*, 2002). A previous study found that mood disorders increased with the number of somatic symptoms in the adult population (Kroenke *et al.*, 1994). Another study reported that greater numbers of somatic symptoms predicted greater time to onset of antidepressant response (Papakostas *et al.*, 2004). Some studies have shown that the presence of somatic symptoms contributes greatly to the occurrence of a new depressive episode several years later (Ising *et al.*, 2004; Kroenke *et al.*, 1994; Terre *et al.*, 2003).

However, several additional aspects of the link between somatic symptoms and depression warrant further investigation. First, few studies have used structured scales to document profiles of the somatic symptoms in order to evaluate a broad spectrum of somatic symptoms. For example, some studies have focused only on specific somatic symptoms, such as pain (Bahk *et al.*, 2011; Corruble and Guelfi, 2000; Fishbain, 1999). Second, some studies assessed whether subjects had specific somatic symptoms without measuring their severity (Creed *et al.*, 2012; Simon *et al.*, 1999). In the association of the severity of somatic symptoms with depression, severe somatic symptoms might have greater clinical significance. Consequently, omitting assessment of the severity of somatic symptoms could

result in overlooking important clinical information. Third, the influences of comorbid physical illnesses (Papakostas *et al.*, 2004; Toft *et al.*, 2005) and other confounding factors such as sex and age have sometimes been ignored (Papakostas *et al.*, 2004). Since older adults commonly have chronic medical illnesses accompanying several somatic symptoms, controlling for these confounding factors is important in the analysis of the association between somatic symptoms and late-life depression.

In this study, therefore, we aim to examine the association between somatic symptoms and depression in community-dwelling elders after controlling for comorbid physical illnesses and other known confounding factors. We investigate how the severity and numbers of somatic symptoms influence late-life depression. We hypothesized that both severe and multiple somatic symptoms increase the risk of severe depression and of suicidality, even after adjustment for comorbid physical illnesses and confounding factors. We evaluate somatic symptoms using the Patient Health Questionnaire-15 (PHQ-15) since it is comprised of items about 15 somatic symptoms or symptom clusters that account for more than 90% physical complaints commonly reported by outpatients (Kroenke *et al.*, 2002). In additions, PHQ-15 is applicable to assess the severity of somatic complaints with high reliability and validity (Han *et al.*, 2009b).

Methods

This study was conducted as part of the Ansan Geriatric (AGE) Study. The AGE study is an ongoing, prospective, population-based epidemiological study established in May 2002. The overall objectives of the AGE study are not only to provide basic information on the medical conditions and characteristics of the rapidly growing Korean geriatric population, but also to identify genetic and environmental risk factors of various diseases. As part of a baseline investigation to construct an elderly cohort in Korea, we sampled the elderly who are at least 60 years old and live in Ansan, a suburb of Seoul, Republic of Korea. Further details of the sampling protocol and design of the AGE study has been previously reported (Han *et al.*, 2009a). The baseline database was used in this cross-sectional study.

Subjects and data collection

The participants enrolled in the present study were 3,210 community-dwelling Korean elders aged 60 years or over. Of these, 3,158 subjects were included in the analysis, and 52 subjects who did not complete the assessment of depressive and somatic symptoms were excluded from the analysis. Participants were asked to choose between two interview locations: their home or the Geriatric Health Clinic and Research Institute (GHCRI) of the Korea University Ansan Hospital, according to their convenience. Structured face-to-face clinical interviews were conducted by two psychiatrists from August 2002 to February 2003. Demographics and health related information were evaluated using standardized self-questionnaires and interviews by three research nurses. Cognitive function was assessed by three certified clinical psychologists. All raters should be trained and inter-rater reliability checked.

All of the participants gave written informed consent to participate in the study's evaluation and assessment. The protocol of the survey was approved by the Research Ethics Committee of Korea University Ansan Hospital.

Assessment of depressive symptoms

The Beck Depression Inventory (BDI) was administrated to evaluate depressive symptoms (Beck *et al.*, 1961). The questionnaire contains 21 questions about emotional, cognitive, motivational, physiological, and other symptoms. The severity of the depressive symptoms was categorized according to the BDI scores: 0–9 points as normal, 10–15 as mild depression, 16–23 as moderate depression, and 24–63 as severe depression. A Korean version of BDI was used in this study (Lee and Song, 1991). It showed high convergent validity ($r=0.59$, $p<0.01$) with the Geriatric Depression Scale in community dwelling elders (Jo *et al.*, 2007; Yesavage, 1988).

Assessment of somatic symptoms

Subjects' somatic symptoms were assessed using the Korean version of the Patient Health Questionnaire-15 (PHQ-15) (Han *et al.*, 2009b). This questionnaire is used in assessing various physical symptoms, including pains commonly complained of by elders. The Patient Health Questionnaire is a self-report version of PRIME-MD (Spitzer *et al.*, 1999), an interview tool for diagnosing mental disorders (Spitzer *et al.*, 1994). The PHQ-15 consists of questions assessing physical symptoms (Kroenke *et al.*, 2002). The severity of each physical symptom was scored as 1 (mild) or 2 (severe).

Other measurements

A semi-structured questionnaire survey on demographic and health related information was administrated to survey participants' mental health, past medical history, dietary habits, and other factors. It was completed by the researcher during interviews with respondents. The presences of co-morbid illnesses were assessed by subjects' medications or history of diagnosed diseases by medical doctors. They were rechecked by reviewing subjects' prescriptions or medical records if they were available. Subjects' cognitive function was assessed using the Korean version of the Mini-Mental State Examination (K-MMSE) (Folstein *et al.*, 1975; Han *et al.*, 2008; Kang *et al.*, 1997).

Statistical analyses

For descriptive statistics, continuous variables are presented as mean values with standard deviations (SD) and categorical variables as frequencies. To examine group differences, we performed statistical comparisons using one-way analysis of variance (ANOVA) with Duncan's post hoc test for continuous variables and chi-square tests for categorical variables.

We tested the influences of the severity and counts of somatic symptoms on the severity of depression and suicidality via multivariate logistic regression analysis. Age, sex, comorbid physical illnesses, education level, cognitive function, alcohol use, and cigarette smoking were included as covariates since they are known to have potential impacts on both somatic symptoms and depression (Tylee and Gandhi, 2005). The effects of variables are described

by odds ratios (ORs) and 95% confidential intervals (CIs). Non-depressed elders (those who scored less than 9 on the BDI scale) were chosen as a reference group in multivariate logistic regression models. Pearson's correlation was used to evaluate the association between somatic symptoms assessed by the PHQ-15 and depressive symptoms on the BDI scale. We set the significance level at a 2-tailed p value of 0.05. All statistical analyses were performed using SPSS software (SPSS version 12.0; SPSS Inc., Chicago, IL, USA).

Results

Characteristics of participants

Of the 3158 subjects, 1388 (44%) were male and 1770 (56%) were female. The average age of the subjects was 68.38 ± 6.26 years (range, 60–96 years). The numbers of elders with mild, moderate, and severe depression were 850, 585, and 526, respectively. Table 1 presents the sociodemographic and clinical values of the study population.

Somatic symptoms and comorbid physical illnesses

Table 2 outlines the frequency rates for the co-occurring medical conditions by physical system. The most common co-morbid physical illnesses were cardiovascular diseases (43%), followed by endocrine disease (31.9%) and gastrointestinal disease (20.3%). The frequency of comorbid physical illnesses was higher in elders with depression than in those without depression, with the exception of urogenital disease.

The subjects presented various somatic symptoms, including pain, gastrointestinal symptoms, and neuro-vegetative symptoms. Depressed elders more commonly reported somatic symptoms than elders without depression (Table 3). The frequency of somatic complaints generally increased according to the severity of depressive symptoms. The most common somatic symptom was pain in the arms, legs, or joints (55.7%). More than half of depressed participants reported back pain.

Relationship between somatic symptoms and severity of depressive symptoms

The severity of depressive symptom as assessed by BDI was significantly associated with the severity of somatic symptoms as assessed by PHQ-15 ($r^2 = 0.218$, $P < 0.001$). The PHQ scores of the mild, moderate, and severe depression subgroups were 5.02 ± 3.86 , 6.73 ± 4.26 , and 8.49 ± 5.58 , respectively. The PHQ-15 scores of depressed elders were significantly higher than those of elders without depression (3.14 ± 3.04) ($P < 0.001$). As shown in Table 4, multivariate logistic regression analyses revealed that having more somatic symptoms increased the risk of higher depression severity in the elderly after adjustment for comorbid physical illnesses and other confounding factors (age, gender, education, cognitive function, alcohol use, and cigarette smoking). Both mild and severe somatic symptoms significantly increased the odds of any depression (OR = 1.169, 95% CI = 1.130–1.208, $P < 0.001$; OR = 1.626, 95% CI = 1.497–1.766, $P < 0.001$; respectively). Severe somatic symptoms increased the risk for severe depression 2.13-fold ($P < 0.001$).

Relationship between somatic symptoms and suicidality

When depressed elders were classified into subgroups according to their suicidality, somatic symptom counts presented as 5.96 ± 3.67 in depressed elders with suicidal ideation, and 5.85 ± 3.6 in those with suicidal intent. These counts were significantly higher than those in depressed elders without suicidal ideation (4.8 ± 3.23) or non-depressed elders (2.72 ± 2.53 ; $df=3$; $P < 0.001$). The PHQ-15 scores in depressed elders with suicidal ideation (7.71 ± 5.25) and suicidal intent (8.19 ± 5.35) were also higher than those in depressed elders without suicidal ideation (6.14 ± 4.51) and non-depressed elders (3.14 ± 3.04 ; $df=3$; $P < 0.001$). Therefore, it is clear that not only was the severity of somatic symptoms significantly related to depression, it was also significantly associated with higher suicidality (Table 5). Mild somatic symptoms increased the risk for depression with suicidal intent 1.136-fold (95% CI=1.028–1.255) ($P=0.012$), and severe somatic symptoms increased the risk 2.028-fold (95% CI = 1.724–2.386; $P < 0.001$).

Discussion

Somatic symptoms are highly prevalent in the elderly. The present study demonstrates that the number and severity of somatic symptoms reported by elderly people are closely related to the severity of depression. Furthermore, somatic symptoms influence depression and suicidality regardless of the presence of comorbid physical illnesses. We found that, in elderly adults who reported multiple somatic symptoms and a high severity of these symptoms, the risks for suicidality and severe depression were doubled. Another notable finding is that even mild somatic symptoms appear to significantly contribute to the severity of depression and suicidality.

Our finding of an association between the number of somatic symptoms and the severity of depression and suicidality in our sample of older adults is consistent with previous reports that found that somatic symptoms were significantly related to severity of depression (Corruble and Guelfi, 2000; Muñoz *et al.*, 2005; Sayar *et al.*, 2003; Vaccarino *et al.*, 2008). In undertaking an exploration of this relationship, it is important to consider the following. Depression is a syndrome that consists of a broad range of affective, cognitive, behavioral, and physical symptoms. The significant association observed could result merely from the methodological approach used, as the scale used to measure depressive symptoms included items related to physical discomfort and neuro-vegetative symptoms. However, the observed association with the severity of depression, as measured by the BDI and the single-item variable of suicidality, remained significant after controlling for comorbid physical illnesses and other confounding factors. This result supports the finding of a robust association between somatic symptom counts and severity of depression.

From a clinical standpoint, however, simply counting somatic symptoms may be arbitrary and insufficient to predict the severity of depression. Thus, based on our findings, the severity of somatic symptoms should also be considered clinically because it impacts both the severity of depression and suicidality. The presence of a severe somatic symptom has about a two-fold impact on increasing the severity of depression and suicidality. This does not mean that the impact of mild somatic symptoms on depression should be ignored. Mild somatic symptoms were also significantly associated with the severity of depression, but

their impact tended to be less than that of severe somatic symptoms. These findings suggest that clinicians should evaluate both the severity and the number of somatic symptoms in depressed elders. Clinicians should consider the influence of somatic symptoms on depression, especially for severe symptoms, but also even when severity is mild.

Suicide is the most lethal event in late-life depression (Van Orden and Conwell, 2011). Therefore, it is important to prevent suicide in depressed elders through early identification of high-risk patients who require more clinical attention and intensive treatment. This study suggests that the severity and number of somatic symptoms may serve as clinical indicators of increased suicide risk. Consistent with our findings, a previous study revealed that suicidal risk was increased by somatic symptoms, and reported that fatigue, a heavy feeling in the chest, and difficulty breathing contributed to increased suicidal ideation in depressed men, and chest pain, tinnitus, headache, and insomnia did so in depressed women (Yoshimasu *et al.*, 2009).

The neurobiological underpinnings of links between somatic symptoms and depression are not yet understood. We can cautiously speculate that elders who are prone to depression may be sensitized to pain, i.e., they have increased vulnerability to somatic pain and physical discomfort through a shared biological mechanism. There are a number of plausible explanations. First, the neurotransmitter hypothesis of depression may be salient, in that serotonin or norepinephrine might mediate the linkage between somatic symptoms and depression (Fava, 2002). Dysregulation of the inhibitory function of the descending serotonergic and noradrenergic pathways might allow routine sensory input to be interpreted as uncomfortable or even painful physical symptoms (Stahl, 2002). A bidirectional relationship between the central nociceptive pathway and the limbic system might also be implicated. Depression may lower the pain threshold by increasing the excitability of the central nociceptive pathways via the limbic system (Janke *et al.*, 2004). In the reverse situation, chronic pain may also contribute to development or aggravation of depression. Pain-induced corticolimbic sensitization may lead to a clinical presentation of chronic pain, affective dysregulation, and behavioral disturbance (Rome and Rome, 2000). Serotonin modulates nociception through both peripheral and central mechanisms (Millan, 1994), and also involves mood regulation (Lowry *et al.*, 2009; Lucki, 1998).

Second, changes in the cytokines associated with depression and somatic symptoms may constitute, at least in part, a shared biological mechanism. The inflammation in depression, which is characterized by increased levels of cytokines like interleukin-1 and 6 (IL-1, IL-6) and tumor necrosis factor (TNF), may cause the occurrence of somatic symptoms of depression (Bob *et al.*, 2010; Maes, 2009; O'Brien *et al.*, 2004). The recent finding of pathologically high levels of cytokines in the brains (IL-6) of people who have attempted suicide links somatic symptoms with suicidal behavior and severity of depression (Lindqvist *et al.*, 2009). The number of somatic symptoms in depression may reflect increased levels of pro-inflammatory cytokines such as IL-6 in the brain, which correlates with suicidal behavior due to low levels of intracerebral serotonin (Bohman *et al.*, 2012; Träskman *et al.*, 1981).

This study has important clinical implications. As previous studies have suggested (Bohman *et al.*, 2010; Lieb *et al.*, 2007), the number of somatic symptoms seems to represent a marker of current depression severity and of suicidality regardless of comorbid physical illnesses. When depressed elders seek care, clinicians should attempt to evaluate concurrent somatic symptoms. In real-world clinical settings, however, it is difficult to count all somatic symptoms while simultaneously assessing their severity since many elders report a large variety of somatic symptoms (Corruble and Guelfi, 2000; Tamayo *et al.*, 2005). Therefore, collective assessment using a structured scale like the PHQ-15 may be useful.

There are several strengths in this study. It was conducted in large sample of community-dwelling elders. We analyzed the complex associations between somatic symptoms and depression after controlling for the confounding factors of comorbid physical illnesses, age, sex, education, cognitive function, alcohol use, and cigarette smoking. Moreover, we assessed various somatic symptoms with respect to both their number and severity. Along with these strengths, this study also has some limitations. Potential cultural differences may limit the generalizability of our results. Styles of expression and attribution of symptoms vary according to people's beliefs and health practice characteristics within a culture (Keyes and Ryff, 2003; Kirmayer and Young, 1998; Kirmayer *et al.*, 1994). In particular, Korean elders are currently experiencing significant psychological conflicts due to the collapse of the traditional family system and changes in social mores, which were previously based on Confucianism. Korean elders believe that it is a virtue to hide their negative emotions, possibly making them prone to somatization of their internal conflicts.

Conclusions

It is very important to identify the effects of somatic symptoms concurrent with physical illness or disability in depressed elderly patients in order to shed light on connections between psychological and physical processes and to provide valuable clinical tools for the treatment of the elderly. This study found that somatic symptoms are closely associated with late-life depression, even after adjustments for comorbid physical illnesses and other confounding factors. Somatic symptoms appear to be a marker for late-life depression, with high numbers and severity of symptoms indicating high levels of severity and suicidality, and with even mild or moderate symptom levels indicating elevated risks.

Therefore, attending to such symptoms can help clinicians to identify patients with late-life depression, especially those who present multiple, severe to mild somatic symptoms simultaneously.

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References

- Bahk WM, Park S, Jon DI, Yoon BH, Min KJ, Hong JP. Relationship between painful physical symptoms and severity of depressive symptomatology and suicidality. *Psychiatry Res.* 2011; 189:357–361. [PubMed: 21329990]
- Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry.* 1961; 4:561–571. [PubMed: 13688369]
- Bob P, Raboch J, Maes M, et al. Depression, traumatic stress and interleukin-6. *J Affect Disord.* 2010; 120:231–234. [PubMed: 19359044]
- Bohman H, Jonsson U, Päären A, von Knorring L, Olsson G, von Knorring AL. Prognostic significance of functional somatic symptoms in adolescence: a 15-year community-based follow-up study of adolescents with depression compared with healthy peers. *BMC Psychiatry.* 2012; 12:90. [PubMed: 22839681]
- Bohman H, Jonsson U, Von Knorring AL, Von Knorring L, Päären A, Olsson G. Somatic symptoms as a marker for severity in adolescent depression. *Acta Paediatr.* 2010; 99:1724–1730. [PubMed: 20545935]
- Chakraborty K, Avasthi A, Kumar S, Grover S. Psychological and clinical correlates of functional somatic complaints in depression. *Int J Soc Psychiatry.* 2012; 58:87–95. [PubMed: 21177704]
- Corruble E, Guelfi JD. Pain complaints in depressed inpatients. *Psychopathology.* 2000; 33:307–309. [PubMed: 11060514]
- Creed FH, Tomenson B, Chew-Graham C, et al. Multiple Somatic Symptoms Predict Impaired Health Status in Functional Somatic Syndromes. *International Journal of Behavioral Medicine.* 2012
- de Waal MW, Arnold IA, Eekhof JA, van Hemert AM. Somatoform disorders in general practice: prevalence, functional impairment and comorbidity with anxiety and depressive disorders. *Br J Psychiatry.* 2004; 184:470–476. [PubMed: 15172939]
- Fava M. Somatic symptoms, depression, and antidepressant treatment. *J Clin Psychiatry.* 2002; 63:305–307. [PubMed: 12000203]
- Feder A, Olfson M, Gameroff M, et al. Medically unexplained symptoms in an urban general medicine practice. *Psychosomatics.* 2001; 42:261–268. [PubMed: 11351117]
- Fishbain DA. The association of chronic pain and suicide. *Semin Clin Neuropsychiatry.* 1999; 4:221–227. [PubMed: 10498789]
- Folstein MF, Folstein SE, McHugh PR. “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res.* 1975; 12:189–198. [PubMed: 1202204]
- Gureje O, Simon GE, Ustun TB, Goldberg DP. Somatization in cross-cultural perspective: a World Health Organization study in primary care. *Am J Psychiatry.* 1997; 154:989–995. [PubMed: 9210751]
- Han C, Jo SA, Jo I, Kim E, Park MH, Kang Y. An adaptation of the Korean mini-mental state examination (K-MMSE) in elderly Korean s: demographic influence and population-based norms (the AGE study). *Arch Gerontol Geriatr.* 2008; 47:302–310. [PubMed: 17936377]
- Han C, Jo SA, Kim NH, Jo I, Park MH. Study design and methods of the Ansan Geriatric Study (AGE study). *BMC Neurol.* 2009a; 9:10. [PubMed: 19236723]
- Han C, Pae CU, Patkar AA, et al. Psychometric properties of the Patient Health Questionnaire-15 (PHQ-15) for measuring the somatic symptoms of psychiatric outpatients. *Psychosomatics.* 2009b; 50:580–585. [PubMed: 19996228]
- Ising M, Lauer CJ, Holsboer F, Modell S. The Munich vulnerability study on affective disorders: premorbid psychometric profile of affected individuals. *Acta Psychiatr Scand.* 2004; 109:332–338. [PubMed: 15049769]
- Janke EA, Holroyd KA, Romanek K. Depression increases onset of tension-type headache following laboratory stress. *Pain.* 2004; 111:230–238. [PubMed: 15363865]
- Jo SA, Park MH, Jo I, Ryu SH, Han C. Usefulness of Beck Depression Inventory (BDI) in the Korean elderly population. *Int J Geriatr Psychiatry.* 2007; 22:218–223. [PubMed: 17044132]

- Kang YW, Na DL, Hahn SH. A validity study on the Korean Mini-Mental State Examination (K-MMSE) in dementia patients. *Journal of Korean Psychiatric Association*. 1997
- Keyes CL, Ryff CD. Somatization and mental health: a comparative study of the idiom of distress hypothesis. *Soc Sci Med*. 2003; 57:1833–1845. [PubMed: 14499509]
- Kirmayer LJ, Young A. Culture and somatization: clinical, epidemiological, and ethnographic perspectives. *Psychosom Med*. 1998; 60:420–430. [PubMed: 9710287]
- Kirmayer LJ, Young A, Robbins JM. Symptom attribution in cultural perspective. *Can J Psychiatry*. 1994; 39:584–595. [PubMed: 7828110]
- Kroenke K. Patients presenting with somatic complaints: epidemiology, psychiatric comorbidity and management. *Int J Methods Psychiatr Res*. 2003; 12:34–43. [PubMed: 12830308]
- Kroenke K, Spitzer RL, Williams JB. The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms. *Psychosom Med*. 2002; 64:258–266. [PubMed: 11914441]
- Kroenke K, Spitzer RL, Williams JB, et al. Physical symptoms in primary care. Predictors of psychiatric disorders and functional impairment. *Arch Fam Med*. 1994; 3:774–779. [PubMed: 7987511]
- Lee YH, Song JY. A study of the reliability and the validity of the BDI, SDS, and MMPI-D scales. *Korean J Clin Psychol*. 1991; 10:98–113.
- Lieb R, Meinlschmidt G, Araya R. Epidemiology of the association between somatoform disorders and anxiety and depressive disorders: an update. *Psychosom Med*. 2007; 69:860–863. [PubMed: 18040095]
- Lindqvist D, Janelidze S, Hagell P, et al. Interleukin-6 is elevated in the cerebrospinal fluid of suicide attempters and related to symptom severity. *Biol Psychiatry*. 2009; 66:287–292. [PubMed: 19268915]
- Lowry CA, Lightman SL, Nutt DJ. That warm fuzzy feeling: brain serotonergic neurons and the regulation of emotion. *J Psychopharmacol*. 2009; 23:392–400. [PubMed: 19074539]
- Lucki I. The spectrum of behaviors influenced by serotonin. *Biol Psychiatry*. 1998; 44:151–162. [PubMed: 9693387]
- Maes M. Inflammatory and oxidative and nitrosative stress pathways underpinning chronic fatigue, somatization and psychosomatic symptoms. *Current opinion in psychiatry*. 2009; 22:75–83.
- Millan MJ. Serotonin and pain: evidence that activation of 5-HT_{1A} receptors does not elicit antinociception against noxious thermal, mechanical and chemical stimuli in mice. *Pain*. 1994; 58:45–61. [PubMed: 7970839]
- Muñoz RA, McBride ME, Brnabic AJ, et al. Major depressive disorder in Latin America: the relationship between depression severity, painful somatic symptoms, and quality of life. *J Affect Disord*. 2005; 86:93–98. [PubMed: 15820276]
- Nakao M, Yamanaka G, Kuboki T. Suicidal ideation and somatic symptoms of patients with mind/body distress in a Japanese psychosomatic clinic. *Suicide Life Threat Behav*. 2002; 32:80–90. [PubMed: 11931013]
- O'Brien SM, Scott LV, Dinan TG. Cytokines: abnormalities in major depression and implications for pharmacological treatment. *Hum Psychopharmacol*. 2004; 19:397–403. [PubMed: 15303243]
- Papakostas GI, Petersen TJ, Iosifescu DV, et al. Somatic symptoms as predictors of time to onset of response to fluoxetine in major depressive disorder. *J Clin Psychiatry*. 2004; 65:543–546. [PubMed: 15119918]
- Rome HP Jr, Rome JD. Limbically augmented pain syndrome (LAPS): kindling, corticolimbic sensitization, and the convergence of affective and sensory symptoms in chronic pain disorders. *Pain Med*. 2000; 1:7–23. [PubMed: 15101960]
- Sayar K, Kirmayer LJ, Taillefer SS. Predictors of somatic symptoms in depressive disorder. *Gen Hosp Psychiatry*. 2003; 25:108–114. [PubMed: 12676424]
- Sheehan B, Banerjee S. Review: Somatization in the elderly. *Int J Geriatr Psychiatry*. 1999; 14:1044–1049. [PubMed: 10607972]
- Simon GE, VonKorff M, Piccinelli M, Fullerton C, Ormel J. An international study of the relation between somatic symptoms and depression. *N Engl J Med*. 1999; 341:1329–1335. [PubMed: 10536124]

- Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. JAMA. 1999; 282:1737–1744. [PubMed: 10568646]
- Spitzer RL, Williams JB, Kroenke K, et al. Utility of a new procedure for diagnosing mental disorders in primary care. The PRIME-MD 1000 study. JAMA. 1994; 272:1749–1756. [PubMed: 7966923]
- Stahl SM. The psychopharmacology of painful physical symptoms in depression. J Clin Psychiatry. 2002; 63:382–383. [PubMed: 12019660]
- Tamayo JM, Román K, Fumero JJ, Rivas M. The level of recognition of physical symptoms in patients with a major depression episode in the outpatient psychiatric practice in Puerto Rico: an observational study. BMC Psychiatry. 2005; 5:28. [PubMed: 15967039]
- Terre L, Poston WS, Foreyt J, St Jeor ST. Do somatic complaints predict subsequent symptoms of depression? Psychother Psychosom. 2003; 72:261–267. [PubMed: 12920330]
- Toft T, Fink P, Oernboel E, Christensen K, Frostholm L, Olesen F. Mental disorders in primary care: prevalence and co-morbidity among disorders. results from the functional illness in primary care (FIP) study. Psychol Med. 2005; 35:1175–1184. [PubMed: 16116943]
- Träskman L, Asberg M, Bertilsson L, Sjöstrand L. Monoamine metabolites in CSF and suicidal behavior. Arch Gen Psychiatry. 1981; 38:631–636. [PubMed: 6166274]
- Tylee A, Gandhi P. The importance of somatic symptoms in depression in primary care. Prim Care Companion J Clin Psychiatry. 2005; 7:167–176. [PubMed: 16163400]
- Vaccarino AL, Sills TL, Evans KR, Kalali AH. Prevalence and association of somatic symptoms in patients with Major Depressive Disorder. Journal of affective disorders. 2008; 110:270–276. [PubMed: 18280580]
- Van Orden K, Conwell Y. Suicides in late life. Curr Psychiatry Rep. 2011; 13:234–241. [PubMed: 21369952]
- Yesavage JA. Geriatric Depression Scale. Psychopharmacol Bull. 1988; 24:709–711. [PubMed: 3249773]
- Yoshimasu K, Kondo T, Tokunaga S, et al. Mental and somatic symptoms related to suicidal ideation in patients visiting a psychosomatic clinic in Japan. Int J Gen Med. 2009; 2:163–170. [PubMed: 20360900]

Figure 1. Relationship between somatic symptoms and depression
PHQ, Patient Health Questionnaire-15; BDI, Beck Depression Inventory.

Figure 2. Comparing somatic symptoms according to suicidality in depressed elders

^aNC: elders without depression

^bD w/o suicide idea: depressed elders without suicidal ideation

^cD w suicide idea: depressed elders with suicidal ideation

^dD w suicide intent: depressed elders with suicidal intent

Table 1

Sociodemographic and clinical profiles of participants

	Severity of Depressive symptoms					P value	Post hoc
	Not depressed (n = 1197)	Mild (n = 850)	Moderate (n = 585)	Severe (n = 526)			
Age	67.7 ± 6.01	68.45±6.16	68.47±6.24	69.31±6.58		< 0.001	Severe > Mild, Moderate > NC
Sex (female, %)	43.6	56.9	67.2	70.5		< 0.001	
Education	8.44 ± 5.04	7.18±4.71	5.91±4.41	4.84±4.53		< 0.001	Severe > Moderate > Mild > NC
MMSE	26.31 ± 3.91	25.90±3.84	24.83±4.43	23.19±4.92		< 0.001	Severe > Moderate > Mild, NC
BDI score	5.54 ± 2.62	12.29±1.67	19.06±2.20	32.27±7.18		< 0.001	Severe > Moderate > Mild > NC
PHQ-15	3.14 ± 3.04	5.02±3.86	6.73±4.26	8.49±5.58		< 0.001	Severe > Moderate > Mild > NC
Comorbid illness(N)	1.30 ± 1.17	1.68±1.35	1.92±1.40	2.02±1.44		< 0.001	Severe, Moderate > Mild > NC

Data were analyzed by the chi-square test and one-way analysis of variance (ANOVA) with Duncan's post hoc test.

Table 2

Frequency rates of comorbid physical illnesses in subjects

	Frequencies		
	Total	NC	Depression
Cardiovascular diseases	43.0%	39.4%	45.1%
Endocrine diseases	31.9%	25.6%	36.1%
Cerebrovascular diseases	5.7%	3.7%	6.6%
Neurological diseases	1.5%	0.9%	1.7%
Respiratory diseases	6.2%	4.8%	6.8%
Gastrointestinal diseases	20.3%	16.0%	23.2%
Musculoskeletal diseases	23.0%	15.6%	27.6%
Urogenital diseases	4.5%	4.6%	4.5%
Hemato-oncological diseases	1.9%	1.6%	2.0%
Other diseases	8.5%	7.0%	9.5%

Table 3

Frequency rates of somatic symptoms reported by subjects

Symptoms	Severity of depressive symptoms				Total
	NC	Mild	Moderate	Severe	
Stomach pain	13.5%	23.6%	32.8%	33.8%	23.2%
Back pain	36.3%	50.2%	59.5%	61.7%	48.5%
Pain in your arms, legs, or joints (knees, hips, etc)	45.1%	54.5%	67.2%	69.3%	55.7%
Headaches	19.9%	33.5%	41.6%	51%	32.7%
Chest pain	12.3%	17%	23%	30.7%	18.6%
Dizziness	18.8%	33.3%	43.1%	51.3%	32.6%
Fainting spells	2%	4.6%	6.7%	13.4%	5.5%
Feeling your heart pound or race	12%	19.4%	26.9%	34.2%	20.4%
Shortness of breath	15.2%	21.6%	30.7%	36.1%	23.3%
Pain or problems during sexual intercourse	12.7%	17.4%	22.1%	21.5%	17.1%
Constipation, loose bowels, or diarrhea	19.3%	28.9%	37.2%	39.1%	28.5%
Nausea, gas, or indigestion	17.2%	27.4%	34.5%	36.6%	26.4%
Feeling tired or having low energy	29.5%	48.9%	60.5%	66%	46.5%
Trouble sleeping	18.4%	38.8%	48.8%	59%	36.2%

Table 4

Influences of somatic symptoms on severity of depressive symptoms

	All Depression		Mild Depression		Moderate Depression		Severe Depression	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
PHQ score	1.215	(1.185–1.245)	1.152	(1.120–1.186)	1.256	(1.215–1.300)	1.3	(1.254–1.347)
Somatic sx. counts								
Mild symptom	1.169	(1.130–1.208)	1.159	(1.115–1.206)	1.218	(1.163–1.275)	1.131	(1.073–1.193)
Severe symptom	1.626	(1.497–1.766)	1.302	(1.186–1.428)	1.686	(1.519–1.873)	2.13	(1.909–2.378)

Data were analyzed by multivariate logistic regression analysis after adjustment for comorbid physical illnesses, age, sex, education, cognitive function, alcohol use, and cigarette smoking.
All data were *P* value < 0.001.

Table 5

Influence of somatic symptoms on suicidality in depressed elders

	<u>Depression without suicidal ideation</u>		<u>Depression with suicidal ideation</u>		<u>Depression with suicidal intent</u>	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
PHQ score	1.202	(1.171–1.233)	1.288	(1.235–1.343)	1.318	(1.241–1.399)
Somatic sx. counts						
Mild symptom	1.155	(1.115–1.196)	1.279	(1.206–1.356)	1.136	(1.028–1.255)*
Severe symptoms	1.590	(1.462–1.730)	1.663	(1.476–1.874)	2.028	(1.724–2.386)

Data were analyzed by multivariate logistic regression analysis after adjustment for comorbid physical illnesses, age, sex, education, cognitive function, alcohol use, and cigarette smoking.
All data were *P* value < 0.001 except *(*P*-value < 0.05)