INTRODUCTION

A substantial body of literature has demonstrated significant comorbidity rate of mental and chronic physical conditions. Patients with mental disorders and psychological stress are at greater risk of various physical conditions including cardiovascular disease, diabetes mellitus, asthma, peptic ulcer, chronic pain and musculoskeletal disease. Conversely, chronic physical disorders have been reported to be associated with higher prevalence of psychological distress and mental disorders. It may be that mental and physical disorders are associated in bidirectional manners, in which physical disorders increase risks of mental disorders and vice versa. Furthermore, mental-physical comorbidity might reflect an integrated pathophysiologic mechanism involving the central nervous, neuroendocrine, and immune systems.

Socioeconomic burden of mental and chronic physical disorders has been growing despite the remarkable progress in public health management during the last century. In 1977, Gruenberg proposed the concept of “the failure of success”, asserting that the technological success in reduction of mortality rate not only extended the life expectancy, but also in-
creased average duration of chronic physical and mental conditions. Consequently, comorbidity of mental and physical disorders has become a major challenge to medicine and public health. It is related with greater socioeconomic burden than simple sum of each condition’s adverse effects on role impairment, health care costs, premature mortality risk, and global score of disability. In this regard, it can be postulated that mental-physical comorbidity is a significant threat to individual and public health in Korea because the nation has been one of the most rapidly developing countries for the past decades. Therefore, it is essential to identify the reality of mental-physical comorbidity among the representative general population of Korea to establish national health policies.

The aims of present study were to estimate the prevalence of mental-physical comorbidity, clarify the risk factors for those conditions among subjects with 12-month major mental disorders, and ascertain the prevalence of 12-month major mental disorders among those with chronic physical conditions in the general Korean population.

METHODS

Data acquisition

Data were derived from Korean Epidemiologic Catchment Area study replication (KECA-R), a nationally representative survey based on DSM-IV. The survey was conducted from August 1, 2006 through April 30, 2007. The target population included all eligible residents aged 18–64 years listed in the updated 2005 population census at community registry offices. A multistage, cluster sampling of the subjects was carried out across 12 catchment areas, with selection according to the population size of each division and accessibility to research centers. A total of 6,510 respondents completed the diagnostic interviews. Detailed information on the sampling process are described elsewhere.

Assessment of psychiatric disorders

The Korean version of Composite International Diagnostic Interview 2.1 (K-CIDI) was administered to all eligible subjects by trained interviewers. K-CIDI is a fully structured and validated diagnostic interview following the guidelines of the World Health Organization. Psychiatric diagnoses in the past 12 months were identified using the definition and criteria of DSM-IV. Twelve-month depressive disorders (major depressive disorder and dysthymic disorder), anxiety disorders (obsessive-compulsive disorder, posttraumatic stress disorder, panic disorder, agoraphobia, social phobia, generalized anxiety disorder, and specific phobias), and substance use disorders (alcohol and nicotine use disorders) were included in the analyses. Psychotic and bipolar disorders were not included because the numbers of the subjects were too small for the analyses (19 and 17 out of 6,510 participants for psychotic and bipolar disorders, respectively).

Assessment of chronic physical conditions

Chronic physical conditions were assessed using the modified Cumulative Illness Rating Scale (CIRS) and K-CIDI questions on chronic pain. Physical disorders in the last 12 months were grouped into 9 categories: chronic pain and musculoskeletal disease (e.g., headache, arthritis, neck and back pain), hypertension, cardiovascular disease (heart and vascular disease), respiratory disease (lung, bronchi and tracheal disease), gastrointestinal disease (upper and lower gastrointestinal tract, and hepatic disease), renal and genitourinary disease (kidney, uterus, bladder, urethra, prostate and genital disease), neurological disease (brain, spinal cord and peripheral nerve disease), endocrine-metabolic disease (diabetes, infections, and toxicity), and disease of eye, ear, nose, and throat. A recent study revealed high agreement of case ascertainment between self-report and physician’s diagnosis of physical disorders.

Assessment of medical risk factors

We additionally assessed major health risk factors in subjects with 12-month mental disorders. Derived from a recent report of The Global Burden of Disease Study (GBD) 2010, we could identify and estimate 4 leading risk factors in Korea using K-CIDI and CIRS: current smoking, heavy drinking, overweight (Body Mass Index, BMI ≥25 kg/m²), and hypertension.

Statistical analyses

Stata Statistical Software for Windows, Release 12.1 (StataCorp LP, College Station, TX, USA) was used to perform the analyses. Survey weights were calculated for the participants and used to adjust the data to approximate the national age and sex distributions according to 2005 Korea census. Weighted prevalence with 95% confidential intervals were calculated, and logistic regression analyses were conducted among the diagnostic groups with controlling for age and sex. Adjusted odds ratios (AORs) for each mental and physical condition groups were calculated compared to participants with no identified disorders. A p-value ≤0.05 was considered to be significant.

Ethics statement

The Institutional Review Board of Seoul National University College of Medicine approved this study (C-0607-009-177). All subjects were fully informed about the aims and methods of the study, and written informed consent was obtained pri...
RESULTS

Chronic physical disorders of subjects with mental disorders

As shown in Table 1, participants with any mental disorder had significantly higher 12-month prevalence of chronic physical disorders compared with those without mental disorders (p<0.001 for all comparisons). As expected, prevalence of current smoking (58.3% vs. 30.4%), heavy drinking (19.9% and 17.5%, respectively), and depression and anxiety disorders (19.2% and 10.6%, respectively) were higher in respondents with mental disorders (AOR=2.7, p<0.001). Similar trends were observed for depressive and anxiety disorders (AOR=2.4, p<0.001) and heavy drinking (AOR=2.4, p<0.001). Overall, subjects with any mental disorder showed signiﬁcantly higher 12-month prevalence of chronic physical disorders of all categories.

Table 1. Prevalence of chronic physical disorders among subjects with mental disorders in the past 12 months, adjusted for age and sex

| Weighted %, (95% CI)    | Chronic pain and musculoskeletal disease | Cardiovascular disease | Respiratory disease | Eye, ear, nose, and throat disease | Gastrointestinal disease | Renal and genitourinary disease | Neurological disease | Endocrine-metabolic disease |
|------------------------|----------------------------------------|------------------------|---------------------|----------------------------------|------------------------|-------------------------------|---------------------|-----------------------------|
| No mental disorder     | 19.4 (18.3–20.4)                       | 8.5 (7.8–9.3)          | 6.0 (5.3–6.6)       | 5.9 (5.3–6.6)                    | 10.6 (9.8–11.5)        | 14.1 (13.1–15.0)              | 5.7 (5.1–6.3)       | 1.7 (1.4–2.1)               |
| Any mental disorder    | 31.7 (28.9–34.5)                       | 11.2 (9.2–13.1)        | 10.0 (8.1–11.8)     | 13.3 (11.2–15.3)                 | 19.2 (16.9–21.6)       | 30.4 (27.6–33.1)              | 9.1 (7.4–10.8)      | 4.2 (3.0–5.4)               |
| AOR                    | 2.2* (1.9–2.5)                          | 1.5* (1.2–1.9)         | 2.1* (1.7–2.7)      | 2.4* (1.9–3.0)                   | 2.1* (1.8–2.5)         | 2.7* (2.3–3.2)                | 1.9* (1.5–2.5)      | 2.8* (2.0–4.1)              |
| Depressive disorder    | 46.2 (38.8–53.7)                       | 11.6 (8.6–16.4)        | 14.4 (9.2–19.7)     | 19.0 (13.1–24.8)                 | 24.0 (17.6–30.4)       | 33.8 (26.8–40.9)              | 15.2 (9.8–20.6)     | 6.3 (2.7–10.0)              |
| AOR                    | 3.4* (2.5–4.7)                          | 1.4 (0.8–2.3)          | 2.4* (1.6–3.8)      | 3.8* (2.5–5.6)                   | 2.6* (1.8–3.7)         | 3.3* (2.4–4.6)                | 2.8* (1.8–4.3)      | 3.7* (1.9–7.2)              |
| Anxiety disorder       | 43.0 (37.8–48.3)                       | 11.9 (8.5–15.3)        | 12.6 (9.1–16.1)     | 15.8 (12.0–19.7)                 | 26.8 (22.1–31.5)       | 33.2 (28.3–38.2)              | 11.2 (7.9–14.5)     | 7.6 (4.8–10.4)              |
| AOR                    | 3.2* (2.5–4.0)                          | 1.9* (1.3–2.7)         | 2.3* (1.6–3.3)      | 3.0* (2.2–4.1)                   | 3.2* (2.4–4.1)         | 3.3* (2.6–4.2)                | 2.1* (1.4–2.9)      | 5.1* (3.2–8.1)              |
| Substance use disorder | 26.5 (23.1–29.8)                       | 11.4 (9.0–13.8)        | 8.4 (6.3–10.5)      | 12.9 (10.4–15.5)                 | 16.5 (13.7–19.3)       | 31.3 (27.8–34.8)              | 7.6 (5.6–9.5)       | 3.6 (2.2–5.0)               |
| AOR                    | 1.9* (1.5–2.3)                          | 1.5* (1.2–2.0)         | 2.0* (1.5–2.8)      | 2.3* (1.8–3.0)                   | 1.8* (1.4–2.3)         | 2.7* (2.3–3.3)                | 1.9* (1.4–2.7)      | 2.6* (1.6–4.2)              |
| Total population       | 21.7 (20.7–22.7)                       | 9.0 (8.3–9.7)          | 6.8 (6.2–7.4)       | 7.1 (6.5–7.8)                    | 12.1 (11.3–12.9)       | 16.8 (15.9–17.7)              | 6.3 (5.7–6.9)       | 2.1 (1.8–2.5)               |

*p<0.001 logistic regression adjusted for age and sex, †p<0.05 logistic regression adjusted for age and sex, AOR: adjusted odds ratio, CI: confidential interval
### Mental disorders of people with chronic physical disorders

Table 3 shows the 12-month prevalence and AORs of each mental disorder in subjects with chronic physical disorders. Any chronic physical disorder was associated with significantly high risk of mental disorders (21.6% vs. 10.5%; AOR=2.6, p<0.001). Substance use disorders were the most prevalent mental disorders among the respondents with chronic physical disorders (13.1%), nevertheless the AORs for depressive and anxiety disorders (AOR=4.0 and 3.6, respectively, p<0.001)

#### Table 2. Prevalence of selected medical risk factors among subjects with mental disorders in the last 12 months, adjusted for age and sex

| Weighted % (95% CI) | Current smoking | Heavy drinking | Overweight | Hypertension |
|---------------------|-----------------|----------------|------------|--------------|
| No mental disorder  | 30.4 (29.1–31.6)| 12.1 (11.3–13.0)| 21.2 (20.1–22.3)| 8.5 (7.8–9.3) |
| Any mental disorder | 58.3 (55.3–61.3)| 29.7 (26.9–32.5)| 24.4 (21.8–27.0)| 11.2 (9.2–13.1) |
| AOR                 | 4.0* (3.3–4.8)  | 2.7* (2.3–3.2) | 1.1 (1.0–1.3) | 1.5* (1.2–1.9) |
| Depressive disorder | 33.3 (26.3–40.4)| 19.9 (13.9–25.9)| 18.2 (12.4–24.0)| 11.6 (6.8–16.4) |
| AOR                 | 2.7* (1.7–4.3)  | 2.7* (1.7–4.0) | 0.9 (0.6–1.3) | 1.4 (0.8–2.3)  |
| Anxiety disorder    | 29.3 (24.5–34.1)| 17.5 (13.5–21.5)| 20.9 (16.6–25.2)| 11.9 (8.5–15.3) |
| AOR                 | 2.0* (1.5–2.8)  | 2.3* (1.7–3.2) | 1.2 (0.9–1.5) | 1.9* (1.3–2.7) |
| Substance use disorder | 81.1 (78.2–84.1)| 40.4 (36.7–44.1)| 26.5 (23.1–29.8)| 11.4 (9.0–13.8) |
| AOR                 | 8.1* (6.3–10.6) | 3.3* (2.7–3.9) | 1.1 (0.9–1.4) | 1.5* (1.2–2.0) |
| Total population    | 34.7 (33.6–35.9)| 14.8 (14.0–15.7)| 21.8 (20.8–22.8)| 9.0 (8.3–9.7)  |

*p<0.001 logistic regression adjusted for age and sex, †p<0.05 logistic regression adjusted for age and sex. AOR: adjusted odds ratio, CI: confidential interval

#### Table 3. Prevalence of mental disorders among subjects with chronic physical disorders in the past 12 months, adjusted for age and sex

| Weighted % (95% CI) | Anxiety disorder | Depressive disorder | Substance use disorder | Any mental disorder |
|---------------------|-----------------|-------------------|-----------------------|--------------------|
| No chronic physical condition | 2.6 (2.1–3.2) | 1.1 (0.7–1.5) | 7.6 (6.7–8.5) | 10.5 (9.4–11.6) |
| Any chronic physical condition | 8.0 (7.1–8.9) | 4.2 (3.5–4.9) | 13.1 (11.9–14.2) | 21.6 (20.2–23.1) |
| AOR                 | 3.6* (2.8–4.6)  | 4.0* (2.8–5.9)   | 2.1* (1.8–2.5)       | 2.6* (2.3–3.1)    |
| Chronic pain and musculoskeletal disease | 10.6 (9.0–12.2) | 5.7 (4.5–6.9) | 12.7 (10.9–14.4) | 23.6 (21.3–25.8) |
| AOR                 | 2.9* (2.3–3.6)  | 3.0* (2.2–4.1)   | 1.7* (1.4–2.0)       | 2.1* (1.8–2.5)    |
| Hypertension        | 7.1 (5.0–9.1)   | 3.5 (2.0–4.9)    | 13.1 (10.4–15.8)     | 20.0 (16.8–23.3)  |
| AOR                 | 1.7* (1.2–2.5)  | 1.4 (0.8–2.3)    | 1.4* (1.1–1.9)       | 1.5* (1.2–1.9)    |
| Cardiovascular disease | 10.0 (7.2–12.8)| 5.7 (3.5–7.9) | 12.9 (9.7–16.0) | 23.7 (19.7–27.7) |
| AOR                 | 2.1* (1.5–2.9)  | 2.2* (1.4–3.4)   | 1.8* (1.3–2.5)       | 2.0* (1.6–2.5)    |
| Respiratory disease | 11.9 (8.9–14.8)| 7.1 (4.7–9.4) | 18.7 (15.2–22.3) | 30.0 (25.8–34.1) |
| AOR                 | 2.8* (2.0–3.8)  | 3.3* (2.2–4.9)   | 2.1* (1.6–2.7)       | 2.4* (1.9–2.9)    |
| Eye, ear, nose, and throat disease | 11.9 (9.6–14.1) | 5.3 (3.7–6.9) | 14.2 (11.8–16.7) | 25.7 (22.7–28.8) |
| AOR                 | 2.9* (2.3–3.8)  | 2.3* (1.6–3.3)   | 1.7* (1.3–2.1)       | 2.1* (1.7–2.5)    |
| GI disease          | 10.6 (8.7–12.4)| 5.4 (4.0–6.7) | 19.3 (16.9–21.6) | 29.1 (26.4–31.8) |
| AOR                 | 3.0* (2.3–3.7)  | 2.8* (2.0–3.9)   | 2.5* (2.1–3.0)       | 2.7* (2.3–3.1)    |
| Renal and urological disease | 9.5 (6.6–12.3)| 6.4 (4.0–8.8) | 12.4 (9.2–15.6) | 23.2 (19.1–27.3) |
| AOR                 | 1.9* (1.3–2.7)  | 2.5* (1.6–3.9)   | 1.8* (1.3–2.4)       | 1.9* (1.5–2.4)    |
| Neurologic          | 19.0 (12.4–25.6)| 7.9 (3.4–12.5)| 17.4 (11.0–23.7) | 31.7 (23.9–39.5) |
| AOR                 | 4.8* (3.0–7.5)  | 3.2* (1.7–6.0)   | 2.2* (1.4–3.6)       | 2.8* (1.9–4.0)    |
| Endocrine-metabolic disease | 11.2 (7.2–15.3)| 4.0 (1.5–6.5) | 13.4 (9.0–17.7) | 23.5 (18.1–28.9) |
| AOR                 | 2.6* (1.7–4.0)  | 1.4 (0.7–2.9)    | 1.7* (1.2–2.6)       | 1.9* (1.4–2.6)    |
| Total population    | 5.3 (4.8–5.9)   | 2.7 (2.3–3.0)    | 10.4 (9.6–11.1)      | 16.1 (15.2–17.0)  |

*p<0.001 logistic regression adjusted for age and sex, †p<0.05 logistic regression adjusted for age and sex. AOR: adjusted odds ratio, CI: confidential interval

www.psychiatryinvestigation.org 499

JH Kim et al.
Prevalence of Mental-Physical Comorbidity

were higher than that of substance use disorders (AOR=2.1, p<0.001). However, prevalence of depressive disorders appeared not to be significantly higher for subjects with hypertension (3.5%; AOR=1.4, p=0.22) and endocrine-metabolic disease (4.0%; AOR=1.4, p=0.29) than for those without any identified chronic physical disorder (1.1%).

DISCUSSION

In the present study, subjects with major mental disorders presented significantly higher risks of chronic physical disorders than those without any mental disorder. The prevalence of one or more chronic physical disorders was approximately two-thirds among the subjects with major mental disorders (67.9%) and about half (47.9%) among those without mental disorders. In addition to physical disorders, risk factors for physical health were more prevalent among the subjects with mental disorders, except overweight and obesity. The results also corroborate previous findings that chronic physical disorders are associated with more than twice the risk of any mental disorder. In summary, mental and physical disorders are significantly correlated with higher prevalence of each other in a representative general population of Koreans.

To our knowledge, this is the first report concerning the epidemiology of mental-physical comorbidity in a nationwide general Korean population. The strength of this paper is that we surveyed for major mental disorders and wide range of chronic physical conditions. Finding of significant mental-physical comorbidity in the present study is consistent with previous reports. This could reflect an integrated pathophysiological mechanism, which would be counter to the traditional “mind-body dualism” in terms of psychiatry vs. bodily medicine. Depressive and anxiety disorders predict development of coronary heart disease, stroke, type 2 diabetes mellitus, asthma, gastrointestinal disease, and chronic pain. It has been postulated that disturbances in the stress management system involving catecholamines and glucocorticoids are associated with development of depressive and anxiety disorders. Dysregulation of these hormones also has been related with various adverse effects including higher risks of atherosclerosis, elevated blood glucose levels, insulin resistance, obesity, and increases in inflammatory response and immunosuppression. In addition, mental disorders could contribute to development of physical disorders through behavioral risk factors, such as lack of exercise, and as replicated in this study, smoking and heavy alcohol drinking. Conversely, various physical disorders are reportedly related with greater risks of developing mental disorders. Researchers suggested that physical disability, and changes in behaviors and social relations would promote subsequent development of mental disorders. Biological mechanisms from physical to affective disturbances have been also implicated, including direct (e.g., endocrine, neurochemical, and metabolic disturbances) and indirect (e.g., medications and cranial irradiation) pathways. The collective present and prior data support the view that the relationship between mental and physical disorders might be bidirectional, in which they simultaneously precipitate and exacerbate each other in a vicious cycle. Mental and physical disorders might have an integrated neurobiological basis. From this point of view, the brain is the key organ in adaptation to acute and chronic stress of life experiences with genetic variations, epigenetic modifications, behavioral changes, and regulation of physiological responses. If the burden of stress causes overload in the brain and body, it could lead to either mental or physical disorders.

The current findings support a mental-physical bidirectionality or integrated pathophysiology of mind and body. However, the present study did not identify the relevance of depression to hypertension and endocrine-metabolic disease, and significant difference in prevalence of overweight and obesity between subjects with and without mental disorders. Implications of these findings are discussed below.

The relationship between depression and hypertension has been controversial. Depression has been reported to be a predictor of later development of hypertension, and a recent meta-analysis study suggested that depression is an independent risk factor for development of hypertension. Contrarily, depression may not be related with hypertension when blood pressure is more precisely evaluated. Additionally, another result of recent meta-analysis did not support the hypothesis that hypertension is a probable risk factor of depression. Furthermore, low blood pressure was associated with depressive symptoms among older subjects whether or not they were treated for hypertension. These contradictory findings might have been resulted from complex bio-psycho-social interactions. Chronic stress and the non-adaptive response to it might elevate blood pressure, rather than acute stress. On the other hand, comorbidity of low blood pressure and depression might arise through impaired cardiovascular control and subsequent reduced cerebral perfusion, and monoamine hypoactivity. Future studies will be needed to provide clarification.

Although this study did not reveal the significant association between depression and endocrine-metabolic disease, depression is well-known to be in bidirectional association with diabetes and metabolic syndrome. Therefore, any premature assumption should not be inferred from the present results. Because the “endocrine-metabolic disease” category of CIRS does not assess diabetes and other endocrine or metabolic diseases as separate diagnoses and does include other
conditions (e.g., infections, poisonings and breast pathology), it might have made the associations equivocal.

Contrary to previous studies from the Western countries, overweight and obesity were not more prevalent among people with depressive and anxiety disorders than normal population in this study. This finding is consistent with a previous result in which the authors reported no significant association between obesity and depressive disorders. Obesity can be resulted from interactions of genetic, behavioral, and environmental factors, and it might have shared genetic susceptibility with depression. A recent meta-analysis revealed that overweight and obesity predicts future development of depression, and depression increases the odds for obesity over time but not for overweight. In the present study, we did not identify this reciprocal relationship between any major mental disorders and obesity. This difference could be accounted for by several reasons. First, our study is a cross-sectional survey that might have been inappropriate to observe the cumulative effect of time and environmental factors. Second, relatively low prevalence of mental disorders and obesity in Korea might have attenuated the manifestation of multifactorial association among biopsychosocial factors. In this regard, cross-cultural and symptomatological differences could attribute to higher diagnostic threshold of mental disorders in Korea, which might have caused selection biases. Additionally, comparatively low prevalence of overweight and obesity in Korea might reflect ethnic differences in metabolic control mechanisms. Third, overweight might not be a noteworthy risk factor for mental and physical health in Korea. A recent international study carried out on more than 1 million participants revealed that East Asians (Chinese, Japanese, and Koreans) with BMI of 22.6 to 27.5 kg/m² showed the lowest risk of death. As mentioned earlier, another previous investigation reported that higher prevalence of depressive disorder was significantly associated with underweight (BMI ≤18.5 kg/m²), not with overweight (BMI ≥25 kg/m²) in a general Korean population. Instead, overweight was rather found to be related with lower prevalence of depressive disorder in male participants in the study. The researchers suggested that cultural differences (e.g., collectivism vs. individualism) and ethnicity might account for this phenomenon, but there has not been a clear explanation. Fourth, to clarify the adverse effects of obesity on mental health in detail, it might be necessary to estimate the relationship between various measures of obesity besides BMI (e.g., waist circumference, waist-to-hip ratio and waist-to-height ratio) and mental symptom dimensions as investigated in an earlier study. Conclusively, shared neurobiological substrate among various mental and physical disorders, eating behaviors, and metabolic control should be elucidated in future investigations.

Mental-physical comorbidity increases personal and socioeconomic burden in terms of more severe symptoms, poor self-management, poorer disease prognosis, higher health care costs, and premature mortality. Furthermore, role impairment and global disability are more severely deteriorated by mental-physical comorbidity than simple sum of the adverse effects. Therefore, it should be considered in both clinical settings and the policy-making process to promote more efficacious treatment and improve the health care system simultaneously.

**Limitations**

The present study has several limitations. First, the results should be interpreted cautiously because of its retrospective and cross-sectional design. There might have been recall bias affecting the prevalence of wide range of mental and physical disorders, and the results indicate association, not causality. Second, non-response to the survey might have been related with possible false negative results, because subjects with severe psychiatric symptoms or cognitive impairment might have difficulties in completing the questionnaires. Thus, there might have been paradoxical under-diagnosis of severe psychiatric disorders. Third, the possibility of false negative also might have been attributable to the household-based sampling design, because institutionalized or homeless individuals were not included. Fourth, Diagnostic reliability of physical disorders could have been insufficient, because it was based on self-report not on precise medical assessment. However, a high degree of agreement in the diagnosis between self-report and physician’s diagnosis has been reported. Fifth, we did not separately assess diabetes mellitus which is one of most prevalent chronic illness. It is due to that we used CIRS which measures chronic medical illnesses as categorized groups rather than separate diagnoses. Considering that 46.3% of diabetic patients are assumed to be undiagnosed, it is possible that the prevalence of endocrine-metabolic disease category in CIRS and its comorbidity with mental disorders might have been underrated. Sixth, we could not identify the correlation between symptom severities of mental disorders and physical disorders, because we used K-CIDI which had been developed to make diagnosis of mental disorders, not to rate the severity. Finally, despite we administered a completely structured diagnostic tool for mental disorders, the possibility of interviewer-respondent interaction cannot be excluded.

**Conclusion**

This study examined the prevalence of mental-physical comorbidity, the risk factors for those conditions among those with 12-month major mental disorders, and the prevalence of
12-month major mental disorders among those with chronic physical conditions in the general Korean population. A significant mental-physical comorbidity rate and higher prevalence of risk factors for chronic medical disorders were evident among subjects with mental disorders. Conversely, existence of chronic physical disorders was associated with higher rate of mental disorders. These results are comparable to those of previous reports and support a mental-physical bidirectionality. Considering its potential threat to public health and psychosocial burden, mental-physical comorbidity should be comprehensively dealt with not only in individual treatment but also in process of health care policy-making.

Acknowledgments
This study was funded by the Korean Ministry of Health and Welfare, which had no role in study design; the collection, analysis, and interpretation of data; the writing of the report; or the decision to submit the paper for publication. The authors thank the interviewers and the Korean Ministry of Health and Welfare for their cooperation and help.

REFERENCES
1. Scott KM, Bruffaerts R, Tsang A, Ormel J, Alonso J, Angermeyer MC, et al. Depression-anxiety relationships with chronic physical conditions: results from the World Mental Health Surveys. J Affect Disord 2007;103:113-120.
2. Goldston K, Baille AJ. Depression and coronary heart disease: a review of the epidemiological evidence, explanatory mechanisms and management approaches. Clin Psychol Rev 2008;28:288-306.
3. Ali S, Stone MA, Peters JL, Davies MJ, Khunti K. The prevalence of comorbid depression in adults with Type 2 diabetes: a systematic review and meta-analysis. Diabet Med 2006;23:1165-1173.
4. Goodwin RD, Jacobs F, Thefold W. Mental disorders and asthma in the community. Arch Gen Psychiatry 2003;60:125-130.
5. Taha F, Lipsitz JD, Galea S, Demmer RT, Talley NJ, Goodwin RD. Anxiety disorders and risk of self-reported ulcer: a 10-year longitudinal study among US adults. Gen Hosp Psychiatry 2014;36:674-679.
6. Carroll LJ, Cassidy JD, Cote P. Depression as a risk factor for onset of an episode of troublesome neck and low back pain. Pain 2004;107:134-139.
7. Okma-Keulen P, Hopman-Rock M. The onset of generalized osteoarthrosis in older women: a qualitative approach. Arthritis Rheum 2001;45:183-190.
8. Evans DL, Charney DS, Lewis L, Golden RN, Gorman JM, Krishnan KR, et al. Mood disorders in the medically ill: scientific review and recommendations. Biol Psychiatry 2005;58:175-189.
9. Scott KM, Oakley Browne MA, McGee MA, Wells JE, Team fNZMH-SR. Mental-physical comorbidity in Te Rau Hinengaro: The New Zealand Mental Health Survey. Aust N Z J Psychiatry 2006;40:882-888.
10. McEwen BS. Brain on stress: how the social environment gets under the skin. Proc Natl Acad Sci U S A 2012;109(Suppl 2):17180-17185.
11. Bliem RW. Global trends in adolescent health. JAMA 1991;265:2711-2719.
12. McMichael AJ, McKee M, Shkolnikov V, Valkonen T. Mortality trends and setbacks: global convergence or divergence? Lancet 2004;363:1155-1159.
13. Gruenberg EM. The failures of success. 1977. Milbank Q 2005;83:779-800.
14. Von Korff M, Scott KM, Gurje O. Global Perspectives on Mental-Physical Comorbidity in the WHO World Mental Health Surveys. New York: Cambridge University Press, Cambridge, 2009.
15. Kessler RC, Ormel J, Demler O, Stang PE. Comorbid mental disorders account for the role impairment of commonly occurring chronic physical disorders: results from the National Comorbidity Survey. J Occup Environ Med 2003;45:1257-1266.
16. Hutter N, Knecht A, Baumeister H. Health care costs in persons with asthma and comorbid mental disorders: a systematic review. Gen Hosp Psychiatry 2011;33:443-453.
17. Scott KM, Von Korff M, Alonso J, Angermeyer MC, Bromet E, Fayyad J, et al. Mental-physical co-morbidity and its relationship with disability: results from the World Mental Health Surveys. Psychol Med 2009;39:33-43.
18. Cho MJ, Chang SM, Lee YM, Rae A, Ahn JH, Son J, et al. Prevalence of DSM-IV major mental disorders among Korean adults: a 2006 National Epidemiologic Survey (KECA-R). Asian J Psychiatr 2010;3:26-30.
19. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 4th Edition. Washington DC, USA: American Psychiatric Association; 1994.
20. Statics Korea. The 2005 Population and Housing Census Report. Daejeon: Statics Korea; 2006.
21. Cho MJ, Hahn BJ, Suh DW, Hong JP, Rae JM, Kim JK, et al. Development of a Korean version of the Composite International Diagnostic Interview (K-CIDI). J Korean Neuropsychiatr Assoc 2002;41:123-137.
22. World Health Organization. Procedures for the Development of New Language Versions of the WHO Composite International Diagnostic Interview (WHO-CIDI). Geneva, Switzerland: World Health Organizati; 1997.
23. Miller MD, Paradis CF, Horuck PR, Marumdar S, Stack JA, Rizai AH, et al. Rating chronic medical illness burden in geropsychiatric practice and research: application of the Cumulative Illness Rating Scale. Psychiatry Res 1992;41:237-248.
24. Baumeister H, Kristen L, Bengel J, Harter M. High agreement of self-report and physician-diagnosed somatic conditions yields limited bias in examining mental-physical comorbidity. J Clin Epidemiol 2010;63:558-563.
25. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2012;380:2224-2260.
26. Bracken P, Thomas P. Time to move beyond the mind-body split. BMJ 2002;325:1433-1434.
27. Kendler KS. A psychiatric dialogue on the mind-body problem. Am J Psychiatry 2001;158:989-1000.
28. Jonas BS, Musselino ME. Symptoms of depression as a prospective risk factor for stroke. Psychosom Med 2000;62:463-471.
29. Renn BN, Feliciano L, Segal DL. The bidirectional relationship of depression and diabetes: a systematic review. Clin Psychol Rev 2011;31:1239-1246.
30. El-Gabalawy R, Mackenzie CS, Pietrzak RH, Sareen J. A longitudinal examination of anxiety disorders and physical health conditions in a nationally representative sample of U.S. older adults. Exp Gerontol 2014;60:46-56.
31. Davidson S, Judd F, Jolley D, Hocking B, Thompson S, Hylbrand B. Cardiovascular risk factors for people with mental illness. Aust N Z J Psychiatry 2001;35:196-202.
32. Ormel J, Kempen GIJ, Penninx BWJ, Brilman EI, Beekman AT, van Sonderen E. Chronic medical conditions and mental health in older people: disability and psychosocial resources mediate specific mental health effects. Psychol Med 1997;27:1065-1077.
33. Cohen S, Rodriquez MS. Pathways linking affective disturbances and physical disorders. Health Psychol 1995;14:374-380.
34. Davidson K, Jonas BS, Dixon KE, Markowitz JH. Do depression symptoms predict early hypertension incidence in young adults in the CARDIA study? Coronary artery risk development in young adults. Arch Intern Med 2000;160:1495-1500.
35. Meng L, Chen D, Yang Y, Zheng Y, Hui R. Depression increases the risk of hypertension incidence: a meta-analysis of prospective cohort studies. J Hypertens 2012;30:842-851.

36. Wiehe M, Fuchs SC, Moreira LB, Moraes RS, Pereira GM, Gus M, et al. Absence of association between depression and hypertension: results of a prospectively designed population-based study. J Hum Hypertens 2006;20:434-439.

37. Long J, Duan G, Tian W, Wang L, Su P, Zhang W, et al. Hypertension and risk of depression in the elderly: a meta-analysis of prospective cohort studies. J Hum Hypertens 2015;29:478-482.

38. Ng TP, Feng L, Niti M, Yap KB. Low blood pressure and depressive symptoms among Chinese older subjects: a population-based study. Am J Med 2010;123:342-349.

39. Sparrenberger F, Cichelero FT, Ascoli AM, Fonseca FP, Weiss G, Berwanger O, et al. Does psychosocial stress cause hypertension? A systematic review of observational studies. J Hum Hypertens 2009;23:12-19.

40. Pan A, Keum N, Okereke OI, Sun Q, Kim M, Rubin RR, et al. Obesity and mental disorders in the general population: results from the world mental health surveys. Int J Obes (Lond) 2008;32:192-200.

41. Scott KM, Bruffaerts R, Simon GE, Alonso J, Angermeyer M, de Girolamo G, et al. Obesity and mental disorders in the general population: results from the world mental health surveys. Int J Obes (Lond) 2008;32:192-200.

42. Eaton WW, Anthony JC, Tepper S, Dryman A. Psychopathology and attrition in the epidemiologic catchment area surveys. Am J Epidemiol 1992;135:1051-1059.

43. de Graaf R, Bijl RV, Smit F, Ravelli A, Vollebergh WA. Psychiatric and sociodemographic predictors of attrition in a longitudinal study: The Netherlands Mental Health Survey and Incidence Study (NEMESIS). Am J Epidemiol 2000;152:1039-1047.

44. International Diabetes Federation. IDF Diabetes Atlas Update Poster, 6th Edition. Brussels, Belgium: International Diabetes Federation; 2014.