

The impact of major depressive disorder on adaptive function

A retrospective observational study

Eun-Hee Park, PhD, Myung Hun Jung, MD, PhD*

Abstract

Although functional impairment is very common among patients with major depressive disorder (MDD) and is a necessary diagnostic criterion for MDD, clinicians have not directed their attention beyond the mood symptoms of MDD. We aimed to multi-dimensionally assess the functional abilities of patients with MDD using a standardized scale of adaptive function reported by caregivers or parents to identify the nature and degree of functional impairment in patients with MDD.

This study was conducted in 40 depressive patients aged 19 to 60 years. Patients were screened according to the DSM-IV-TR and a Hamilton Depression Rating Scale score ≥ 8 . We administered the parent/caregiver rating form of the Korean Vineland Adaptive Behavior Scale to assess functional outcomes in the patients.

Patients with MDD showed significant differences in both global and domain-specific functional abilities compared to those of the normal group (all $t > -6.35$, $P < .05$) and the patients' premorbid IQ (all $t > 4.30$, $P < .001$). The number of episodes among clinical factors was negatively correlated with overall adaptive functioning ($r = -0.32$, $P < .05$) and expressive communication ($r = -0.42$, $P < .01$).

Our present study replicates existing evidence showing impairment in both broad and various functional areas in patients with MDD, suggesting the importance of quantitatively assessing functional outcomes and acquiring information about functioning from informants other than patients.

Abbreviations: ABC = Adaptive Behavior Composite, DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text-revision, K-CES-D = Korean version of the Center for Epidemiological Studies-Depression Scale, K-HDRS = Korean version of the Hamilton Depression Scale, KPIE = Korea Premorbid Intelligence Estimate, K-Vineland-II = Korean Vineland Adaptive Behavior Scale-II, K-WAIS-IV = Korean version of the Wechsler Adult Intelligence Scale-IV, MDD = Major Depressive Disorder, MINI-Plus = Korean version of the Mini International Neuropsychiatric Interview Plus Version 5.0.

Keywords: adaptive function, functional disability, major depressive disorder

1. Introduction

Major depressive disorder (MDD) is a major psychiatric disorder that affects mood, cognition, and behavior and significantly hampers adaptive functioning. The global burden of MDD due to functional impairment, particularly loss of productivity, as well as symptom severity, is increasing.^[1] It is predicted that by 2030, MDD will be the most common cause of disability worldwide,

according to the World Health Organization. The direct and indirect social and economic costs associated with MDD are also burdensome. Functional impairment in patients with MDD is very common; more than 90% of patients report functional impairment in at least one area during a major depressive episode^[2] and this can persist even after depressive symptoms improve.^[3,4] Incomplete functional recovery has been associated with an increased risk of relapse or recurrence of depression.^[5,6]

Although there are evidence and opinions about how functional disability patterns change depending on severity of depression,^[2,7] scientists have gradually reported stronger contradictory evidence supporting how functional disability and depressive symptoms may exist independently of each other.^[8-10] In other words, evidence suggests that mood symptoms alone do not fully explain the severity of functional disability, and functional improvement does not always occur in synchrony with improved depressive symptoms. In such context, evaluating adaptive functioning when properly treating depression is necessary to improve treatment results. From the patient perspective, mood improvement may be very important for them to successfully return to the lifestyle they had before falling ill.^[11] This may be particularly important for the young, active, and productive age group.

Functional recovery is highlighted more and more as a treatment target in the clinical field. Scientists and clinicians are recommending that adaptive functioning be accurately measured

Editor: Massimo Tusconi.

The authors have no conflicts of interest to disclose.

Department of Psychiatry, Hallym University Sacred Heart Hospital, Hallym University College of Medicine, Anyang, Gyeonggi-do, Republic of Korea.

* Correspondence: Myung Hun Jung, Department of Psychiatry, Hallym University Sacred Heart Hospital, 22, Gwanpyeong-ro 170beon-gil, Dongan-gu, Anyang 14068, South Korea (e-mail: mhjung@hallym.or.kr).

Copyright © 2019 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and buildup the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

How to cite this article: Park EH, Jung MH. The impact of major depressive disorder on adaptive function: a retrospective observational study. *Medicine* 2019;98:52(e18515).

Received: 13 August 2019 / Received in final form: 21 November 2019 / Accepted: 28 November 2019

<http://dx.doi.org/10.1097/MD.00000000000018515>

and quantified. However, surprisingly, <5% of clinical trial research for MDD has used scales to measure functional level.^[4] Research on the functional aspects of MDD is scarce, and most previous studies considered general functional outcomes rather than differentiating among specific functional aspects.

Therefore, the aim of this study was to multi-dimensionally assess the functional abilities of patients with MDD using a standardized adaptive functioning scale. We attempted to demonstrate different aspects and degrees of impaired functioning in patients with MDD. We hypothesized that patients with MDD experience widespread functional deficits that impact various aspects of their adaptive functioning.

2. Materials and methods

2.1. Subjects

This study was conducted on outpatients and inpatients admitted to the psychiatry department at Hallym University Medical Center, aged 19 to 60 years, who were diagnosed with MDD. Patients were screened according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text-revision (DSM-IV-TR),^[12] the Korean version of the Mini International Neuropsychiatric Interview Plus Version 5.0 (MINI-Plus)^[13] and the Korean version of the Hamilton Depression Scale (K-HDRS).^[14] Patients who were included in the final the analysis met the MDD criteria of the DSM-IV-TR and scored 8 or above on the K-HDRS ($n=40$). The patients were asked for their informed consent prior to the studies, and further inclusion screening proceeded only for those who agreed to participate in the study. A brief interview was administered to check personal information and medical/psychiatric history. Some patients were excluded from participation based on the following criteria: physical disability, life-threatening medical disorder, history of neurological illness, bipolar depression, history of psychotic features/disorders, or a neurodevelopmental disorder including an intellectual disability. The demographic and clinical characteristics of the patients with MDD are shown in Table 1. A total of 13 of the 40 patients had at least one current comorbid psychiatric disorder; most had a comorbid anxiety disorder ($n=9$), whereas others had somatoform disorder, anorexia nervosa, attention deficit hyperactivity disorder, and adjustment disorder. The Korean Vineland Adaptive Behavior

Scale-II (K-Vineland-II) caregiver/parent report form was used as the major measurement tool. We used the adaptive functioning caregiver/parent reporting scale with consideration for potential negative self-reporting bias.^[15] The Korean version of the Center for Epidemiological Studies-Depression Scale (K-CES-D)^[16] was used to measure to the severity of depressive symptoms. The Korean version of the Wechsler Adult Intelligence Scale-IV (K-WAIS-IV)^[17] was used to measure premorbid intellectual ability. The study protocol was reviewed and approved by the Hallym Sacred Heart Hospital Institutional Review Board/Ethic Committee (IRB No. 2015-I097).

2.2. Measures

2.2.1. Mini International Neuropsychiatric Interview-Plus.

The MINI, developed by Sheehan et al,^[18] is a structured clinical interview tool used to evaluate Axis I psychiatric disorders based on the DSM-IV and the ICD-10. The questions within this interview contain inclusion and exclusion criteria for psychiatric diagnoses. In the Korean validity study, it had internal consistencies ranging from 0.42 to 0.91.^[13] The MINI-Plus is the most in-depth version of various versions of the MINI.

2.2.2. Korean Version of the Hamilton Depression Rating Scale.

The K-HDRS is a semi-structured and clinician-administered interview used to evaluate symptom severity and treatment outcomes in patients with depression. It contains 17 items measuring depressive symptoms over the past 7 days. The total score on the K-HDRS ranges from 0 to 52. The scale was developed by Yi et al and has good reliability and validity.^[14]

2.2.3. Center for Epidemiological Studies-Depression Scale.

The CES-D scale is a brief self-report questionnaire developed to measure self-reported symptoms associated with depression experienced in the past week.^[19] The CES-D scale includes 20 items comprising 6 scales reflecting major facets of depression: depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance. The total score ranges from 0 to 60, with higher scores indicating more severe depressive symptoms. The suggested cutoff-score for screening cases meeting MDD diagnostic criteria of the K-CES-D, developed by Cho and Kim, is 25.^[16]

2.2.4. Korean-Vineland Adaptive Behavior Scale-II.

The K-Vineland-II was developed by Hwang et al, and its reliability and validity have been verified.^[15] There are two versions of the K-Vineland-II: an interview format version and a parent/caregiver self-report format version. Item content and the order of both forms are the same. No significant differences are observed between the results from the two forms.^[20] In this study, we used the caregiver/parent rating form for convenience and effectiveness and, if necessary, we conducted an additional interview with a caregiver by phone or in person to minimize possible rater bias.

The K-Vineland-II consists of three subscales:

1. communication (receptive, expressive, and written),
2. daily living skills (personal, domestic, and community), and
3. socialization (interpersonal relationships, play and leisure, and coping skills).

The three domain scores are combined to yield an adaptive behavior composite (ABC) score. The age-normed standard scores for the three domains and the ABC have a mean of 100 and SD of 15. Age-normed standard scores for the nine subdomains

| Table 1 | |
|--|------------------|
| Demographic and clinical characteristics of patients with MDD. | |
| Patients with MDD | N = 40 |
| | N (%) |
| Gender, M:F | 20 (50): 20 (50) |
| Job (+) | 28 (70) |
| Family loading (+) | 8 (20) |
| | Mean (SD) |
| Age | 29.93 (12.91) |
| Education | 13.38 (1.98) |
| Premorbid IQ | 103.56 (12.43) |
| Age of onset | 25.80 (14.12) |
| Duration (days) | 219.55 (121.11) |
| Depressive episodes | 1.90 (0.78) |
| K-CES-D | 38.40 (11.71) |
| K-HDRS | 19.13 (7.34) |

MDD = major depressive disorder, K-CES-D = Korean version of Center for Epidemiologic Studies Depression Scale, K-HDRS = Korean version of Hamilton Depression Rating Scale.

have a mean of 15 and SD of 3, with higher scores indicating better adaptive function.

2.2.5. Premorbid IQ. We used the Korea Premorbid Intelligence Estimate (KPIE) as an estimate of premorbid intellectual functioning.^[21] Both demographic and current performance methods are utilized in a regression algorithm for the KPIE procedure. To measure current performance, we administrated four subtests of the K-WAIS-IV: vocabulary (VC), information (IN), matrix reasoning (MR), and visual puzzle (VP). We used the KPIE-4 (4ST) among the KPIE-4 equations, and its prediction algorithm was as follows:

$$26.86 + 0.498(\text{VC}) + 0.93(\text{IN}) + 0.929(\text{MR}) + 0.986(\text{VP}) + 0.555(\text{age}) - 0.9(\text{education})$$

2.3. Statistical analysis

We conducted the one sample *t* test to compare scores on each measurement of adaptive functioning in the patients with MDD and the known mean value of the general population. The test value that we used to assess the difference in the mean scores of our sample against the mean of the normal group on the K-Vineland-II was 100 for ABC and the three domain scores, and 15 for the nine subdomain scores.^[15] After dividing the patients with MDD into two groups, MDD with comorbid psychiatric diseases (MDD+, *n* = 13) and MDD without comorbid psychiatric diseases (MDD–, *n* = 27), we carried out an independent *t* test to compare differences in the adaptive functioning measurements between the two groups. The K-Vineland-II was more easily comparable with intellectual ability due to having the same standardized scores (e.g., mean of 100 and SD of 15). Therefore, we compared the adaptive function scores measured by the K-Vineland-II with the IQ scores estimated by the K-WAIS-IV to identify a decline in expected adaptive function given the premorbid IQ.

3. Results

Table 2 shows the results of the correlation analysis between the demographic/clinical characteristics and adaptive functioning.

The ABC score of the K-Vineland-II was negatively correlated with the number of depressive episodes (*r* = –0.32, *P* < .05) and the socialization domain score was positively correlated with gender (*r* = 0.38, *P* < .05). The expressive subdomain score on the K-Vineland-II was positively correlated with age and age at onset (all *r* > 0.32, *P* < .05), but was negatively correlated with the number of depressive episodes (*r* = –0.42, *P* < .05). The domestic subdomain score was positively correlated with gender (*r* = 0.33, *P* < .05) but negatively correlated with education (*r* = –0.37, *P* < .05). The interpersonal relationships subdomain score and the play and leisure subdomain score were positively correlated with gender (*r* = 0.37, *r* = 0.41, respectively; *P* < .05).

The results of the one sample *t* test showed that patients with MDD received significantly lower scores than the norm group regarding the mean on the ABC and the three domain scores measured by the K-Vineland-II (ABC *t* = –6.11, *P* < .001; communication *t* = 5.67, *P* < .001; daily living skills *t* = –3.17, *P* < .01; and socialization *t* = –5.18, *P* < .001; Table 3). Patients had significantly lower scores than the norm group for all subdomains of the K-Vineland-II except for the personal subdomain (Table 3). Furthermore, patients indicated significantly lower adaptive function than their estimated premorbid IQ (Table 4). None of the scores on any of the scales differed between the MDD+ and MDD– groups (all *t* > 1.32, *P* > .05).

In addition, we investigated how many patients were one SD below the mean of the norm group for each adaptive functioning scale. The results showed that 48% to 94% of patients were less than one SD away from the mean value on the K-Vineland-II of the norm group (Fig. 1).

4. Discussion and conclusions

This study investigated the impact of MDD on adaptive functioning. Patients with MDD showed functional impairment in the overall domain and in some specific domains compared to the norm group. This study also revealed a significant functional decline relative to the patients’ estimated premorbid IQ. Furthermore, the MDD+ and MDD– groups were not significantly different in their levels of functional impairment.

Table 2
The results of the correlational analysis between adaptive function (K-Vineland-II) and demographic/clinical variables in patients with MDD.

| | Gender ^a | Age | Education | Age of onset | Duration | Depressive episodes | K-CES-D |
|-----------------------------|---------------------|-------|-----------|--------------|----------|---------------------|---------|
| Receptive | 0.05 | 0.22 | –0.03 | 0.13 | 0.02 | –0.05 | –0.05 |
| Expressive | 0.02 | 0.32* | –0.06 | 0.33* | 0.01 | –0.42** | 0.00 |
| Written | 0.19 | 0.19 | 0.02 | 0.20 | –0.13 | –0.07 | 0.05 |
| Communication | 0.09 | 0.29 | –0.04 | 0.30 | –0.06 | –0.30 | 0.01 |
| Personal | 0.12 | 0.21 | –0.17 | 0.23 | –0.16 | –0.17 | 0.22 |
| Domestic | 0.33* | 0.02 | –0.37* | 0.03 | –0.15 | –0.16 | –0.06 |
| Community | 0.17 | 0.10 | –0.01 | 0.14 | –0.13 | –0.22 | 0.14 |
| Daily living skills | 0.28 | 0.15 | –0.21 | 0.18 | –0.19 | –0.27 | 0.15 |
| Interpersonal relationships | 0.37** | 0.18 | 0.00 | 0.25 | –0.08 | –0.29 | 0.09 |
| Play and leisure | 0.41** | 0.07 | –0.16 | 0.09 | –0.16 | –0.01 | –0.25 |
| Coping skills | 0.29 | 0.09 | –0.13 | 0.18 | 0.14 | –0.13 | –0.05 |
| Socialization | 0.38* | 0.08 | –0.07 | 0.17 | –0.10 | –0.22 | –0.08 |
| ABC | 0.30 | 0.17 | –0.10 | 0.23 | –0.14 | –0.32* | 0.03 |

ABC = Adaptive Behavior Composite, K-CES-D = Korean version of Center for Epidemiologic Studies Depression Scale, K-Vineland-II = Korean Vineland Adaptive Behavior Scales-II, MDD = major depressive disorder.

^a Male = 0, female = 1.

* *P* < .05.

** *P* < .01.

Table 3
Comparisons of mean standard scores on K-Vineland-II between patients with MDD and norm reference group.

| | Mean | SD | <i>t</i> | <i>df</i> | <i>P</i> | Mean differences ^a |
|-----------------------------|-------|-------|----------|-----------|----------|-------------------------------|
| Receptive | 13.00 | 3.10 | -4.09 | 39 | .000 | -2.00 |
| Expressive | 12.68 | 3.32 | -4.42 | 39 | .000 | -2.33 |
| Written | 13.10 | 2.71 | -4.44 | 39 | .000 | -1.90 |
| Communication | 86.30 | 15.27 | -5.67 | 39 | .000 | -13.70 |
| Personal | 14.43 | 3.08 | -1.18 | 39 | .245 | -.58 |
| Domestic | 14.03 | 2.39 | -2.58 | 39 | .014 | -.98 |
| Community | 13.45 | 3.19 | -3.08 | 39 | .004 | -1.55 |
| Daily living skills | 92.63 | 14.71 | -3.17 | 39 | .003 | -7.38 |
| Interpersonal relationships | 12.03 | 2.97 | -6.35 | 39 | .000 | -2.98 |
| Play and leisure | 13.20 | 3.63 | -3.14 | 39 | .003 | -1.80 |
| Coping skills | 13.10 | 2.64 | -4.48 | 39 | .000 | -1.90 |
| Socialization | 85.28 | 17.97 | -5.18 | 39 | .000 | -14.73 |
| ABC | 84.10 | 16.46 | -6.11 | 39 | .000 | -15.90 |

ABC=adaptive behavior composite, K-Vineland-III=Korean Vineland Adaptive Behavior Scales-II, MDD=major depressive disorder.

^a Comparison result with the mean of normative group (Domain 100, subdomain 15).^[20]

This study replicated the existing evidence^[22,23] by showing significant differences between global and domain-specific functional outcomes in patients with MDD and a general healthy population. A major clinical implication of our results was the quantitative assessment of the nature and degree of impairment in adaptive functioning in patients with MDD using a standardized multidimensional scale, the K-Vineland-II, reported by caregivers or parents. Such a scale has seldom been used in previous studies. We used this scale and were able to emphasize the importance of the type of measure used for adaptive functioning to manage and treat patients.

Patients with MDD had several impaired adaptive functions, such as communication, daily living skills, and socialization. This finding was consistent with previous studies showing that MDD has an adverse effect on the number of adaptive functions in areas of family, school, interpersonal relationships, and general health, resulting in decreased quality of life.^[24,25] Although the patients showed a similar performance to the norm group in objective language ability measured by vocabulary and information on the K-WAIS-IV, their performance on the K-Vineland-II communication domain was significantly poorer compared to that of the norm group. This finding implies that the decline in patient communication skills was not due to their language ability, but rather that the patients tended to be preoccupied with their thoughts and emotions.^[26,27] This may then cause longer latency periods during discourse^[28] and distract them from the topic of conversation.^[29] This can make smooth and reciprocal communication difficult for patients.

Consistent with our results, impaired social functioning due to interpersonal difficulties and coping deficits has been frequently reported in patients with MDD.^[30] Diverse factors can cause

defective social/interpersonal interactions: failure in socio-emotional recognition and regulation, impaired ability to assess interpersonal threats and safety,^[31] decreased social drive and needs,^[32] deficits in the empathic response during social interaction,^[33] and a lack of nonverbal expression, such as a decrease in pleasurable facial expressions and smiling.^[34] Disability in social interactions can persist even after symptoms resolve; it can continue for 3 years after depressive symptoms recover^[35] and cause disability in occupational functioning, such as unemployment and decreased job performance.^[36] Patients with MDD have a higher risk for occupational impairment and a greater chance of loss of job productivity compared to those of a normal population.^[37,38] The decreased occupational functioning accompanied by loss of productivity can be twice as burdensome for patients with MDD.

Patients with MDD scored significantly lower in the play and leisure subdomain than the norm group. Patients with MDD typically show diminished interest in activities for most of the day and loss of interest in activities that are usually considered pleasurable. Play and leisure activities give patients a chance to experience positive emotions; thus, the notable decrease in these activities is associated with the risk of aggravating unwanted mood symptoms. Many studies have demonstrated the relationship between depression and the level of involvement in activities by patients. A longitudinal study in the general population recorded depressive symptoms and the time spent on physical activities per week at the ages of 23, 33, 42, and 50 years, and showed a bidirectional relationship between depressive symptoms and time spent on physical activities.^[39] In other words, people with increased frequency of leisure time and engagement in physical activities reported only a few depressive symptoms,

Table 4
Adaptive function compared to estimated premorbid IQ in patients with MDD.

| | Mean differences | SD | <i>t</i> | <i>df</i> | <i>P</i> |
|----------------------------------|------------------|--------|----------|-----------|----------|
| Premorbid IQ—communication | 17.262 | 16.566 | 6.591 | 39 | .000 |
| Premorbid IQ—daily living skills | 10.937 | 16.105 | 4.295 | 39 | .000 |
| Premorbid IQ—socialization | 18.287 | 20.772 | 5.568 | 39 | .000 |
| Premorbid IQ—ABC | 19.462 | 18.037 | 6.824 | 39 | .000 |

ABC=adaptive behavior composite, MDD=major depressive disorder.

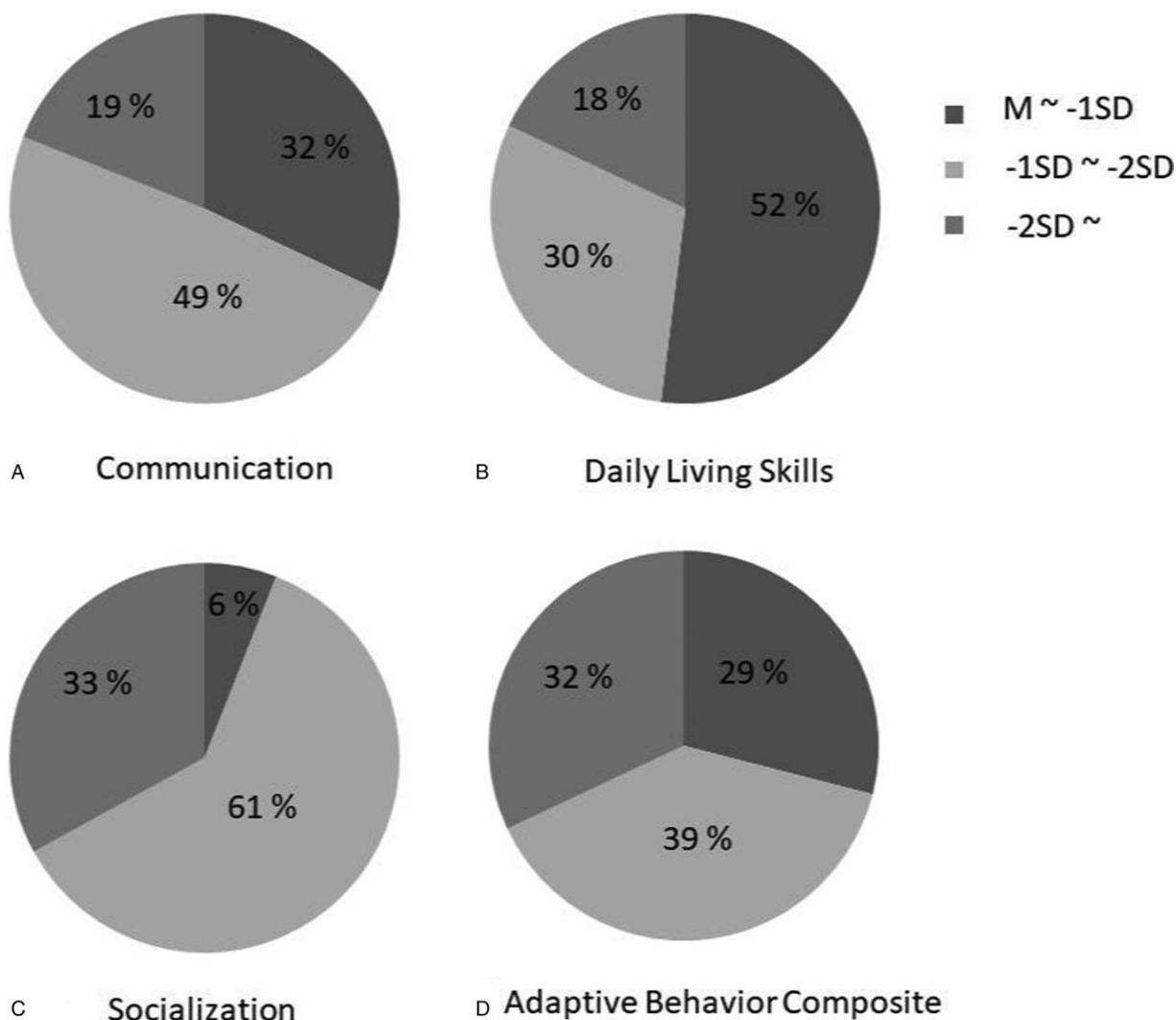


Figure 1. Percentage of low adaptive functioning on ABC and three domains of K-Vineland-II in patients with MDD compared to the mean and standard deviation of the norm group. ABC=adaptive behavior composite score, K-Vineland-II=Korean-Vineland Adaptive Behavior Scales-II, MDD=major depressive disorder.

whereas people who participated in fewer physical activities reported many depressive symptoms. A Cochrane review of the literature comparing physical activities to standard treatment or no treatment concluded that physical activities have a clinically moderate effect on depression.^[40] Involvement in pleasurable leisure activities not only plays a pivotal role in coping with daily stress but also promotes positive emotions and emotional well-being.^[41] Denovan and Macaskill^[42] reported that leisure activities contribute to buffering stress, generating positive emotions, achieving a healthy work-life balance, and prompting interpersonal relationships. Therefore, helping patients with MDD to enhance their play and leisure activities could contribute to rapid recovery and inhibit relapse by offsetting the adverse effects of depressive symptoms on socially adaptive functioning.

Studies investigating daily living skills in patients with MDD have mostly focused on older adults, not younger adults, and decreases in basic and complex daily living skills were demonstrated in these studies.^[43,44] However, only a few studies have investigated daily living skills in adult patients with MDD. Patients with MDD exhibited significantly poorer performance

compared to that of the norm group in domestic and community skills, except personal living skills, in the daily living skills subdomain of the K-Vineland-II. In other words, patients may have difficulty with living skills more complex than basic daily living skills such as personal living skills. One reason for this may be that the age of the patients recruited for this study was <60 years.

The K-Vineland-II utilized in this study is a standardized multi-dimensional tool used to assess adaptive functioning via caregiver or parent report. Using this standardized measure made it easier to quantify patients' functional outcomes and compare them with results from other studies. We used the caregiver- or parent-reported scale of adaptive functioning as an alternative method to mitigate the response bias that may occur with self-reported scales. Previous research mainly used self-reported measures of adaptive functioning, which tend to be susceptible to the rater's response bias.^[45] Depressed subjects lose their ability to rate themselves objectively and tend to answer most questions negatively.^[46] This negative response bias may inflate the correlation between measurements. Moreover, we had 21

patients for whom we could independently verify K-Vineland-II scores to check for consensus between the patient-rated and caregiver-rated responses. We also carried out a correlation analysis between patient-administered measurements and the caregiver-administered measurements on the K-Vineland-II. According to the results, a significant correlation was observed in the communication domain of the K-Vineland-II ($r=0.59$, $P<.01$) but no significant correlations were observed in the other two domains (daily living skills, $r=0.27$, $P>.05$; and socialization, $r=0.38$, $P>.05$) or the ABC ($r=0.42$, $P>.05$) of the K-Vineland-II between the patient and caregiver reports. This result is likely due to the different viewpoints patients and their caregivers have on adaptive functioning; the patients tend to cast a more negative view on their functions than their caregivers. Another possible reason for this disagreement may be due to self-awareness of the decreased adaptive functioning that allows patients to see what people around them may not see. If true, it may bring about additional distress, which makes it necessary to clarify this issue using objective measures of adaptive functioning. Given this disagreement between raters, acquiring information from diverse informants other than the patients themselves to measure adaptive function may enhance the validity of the information and clarify the relationship between the measures.

We conducted a correlation analysis to assess the relationship between adaptive function and clinical/demographic factors. The number of episodes among clinical factors was negatively correlated with overall adaptive functioning and expressive communication, indicating that recurrent episodes may have a negative effect on adaptive function. This result is consistent with previous studies.^[6,47] Age of onset was positively correlated with adaptive function (e.g., expressive communication), indicating that patients with a later age of onset had better adaptive function, as expected from prior studies.^[48,49] The socialization and domestic subdomain within daily living skills was significantly correlated with gender rather than other clinical characteristics related to mood. That is, the effect of gender seemed to be greater than that of depression on those two functional domains. Female dominance over males in these adaptive functions has been reported.

The present study had several limitations. Our study only compared adaptive function between only patients with MDD and the norm group without considering other clinical groups, which leaves room for future studies. This study had a cross-sectional design with a small sample size. While we did not assess the premorbid levels of adaptive functioning, we estimated patients' premorbid IQ and investigated the degree to which their adaptive functions had declined, given the premorbid IQ. A large longitudinal scale study may be necessary in the future to identify functional decline compared to the premorbid functional status as well as premorbid IQ. Another limitation to this study may also be that the caregiver and self-report format was not completely free from response bias. To minimize this problem, we conducted additional interviews with caregivers by phone or in person.

Despite these limitations, this study has a major clinical implication in terms of measuring the nature and the extent of various functional outcomes in patients with MDD using a standardized multidimensional scale reported by caregivers or parents. Although subjective complaints regarding adaptive functional decline are common among MDD patients, both clinicians and researchers have paid relatively little attention to the functional outcomes. Our results highlight the importance of measuring functional impairment properly, and the importance

of recognizing and managing functional outcomes in clinical practice. Further studies are needed to identify which specific adaptive functioning would be one of the best markers for MDD.

Acknowledgments

None.

Author contributions

Conceptualization: Eun-Hee Park, Myung Hun Jung.

Data curation: Myung Hun Jung.

Formal analysis: Eun-Hee Park.

Investigation: Eun-Hee Park, Myung Hun Jung.

Writing – original draft: Eun-Hee Park.

Writing – review & editing: Myung Hun Jung.

Myung Hun Jung orcid: 0000-0003-2393-3930.

Eun-Hee Park orcid: 0000-0002-0791-4687.

References

- [1] Murray CJ, Lopez AD. Measuring the global burden of disease. *N Engl J Med* 2013;369:448–57.
- [2] Kessler RC, Berglund P, Demler O, et al. The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). *JAMA* 2003;289:3095–105.
- [3] Kennedy N, Foy K, Sherazi R, et al. Long-term social functioning after depression treated by psychiatrists: a review. *Bipolar Disord* 2007;9:25–37.
- [4] McKnight PE, Kashdan TB. The importance of functional impairment to mental health outcomes: a case for reassessing our goals in depression treatment research. *Clin Psychol Rev* 2009;29:243–59.
- [5] Hardeveld F, Spijker J, De Graaf R, et al. Prevalence and predictors of recurrence of major depressive disorder in the adult population. *Acta Psychiatr Scand* 2010;122:184–91.
- [6] Solomon DA, Keller MB, Leon AC, et al. Multiple recurrences of major depressive disorder. *Am J Psychiatry* 2000;157:229–33.
- [7] Judd LL, Akiskal HS, Zeller PJ, et al. Psychosocial disability during the long-term course of unipolar major depressive disorder. *Arch Gen Psychiatry* 2000;57:375–80.
- [8] Iosifescu DV. The relation between mood, cognition and psychosocial functioning in psychiatric disorders. *Eur Neuropsychopharmacol* 2012;22(Suppl 3):S499–504.
- [9] Jaeger J, Berns S, Uzelac S, et al. Neurocognitive deficits and disability in major depressive disorder. *Psychiatry Res* 2006;145:39–48.
- [10] Lam RW, Kennedy SH, McLintyre RS, et al. Cognitive dysfunction in major depressive disorder: effects on psychosocial functioning and implications for treatment. *Can J Psychiatry* 2014;59:649–54.
- [11] Zimmerman M, McGlinchey JB, Posternak MA, et al. Discordance between self-reported symptom severity and psychosocial functioning ratings in depressed outpatients: implications for how remission from depression should be defined. *Psychiatry Res* 2006;141:185–91.
- [12] American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed., text-revision. Washington, DC: American Psychiatric Association; 2000.
- [13] Yoo SW, Kim Y S, Noh F S, et al. Validity of Korean version of the Mini-International Neuropsychiatric Interview. *Anxiety Mood* 2006;2:50–5.
- [14] Yi JS, Bae SO, Ahn YM, et al. Validity and reliability of the Korean version of the Hamilton Depression Rating Scale (K-HDRS). *J Korean Neuropsychiatr Assoc* 2005;44:456–65.
- [15] Hwang ST, Kim JH, Hong SH, et al. Standardization study of the Korean Vineland Adaptive Behavior Scales-II (K-Vineland-II). *Korean J Clin Psychol* 2015;34:851–76.
- [16] Cho MJ, Kim KH. Diagnostic validity of the CES-D (Korean version) in the assessment of DSM-III-R major depression. *J Korean Neuropsychiatr Assoc* 1993;32:381–99.
- [17] Hwang ST, Kim JH, Park KB, et al. Korean-Wechsler Adult Intelligence Scale-IV. Daegu: Korea Psychology; 2012.
- [18] Sheehan DV, Lecrubier Y, Sheehan KH, et al. The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *J Clin Psychiatry* 1998;59(Suppl 20):22–33. quiz 34–57.

- [19] Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas* 1977;1:385–401.
- [20] Na YA, Hwang ST, Hong SH, et al. A preliminary study for the standardization of the Korean version of Vineland Adaptive Behavior Scales revised: a comparison between Survey Interview Forms and Parent/Caregiver Rating Forms. *Korean J Clin Psychol* 2015;34:375–90.
- [21] Kim SG, Lee EH, Hwang ST, et al. Estimation of K-WAIS-IV premorbid intelligence in South Korea: development of the KPIE-IV. *Clin Neuropsychol* 2015;29(Suppl 1):19–29.
- [22] Hammer-Helmich L, Haro JM, Jonsson B, et al. Functional impairment in patients with major depressive disorder: the 2-year PERFORM study. *Neuropsychiatr Dis Treat* 2018;14:239–49.
- [23] IsHak WW, James DM, Mirocha J, et al. Patient-reported functioning in major depressive disorder. *Ther Adv Chronic Dis* 2016;7:160–9.
- [24] Hirschfeld RM, Dunner DL, Keitner G, et al. Does psychosocial functioning improve independent of depressive symptoms? A comparison of nefazodone, psychotherapy, and their combination. *Biol Psychiatry* 2002;51:123–33.
- [25] Miller IW, Keitner GI, Schatzberg AF, et al. The treatment of chronic depression, part 3: psychosocial functioning before and after treatment with sertraline or imipramine. *J Clin Psychiatry* 1998;59:608–19.
- [26] Grimm S, Ernst J, Boesiger P, et al. Reduced negative BOLD responses in the default-mode network and increased self-focus in depression. *World J Biol Psychiatry* 2011;12:627–37.
- [27] Schwartz-Mette RA, Rose AJ. Conversational self-focus in adolescent friendships: observational assessment of an interpersonal process and relations with internalizing symptoms and friendship quality. *J Soc Clin Psychol* 2009;28:1263–97.
- [28] Yang Y, Fairbairn C, Cohn JF. Detecting depression severity from vocal prosody. *IEEE Trans Affect Comput* 2013;4:142–50.
- [29] Schwartz-Mette RA, Rose AJ. Depressive symptoms and conversational self-focus in adolescents' friendships. *J Abnorm Child Psychol* 2016;44:87–100.
- [30] Ellgring H. *Non-verbal Communication in Depression*. Cambridge: Cambridge University Press; 2017.
- [31] Tse WS, Bond AJ. The impact of depression on social skills. *J Nerv Ment Dis* 2004;192:260–8.
- [32] Kupferberg A, Bicks L, Hasler G. Social functioning in major depressive disorder. *Neurosci Biobehav Rev* 2016;69:313–32.
- [33] Schreier S, Pijnenborg GH, Aan Het Rot M. Empathy in adults with clinical or subclinical depressive symptoms. *J Affect Disord* 2013;150:1–6.
- [34] Gotlib IH, Whiffen VE. Depression and marital functioning: an examination of specificity and gender differences. *J Abnorm Psychol* 1989;98:23–30.
- [35] Rhebergen D, Beekman AT, de Graaf R, et al. Trajectories of recovery of social and physical functioning in major depression, dysthymic disorder and double depression: a 3-year follow-up. *J Affect Disord* 2010;124:148–56.
- [36] Rizvi SJ, Cyriac A, Grima E, et al. Depression and employment status in primary and tertiary care settings. *Can J Psychiatry* 2015;60:14–22.
- [37] Greden JF. Workplace depression: personalize, partner, or pay the price. *Am J Psychiatry* 2013;170:578–81.
- [38] Trivedi MH, Morris DW, Wisniewski SR, et al. Increase in work productivity of depressed individuals with improvement in depressive symptom severity. *Am J Psychiatry* 2013;170:633–41.
- [39] Pinto Pereira SM, Geoffroy MC, Power C. Depressive symptoms and physical activity during 3 decades in adult life: bidirectional associations in a prospective cohort study. *JAMA Psychiatry* 2014;71:1373–80.
- [40] Cooney GM, Dwan K, Greig CA, et al. Exercise for depression. *Cochrane Database Syst Rev* 2013;CD004366.
- [41] Iwasaki Y, Coyle CP, Shank JW. Leisure as a context for active living, recovery, health and life quality for persons with mental illness in a global context. *Health Promot Int* 2010;25:483–94.
- [42] Denovan AM, Macaskill A. Stress, resilience, and leisure coping among university students: applying the broaden-and-build theory. *Leisure Stud* 2017;36:852–65.
- [43] Kazama M, Kondo N, Suzuki K, et al. Early impact of depression symptoms on the decline in activities of daily living among older Japanese: Y-HALE cohort study. *Environ Health Prev Med* 2011;16:196–201.
- [44] Wada T, Ishine M, Sakagami T, et al. Depression, activities of daily living, and quality of life of community-dwelling elderly in three Asian countries: Indonesia, Vietnam, and Japan. *Arch Gerontol Geriatr* 2005;41:271–80.
- [45] Voncken MJ, Bogels SM, Peeters F. Specificity of interpretation and judgemental biases in social phobia versus depression. *Psychol Psychother* 2007;80:443–53.
- [46] Spielmans GI, McFall JP. A comparative meta-analysis of Clinical Global Impressions change in antidepressant trials. *J Nerv Ment Dis* 2006;194:845–52.
- [47] Ryttsala HJ, Melartin TK, Leskela US, et al. Functional and work disability in major depressive disorder. *J Nerv Ment Dis* 2005;193:189–95.
- [48] Spijker J, Bijl RV, de Graaf R, et al. Determinants of poor 1-year outcome of DSM-III-R major depression in the general population: results of the Netherlands Mental Health Survey and Incidence Study (NEMESIS). *Acta Psychiatr Scand* 2001;103:122–30.
- [49] Zisook S, Rush AJ, Albala A, et al. Factors that differentiate early vs. later onset of major depression disorder. *Psychiatry Res* 2004;129:127–40.