

## Geriatric Dwelling Depression Measurement Based on Projective Image Analysis Modeling

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### Abstract

The growth of the older population is expected to further increase social problems associated with population aging, such as isolation, poverty, and depression. The emerging issues associated with the older population are also expected to provide further momentum on studies about the dwelling environment as factors that ensure the health of older people as well as improve their quality of life. Therefore, approaches for explaining the issues of the older age group should be diversified using a variety of factors and appropriate analytic tools. Studies on measuring depression have principally focused on assessing an objective self-report questionnaire, usually in a highly structured, textual form which may not reflect the cognitive impairment of older adults. The aim of this study was to define and measure dwelling depression among older adults in Korea. There are two specific hypotheses in this study as follows: (a) there will be statistically significant relationships with dwelling dissatisfaction and depression, and (b) dwelling depression tools containing text and images will be, respectively, assessment tools that have a good construct with content validity and reliability. In the first experiment, to define and measure dwelling depression, 301 people over 65 years old living in single and two-person households were surveyed using a text-based dwelling depression questionnaires from September 1–30, 2017. In the second experiment, to examine whether the projective image questionnaire could serve as a suitable replacement for the text-based questionnaires, the same participants were surveyed from January 22 to February 2, 2018. The results show that depression has a close correlation with dwelling dissatisfaction. In addition, the geriatric dwelling depression index (GDDI) based on the projective image was refined. Additionally, the projective image questionnaire has a close correlation with the text-based questionnaire. Finally, through ROC curve analysis, it was found that the projective image questionnaire can accurately predict a depression group. To this end, this preliminary study examined the validity of the projective image questionnaire in older adults to make this instrument feasible for older populations and to contribute to a profound understanding of geriatric depression due to the living environment. We hope they will provide a basis for further research on psychological diagnoses using projective images.

**Keywords:** Projective Techniques, Scale Validation, Dwelling Depression, Older Adults, Older Households

### 1. Introduction

Population aging is expected to further increase social problems, such as isolation, depression, and loss of control over their everyday lives. The older population is characterized by a stronger need for a decent dwelling condition, which is one of the crucial elements that determine one's quality of life, than any other age group.

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In the elderly, reports of the prevalence of depression among the non-institutional population range from approximately 8 to 16% [1, 2]. Late life depression often is associated with the aging process and worsens their physical health. It is reported that retirement, physical degeneration, and personal control account for the rise in depression in those over 60 years of age [3]. Especially, living environments are described as an important element in the lives of older people because they spend much time indoors due to the decreasing number of people who are in the workforce. Compared to depression in other age groups, geriatric depression tends to increase, sustained by such triggers as reduced physical functions, poverty, social isolation, and the death of spouses. Moreover, role loss, reduced income, widowhood and decreased physical capacities limit the activity space of older people and make the proximate environment more important [4]. Research on geriatric depression thus takes into consideration the changes in the lives of older people. The emerging issues associated with the older population are also expected to provide further momentum to studies on the dwelling environment as factors that ensure the health of older people as well as improve their quality of life. Previous studies have shown that depressive symptoms were higher in those with high levels of housing-related external control beliefs and lower in those with low levels of housing-related external control beliefs [5]. Extant literature on the dwelling environment of older occupants has reported a close correlation between their quality of life and depression. This implies that a different dwelling environment can lead to differences in older people's feelings of psychological loneliness, social isolation, and depression. Understanding the role of the dwelling as a factor that influences the health conditions of older occupants thus requires a comprehensive analysis of the physical, socio-economic, and cultural circumstances of the residence [6]. Therefore, the role of the housing environment as a factor to improve the physical and psychological health and quality of life of elderly will be emphasized. Additionally, understanding the difficulties of the elderly and measures of elderly depression can effectively prevent or reduce suicide risk factors and the correlates of mental disorders.

Because of the importance of the well-being of the elderly which is related to their housing environment and surrounding community, interest in the clinical psychology of aging has gained much attention. However, few tools provide an analysis of an older adult's perceived living environment even though several assessment tools are essential for diagnosing mental health in the elderly. Studies ON measuring depression in older age groups have principally focused on assessing an objective self-report questionnaire such as the Geriatric Depression Rating Scale (GDS) [7] and the Beck Depression Inventory (BDI) [8]. Approaches to understanding or explaining the issues of older age groups should be diversified using the appropriate analytic tools because the use of objective questionnaires have several disadvantages compared with subjective questionnaires. Previous research has reported that understanding the objective form demands a complicated cognitive process compared to the subjective form [9]. It may not reflect cognitive impairment in older adults who experience difficulty in concentration. Some of the limitations of affect questionnaires, including cognitive load, overall burden, and time-to-complete, can be overcome using methods that rely on subjective questionnaires. There are several measurements that collect self-report data with the proper design for clinical use. For example, Self-assessment manikin (SAM) is the pictorial self-report scales that measure affective dimensions such as pleasure, arousal, and dominance [10]. Snodgrass and Vanderwart (1980) provided an accompanying series of subjective ratings for the images, which have been proven to be extremely useful to researchers [11]. In contrast to structured personality tests, a projective image questionnaire presents the supplementary information that cannot be expressed in the text.

Depression may be masked by atypical physical and/or psychological symptoms, which may lead to under-diagnosis or even misdiagnosis [12]. Research indicates that subjective tests such as projective technique, as opposed to objective tests, may compensate for conscious defenses. Carl Gustav Jung viewed the mind as consisting of both the conscious and the unconscious, wherein the unconscious serves as a means to project the qualities of our hidden, unacknowledged inner selves onto others [13]. Projective techniques are processes to understand inner emotions, desires or feelings that are projected outwards and perceived as something external [14]. Projective technique is the subjective tool that evaluates an individual's personality and emotional disorder. Projective technique assesses psychological conditions by observing an individual's emotions that are projected through vague stimuli such as images. Accordingly, the projective method is useful in diagnosing an individual's psychological condition and personality structure in clinical research settings.

Some researchers have used projective technique in an attempt to the understanding the aging process. For example, House-Tree-Person (HTP) [15] is one of the most widely used projective technique for children and adults. Moreover, the Kinetic House-Tree-Person (KHTP) [16], which is a modified form of the standardized HTP technique, was developed. The KHTP test not only maintains the standardized features but also provides the kinetic interaction between the drawn person, house, and tree, as well as extended information such as the projections and perceptions that the drawers perceive towards self, others, and the surrounding environment [9, 17]. In the KHTP, mental health, including positive interpersonal relationships, self-regard, and affect, can be inferred based on the location, size, and shape of the house, tree, and person as well as mental problems such as aggression, anger, compulsion, a sense of inferiority, anxiety, and depression [18]. The tree often reflects individual changes; the person depicts the ego function through its interaction with the tree, and life aspects can be observed through the drawing of the house. The KHTP reflects the sociability and self-image through the dynamic between the size, distance, and interaction of the house, tree, and person. Thus, it is effective in diagnosing the inner traits of individuals as well as their domestic dynamics [19].

## 2. Method

In this study, we used Yesavage's 15-item Geriatric Depression Scale (GDS-15) [20] to measure depression. The GDS-15 consisting of 15 questions is easily used to diagnose mental illness. We adopted a 5-point Likert scale for the 15 items and asked the survey respondents to provide answers accordingly. Each scale was anchored between 1 = "strongly disagree" and 5 = "strongly agree," The range of scores was 15-75 for depression. We measured subjective dwelling dissatisfaction (DDS) among older people which includes the physical, socio-economic, cultural, and psychological characteristics of the dwelling environment.

To take into consideration the various aspects of the respondents' awareness of and satisfaction with their dwelling environment including the physical, social, and psychological aspects, we incorporated into our survey not only the physical elements but also the elements required to sustain life, to avoid danger (safety and protection) and to maintain health (health) as well as elements that address inconveniences in daily lives (convenience), ensure a comfortable life (pleasantness) and sustain future life (sustainability). The physical elements of the residences were divided into home ownership and occupancy status, and a total of 12 question items about convenience, safety, and the dwelling environment were designed with a 5-point Likert scale to gain a comprehensive picture of the overall degree of dwelling dissatisfaction. Each scale was anchored between 1 = "strongly disagree" and 5 = "strongly agree," The range of scores was 12-60 for dwelling dissatisfaction.



**Figure 1. Samples of the Dwelling Depression Questionnaire based on a projective image:  
(a) ego-projected image (b) KHTP**

Also, we developed a projective image scale [21, 22] on dwelling depression for older adults examining whether the image-based scale can replace the text-based scale. In the first experiment, to define and measure dwelling depression, 301 people over 65 years old living in single and two-person households were surveyed using text-based dwelling depression questionnaires from September 1–30, 2017. In the second experiment, to examine whether the projective image questionnaire could serve as a suitable replacement for the text-based questionnaires, the same participants were surveyed from January 22 to February 2, 2018. Twelve out of 50 images were constructed for a new assessment of depression symptoms by 4 clinical art psychotherapy experts in the pilot experiment. The pilot test participants observed samples with different image sizes, positions, and

line directions and compared the emotional response. The developed questionnaire was designed on a 5-point Likert scale to gain a comprehensive image of the overall degree of depression. Each scale was anchored between 1 = “strongly disagree” and 5 = “strongly agree,” The range of scores was 12-60 for dwelling depression.

### 3. Results

**Table 1. Main parameters**

Category	No. of respondents	Proportion (%)
Gender	Men	44.9
	Women	55.1
Age (years)	65-69	32.6
	70-74	33.6
	74-49	19.6
	81-84	12.0
	85-89	2.3
Area of residence	Dong-gu	23.3
	Seo-gu	32.9
	Jung-gu	23.6
	Gye-ryong City	7.0
	Gongju City	8.0
	Geumsan County	5.0
	Yuseong-gu	0.3

As shown in Table 1 below, we divided the demographic variables into gender, area of residence, form of household, housing category, and type of occupancy. The GDS-15 and the dwelling satisfaction scale were used to examine the degree of dwelling dissatisfaction and depression among the older people. First, principal component analysis (PCA) was used to evaluate the factor structure and the reliability analysis was done to identify the degree of internal consistency of the GDS-15 and the dwelling satisfaction scales. The reliability analysis of the GDS scale (Cronbach's  $\alpha = .934$ ) and dwelling dissatisfaction scale (Cronbach's  $\alpha = .943$ ) indicated a high consistency. Pearson's correlation coefficient was used to identify the correlation between dwelling and depression using the depression scale and dwelling dissatisfaction. As a result, we found that an older household generally had a higher degree of depression when the residents felt dissatisfied with their dwelling environment.

We performed a linear regression analysis, with the respondents' basic characteristics set as the independent variable and geriatric depression as the dependent variable to control for the influence of other variables on depression. A high GDS-15 score generally leads to high dwelling dissatisfaction scores. However, special cases, in which the GDS-15 score is high but dwelling dissatisfaction is low, cannot be interpreted as severe dwelling depression. We found that the mean value of the variance explained in the dwelling dissatisfaction among the 301 people was 36. Therefore, if the Dwelling Dissatisfaction was under 36, it can be said that the respondents' dwelling depression does not have a great impact on depression.

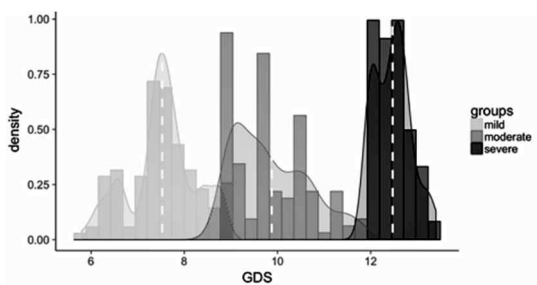


Figure 2. Histogram of the Depression Types

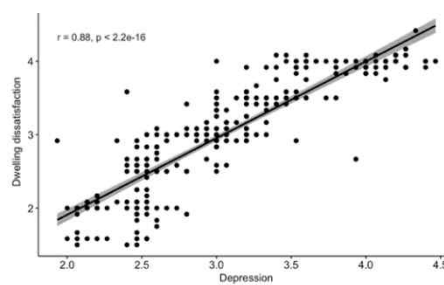


Figure 3. Correlation between depression and dwelling dwelling dissatisfaction

The group with GDS-15 scores above 60 and 75 or below was defined as the “severe dwelling depression” category. This group satisfies the dwelling dissatisfaction requirement of 36 or below. Additionally, the group with GDS-15 scores above 45 and 59 or below and a dwelling dissatisfaction score of 36 or below was defined as the “moderate dwelling depression” category. The group with a GDS-15 score above 20 and 44 or below and a dwelling dissatisfaction score of 36 or below, was defined as the “mild dwelling depression” category. Even in cases for which the GDS-15 score exceeds 20 and is 44 or below, it can be said that the group in question exhibits depression due to factors unrelated to dwelling depression if the dwelling dissatisfaction score is under 36. Such cases were deemed inappropriate for inclusion in the dwelling depression categories.

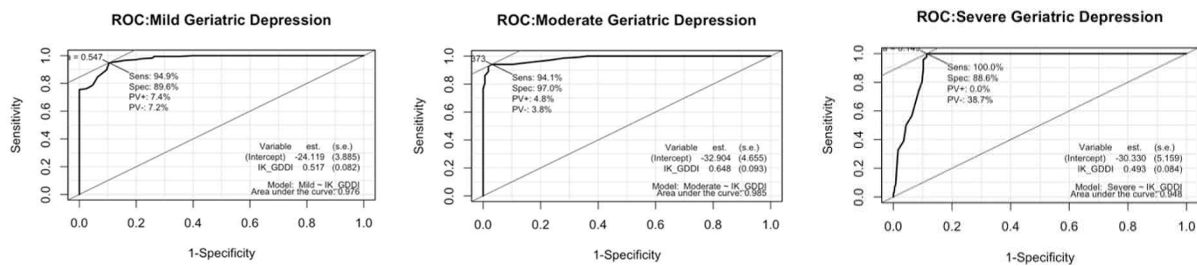
Table 2. Dwelling depression group

GDS \ DDS	DDS	
	Above 36	36 or below
Above 60-75	Severe dwelling depression	Moderate dwelling depression
45-59	Moderate dwelling depression	Mild dwelling depression
20-44	Mild dwelling depression	Depression risks due to factors other than dwelling

In the second experiment, to examine whether the projective image questionnaire could serve as a suitable replacement for the text-based questionnaire, an exploratory factor analysis and reliability analysis were performed to identify the degree of internal consistency of the projective image scale. The factor analysis of the projective image scale showed a relatively balanced factor loading under one component. The reliability analysis of the projective image scale also indicated a high consistency with Cronbach’s  $\alpha = 0.949$ .

$$GDDI(I) = \sum_{i=1}^{10} I + gender(x) \times 0.12 \quad \text{gender}(x) = \begin{cases} 1, & \text{if } x = male \\ 0, & \text{else} \end{cases}$$

In creating the Geriatric Dwelling Depression Index (GDDI) based on the projective image, we did a linear regression analysis with the respondents’ basic characteristics set as the independent variable and the projective image as the dependent variable to control for the influence of other variables. As a result, it was confirmed that the respondents’ gender, health conditions, tenure type, and economic condition were found to have a significant impact on the projective image scale. Thus, a new index was created by eliminating the impact of gender on the responses to each of the categories under the projective image scale from the total score. Health conditions, tenure type and economic status are categorical variables and were thus deemed inappropriate for inclusion in the index.



**Figure 4. ROC curve to diagnose dwelling depression based on the projective image scale**

Finally, ROC curve analysis was conducted to examine whether the projective image questionnaire can replace the text-based questionnaire and accurately predict the dwelling depression group. The aim of a ROC curve used in replacing and validating a diagnostic scale is to determine the extent to which a linear value can predict the diagnostic outcome by analyzing the sensitivity and specificity. The current study checked the area under the ROC curve (AUC) value. To make a diagnosis on dwelling depression, the subjects diagnosed with dwelling depression under the GDDI were set as the diagnosed value and the rest as the non-diagnosed value, and the sensitivity of predicting the diagnosis and the specificity of predicting the non-diagnosis were examined. A high sensitivity and specificity imply that the present index can replace the GDDI in diagnosing dwelling depression.

As shown in Fig. 4, for the severe geriatric dwelling depression category, the 301 subjects were divided into 46 diagnosed and 255 non-diagnosed cases, and the AUC value for the projective image scale-based geriatric dwelling depression index was 0.948. These correspond to a sensitivity value of 1.000 and a specificity value of 0.886. Next, for the moderate geriatric dwelling depression category, the 301 subjects were divided into 90 diagnosed and 211 non-diagnosed cases. The ROC curve analysis put the AUC value for the projective image scale-based geriatric dwelling depression index at 0.985. These are equivalent to a sensitivity value of 0.941 and a specificity value of 0.970. For the mild geriatric dwelling depression category, the 301 subjects were divided into 40 diagnosed and 261 non-diagnosed cases, and the AUC value for the projective image scale-based geriatric dwelling depression index was 0.970. These represent a sensitivity value of 0.949 and a specificity value of 0.896. The cut-off score, where the projective image scale-based GDDI produces optimal diagnoses of the severe, moderate, and mild geriatric dwelling depression categories were 58, 50, and 47, respectively.

#### 4. Conclusion

This study, along with defining the concept of dwelling depression, measured depression by applying the projective technique and verified the validity of the projective image questionnaire. We established a correlation between dwelling dissatisfaction and depression in older people. We defined the categories of dwelling depression to predict its severity using the outcome from the developed scales. To this end, the validity of the projective image scale, which can measure the degree of dwelling depression, was examined, and it was found that this instrument is feasible for older populations.

To summarize our findings, first, geriatric depression was found to have a close correlation with the dwelling environment with many of the depressed older people feeling dissatisfied with their dwelling conditions. More specifically, more severe geriatric depression has a negative impact on the factors influencing dwelling depression, such as convenience, safety, and the surrounding environment, which were considered under the dwelling satisfaction scale in the current study. This point is consistent with Kenneth's finding that stressful life events such as financial problems, serious housing problems, serious illness or injury, and job loss have a substantial causal relationship with the onset of episodes of major depression [24]. Second, there were only a small number of respondents who felt severely depressed but relatively satisfied with their dwelling environment, or who had a very low degree of depression despite their dissatisfaction with their dwelling

environment. Third, projective image-based questionnaire enabled us to examine severe, moderate, and mild dwelling depression groups which were calculated according to the GDDI based on the projective image equation. It is important because dwelling depression levels vary not only due to their psychoactive properties but also to the risks associated with their mental states.

We provide basic data for research on older people's housing stability which measures the degree of depression in older people. Moreover, our newly developed projective image scale and its categories will enable a more complementary alternative diagnosis of the degree of geriatric dwelling depression. We call for future research that considers the factors of dwelling depression based on the physical and psychological characteristics of the geriatric population, thereby measuring dwelling depression and presenting an associated scale in a more advanced manner.

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