

This is the peer reviewed version of the following article: Park, G-R, Seo, BK. Revisiting the relationship among housing tenure, affordability and mental health: Do dwelling conditions matter?. *Health Soc Care Community*. 2020; 28: 2225– 2232, which has been published in final form at <https://doi.org/10.1111/hsc.13035>. This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for Use of Self-Archived Versions.

## **Main text**

### **1. Introduction**

Housing is a fundamental social determinant of health (Dunn et al., 2004; Shaw, 2004). Most health research has focused on three key aspects of housing: physical housing conditions, housing affordability, and housing tenure. Specifically, substandard dwelling conditions, such as overcrowding and poor ventilation, are the well-known primary risk factors of infectious and respiratory disease. Also, housing problems may cause family disruption and deprivation (Singh, Aitken, Baker & Bentley, 2019; Chung et al., 2020). While homeownership gives homeowners a greater sense of comfort derived from favorable economic status (Baker, Mason, & Bentley, 2013; Rohe & Stegman, 1993), inadequate housing conditions tend to cause anxiety and depression (Shaw et al., 2004), and difficulties in affording adequate housing are likely to cause mental health problems (Mason, Baker, Blakely, & Bentley, 2013).

However, the association between housing and health outcomes requires a more in-depth and comprehensive analysis in view of the complicated relationship among the housing factors, themselves. For example, homeownership and affordable housing do not necessarily accompany decent dwelling conditions, particularly among low-income households (Pollack, Griffin, & Lynch, 2010). Although higher-income households are more likely to be homeowners, some of the low-income households might also be homeowners (Baker, Mason, & Bentley, 2013; Macintyre et al., 2003). Moreover, higher-income households tend to pay higher housing costs, but this is often because of their willingness to pay for decent housing, rather than financial hardship (Bentley et al., 2011; Rowley & Ong, 2012; Yates, 2007). It is therefore urged that research on the health

effect of housing needs more in-depth examinations, particularly of the simultaneous interplay of different dimensions of housing (Howden-Chapman, Chandola, Staffor, & Marmot, 2011).

Housing scene is multifaceted in the Republic of Korea (hereafter referred to as *Korea*). While 61% of the total households own their home in Korea, 49% of the low-income families (those in the lowest four income deciles) are owner-occupiers (MLIT, 2018). Moreover, while homeowners are usually exempted from most of the welfare services in Korea, homeownership assistance through tax benefits is advantaged to mainly the working population (Ha, 2004; OECD, 2018; Seo & Joo, 2018). Also, Korea ranked the lowest (15.2%) in spending for housing (i.e., the percentage of disposable income spent on housing) among the OECD (Organisation for Economic Co-operation and Development) member countries (19% on average)—presumably due to its unique housing lease system (Bank of Korea, 2018) — but the price-to-income ratio in Seoul has reached over 14, marking it as one of the highest among the developed Asian cities. The overall dwelling conditions in Korea, although it has been improved since 2000 (MLIT, 2018), have not surpassed those in other OECD countries (e.g., per capita room ranking 23rd out of 40; household sanitary facilities ranking 27th out of 40) (Keevers, Treleaven, & Sykes, 2016), and a noticeable number of people still stay in informal and non-residential structures (e.g., shanty or vinyl houses) which are not equipped with essential facilities (Ha, 2002, 2004). Under the circumstances, the approach considering only housing affordability index or housing tenure may not be able to capture the health effects of housing in Korea accurately.

Meanwhile, Korea has witnessed unprecedentedly increasing rates of suicide (24.6 per 100,000 persons in 2016), ranking the highest among the OECD member countries (OECD, 2020). This is

arguably attributable to mental health problems of Korean people (e.g., depression) which have worsen since the economic crisis causing unemployment and wealth inequalities. This phenomenon has led scholars to increasingly pay attention to the relationship between socioeconomic inequalities and mental health problems (e.g., Kim, Jung-Choi, Jun & Kawachi, 2010). However, there has been a lack of concern on housing conditions as significant factors of mental health problems, while scholarly focus has been placed on income and employment. Although a handful of studies have unearthed evidence for the association between housing and mental health in Korea (Park & Jung, 2019; Lee et al., 2016), they did not take into account the multifaceted and complicated aspects of housing for low-income households.

To fill this gap in the literature, we examined how housing affordability and housing tenure are concomitantly associated with mental health outcomes among low-income households in Korea, with consideration of housing conditions. In particular, we adopted the ‘30/40 indicator ’ to measure housing affordability stress (e.g., whether the bottom 40% of the income distribution spend more than 30% of their income on housing). This method can effectively operationalize the measurement of housing cost burden among low-income groups for policy-making purposes (Baker, Mason, & Bentley, 2015; Mason, Baker, Blakely, & Bentely, 2013; Rowley & Ong, 2012; Seeling & Phibbs, 2006; Yates, 2007). This study aims to answer the following research questions: First, is tenure associated with depressive symptoms among lower-income households? Second, how is housing affordability stress related to their depressive symptoms? Third, is there any difference in these associations according to different dwelling conditions?

## **2. Method**

## **2.1. Dataset**

We used data from the Korean Welfare Panel Study (KOWEPS), one of the nationally representative datasets. The data was jointly collected by the Seoul National University and the Korea Institute for Health and Social Affairs (KiHASA). We did not need informed consent from participants because the dataset is publicly available from the official website (<https://www.koweps.re.kr>). The Institutional Review Board of the KiHASA approved the dataset. Data, of which survey population represents 90% of the 2005 census, has been collected using a stratified sampling design since 2006. There have been a number of samples added since 2012 in light of the decreasing follow-up response rates (KiHASA & SNU-ISW, 2017).

To align the data with the research design of this study, only the data on the bottom 40% of the income distribution were used for analysis. As a result, out of 14,923 variables during the two survey periods, the final sample size was 3,858 individuals after excluding 4,407 ineligible variables (e.g., higher-income households) and 6,658 missing variables, and the data from the 12<sup>th</sup> wave (for adjusting for covariates) to the 13<sup>th</sup> wave (for independent and dependent variables) was used for analysis. An analysis of longitudinal studies revealed that risk factors, such as housing affordability and housing tenure, did not keep constant over time, and their incidence was temporal. We thus concluded that a cross-sectional study was suitable for our investigation of the relationship between housing and mental health with adjusting for covariates at the baseline.

## **2.2. Measures**

### **2.2.1 Depressive symptoms**

The survey contains 11 questions from the Center for Epidemiologic Studies Depression (CES-D) scale, which has been widely used and validated in health studies (Takeshita et al., 2002). The study participants were required to answer the questions, “How often did you have the following feelings?”. Each question has responses ranging from 0 (very rare) to 3 (very often). The responses were summed totaling from 0 (lowest) to 33 (highest). The total scores were again adjusted to range from 0 to 20, and referring to previous studies (Takeshita et al., 2002), we considered participants with a score of over 16 as having depressive symptoms.

## **2.2.2 Housing characteristics**

### **2.2.2.1 Housing tenure**

On the questionnaire, we asked participants, “What was your housing tenure status as of the 31<sup>st</sup> December last year?”. The participants’ housing tenure was categorized into either 1 (private and public renters) or 0 (owner-occupiers, including mortgagors). Those who responded *other* were excluded (e.g., renters who own a house somewhere else).

### **2.2.2.2 Housing affordability**

In applying the 30/40 indicator, we considered participants whose housing cost exceeded 30% of the household income as having housing affordability stress (or Category 1), with all others falling under 0. We used equalized income data instead of gross household income, which can reflect the household size in assessing whether the residual income (i.e., income after housing cost) is sufficient for non-housing consumption. The equalized disposable income (including earnings, cash transfers, capital gain, etc.) was used for the household income data, and the sum of monthly mortgage principal and interest payments, monthly rent and utility costs (e.g., electricity, fuel,

water, maintenance fee) were taken as the housing expenditure data. These data were collected in the form of continuous variables in the Korean currency (KRW) and were rescaled to annual values prior to the analysis.

### **2.2.2.3 Dwelling conditions**

Based on the national minimum housing standards that specify the minimum floor space, sanitary facilities (e.g., water, sewage, and toilets), and basic building services installations including ventilation and heating system (Ha, 2002), we established a dichotomous variable: 1 = *substandard dwelling conditions*, and 0 = *non substandard dwelling conditions*. In this study, substandard housing conditions additionally included informal and non-residential places (such as shacks and vinyl houses made with wooden boards and vinyl).

### **2.2.3 Covariates**

Age (continuous variable), gender (male or female), marital status (single, married, divorced, widowed, or separated), logged household income, educational attainment (junior high or less, high school graduate or higher) and depressive symptoms at the baseline were included as covariates for analysis. All covariates were measured at the baseline (12<sup>th</sup> waves).

## **2.3. Statistical analysis**

We first identified the general characteristics of the study participants, and the prevalence of depressive symptoms was compared within and across covariates and dwelling conditions by using chi-square tests. Then, we conducted a series of logistic regression analyses on the total study participants, who were further divided into those who live in adequate dwelling conditions and

those who live in substandard dwelling conditions for the following analysis. The odds ratios were adjusted for covariates, including age, gender, income, educational attainment, marital status, and outcomes at the baseline. Odds ratios (ORs) and 95% confidence intervals (95 % CIs) were presented in the results of all the models. STATA/SE version 15.0 (Stata Corp, College Station, TX) was used for the analysis.

### **3. Results**

#### **3.1. Distribution of the study population and the prevalence of depressive symptoms**

Table 1 shows the overall distribution of the characteristics of the study population. With regard to the housing-related characteristics, 66.7% of the study population was owner-occupiers, 25.6% experienced housing affordability stress in the past year, and 18.6% lived in substandard housing (718 out of 3,858). Although the proportion of owner-occupiers was higher among those who live in standard housing (68.5%) than those who live in substandard housing (58.8%), the share of people with housing affordability stress was similar between the two groups—25.6% and 25.9%, respectively. Meanwhile, 21.5% of the study population was found to have depressive symptoms. In general, renters who have housing affordability stress and live in substandard housing showed a higher prevalence of depressive symptoms than their counterparts. With regard to the covariates, about 63.4% of the study population was female, 54.6% were married, and 28.6% attained an education level of high school or above. Those who live in substandard housing showed slightly less prestigious status than adequate housing dwellers in terms of household income and educational attainment. In general, females with a lower education level and who were divorced, widowed, or separated reported a higher prevalence of depressive symptoms than their counterparts, regardless of their dwelling conditions.

[Table 1]

### **3.2. Association of housing tenure and housing affordability stress with depressive symptoms**

Table 2 presents the association between housing tenure, affordability stress, and depressive symptoms, in which the dwelling conditions were not considered. When the independent variables were included in Model 1 and Model 2—for which all covariates were controlled—we found that renters were more likely to have depressive symptoms (OR: 1.63; 95% CI [1.36-1.99]) than owner-occupiers, as were those with affordability stress (OR: 1.50; 95% CI [1.25-1.81]) than those without affordability stress. When two independent variables were added simultaneously in Model 3, both variables became statistically significant to explain the likelihood of having depressive symptoms. The likelihood of having depressive symptoms was higher among renters (OR: 1.48; 95% CI [1.21-1.81]) and those with housing affordability stress (OR: 1.28; 95% CI [1.03-1.57]), as compared to the reference groups.

[Table 2]

### **3.3. Association between housing tenure, housing affordability stress, and depressive symptoms among adequate housing dwellers**

Table 3 presents the association of depressive symptoms with housing tenure and affordability stress among adequate housing dwellers. As shown in Table 2, housing tenure and housing affordability were significantly associated with depressive symptoms in Model 1 (OR: 1.68; 95%



CI [1.36-2.08]) and Model 2 (OR: 1.44; 95 % CI [1.16-1.78]) respectively, when all the covariates were controlled for. However, when both variables were added simultaneously in Model 3, we found that only housing tenure was significant, showing that renters were more likely to report depressive symptoms (OR: 1.56; 95% CI [1.23-1.97]) than owner-occupiers.

[Table 3]

### **3.4. Association between housing tenure, housing affordability stress, and depressive symptoms among substandard housing dwellers**

The effects of housing tenure and housing affordability on substandard housing dwellers' depressive symptoms are presented in Table 4. While housing tenure, alone, was not found to be significantly associated with depressive symptoms (Model 1; OR: 1.36; 95% CI [0.94-1.98]), odds of reporting depressive symptoms were greater for those with housing affordability stress than those without affordability stress (Model 2; OR: 1.76; 95% CI [1.20-2.60]). This pattern remained significant in Model 3, where both variables were considered simultaneously. The odds of reporting depressive symptoms were insignificant among renters. Meanwhile, the odds ratios have consistently remained significant for those who have housing affordability stress (OR: 1.68; 95% CI [1.10-2.61]) compared to those without affordability stress.

[Table 4]

## **4. Discussion**

In this study, we examined the association between housing tenure, housing affordability, and depressive symptoms under different dwelling conditions among low-income households. Our findings showed that housing tenure and housing unaffordability are significantly associated with a higher likelihood of depressive symptoms. When dwelling conditions were considered, housing tenancy, compared with ownership, tended to be associated with depressive symptoms among adequate housing dwellers, whereas housing unaffordability was associated with depressive symptoms mainly among those living in substandard housing conditions.

Our findings demonstrate that the effect of housing on health is different among adequate housing dwellers and substandard housing dwellers. Depressive symptoms among adequate housing dwellers are more likely to occur in renters than owner-occupiers, implying that psychological comfort and ontological security derived from homeownership are manifested among low-income owner-occupiers if their housing conditions are adequate (McKee, 2012; Rohe, Van Zandt, & McCarthy, 2002). In line with the economists' view (Howden-Chapman, Chandola, Staffor, & Marmot, 2011; Kavanagh et al., 2006; Searle et al., 2009), this is possibly because homeownership falls under the "positional goods" category, in that it conveys good standing in society and can act as a buffer against potential financial risks, such as income loss and tenure insecurity. However, this association seems invalid among substandard housing dwellers. The sense of security that often accompanies homeownership does not seem to have the same psychosocial benefits for homeowners living in poor dwelling conditions. As people spend time in a house relaxing, eating, and studying, the quality of internal dwelling conditions seems to influence residents' feelings and emotional status directly, unlike a sense of financial security, which does in direct ways. Existing evidence shows that there is a higher concentration of poor internal dwelling conditions in

neighborhoods where there is a high crime rate and poor infrastructure, such as limited access to public transportation and amenities (Rohe & Stegman, 1994; Türkoğlu, 1997). Also, insufficient sound-proof systems were reported to cause social exclusion as well as conflicts with neighborhoods, leading to psychological distress. These studies suggest that the effects of housing tenure are overwhelmingly suppressed by the effect of dwelling conditions (Macintyre et al., 2003). In other words, where we live represents a range of individual and local level attributes, which needs concern for compositional and contextual place-effects on health (Macintyre, Ellaway, & Cummins, 2002).

Housing affordability stress is also a risk factor of depressive symptoms in both groups. The negative effect of housing affordability stress on mental health among substandard housing dwellers, similar to what has been argued elsewhere (e.g., Bentley et al., 2011; Rohe, Van Zandt, & McCarthy, 2002; Yates, 2007), is arguably due to their relatively lower household income. According to Table 1, the average annual household income of substandard housing dwellers (approx. USD 10,000) is lower than that of adequate housing dwellers (approx. USD 10,715). When low-income people are forced to pay a large proportion of their income for accommodation whose quality is not worth the housing cost, it might cause mental stress to the residents, regardless of whether they own the home or not. As housing expenditure tends to be inelastic, housing cost burden can put pressure on individuals' economic conditions for their survival, such as food insecurity, which both directly and indirectly influences health (Kirkpatrick et al., 2011). In this regard, the most underprivileged are highly subject to poverty and poor housing conditions.

A possible interpretation of the association between housing affordability and mental health among substandard housing owners is that low-income homebuyers tend to purchase lower quality houses (Rohe & Stegman, 1994). In addition, people who purchased a house a long time ago whose quality was below the minimum housing standards formulated recently have seen their earnings decline over time, leading to residential discontent and psychological discomfort. However, the statistical significance of the negative effect of housing affordability stress on depressive symptoms disappears among adequate housing dwellers when it is considered together with housing tenure as an explanatory variable. In short, for adequate housing dwellers, homeownership is the key housing feature that seems conducive to mental health, but for substandard housing dwellers, housing affordability stress is the major risk factor of mental health.

This study's featured population is generally characterized by a less favorable housing scene than the top 20% of the income distribution, similar to other studies' results (e.g., Bentley et al., 2011; Bentley, Baker, & Mason, 2012; Ellaway et al., 1998; Mason, Baker, Blakely, & Bentley, 2013). Although not shown in the results, owner-occupiers tended to be relatively higher-income households, did not experience difficulty in affording housing and did not live in poor housing conditions. However, although a considerable percentage of the study population own home (66.7%), 16.4% of them live in poor-quality housing, and 25.6% suffer from unaffordable housing, which could possibly affect their health. It implies that homeownership is still deemed an important contributor to health, but focusing solely on housing tenure cannot capture the comprehensive association between health and housing (Barlow & Duncan, 1988). In the Korean context, the eligibility criteria for welfare provision have targeted mostly low-income renters, except for a handful of recent assistance provided to income-poor owner-occupiers for house repairs (Ronald

& Jin, 2010). Given that it is difficult to liquidate substandard housing assets to support household welfare, public health policy formulated on the basis of tenure status or income without considering dwelling conditions may result in the unintended exclusion of certain groups in policy intervention. Therefore, various housing factors should be taken into account concomitantly during the policymaking processes.

## **5. Limitations and strengths of the study**

Despite the significance of the methodological approaches and findings, this study encountered some limitations. First, this study was not able to provide a temporal association between housing factors and mental health due to the cross-sectional design. Therefore, it is possible that mental health problems might cause housing-related problems. Second, the amount of the remaining mortgage payments was not considered in calculating housing expenditure. Even if the mortgage did not need to be paid off at the time of the survey, it might have influenced the current and future non-housing expenditure. In effect, there have been debates over whether households' consumption attitudes are determined by their current income or permanent income (Friedman, 1957), but the measurement of housing affordability has relied on current income rather than permanent income, without considering cyclical sensitivity (Hulchanski, 1995). For a more accurate measurement of housing expenses over the lifecycle, future researchers should use a qualitative method to account for how people arrange mortgage payments. Third, as the dataset was collected through a self-report survey, there may have been information bias. For instance, the respondents might have accidentally provided inaccurate information about their housing features and expenses. Nevertheless, this study's strength was that we could demonstrate that the interplay of housing tenure and affordability burden affects mental health differently among adequate

housing dwellers and substandard housing dwellers. Further studies are required to explore its effects on physical and mental health.

### **Conflict of interest**

The authors have no conflicts of interest associated with the material presented in this paper.

### **Reference**

- Baker, E., Mason, K., & Bentley, R. (2015). Measuring Housing Affordability: A Longitudinal Approach. *Urban Policy and Research*, 33(3), 275-290.  
<https://doi.org/10.1080/08111146.2015.1034853>
- Baker, E., Bentley, R., & Mason, K. (2013). The mental health effects of housing tenure: causal or compositional? *Urban Studies*, 50(2): 426-442.  
<https://doi.org/10.1177/0042098012446992>
- Bank of Korea. (2019). Housing prices and price-to-income ratio by income decile..
- Barlow, J. & Duncan, S. (1998). The use and abuse of housing tenure. *Housing Studies*, 3(4): 219-231. <https://doi.org/10.1080/02673038808720632>
- Bentley, R., Baker, E., & Mason, K. (2012). Cumulative exposure to poor housing affordability and its association with mental health in men and women. *Journal of Epidemiology and Community Health*, 66(9): 761-766. [https://doi: 10.1136/jech-2011-200291](https://doi:10.1136/jech-2011-200291).
- Bentley, R., Baker, E., Mason, K., Subramanian S.V. & Kavanagh, A.M. (2011). Association Between Housing Affordability and Mental Health: A Longitudinal Analysis of a Nationally Representative Household Survey in Australia. *American Journal of Epidemiology*, 174(7): 753-760. <https://doi.org/10.1093/aje/kwr161>

- Chung, R. Y., Chung, G. K., Gordon, D., Mak, J. K., Zhang, L. F., Chan, D., Lai, F. T. T., Wong, H. & Wong, S. Y. (2019). Housing affordability effects on physical and mental health: household survey in a population with the world's greatest housing affordability stress. *Journal of Epidemiology and Community Health*, **74**: 164–172. doi:10.1136/jech-2019-212286
- Dunn, J.R., Hayes, M., Hulchanski, D., Hwang, S. & Potvin, L. (2004). Housing as a socio-economic determinant of health: a Canadian research framework. *Housing & Health: Research, Policy & Innovation*, p. 12-39.
- Ellaway, A. & Macintyre, S. (1998). Does housing tenure predict health in the UK because it exposes people to different levels of housing related hazards in the home or its surroundings? *Health & Place*, **4**(2): 141-150.
- Friedman, M. (1957). *The Permanent Income Hypothesis. A Theory of the Consumption Function*. Princeton University Press.
- Ha, S.-K. (2004). Housing poverty and the role of urban governance in Korea. *Environment and Urbanization*, **16**(1): 139-154.
- Ha, S.-K. (2002). The urban poor, rental accommodations, and housing policy in Korea. *Cities*, **19**(3): 195-203. [https://doi.org/10.1016:S0264-2751\(02\)00016-1](https://doi.org/10.1016/S0264-2751(02)00016-1)
- Howden-Chapman, P.L., Chandola, T., Staffor, M. & Marmot, M. (2011). The effect of housing on the mental health of older people: the impact of lifetime housing history in Whitehall II. *BMC Public Health*, **11**:682. doi:10.1186/1471-2458-11-682
- Hulchanski, J.D. (1995). The concept of housing affordability: Six contemporary uses of the housing expenditure-to-income ratio. *Housing Studies*, **10**(4): 471-491. <https://doi.org/10.1080/02673039508720833>

- Kavanagh, A.M., Aitken, Z., Baker, E., LaMontagne, A.D., Milner, A. & Bentely, R. (2016). Housing tenure and affordability and mental health following disability acquisition in adulthood. *Social Science & Medicine*, **151**: 225-232.  
<https://doi.org/10.1016/j.socscimed.2016.01.010>
- Keevers, L. and Treleaven, L. & Sykes, C. (2016). Partnership and participation: contradictions and tensions in the social policy space. *Australian Journal of Social Issues*, **43**(3): 459-477.  
<https://doi.org/10.1002/j.1839-4655.2008.tb00113.x>
- Kirkpatrick, S.I. and Tarasuk, V. (2011). Housing Circumstances are Associated with Household Food Access among Low-Income Urban Families. *Journal of Urban Health*, **88**(2): 284-296. <https://doi.org/10.1007/s11524-010-9535-4>
- Kim, M-H., Jung-Choi K., Jun H-J. & Kawachi, I (2010). Socioeconomic inequalities in suicidal ideation, parasuicides, and completed suicides in South Korea. *Social Science & Medicine*, **70**(8): 1254-1261. <https://doi.org/10.1016/j.socscimed.2010.01.004>
- Korea institute for Health and Social Affairs & Seoul National University Institute of Social Welfare. (2017). Korean Welfare Panel User's Guide
- Lee, T. H., Park, E. C., Kim, W., Kim, J., Shin, J. & Kim, T. H. (2016). Depressive symptoms of house-poor persons: Korean panel data evidence. *International Journal of Social Psychiatry*, **62** (6): 569-577, <https://doi.org/10.1177/0020764016653773>
- Macintyre, S., Ellaway, A., Hiscock, R., Kearns, A., Der, G. & McKay, L. (2003). What features of the home and the area might help to explain observed relationships between housing tenure and health? Evidence from the west of Scotland. *Health & Place*, **9**(3): 207-218. [https://doi.org/10.1016/S1353-8292\(02\)00040-0](https://doi.org/10.1016/S1353-8292(02)00040-0)



- Macintyre, S., Ellaway, A. & Cummins, S. (2002). Place effects on health: how can we conceptualise, operationalise and measure them? *Social Science & Medicine*, **55**(1): 125-139.
- Mason, K., Baker, E., Blakely, T. & Bentely, R. (2013). Housing affordability and mental health: does the relationship differ for renters and home purchasers? *Social Science & Medicine*, **94**: 91-97. <https://doi.org/10.1016/j.socscimed.2013.06.023>
- McKee, K. (2012). Young People, Homeownership and Future Welfare. *Housing Studies*, **27**(6): 853-862.
- Ministry of Land, Infrastructure and Transport. (2018). 2018 Survey on Living Conditions. Republic of Korea.
- OECD. (2018). Housing Dynamics in Korea: Building Inclusive and Smart Cities, Paris: OECD.
- OECD. (2020). Suicide rates (indicator). doi: 10.1787/a82f3459-en (Accessed on 08 April 2020)
- Park, G-R. & Jung, Y. (2019). Housing insecurity and health among people in South Korea: focusing on tenure and affordability. *Public Health*, **171**:116-122, [10.1016/j.puhe.2019.02.017](https://doi.org/10.1016/j.puhe.2019.02.017)
- Pollack, C.E., Griffin, B.A. & Lynch, J. (2010). Housing affordability and health among homeowners and renters. *American Journal of Preventive Medicine*, **39**(6): 515-521. doi: [10.1016/j.amepre.2010.08.002](https://doi.org/10.1016/j.amepre.2010.08.002).
- Rohe, W.M., Van Zandt, S. & McCarthy, G. (2002). Social benefits and costs of homeownership: A Critical Assessment of the Research. Research Institute on Housing America. p. 381-406.

- Rohe, W.M. and Stegman, M.A. (1994). The Effects of Homeownership: on the Self-Esteem, Perceived Control and Life Satisfaction of Low-Income People. *Journal of the American Planning Association*, **60**(2): 173-184. <https://doi.org/10.1080/01944369408975571>
- Ronald, R. & Jin, M.-Y. (2010). Homeownership in South Korea: Examining Sector Underdevelopment. *Urban Studies*, **47**(11): 2367-2388. <https://doi.org/10.1177/0042098009357967>
- Rowley, S. & Ong, R. (2012). Housing affordability, housing stress and household wellbeing in Australia. *AHURI Final Report*. Australian Housing and Urban Research Institute.
- Searle, B.A., Smith, S.J. & Cook, N. (2009). From housing wealth to well-being? *Sociology of Health & Illness*, **31**(1): 112-127. doi: 10.1111/j.1467-9566.2008.01113.x
- Seelig, T. & Phibbs, P. (2006). Beyond the Normative: Low Income Private Renters' Perspectives of Housing Affordability and Need for Housing Assistance. *Urban Policy and Research*, **24**(1): 53-66. <https://doi.org/10.1111/j.1467-9566.2008.01113.x>
- Seo, B. & Joo, Y.-M. (2018). Housing the very poor or the young? Implications of the changing public housing policy in South Korea, *Housing Studies*. **33**(8): 1227-1245.
- Singh, A., Aitken, Z., Baker E. & Bentley, R (2019). Do financial hardship and social support mediate the effect of unaffordable housing on health? *Social Psychiatry and Psychiatric Epidemiology*, Sep 13. doi: 10.1007/s00127-019-01773-z
- Shaw, M. (2004). Housing and public health. *Annual Review of Public Health*, **25**: 397-418.
- Takeshita, J., Masak, K., Ahmed, I., Foley, D. J., Li, Y., Chen, R., Fujii, D., Ross, G.W., Petrovitch, H. & White, L. (2002). Are Depressive Symptoms a Risk Factor for Mortality in Elderly Japanese American Men?: The Honolulu-Asia Aging Study. *The American Journal of Psychiatry*, **159**(7): 1127-1132.

Türkođlu, H.D. (1997). Residents' satisfaction of housing environments: the case of Istanbul, Turkey. *Landscape and Urban Planning*, **39**(1): 55-67. [https://doi.org/10.1016/S0169-2046\(97\)00040-6](https://doi.org/10.1016/S0169-2046(97)00040-6)

Yates, J. (2007). Housing affordability and financial stress, *AHURI Research Paper*. Australian Housing and Urban Research Institute.

Table 1. Distribution and the prevalence of depressive symptoms among lower income households in Korea (N=3,858)

	Total (N=3,858)					Dwelling conditions									
	Distribution		Depressive symptoms			Adequate (N=3,140)					Substandard (N=718)				
	N	(%)	N	(%)	p-value <sup>1</sup>	N	(%)	N	(%)	p-value <sup>1</sup>	N	(%)	N	(%)	p-value <sup>1</sup>
<b>Housing tenure</b>															
Owner-occupiers	2,574	66.7	454	17.6	<0.001	2,152	68.5	345	16.0	<0.001	422	58.8	109	25.8	0.083
Renters	1,284	33.3	376	29.3		988	31.5	282	28.5		296	41.2	94	31.8	
<b>Housing affordability</b>															
Affordable	2,870	74.3	557	19.4	<0.001	2,338	74.5	422	18.0	<0.001	532	74.1	135	25.4	0.004
Unaffordable	988	25.6	273	27.6		802	25.5	205	25.6		186	25.9	68	36.6	
<b>Gender</b>															
Male	1,414	36.6	233	16.5	<0.001	1,151	36.7	178	15.5	<0.001	263	36.6	55	20.9	0.001
Female	2,444	63.4	597	24.4		1,989	63.3	449	22.6		455	63.4	148	32.5	
<b>Age (mean, SD)</b>	65.5	15.8	68.4	14.5	<0.001	65.1	15.8	68.2	14.3	<0.001	67.0	15.6	69.0	15.1	0.034
<b>Income (KRW, mean SD)</b>	1,244	424.0	1,111	419.6	<0.001	1,259	424.7	1,118	423.1	<0.001	1,180	414.8	1,085	408.4	<0.001
<b>Marital status</b>															
Married	2,108	54.6	338	16.0	<0.001	1,781	56.7	260	14.6	<0.001	327	45.5	78	23.9	0.013
Divorced/widowed	1,395	36.1	415	29.8		1,079	34.4	308	28.5		316	44.0	107	33.9	
Single	355	9.2	77	21.7		280	8.9	59	21.1		75	10.4	18	24.0	
<b>Educational attainment</b>															
Junior high or less	2,755	71.4	653	23.7	<0.001	2,198	70.0	483	22.0	<0.001	557	77.6	170	30.5	0.013
High school or higher	1,103	28.6	177	16.1		942	30.0	144	15.3		161	22.4	33	20.5	
<b>Total</b>	3,858	100.0	830	21.5		3,140	100.0	627	20.0		718	100.0	203	28.3	

<sup>1</sup>Chi-square test comparing prevalence of depressive symptoms by each potential confounder.

Table 2. The association between housing tenure, housing affordability stress, and depressive symptoms (N=3,858)

	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
<b>Housing tenure</b>						
Owner-occupiers	1	(reference)			1	(reference)
Renters	1.63 <sup>***</sup>	(1.36-1.99)			1.48 <sup>***</sup>	(1.21-1.81)
<b>Housing affordability</b>						
Affordable			1	(reference)	1	(reference)
Unaffordable			1.50 <sup>***</sup>	(1.25-1.81)	1.28 <sup>*</sup>	(1.03-1.57)

Note: adjusted for age, gender, marital status, educational attainment, log income, depressive symptoms at baseline

Table 3. The association between housing tenure, affordability stress, and depressive symptoms among adequate housing dwellers (N=3,140)

	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
<b>Housing tenure</b>						
Owner-occupiers	1	(reference)			1	(reference)
Renters	1.68 <sup>***</sup>	(1.36-2.08)			1.56 <sup>***</sup>	(1.23-1.97)
<b>Housing affordability</b>						
Affordable			1	(reference)	1	(reference)
Unaffordable			1.44 <sup>**</sup>	(1.16-1.78)	1.20	(0.95-1.52)

Note: adjusted for age, gender, marital status, educational attainment, log income, and depressive symptoms at baseline

Table 4. The association between housing tenure, unaffordability, and depressive symptoms among substandard housing dwellers (N=718)

	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
<b>Housing tenure</b>						
Owner-occupiers	1	(reference)			1	(reference)
Renters	1.36	(0.94-1.98)			1.07	(0.73-1.66)
<b>Housing affordability</b>						
Affordable			1	(reference)	1	(reference)
Unaffordable			1.76 <sup>**</sup>	(1.20-2.60)	1.68 <sup>*</sup>	(1.10-2.61)

Note: adjusted for age, gender, marital status, educational attainment, log income, and depressive symptoms at baseline