

1 **Food insecurity and housing affordability among low-income families: Does** 2 **housing assistance reduce food insecurity?**

3

4 **Abstract**

5 **Objective:** Given the competing needs for food and housing under the limited household income
6 among poor families, there is lack of research on the associations between housing affordability
7 and food insecurity. This study examines how housing cost burden affects food insecurity of
8 low-income families and whether decreased housing cost enhance food security.

9 **Design:** Longitudinal data from the Korean Welfare Panel Study, of which the final sample for
10 the analysis consisted of 31,304 household-level observations from 5,466 households based on
11 12 waves (2007-2018)

12 **Setting:** South Korea

13 **Participants:** Low-income households in the lowest 40% of household income distribution

14 **Results:** 19.3% had food insecurity, and housing cost burden was associated with food
15 insecurity. While in-kind housing assistance and in-cash assistance from all sources were likely
16 to reduce food insecurity partially through influencing housing cost burden, in-cash housing
17 assistance was associated with higher likelihood of food insecurity.

18 **Conclusions:** Housing cost burden potentially limits food access among poor families, and
19 housing assistance, particularly public housing and sufficient in-cash assistance, are conducive to
20 alleviating food insecurity.

21

22 **1. Introduction**

23 The United Nations estimates that about 690 million people are currently affected by hunger
24 worldwide, and its prevalence is constantly rising ⁽¹⁾. Food insecurity, a typical indicator of the
25 lack of subsistence, broadly refers to the status of being without sufficient nutritious and safe
26 food and having limited ability to acquire such food ⁽²⁻⁴⁾. Food insecurity generally has adverse
27 effects on health and is associated with diabetes ⁽⁵⁾, obesity ⁽⁶⁾, psychological stresses and
28 depression ^(7, 8), children's inadequate physical development and diverse illnesses ^(9, 10), and
29 underutilisation of medical care resources ⁽¹¹⁾. Therefore, many countries have endeavoured to
30 tackle food insecurity problems of socioeconomically vulnerable groups by improving existing

1 food systems and implementing food aid programs ^(1, 6). Yet there has been limited attention to
2 other risk factors of food insecurity, such as housing.

3
4 Previous research has investigated food insecurity of disadvantaged groups in relation to their
5 housing circumstances ^(4, 12-15). It was found that food insecurity is prevalent among households
6 who suffer housing instability, which can be defined as limited access to adequate housing <sup>(11, 15-
7 18)</sup>. In addition, non-homeowners are more likely food insecure than homeowners ⁽¹⁹⁻²¹⁾, and
8 market renters, particularly those who are in immediate need for subsidised housing or
9 experience rent arrears, are more likely to have food insecurity ^(19, 22). It was also identified that
10 food insecurity and housing instability are independently associated with unfavourable health
11 and social outcomes among the poor ^(4, 11, 18).

12
13 Nevertheless, there remain two significant research gaps. First, there are few studies that
14 examined how housing instability, particularly housing affordability, affects food insecurity of
15 low-income households using longitudinal data ⁽¹³⁾. Resource-constrained families often confront
16 difficult choices of spending household income between competing basic needs, such as food
17 and housing. As housing cost is usually far greater and more inelastic than food cost ⁽²³⁾, an
18 increase in housing expenditure within a limited income is likely to affect food expenditure and
19 food insecurity ^(22, 24). While few scholars have identified the correlations between housing cost
20 burden and food insecurity among low-income households using cross-sectional data ^(15, 22, 24),
21 there is limited evidence for whether unaffordable housing actually causes food insecurity.
22 Second, given the competing needs for food and housing under the limited household income
23 among poor families, little is known about whether decreased housing cost can improve low-
24 income people's food security. There are various types of in-kind and in-cash housing assistance
25 programs to help alleviate the housing affordability problems of low-income households. If
26 housing cost burden leads to or exacerbates household food insecurity, we can posit that the
27 monetary resources freed up by housing assistance could be utilised to improve household food
28 security conditions. However, the effects of housing assistance on food insecurity have been
29 largely unexplored ⁽²²⁾.

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1 This study intends to fill these gaps by examining the following two research questions: 1) Are
2 families with housing cost burden likely to have household food insecurity? 2) Does housing
3 assistance reduce household food insecurity? This study investigated these questions using the
4 longitudinal data on welfare among low-income households in South Korea (Korea hereafter). In
5 Korea, 5.4 percent of the households experience food insecurity, but 21.5 percent of the families
6 below the poverty line are food insecure ⁽²⁵⁾. Despite some food assistance programs targeting
7 children from low-income families and elderly persons living alone, there has been limited
8 policy discussion on the potential effect of housing cost burden or housing assistance on food
9 insecurity, while poor families' housing affordability problems have remained unfavourable ^{(26,}
10 ²⁷⁾. Currently, two modes of housing assistance are being implemented in Korea to alleviate low-
11 income families' housing cost burden: in-kind assistance in the form of public housing and in-
12 cash assistance in the form of housing benefit as part of the social safety net package and cash
13 subsidies for home purchase or rental deposit payment. Low-income households are also free to
14 use other allowances or cash subsidies from the local governments to pay for their housing.
15 While the effectiveness of these programs has been debated ⁽²⁸⁻³⁰⁾, our study intends to extend
16 this discussion by examining the effects of these assistance programs that can alleviate housing
17 cost burden on low-income families' food insecurity. The findings will enable us to draw some
18 causal inferences about housing affordability and food insecurity and contribute to the
19 international literature on nutrition and health of disadvantaged people.

20

21 **2. Methods**

22 **Data**

23 This study used longitudinal data from the Korean Welfare Panel Study (hereafter KOWEPS),
24 one of the nationally representative longitudinal datasets, which was co-launched by Seoul
25 National University and the Korea Institute for Health and Social Affairs (KiHASA). The
26 KOWEPS collects detailed information of demographic characteristics, socio-economic status,
27 welfare-related status, and health conditions every year. The KOWEPS dataset was approved by
28 the Institutional Review Board of KiHASA. Using stratified sampling design, KOWEPS initially
29 collected 7,072 households at baseline in 2006 and has added samples since 2012 in preparation
30 for decreasing follow-up rates. Because the present study was interested in examining household
31 level effects, our study used household-level data from 2007 to 2018 which constituted a total of

1 12 waves. In line with the research questions concerning low-income households, we restricted
2 the study participants to those in the lowest 40% of household income distribution who were
3 deemed susceptible to material hardship, such as that related to food and housing. After
4 excluding the first wave data in 2006 that does not contain the information about housing
5 expenditure and missing variables of observations in each wave, our final sample consisted of
6 31,304 household-level observations over the survey periods from 5,466 households.

8 **Measures**

9 Food insecurity is the key dependent variable in our study. We used two items that measured
10 food insecurity: 1) “In the past year, were you and other members in your family unable to eat
11 balanced meals because there was not enough money to purchase food?” and 2) “In the past year,
12 did you and other members in your family ever cut the portion size of the meals or skip meals
13 because there was not enough money to purchase food?” These two items are in line with the
14 measurement widely adopted in previous research that used the Korean Household Food Security
15 Survey Module (K-HFSS), with proved internal consistency, which was developed based on the
16 US Household Food Security Survey Module (UH-HFSS) guidelines ^(21, 25, 31). If the study
17 participants answered ‘yes’ to either of the two questions, we defined them as ‘experiencing food
18 insecurity’ (otherwise = 0).

19
20 The primary independent variables are in-kind and in-cash housing assistance that the study
21 participants were receiving at the time of data collection. We defined households living in
22 below-market housing constructed with the government subsidies as in-kind housing assistance
23 recipients; and households receiving housing benefit for rent payment or cash subsidies for home
24 purchase or rental deposit payment as in-cash housing assistance recipients. As low-income
25 families may use other sources of monetary subsidies for housing expenses, we also counted
26 other types of in-cash assistance allocated to the household, such as living allowance provided by
27 the national government and other types of in-cash transfer provided by the local governments.

28
29 Housing cost burden, another key independent variable as well as mediator, was calculated based
30 on the data about household income and housing expenses. Household income included earnings,
31 cash transfers, and capital gain, and housing expense was computed by aggregating the payments

1 of monthly mortgage, interest, rent and utility (e.g., electricity, heating, water, maintenance fees)
2 which allows us to measure *gross* amount of expenditure related to housing⁽³²⁾. When it comes
3 to the standards or indicators of appropriate housing expenditure level, there has been a
4 normative concern about how much of the household income should be left after paying for
5 housing to ensure meeting other necessities, including food⁽²³⁾. In the housing literature, it has
6 been considered a norm that if a household pays more than 30 percent of the household income,
7 the household is deemed to experience housing cost burden⁽³⁴⁾. This conventional standard
8 originated in the 19th century's norm that working class families spent about one week's
9 earnings for a month's rent in the U.S.⁽³³⁾. Since then, this 25 percent of income standard was
10 used in the U.S. housing policies to measure housing affordability until it was increased to 30
11 percent in the 1980s^(32, 33). The 30 percent of income standard is widely adopted in housing
12 research and policymaking across nations^(23, 33-35). This threshold is critical particularly to low-
13 income groups because the remaining 70 percent of the income may not suffice to meet their
14 non-housing needs^(23, 34). Therefore, if a study participant spent more than 30 percent of his or
15 her household income as housing expense, the household was regarded as experiencing housing
16 cost burden (otherwise = 0).

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18 **Statistical analyses**

19 We first presented the frequency and distribution of the study population according to each study
20 variable to explore the general characteristics of the study population. Then we conducted
21 logistic regression analysis to examine whether housing cost burden is associated with food
22 insecurity. For all analytic processes, we used a fixed effects model. Since this model primarily
23 focuses on within-subject differences that can coincide with changes in outcomes over the
24 observation periods, it allows for assessing potential effects of changes in explanatory variables
25 on dependent variables by adjusting for confounded or unmeasured individual differences⁽³⁶⁾.
26 Therefore, we conclude that this approach can better explore the extent to which changes in food
27 insecurity occur if any changes in housing cost burden/housing assistance occur over time points.
28 In order to assess whether housing assistance reduces the probability of food insecurity by
29 lowering housing cost burden, we used a mediation analysis model. According to Baron et al.
30⁽³⁷⁾, mediation effects are supported if 1) an independent variable significantly influences a
31 dependent variable; 2) an independent variable significantly influences a mediator; and 3) the

1 influence of an independent variable on a dependent variable decreases (partial mediation) or
2 disappears (complete mediation) when the mediator is controlled for. Following the analytic
3 steps suggested by Baron et al. ⁽³⁷⁾, we tested the mediation effect of housing cost burden on the
4 relationship between housing assistance and food insecurity (Figure 1). In-cash housing
5 assistance and in-cash assistance from all sources (including in-cash housing assistance and other
6 cash subsidies) were considered separately to identify the effect of in-cash housing assistance on
7 food insecurity.

8

9 Covariates, such as household income, housing tenure, household size, and survey years, were all
10 controlled for. STATA/SE version 15.0 (Stata Corp, College Station, TX) was used for statistical
11 analysis, and (adjusted) odds ratios (ORs) and 95% confidence intervals (95% CIs) were
12 presented in all models.

13

14 [Figure 1 here]

15

16 **3. Results**

17 **Overall characteristics of the sample**

18 The analytic sample consisted of 5,466 low-income households, of which 19.3% were found to
19 have food insecurity, while 25.6% experienced housing cost burden during the observation
20 period (Table 1). Among the total observations, 48.3% were found to earn below 50% of the
21 poverty line (50% of median income), and 7.5% were found to earn 75% or above of the poverty
22 line. Also, 68.0% were owner-occupiers, including mortgagors, whereas 32.0% were renters. The
23 proportions of households receiving in-cash housing assistance, in-cash assistance from all
24 sources and in-kind housing assistance in the sample were 22.2%, 75.9% and 8.5% respectively.

25

26 [Table 1 here]

27

28 **Effects of housing cost burden on food insecurity**

29 Table 2 shows the result of fixed effects analysis of the association between housing cost burden
30 and food insecurity. The odds ratios accounted for covariates including income, household size,
31 and survey years. The odds ratio of reporting food insecurity was significant among those who

1 became cost-burdened families (adjusted OR: 1.26, 95% CI: 1.14-1.40). We also stratified
2 analysis by housing tenure. It was found that while housing cost burden was associated with food
3 insecurity among renters (OR: 1.41, 95% CI: 1.22-1.63), it was not among owner-occupiers (OR:
4 1.14, 95% CI: 0.95-1.35).

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6 [Table 2 here]

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8 **Effects of housing assistance on food insecurity: mediation effect of housing cost burden**

9 Another fixed effects logistic regression was performed with the covariates adjusted for, to
10 examine the effects of housing assistance on housing cost burden. To present the result more
11 succinctly, housing tenure was adjusted for in all mediation analyses. As presented in Table 3,
12 the odds ratio of housing cost burden was all below one for the three types of assistance. This
13 result indicates that in-cash housing assistance (adjusted OR: 0.45, 95% CI: 0.35-0.56), in-cash
14 assistance from all sources (adjusted OR: 0.55, 95% CI: 0.47-0.63), and in-kind housing
15 assistance (adjusted OR: 0.48, 95% CI: 0.37-0.65) were associated with a lower likelihood of
16 transitioning into housing cost burden. This result met the first requirement of the mediation
17 analysis model that the influence of independent variables (in-cash and in-kind assistance) on the
18 mediator (housing cost burden) is statistically significant.

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20 [Table 3 here]

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22 Table 4 illustrates the result of the mediation effect of housing cost burden on the relationship
23 between in-cash housing assistance and food insecurity. When food insecurity was regressed on
24 in-cash housing assistance (model 1), the result was statistically insignificant (adjusted OR: 1.18,
25 95% CI: 0.99-1.39) which indicates that in-cash housing assistance did not translate into
26 reduction of food insecurity. In model 2 where housing cost burden was included, in-cash
27 housing assistance (adjusted OR: 1.19; 95% CI: 1.02-1.41) and housing cost burden (adjusted
28 OR: 1.27, 95% CI: 1.14-1.40) both increased the likelihood of food insecurity, and these effects
29 were statistically significant. This result shows that housing cost burden did not play as a
30 mediator on the relationship between in-cash housing assistance and food insecurity. Rather, in-
31 cash housing assistance and housing cost burden both operated as predictors of food insecurity.

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[Table 4 here]

Table 5 shows the result of the mediation effect of housing cost burden on the relationship between in-cash assistance from all sources and food insecurity. In model 1, in-cash assistance from all sources was negatively associated with food insecurity (adjusted OR: 0.63, 95% CI: 0.56-0.72). When housing cost burden was included (model 2), its association with food insecurity was significant (adjusted OR: 1.24, 95% CI: 1.12-1.37), and adjusted ORs of food insecurity among households with in-cash assistance from all sources changed to 0.64 while remaining significant (95% CI: 0.56-0.73). The mediation analysis result requires cautious interpretation as the odds ratios are below one, indicating the negative influence of independent variable on dependent variable. Hence, the increased odds ratio from model 1 to model 2 should be interpreted that the effect size of in-cash assistance from all sources on food insecurity has decreased. Therefore, the implication of this result is that partial mediation exists in the association between in-cash assistance from all sources and food insecurity through housing cost burden.

[Table 5 here]

Table 6 shows the result of the mediation effect of housing cost burden on the relationship between in-kind housing assistance and food insecurity. Those who became public housing residents showed a lower likelihood of reporting food insecurity (adjusted OR: 0.62; 95% CI: 0.48-0.80) (model 1). When housing cost burden was included (model 2), adjusted OR of reporting moderate food insecurity changed to 0.64 (95% CI: 0.50-0.83) while the association between housing cost burden and food insecurity was significant (adjusted OR: 1.25, 95% CI: 1.12-1.38). That is, the effect size of in-kind housing assistance on food insecurity has decreased. Similar to the interpretation of the result in Table 5, it can be understood that partial mediation exists in the association between in-kind housing assistance and food insecurity through housing cost burden.

1 [Table 6 here]

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3 **4. Discussion**

4 The findings of this study show that household food insecurity is more prevalent among low-
5 income groups (19.3%) than the whole population of the panel study (9.1%), and housing cost
6 burden is also more common among this income segment (25.6%) compared to the whole panel
7 study population (15.3%). It implies that food insecurity and housing cost burden are archetypal
8 characteristics of low-income families. The evidence presented above affirms that housing cost
9 burden is likely to increase the probabilities of falling into food insecurity among low-income
10 households, which addresses the first research question. However, as demonstrated in previous
11 research (19, 20), this association was significant among renters, not among owner-occupiers. It
12 partly supports the assumption that poor people with limited income tend to reduce their food
13 expenditure when housing cost increases and exceeds certain level of household income—30
14 percent in this study, and renters are more vulnerable to this problem. This result indicates that
15 the housing affordability problem is a significant risk factor of food insecurity among low-
16 income households, particularly non-homeowners. Relating to the second research question, this
17 study demonstrated that in-kind housing assistance, in-cash housing assistance, and in-cash
18 assistance from all sources are all effective in alleviating housing cost burden of low-income
19 families to some extent. However, it found that only in-kind housing assistance and in-cash
20 assistance from all sources are associated with the lower likelihood of food insecurity as they
21 relieve housing cost burden, while in-cash housing assistance is associated with the higher
22 likelihood of food insecurity.

23

24 The findings of this study have several important implications. While both in-kind and in-cash
25 housing assistance programs reduce housing cost burden, in-cash housing assistance alone seems
26 ineffective to relieve food insecurity alongside housing cost burden. This result could be partly
27 attributable to the small amount of in-cash housing assistance in the form of monthly housing
28 benefit or one-off cash subsidies. In view of the constantly increasing housing prices in the
29 market, it has been noted that housing cost burden is greater among in-cash housing assistance
30 recipients compared to in-kind housing assistance recipients in Korea ⁽²⁹⁾. Therefore, the finding
31 of our study implies that the amount of in-cash housing assistance provided to low-income

1 Koreans may suffice merely to lessen housing cost burden to some extent, but it is insufficient to
2 enable to free up portion of household income to secure adequate food consumption. Our study
3 also showed that food insecurity is higher among in-cash housing assistance recipients than non-
4 recipients, indicating that in-cash housing assistance plays a role as a marker of food insecurity
5 rather than a countermeasure. In this regard, public housing has a comparative advantage over
6 housing benefit in terms of its impact on residents' food security and, by extension, health.

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8 Moreover, this study found that in-cash assistance from all sources, including in-cash housing
9 assistance, livelihood benefits from the national government and other allowances from the local
10 governments, reduces not only housing cost burden but also food insecurity. This result
11 demonstrates that in-cash assistance provided by the public sector in various forms is effective in
12 helping low-income families to pay for housing and food which are the most basic needs of
13 human beings. However, despite its convenience and flexibility in terms of distribution and
14 utilisation, in-cash assistance can be a double-edged sword in meeting diverse basic needs of
15 low-income people. If low-income households cannot afford market housing with current income
16 and even with in-cash housing assistance, they are likely to use part of other in-cash assistance
17 for housing expenses, in which case their other basic needs, such as food, education,
18 transportation, and medical care, would be essentially compromised. Conversely, low-income
19 households without housing cost burden or food insecurity may deliberately free up monetary
20 resources, including in-cash housing assistance, for food expenses, in which case the quality of
21 housing could be largely compromised ⁽²²⁾. It is also noted that unequal in-cash assistance
22 provided by different local governments with varied financial capabilities might aggravate
23 regional disparity of housing cost burden and food insecurity. In particular, more careful policy
24 design is required to embrace the needs of those who live in poverty but receive only in-cash
25 assistance related to housing as they are subject to lack of resources to secure adequate food.

26

27 **5. Conclusion**

28 This paper is one of the few studies that investigated the effects of housing affordability on food
29 insecurity among low-income households using longitudinal data. We employed the fixed-effects
30 model that can solely estimate the effects of housing cost burden and housing assistance
31 programs on food insecurity, which allowed us to draw rational causal inferences from the

1 dataset. The associations between housing assistance and food insecurity through housing cost
2 burden demonstrate that housing cost burden potentially limits food access among poor families,
3 and that housing assistance, particularly public housing and sufficient in-cash assistance, are
4 conducive to alleviating food insecurity. A closer re-examination of various housing assistance
5 programs is needed to address low-income families' food insecurity problems affected by
6 housing cost burden.

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8 An issue that was not addressed in this study due to the limitation of the dataset is whether low-
9 income people who are experiencing neither housing cost burden nor food insecurity are actually
10 suffering poor housing quality. In addition, whether a household is receiving regular food aids
11 through informal social network or social organisations was not controlled for in our analyses
12 because of the data unavailability. Future research on other potential mediators linking housing
13 expenses and food insecurity, the relations between housing affordability, housing quality and
14 food insecurity, and the effects of energy insecurity as part of housing cost burden on food
15 insecurity would advance our knowledge of how low-income families utilise their limited
16 resources to ensure access to adequate food.

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1 Table 1. Descriptive statistics of the full sample over waves (31,304 observations from 5,466
 2 households)

Category	% of all observations
Housing cost burden	
No	74.4
Yes	25.6
Household income	
< 50% of the poverty line ¹⁾	48.3
< 75% of the poverty line	44.2
>= 75% of the poverty line	7.5
Tenure	
Owner-occupiers	68.0
Renters	32.0
Household size	
1	49.3
2	36.4
3 or more	14.2
In-cash housing assistance	
No	77.8
Yes	22.2
In-cash assistance from all sources	
No	24.1
Yes	75.9
In-kind housing assistance	
No	91.5
Yes	8.5
Food insecurity	
No	80.7
Yes	19.3
Total	100.0

3 38. Note: 1) The term 'poverty line' in this study refers to 50 percent of the median household
 4 income.

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1 Table 2. Fixed-effects logistic regression: housing cost burden and food insecurity by tenure
 2 (18,048 observations, 2,253 households)

	Total		Owner-occupiers		Renters	
	OR	95% CI	OR	95% CI	OR	95% CI
Housing cost burden						
No	1	(reference)	1	(reference)	1	(reference)
Yes	1.26 ^{***}	(1.14-1.40)	1.14	(0.95-1.35)	1.41 ^{***}	(1.22-1.63)

3 ^{*} $p < 0.05$, ^{**} $p < 0.01$, ^{***} $p < 0.001$. Adjusted for income level, household size, and waves

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5 Table 3 Fixed-effects logistic regression: housing assistance and housing cost burden (17,044
 6 observations, 2,265 households)

	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
In-cash housing assistance						
No	1	(reference)				
Yes	0.45 ^{***}	(0.35-0.56)				
In-cash assistance from all sources						
No			1	(reference)		
Yes			0.55 ^{***}	(0.47-0.63)		
In-kind housing assistance						
No					1	(reference)
Yes					0.48 ^{***}	(0.37-0.63)

7 ^{*} $p < 0.05$, ^{**} $p < 0.01$, ^{***} $p < 0.001$. Adjusted for income level, tenure, household size, and waves

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1 Table 4 Fixed effects logistic regression: In-cash housing assistance, housing cost burden and food
 2 insecurity (18,048 observations, 2,253 households)

	Model 1		Model 2	
	OR	95% CI	OR	95% CI
In-cash housing assistance				
No	1	(reference)	1	(reference)
Yes	1.18	(0.99-1.39)	1.19*	(1.02-1.41)
Housing cost burden				
No			1	(reference)
Yes			1.27***	(1.14-1.40)

3 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Adjusted for income level, tenure, household size, and waves

4

5 Table 5 Fixed effects logistic regression: In-cash assistance from all sources, housing cost burden
 6 and food insecurity (18,048 observations, 2,253 households)

	Model 1		Model 2	
	OR	95% CI	OR	95% CI
In-cash assistance from all sources				
No	1	(reference)	1	(reference)
Yes	0.63***	(0.56-0.72)	0.64***	(0.56-0.73)
Housing cost burden				
No			1	(reference)
Yes			1.24***	(1.12-1.37)

7 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Adjusted for income level, tenure, household size, and waves

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1 Table 6. Fixed effects logistic regression: In-kind housing assistance, housing cost burden and
 2 food insecurity (18,048 observations, 2,253 households)

	Model 1		Model 2	
	OR	95% CI	OR	95% CI
In-kind housing assistance				
No	1		1	(reference)
Yes	0.62 ^{***}	(0.48-0.80)	0.64 ^{**}	(0.50-0.83)
Housing cost burden				
No			1	(reference)
Yes			1.25 ^{**}	(1.12-1.38)

3 ^{*} $p < 0.05$, ^{**} $p < 0.01$, ^{***} $p < 0.001$. Adjusted for income level, tenure, household size, and waves

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