Housing and health inequities during COVID-19: findings from the national Household Pulse Survey

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ABSTRACT

Background COVID-19 has exploited the inequities within the US housing system. Examining the association between housing and health during the pandemic is imperative to reducing health inequities and improving population health.

Methods We analysed 957 714 responses from the Household Pulse Survey Study, collected between April and July 2020. Using survey-weighted multivariable regression analyses, we assessed the relationships between housing tenure and health, both on average and over time, as well as how these relationships were moderated by COVID-19-related hardships including job loss, food insecurity and inability to afford housing-related costs. We controlled for a variety of potential socioeconomic and demographic confounding factors.

Results We found that housing tenure was significantly associated with both self-rated health and mental distress. Compared with homeowners without mortgage debt, homeowners with mortgage debt reported worse self-rated health (β=−0.13; 95% CI −0.15 to −0.12, p<0.001) and greater mental distress (β=0.50; 95% CI 0.44 to 0.55, p<0.001). Renters also reported worse self-rated health (β=−0.18; 95% CI −0.20 to −0.16, p<0.001) and greater mental distress (β=0.76; 95% CI 0.69 to 0.83, p<0.001) than homeowners without mortgage debt. Across all tenure groups, self-rated health decreased (β=−0.007; 95% CI −0.011 to −0.004, p<0.001) and mental distress increased (β=0.05; 95% CI 0.05 to 0.06, p<0.001) over this period. Additionally, time and COVID-19-related hardships compounded differences in health status between homeowners and renters.

Conclusions These results add to a limited body of evidence suggesting that, during this period, housing instability and COVID-19-related hardships have contributed to an increase in health inequities in the USA.

INTRODUCTION

Housing affordability has direct impacts on health and health inequities.[1 2] Affordable housing is often defined in terms of a ratio of income to housing-related expenditures, including but not limited to rent, mortgage, property taxes, utilities and repairs. In the USA, the Department of Housing and Urban Development defines affordable housing as a household that spends no more than 30% of its income on housing costs.[3] Homes that pay more than this are considered housing insecure with implications of having less money for food, transportation and medication, among other basic needs.[4 5] Combined with a chronic shortage of affordable housing and a growing urban population, housing insecurity is a rising issue in the USA and global cities like Bogota, Moscow and Beijing.[6] In 2019, 37.1 million US households were housing insecure, while 17.6 million households were spending more than 50% of their income on housing costs.[7] A large proportion were low-income households, placing them at higher risk of housing instability. For those already living in unstable situations prior to the pandemic, eviction was a risk, with more than 2 million eviction cases filed per year and about half of them resulting in displacement.[8] COVID-19 has exacerbated housing inequalities resulting in what is projected to be an increase in future evictions and greater housing instability.[9 10] Although moratoria of evictions and foreclosures have helped stave off a flood of evictions, they have not solved the accumulating debt these households will face post-moratoria.[11 12] The fear or experience of being evicted or foreclosed, as well as frequently moving and in some cases, becoming homeless, has been associated with negative health outcomes.[13–15]

Although limited, existing research has connected housing unaffordability and instability to self-rated health (SRH), mental health, including symptoms of depression and anxiety, and cardiovascular disease.[16–18] Due to the COVID-19 pandemic, recent studies have examined the health consequences of evictions during COVID-19 and the effects of housing conditions during a time where 'staying home' was a primary preventive method.[19–21] However, there remain few studies that have considered the socioeconomic impacts of COVID-19 on the associations between housing and health. Prior to the pandemic, job loss or financial strain was associated with housing instability and poor health, particularly among renters. One study showed that those who reported being housing insecure (feeling worried about having enough money to pay rent or mortgage costs) were approximately two times more likely to postpone medical treatment or self-report poor or fair health.[22] Other studies have reported higher risk of depression and poorer health among those who have been evicted, compared with those who have not.[23] Examining these relations during COVID-19 is a critical step to ensure policies and programmes are in place to reduce the housing and health inequities in years to come.

In this paper, we examined associations between housing tenure and SRH and mental distress, among US adults, from April to July 2020. Additionally, we examined how the duration of the pandemic and COVID-19-related hardships—including job loss, food insecurity and the inability to pay housing-associated costs—moderated these associations.

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METHODS

Study setting and dates

We used the Household Pulse Survey (HPS) phase I dataset for this study.[24] The HPS is a national survey, designed and administered by the US Census Bureau (CB), which asks Americans about their experiences related to health, housing, employment and food during the COVID-19 pandemic.[24] Phase I data collection began 23 April and ended 21 July 2020.[25] Phase I data consisted of 12 public-use data files published weekly on the CB's website (https://www.census.gov/householdpulsedata).

Study sample

The study sample was generated from the CB's Master Address File.[25] Individuals were contacted by phone or email and invited to complete the online questionnaire. Eligible individuals included adults, aged 18 years and over. Individuals were asked to complete two additional questionnaires in the following 2 weeks, for up to three waves of responses per participant. In total, phase I of the HPS collected 1 088 314 survey responses from 850 018 individuals.

Dependent variables

We examined two health-related variables. *SRH* was measured by a single item asking respondents to rate their health status on a 1 (poor health) to 5 (excellent health) scale. SRH is a commonly used measure of health status and is a reliable predictor of other health outcomes.[26–28] We analysed SRH as a continuous variable. *Mental distress* was derived from four items asking respondents about the frequency with which they experienced feelings of depression or hopelessness, lack of interest or enjoyment, uncontrollable worry, and nervousness or anxiety. Each item was asked on a 0 (not having experienced the feeling at all) to 3 (having experienced the feeling nearly every day) scale. These four items represented modified versions of the two-item Patient Health Questionnaire (PHQ-2) and Generalized Anxiety Disorder scales.[29 30] To create one continuous indicator of mental distress with a 0–12 range (ie, the PHQ-4 score), we summed these items. PHQ-4 has been shown to be an accurate and reliable measure of mental health in a variety of populations.[31–33]

Independent variables

We used five additional variables to examine the associations between health and housing tenure, time and COVID-19-related hardships. *Housing tenure* was determined by asking respondents to identify whether they owned their home without loan or mortgage debt, owned their home with mortgage debt, rented their home or occupied their home without rent. We used the *week number* of the HPS data release to assess change in health status related to the duration of the pandemic. Week 1 referred to data collected between 23 April and 5 May, while week 12 referred to data collected between 16 July and 21 July. *Job loss* was measured by an item which asked respondents to identify whether anyone in their household had lost employment since 13 March 2020. *Food security* was measured by asking respondents to identify how confident they were in their ability to afford the foods they need in the next 4 weeks. Response values ranged from 1 (not confident at all) to 4 (very confident). Given few responses indicating 'not confident at all' (0) or 'slightly confident', (1) we combined these categories as 'low confidence' for analysis. Finally, *ability to pay housing-associated costs* was measured by asking respondents how confident they were in their ability to pay their next rent/mortgage payment on time. Only homeowners with loans/mortgages and renters were asked this question. Response values ranged from 1 (no confidence) to 4 (high confidence) in their ability to pay the next month's rent/mortgage, as well as if they planned to defer their next payment. Because of small cell sizes, we grouped the 'no confidence' and 'slight confidence' responses together as 'low confidence'.

Control variables

Household-level control variables included number of people living in the household and household income. Individual-level control variables included age, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other), gender (male, female), educational attainment (less than high school graduate, high school graduate, at least some college), marital status (currently married, currently single), and health insurance status (any health insurance, no health insurance).

Data exclusions

For our analyses, we initially excluded 10.88% (118 454) of phase I survey responses because of missingness in one of three key fields: housing tenure, SRH or mental distress. Because of the small number of respondents who stated they occupied their home without rent (1.12%, 12 146), we also excluded this category of housing tenure from our analyses. In total, we analysed 957 714 survey responses.

Data analysis

First, we pooled all 12 waves of HPS data together. We summarised the data, and assessed associations between housing tenure and all other variables of interest. To assess associations between housing tenure and continuous variables (SRH, mental distress, age, number of people in household), we performed analysis of variance tests. To assess associations between housing tenure and categorical variables (job loss, food security, rent/mortgage confidence, race, gender, educational attainment, marital status and household income), we performed X^2 tests.

Next, we fit survey-weighted, multivariable, generalised linear regression models (GLMs) to determine how housing tenure was associated with SRH and mental distress. We chose GLMs over hierarchical linear models for our analyses because 80% of survey respondents were only surveyed once, and because when we calculated the unconditional intraclass correlation (ICC) for these data, we found that the per cent of variance in both SRH (ICC=0.002) and mental distress (ICC=0.002) explained by the clustering of survey responses within individuals was less than 1%. Researchers have observed that bias in the parameter estimates of weighted multilevel models increases as ICC decreases.[34 35]

Finally, we fit a series of GLMs with interaction terms to determine if and how relationships between housing tenure and health were moderated by (1) time, (2) household job loss, (3) food security and (4) ability to pay housing-associated costs. To test the overall significance of the interaction terms (ie, to identify significant moderation), we compared the fit of models that included interaction terms to the fit of comparable models that did not, using X^2 tests. We present adjusted regression coefficients from our analyses in which we controlled for the effects of the household-level and individual-level socioeconomic and demographic variables described above. We only report interaction effect estimates for models in which including the interaction term significantly improved model fit. We performed our analyses in R (V.0.2) using the *survey* package (V.4.0) to apply survey weights.[36 37] The HPS public-use data files include survey weights, calculated by the CB, which can be used to make statistical analyses of the HPS data

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Table 1 Description of weighted Household Pulse Survey data, overall and by housing tenure

			Housing tenure			
	% missing	Overall	Owned, no loan	Owned with loan	Rented	P value
No of survey responses, waves 1–12 (N)	–	957 714	229 129	485 739	242 846	–
SRH (mean (SD))	0.0	3.5 (1.1)	3.5 (1.1)	3.6 (1.0)	3.3 (1.1)	<0.001
Mental distress (mean (SD))	0.0	3.8 (3.7)	2.9 (3.4)	3.6 (3.5)	4.7 (3.4)	<0.001
Age (mean (SD))	0.0	48.5 (16.8)	58.5 (16.8)	48.5 (15.4)	41.4 (15.3)	<0.001
Number of people in household (mean (SD))	0.0	3.5 (2.0)	3.2 (2.1)	3.6 (1.9)	3.4 (2.0)	<0.001
Job loss (%)	0.1					<0.001
Yes		48.3	35.0	48.0	58.2	
No		51.7	65.0	52.0	41.8	
Food security (%)	0.1					<0.001
High		46.1	59.1	51.5	29.2	
Moderate		21.5	19.2	22.0	22.6	
Low		32.3	21.7	26.5	48.3	
Rent/mortgage confidence (%)	0.4*					<0.001
High		54.0	–	62.8	41.3	
Moderate		21.4	–	20.6	25.7	
Low		24.4	–	14.0	32.0	
Will defer		2.0	–	2.7	1.0	
Race (%)	0.0					<0.001
Non-Hispanic white		64.1	74.9	69.0	49.6	
Non-Hispanic black		11.0	6.4	8.3	18.2	
Hispanic		16.4	11.0	13.9	22.8	
Other		8.8	7.8	8.8	9.4	
Gender (%)	0.0					<0.001
Male		48.4	49.4	50.1	45.4	
Female		51.6	50.6	49.9	54.6	
Educational attainment (%)	0.0					<0.001
Less than high school grad		7.7	6.5	5.2	12.1	
High school grad		29.8	32.4	26.4	32.9	
At least some college		62.5	61.0	68.4	55.0	
Marital status (%)	0.3					<0.001
Currently married		56.0	62.8	67.4	34.7	
Currently single		44.0	37.2	32.6	65.3	
Any health insurance (%)	0.0					<0.001
Yes		81.0	74.1	81.3	85.3	
No		19.0	25.9	18.7	14.7	
Household income (%)	3.5					<0.001
Less than $25 000		15.6	13.8	6.4	30.0	
$25 000–$34 999		12.0	12.0	7.7	18.2	
$35 000–$49 999		12.7	13.0	10.7	15.5	
$50 000–$74 999		18.1	19.0	19.0	16.1	
$75 000–$99 999		13.3	13.3	16.5	8.6	
$100 000–$149 999		14.8	14.0	20.6	6.9	
$150 000+		13.5	14.8	19.1	4.5	

*The per cent missingness for rent/mortgage confidence is based only on the per cent missingness among homeowners with a mortgage and renters, as homeowners without a mortgage were not asked this question.
SRH, self-rated health.

nationally representative by accounting for respondents' unequal probabilities of being selected to participate in the survey. We weighted all summaries and analyses to account for the complex design and sampling methodology of the HPS.

RESULTS

Table 1 summarises the data used in this study. Between April and July 2020, approximately 51.6% of the US adult population was female, 56.0% was married, 64.1% identified as non-Hispanic white, 62.5% had received some college education, 81.0% had some health insurance and 58.4% lived in households that had an income of less than $75 000 per year. The mean age of the adult population was 48.5 (SD=16.8), and the average number of people per household was 3.5 (SD=2.0).

Approximately 22.3% of US adults owned their homes without any mortgage debt (including non-conventional loans),

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Table 2 Summary of associations between housing tenure, time and health outcomes

	SRH		Mental distress	
	Adjusted* coefficient (95% CI)	P value	Adjusted* coefficient (95% CI)	P value
(Intercept)	4.622 (4.560 to 4.685)	<0.001	3.309 (3.113 to 3.504)	<0.001
Tenure				
Owned, no loan	Reference		Reference	
Owned w/ loan	−0.082 (−0.116 to −0.049)	<0.001	0.495 (0.440 to 0.550)	<0.001
Rented	−0.127 (−0.166 to −0.088)	<0.001	0.762 (0.690 to 0.833)	<0.001
Time				
Week	−0.007 (−0.011 to −0.004)	<0.001	0.054 (0.047 to 0.060)	<0.001
Interaction effects				
Owned w/ loan×week	−0.008 (−0.012 to −0.003)	<0.001	–	–
Rented×week	−0.008 (−0.013 to −0.003)	0.001	–	–
Observations	921 742		921 742	

*Adjusted models control for the effects of the number of people living in the household, household income, age, gender, race, marital status, educational attainment and health insurance status.
SRH, self-rated health.

46.0% owned a home with mortgage debt, while 31.7% rented their homes. Housing tenure was significantly associated with all variables of interest in this study. Renters, on average, reported the poorest SRH (mean=3.3, SD=1.1) and the highest levels of mental distress (mean=4.7, SD=3.4). Renters were more likely to have experienced job loss (58.2%), food insecurity (48.3%) and inability to pay housing-associated costs during this period (32.0%) than homeowners. In adjusted regression analyses, we found that, compared with homeowners without mortgage debt, homeowners with mortgage debt reported worse SRH (β=−0.13; 95% CI −0.15 to −0.12, p<0.001) and greater mental distress (β=0.50; 95% CI 0.44 to 0.55, p<0.001). Renters also reported worse SRH (β=−0.18; 95% CI −0.20 to −0.16, p<0.001) and greater mental distress (β=0.76; 95% CI 0.69 to 0.83, p<0.001) than homeowners without mortgage debt.

Housing tenure and health, over time

Table 2 summarises associations between housing tenure and health outcomes, over time. Across all tenure groups, average SRH decreased and mental distress increased between April and July; however, time was only a significant moderator of housing tenure's relationship with SRH, $X^2(2, N=921\ 720)=117.67$, p=0.002. Renters and homeowners with mortgage debt experienced greater decline in SRH compared with homeowners without mortgage debt.

Housing tenure and health, by job loss

Table 3 summarises associations between housing tenure, job loss and health outcomes. Job loss was associated with reduced SRH and increased mental distress across all tenure groups; however, job loss was only a significant moderator of the housing tenure's relationship with mental distress, $X^2(2, N=920\ 807)=825.37$, p=0.025. Significant interaction effects show that homeowners with mortgage debt and renters who experienced job loss reported significantly higher levels of mental distress than homeowners without mortgage debt who experienced the same.

Housing tenure and health, by food security

Table 4 summarises associations between housing tenure, food security and health outcomes. Individuals who reported

Table 3 Summary of associations between housing tenure, job loss and health outcomes

	SRH		Mental distress	
	Adjusted* coefficient (95% CI)	P value	Adjusted* coefficient (95% CI)	P value
(Intercept)	4.712 (4.655 to 4.769)	<0.001	2.853 (2.656 to 3.051)	<0.001
Tenure				
Owned, no loan	Reference		Reference	
Owned w/ loan	−0.121 (−0.137 to −0.107)	<0.001	0.326 (0.261 to 0.391)	<0.001
Rented	−0.167 (−0.187 to −0.147)	<0.001	0.554 (0.467 to 0.641)	<0.001
Job loss				
No	Reference		Reference	
Yes	−0.122 (−0.135 to −0.109)	<0.001	1.149 (1.055 to 1.243)	<0.001
Interaction effects				
Owned w/ loan×job loss	–	–	0.146 (0.037 to 0.254)	0.009
Rented×job loss	–	–	0.157 (0.031 to 0.283)	0.015
Observations	920 830		920 830	

*Adjusted models control for the effects of the week of the pandemic, number of people living in the household, household income, age, gender, race, marital status, educational attainment and health insurance status.
SRH, self-rated health.

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Table 4 Summary of associations between housing tenure, food security (FS) and health outcomes

	SRH		Mental distress	
	Adjusted* coefficient (95% CI)	P value	Adjusted* coefficient (95% CI)	P value
(Intercept)	4.782 (4.727 to 4.837)	<0.001	2.882 (2.700 to 3.063)	<0.001
Tenure				
Owned, no loan	Reference		Reference	
Owned w/ loan	−0.097 (−0.116 to −0.079)	<0.001	0.222 (0.169 to 0.276)	<0.001
Rented	−0.110 (−0.135 to −0.085)	<0.001	0.461 (0.381 to 0.541)	<0.001
FS				
High FS	Reference		Reference	
Moderate FS	−0.456 (−0.487 to −0.424)	<0.001	1.680 (1.574 to 1.786)	<0.001
Low FS	−0.728 (−0.762 to −0.695)	<0.001	2.994 (2.869 to 3.120)	<0.001
Interaction effects				
Owned w/ loan×moderate FS	0.051 (0.014 to 0.088)	0.007	−0.033 (−0.158 to 0.092)	0.604
Owned w/ loan×low FS	0.061 (0.023 to 0.099)	0.002	0.100 (−0.043 to 0.242)	0.171
Rented×moderate FS	0.019 (−0.023 to 0.061)	0.364	−0.127 (−0.274 to 0.021)	0.092
Rented×low FS	0.047 (0.005 to 0.089)	0.028	−0.081 (−0.235 to 0.074)	0.307
Observations	921 028		921 028	

*Adjusted models control for the week of the pandemic, number of people living in the household, household income, age, gender, race, marital status, educational attainment and health insurance status.
SRH, self-rated health.

moderate or low food security had lower SRH than individuals who reported high food security. Similarly, individuals who reported moderate or low food security had higher levels of mental distress. While the association between housing tenure and SRH was moderated by food security, $X^2(4, N=921\,002)=117.85$, $p=0.007$, interaction effect estimates were small compared with the main effects of food security. Including an interaction between tenure and food security in the mental distress model did significantly improve model fit, $X^2(4, N=921\,002)=1121.49$, $p=0.037$; however, the estimated interaction effects were not significant. This suggests the effects of food security on SRH and mental distress were similar for renters and homeowners.

Housing tenure and health, by rent/mortgage confidence

Table 5 summarises associations between housing tenure, rent/mortgage confidence and health outcomes. Because homeowners without mortgage debt were not asked this question, these analyses only compared renters and homeowners with mortgage debt. Individuals who reported only low or moderate rent/mortgage confidence experienced worse SRH and greater mental distress than individuals who had high rent/mortgage confidence. Individuals who planned to defer their payments reported worse SRH and higher levels of mental distress than individuals with high rent/mortgage confidence; however, they reported better SRH and lower levels of mental distress than individuals with

Table 5 Summary of associations between housing tenure, confidence in ability to pay rent/mortgage and health outcomes

	SRH		Mental distress	
	Adjusted* coefficient (95% CI)	P value	Adjusted* coefficient (95% CI)	P value
(Intercept)	4.754 (4.696 to 4.813)	<0.001	2.784 (2.585 to 2.983)	<0.001
Tenure				
Owned w/ loan	Reference		Reference	
Rented	−0.062 (−0.081 to −0.042)	<0.001	0.387 (0.319 to 0.454)	<0.001
Rent/mortgage confidence (R/MC)				
High R/MC	Reference		Reference	
Moderate R/MC	−0.435 (−0.456 to −0.414)	<0.001	2.051 (1.974 to 2.129)	<0.001
Low R/MC	−0.575 (−0.606 to −0.545)	<0.001	3.090 (2.989 to 3.190)	<0.001
Will defer	−0.193 (−0.256 to −0.130)	<0.001	1.617 (1.415 to 1.818)	<0.001
Interaction effects				
Rented×moderate R/MC	0.034 (0.0004 to 0.067)	0.048	−0.296 (−0.419 to −0.173)	<0.001
Rented×low R/MC	0.058 (0.016 to 0.101)	0.007	−0.438 (−0.581 to −0.294)	<0.001
Rented×will defer	−0.073 (−0.187 to 0.041)	0.210	−0.572 (−1.052 to −0.091)	0.020
Observations	704 195		704 195	

*Adjusted models control for the effects of the week of the pandemic, number of people living in the household, household income, age, gender, race, marital status, educational attainment and health insurance status.
SRH, self-rated health.

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moderate or low rent/mortgage confidence. Including interaction terms in both the SRH and mental distress models significantly improved model fit: $X^2(3, N=704\ 170)=113.00$, $p=0.008$ and $X^2(3, N=704\ 170)=5916.92$, $p<0.001$, respectively. However, health differences between homeowners and renters within each level of rent/mortgage confidence were small relative to differences across levels of rent/mortgage confidence. This suggests that inability to pay housing-associated costs had similar effects on SRH and mental distress for both renters and homeowners.

DISCUSSION

We found that during the early months of the COVID-19 pandemic in the USA, housing tenure was significantly associated with SRH and mental distress. Moreover, we found population-level decreases in SRH and increases in mental distress among adults during this period. Renting or owning a home with mortgage debt was associated with greater decreases in SRH, compared with owning a home without mortgage debt. These findings are consistent with other research studies that have demonstrated associations between housing and health before the pandemic.[22 38 39]

We also examined how COVID-19-related hardships (job loss, food insecurity and inability to pay housing-associated costs) moderated associations between housing tenure and health during this period. Our results suggest that job loss exacerbated differences in mental distress between renters and homeowners. Food insecurity and low confidence in paying rent/mortgage were associated with low SRH and high mental distress among both renters and homeowners; however, renters were more likely to experience these hardships. Overall, low confidence in paying rent/mortgage had the strongest association with mental distress, while low food confidence had the strongest association with SRH. The worst health status was associated with renters who had experienced job loss, food insecurity and low confidence in paying rent.

Conversely, our analyses highlight the positive effects of secure housing. Even after adjusting for socioeconomic and demographic characteristics of the US adult population, individuals who owned their homes without mortgage debt reported the best SRH and lowest levels of mental distress. Over time, these individuals experienced the least negative change in their health status, and were less affected by job loss than renters or homeowners with mortgage debt.

Our findings suggest that eviction and foreclosure moratoria may have been effective strategies for mitigating some of the negative impacts of housing insecurity during the COVID-19 pandemic over this period. Renters and homeowners with mortgage debt who planned to defer their rent/loan payments reported better SRH and less mental distress than those with low or moderate confidence in their ability to make those payments. Still, there remain questions on how deferral decisions are made and what they imply. Among renters, deferral of rent may have occurred as an agreement between landlord and tenant during this time. Alternately, renters in the sample may have relied on the moratorium on evictions implemented by local, state and federal governments throughout the pandemic. Although such moratoria made it illegal to evict tenants during their implemented period, they did not stop rent from accumulating. Therefore, unless tenants can take advantage of state-implemented rent relief programmes like the Michigan Eviction Diversion Program, they could be evicted once moratoria end. Contrary, homeowners were provided relief under the CARES Act through a moratorium on foreclosures for all federally or Government Sponsored Enterprises-backed mortgages (Fannie Mae or Freddie Mac). The CARES Act also granted homeowners the ability to request and obtain a forbearance for up to 1 year. Unlike renters, there would be no accumulation of interest or additional fees. This suggests that in the short term, having the option to defer payments may have helped improve health outcomes for individuals who might not have otherwise been able to afford these payments, providing some evidence on the success of such policies.

Our study has several strengths, including that it is one of the first studies to examine health inequities associated with housing tenure during the COVID-19 pandemic. We analysed these associations at the population level, using nationally representative data from the HPS. We adjusted our models for various individual-level and household-level factors which limits the possibility that the associations we found between housing and health are confounded by other measures like age or income.

Our study also has limitations. We used multiwave cross-sectional analyses to test associations between housing tenure and health; however, these analyses cannot demonstrate causation. Future research should examine associations between housing and health using stronger study designs. Additionally, while our analyses are weighted to be nationally representative, there may be regional variation in associations between housing tenure and health. Future research should examine these associations at the state and metropolitan area levels to determine how local responses to COVID-19 may have ameliorated or exacerbated housing-related health inequities. Further, we only examined a 12-week period near the beginning of the pandemic when most stay-at-home orders were implemented. Associations between housing tenure and health may have changed over the course of the pandemic. Future research should examine these association over longer periods of time by analysing data from subsequent phases of the HPS. Finally, our study is subject to various forms of bias including sampling bias, uncontrolled confounder bias and measurement bias. We have tried to minimise these sources of bias by fitting survey-weighted regression models to account for individuals' differential probabilities of being selected for the

What is already known on this subject

- Housing is an important and complex social determinant of health. Housing insecurity is associated with poor physical and mental health outcomes. The ongoing socioeconomic impacts of COVID-19 will result in an increase in housing insecurity and ultimately health inequities.

What this study adds

- Renters and homeowners with mortgage debt in the USA reported worse health status and greater mental distress than homeowners without mortgage debt at the beginning of the COVID-19 pandemic. Differences in health status and mental distress between renters and homeowners grew over time, and were compounded by job loss, food insecurity, and inability to pay housing-associated costs, such as rent or mortgage. By examining these differences, and highlighting these growing inequities, programmes and policies can be developed or modified to reduce the socioeconomic impacts of the pandemic.

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survey, by controlling for potential socioeconomic and demographic confounding factors, and by using measures of health status which have been evaluated in other studies. Future studies should consider using alternative data sources, sampling strategies, or outcome measures to quantify relationships between housing tenure and health with better precision.

In conclusion, this study demonstrates how housing tenure was associated with health during the beginning of COVID-19 pandemic. Being a renter or homeowner with mortgage debt during this time was associated with worse SRH and higher levels of mental distress compared with being a homeowner without mortgage debt. Health differences between renters and homeowners were exacerbated by the duration of the pandemic and job loss. Food insecurity and inability to pay rent/mortgage were associated with poor SRH and mental distress among both renters and homeowners; however, renters were more likely to experience these forms of hardship. Characterising these associations can help decision-makers to allocate resources effectively and design preventative interventions to address housing-related needs that can promote population health and reduce health inequities.

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