# Housing Affordability and Health Among Homeowners and Renters

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**Background:** Although lack of affordable housing is common in the U.S., few studies have examined the association between housing affordability and health.

**Purpose:** Using quasi-experimental methods, the aim of this study was to examine whether housing affordability is linked to a number of important health outcomes, controlling for perceptions of neighborhood quality, and determining whether this association differs by housing tenure (renting versus owning).

**Methods:** Data from the 2008 Southeastern Pennsylvania Household Health Survey, a telephone-based survey of 10,004 residents of Philadelphia and its four surrounding counties, were analyzed. The association between housing affordability and health outcomes was assessed using propensity score methods to compare individuals who reported living in unaffordable housing situations to similar individuals living in affordable ones.

**Results:** Overall, 48.4% reported difficulty paying housing costs. People living in unaffordable housing had increased odds of poor self-rated health (AOR=1.75, 95% CI=1.33, 2.29); hypertension (AOR=1.34, 95% CI=1.07, 1.69); arthritis (AOR=1.92, 95% CI=1.56, 2.35); cost-related healthcare nonadherence (AOR=2.94, 95% CI=2.04, 4.25); and cost-related prescription nonadherence (AOR=2.68, 95% CI=1.95, 3.70). There were no significant associations between housing affordability and heart disease, diabetes, asthma, psychiatric conditions, being uninsured, emergency department visits in the past year, obesity, and being a current smoker. Renting rather than owning a home heightened the association between unaffordable housing and self-rated health (AOR=2.55, 95% CI=1.93, 3.37 for renters and not significant among homeowners) and cost-related healthcare nonadherence (AOR=4.74, 95% CI=3.05, 7.35 for renters and AOR=1.99, 95% CI=1.15, 3.46 for homeowners).

**Conclusions:** The financial strain of unaffordable housing is associated with trade-offs that may harm health. Programs that target housing affordability for both renters and homeowners may be an important means for improving health.
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## Introduction

The number of households living in unaffordable housing—commonly defined as spending more than 30% of household income on housing expenses—was estimated to be 39.5 million in the U.S. in 2007.[1] The number of households in unaffordable housing had climbed by nearly 6% from 2001 to 2007.[1] Declining real wages for the lowest earners, combined with high housing costs, has led to an insufficient supply of affordable rental housing units.[2] In recent years, the housing bubble and lax lending standards have produced high levels of both foreclosure and household debt.[1]

High housing costs relative to income, as well as financial strain more broadly, may be an important determinant of health.[3–7] Financial strain has been linked to poor health outcomes including all-cause mortality, higher prevalence of chronic conditions, and depressive symptoms.[8–11] Receiving subsidized housing is associated with improvement in certain health outcomes,[12] for example, in children's nutritional status.[4,13,14] High housing-related costs may pose health risks through multiple mechanisms, including forcing trade-offs between housing costs and paying for other health-promoting goods and services (e.g., health insurance,

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medications, and healthy foods[5–7,15]); causing high levels of stress and emotional strain,[16–18] which may be heightened given people's emotional attachment to their home[17,19]; through the potential association with housing quality and neighborhood features; and as a marker for low SES associated with material deprivation across other domains.[20]

The present study uses propensity score methods to examine whether unaffordable housing is linked to poor health and lower healthcare utilization. The present study tests whether the association between housing affordability and health and healthcare utilization outcomes differs for homeowners and renters. People who own their homes have been shown to enjoy better health than renters,[21–26] and homeowners tend to have higher levels of wealth, which is also associated with health.[27,28] However, it is not known whether homeowners who have difficulty affording their housing-related expenses enjoy the health benefits linked to homeownership.

## Methods

### Data Source

The current study draws on data from the Philadelphia Public Health Management Corporation's 2008 Southeastern Pennsylvania Household Health Survey,[29] which is a biennial survey of residents of Philadelphia County and the four surrounding counties (Bucks, Chester, Delaware, and Montgomery) with households selected via random-digit dialing to land telephone lines and additional interviews conducted via cell phone. Respondents were eligible if they were aged >18 years and resided in one of the five counties. In households with more than one eligible adult, the person with the last birthday prior to the interview was selected. The survey oversampled people aged ≥60 years. Interviews were conducted in English and Spanish. When a randomly selected adult respondent was not able to be interviewed because of health impairments or language barriers, the interview was conducted with an adult proxy ($n=17$). The level of response for the telephone survey was 25% (AAPOR 3). A total of 10,007 individuals were surveyed in the summer of 2008.

### Measure of Housing Affordability

Housing affordability was assessed with a single item: *Housing costs refer to the money that you and your household spend on utility bills, rent, mortgage payments, and property taxes. Overall, how difficult was it for you to afford your housing costs during the past year?* Response options were *very difficult*, *somewhat difficult*, *not very difficult*, and *not difficult at all*. Responses were dichotomized into *very difficult* and *somewhat difficult*, which are here termed "unaffordable housing," versus *not very difficult* and *not difficult at all*, which was termed "affordable housing." This item was developed by the authors and pretested among Philadelphia residents.

### Independent Variables

Respondents were classified according to demographic characteristics (age; race/ethnicity [white, black, and other]; and gender) and

SES (educational attainment; low income [i.e., size-adjusted household income less than 200% of the federal poverty level]; and an indicator of unemployment). Respondents were also categorized as either homeowners or renters, and whether individuals lived in Philadelphia or one of the four surrounding counties.

### Perceptions of Neighborhood Quality

Our analysis included three self-reported measures of neighborhood quality thought to potentially confound the effect of housing affordability on health outcomes. Some renters and homeowners may choose to spend more on housing in order to reside in a neighborhood with desirable attributes, such as safe public spaces, access to grocery stores, or a strong social environment. In this case, the negative effects of unaffordable housing on health may be offset by improved neighborhood quality.

The measures addressed whether the respondent felt they lived in a safe neighborhood, one with adequate access to grocery stores, and a strong social environment. These measures came from questions asking respondents about (1) whether they did or did not go someplace during the day because they felt unsafe; (2) the ease or difficulty in finding fresh fruits and vegetables; (3) the quality of grocery stores in their neighborhood; (4) whether people in their neighborhood are willing to help neighbors; (5) whether people work together to improve the neighborhood; (6) whether the respondent feels that he or she belongs and is a part of the neighborhood; and (7) whether most people in the neighborhood can be trusted. A dichotomized measure of adequate access to food was created to indicate whether the respondent reported either difficulty accessing fruits/vegetables or access to grocery stores (Questions 2–3) and a dichotomized measure of a social environment was created to indicate whether the respondent had any difficulty with the neighborhood social environment (Questions 4–7).

### Dependent Variables

Multiple measures (13 total) of health status and healthcare utilization were used as dependent variables. Self-rated health status on a 4-point Likert-type scale was dichotomized into *fair* or *poor* versus *excellent* or *good*. Respondents were asked about clinician-diagnosed chronic conditions. Other items addressed insurance status (uninsured versus all others); cost-related healthcare and prescription nonadherence (whether the participant had not sought medical care/prescription medications in the past 12 months because of the cost); emergency department use in the past 12 months; current smoking status; and obesity (BMI of 30 or greater calculated from self-reported height and weight).

### Statistical Analysis

**Propensity scores weights.** The analytic approach was designed to obtain robust estimates of the association between housing affordability and health outcomes. Specifically, propensity score weighting was used to address important imbalances that existed in the current sample between those who reported living in a housing affordable situation and those who did not. Propensity score weights give more weight to individuals in the control condition (here, affordable housing) who look like individuals in the

> See related Commentary by Fullilove in this issue.

treatment condition (unaffordable housing) and less weight to those who do not. In doing so, a computation is being made of the Average "Treatment" effect on the "Treated" population, or ATT,[30–33] which makes the current results generalizable to respondents like those in the treatment condition (i.e., those living in unaffordable housing situations). The analysis aims to answer the policy-relevant question: what would happen to individuals living in unaffordable housing situations had they lived in affordable housing situations?

Computing the ATT is a quasi-experimental strategy that requires that an estimation of counterfactuals be made for those in the treatment group (e.g., outcomes for the unaffordable housing respondents were they living in affordable housing situations). This was accomplished with the creation of propensity score weights to weight the affordable housing group to look similar to the unaffordable housing group with respect to the key independent variables (age, gender, race, education, unemployment, county of residence, housing tenure, poverty indicator, and the perception of neighborhood quality variables). Weights were estimated using a generalized boosted model, which is a flexible, nonparametric estimation technique that adaptively captures the functional form of the relationship between the covariates and exposure with less bias than traditional approaches such as logistic regression.[34] The weight estimation was implemented using the "twang" package in R, and balance between the affordable and unaffordable housing groups was assessed across a number of criteria.[35]

To show how comparable the unaffordable and affordable housing groups were after applying the propensity score weights, a calculation was made of the pre- and post-weighting standardized mean difference for each variable used to create the weights, and absolute standardized differences greater than 0.20 are considered to be moderate effect size differences.[36] All results are appropriately adjusted for sampling weights.

**Outcome analyses.**
The ATT was estimated for each outcome separately by fitting propensity score–weighted logistic regression models that controlled for whether the respondent lived in an unaffordable housing situation and the eight independent variables listed above ("doubly robust" estimation).[37] After estimating the main effect of housing unaffordability on each outcome, weighted logistic models were fitted that also included an interaction term between unaffordable housing and the indicator for whether or not a respondent owned his or her home, to assess whether the effects of unaffordable housing differed for homeowners and renters.

Missingness in the data ranged from 0.1% to 14%, with a median of 0.5% and a mean of 1.5%. Missing data were multiply im-

**Table 1.** Sociodemographic characteristics of people living in unaffordable and affordable housing

| Characteristics | Unaffordable housing group (*n*=4850) | Unweighted affordable housing group (*n*=5156) | Weighted affordable housing group (*n*$_{weighted}$=1909) |
|---|---|---|---|
| **Age (years [M])** | 46.2 | 50.6[a] | 46.3 |
| **Homeowner (%)** | 32.5 | 21.6[a] | 32.9 |
| **Female** | 59.2 | 48.9[a] | 59.5 |
| **Race/ethnicity** | | | |
| White | 66.2 | 76.8[a] | 66 |
| Black | 25.4 | 17.3 | 25.7 |
| Other | 8.4 | 5.9 | 8.3 |
| **Education** | | | |
| College graduate | 31.8 | 49.9[a] | 32.2 |
| Some college | 22.2 | 18.9 | 21.9 |
| High school or less | 46.0 | 31.2[a] | 45.9 |
| **Living in poverty** | 35.5 | 14.5[a] | 35 |
| **Unemployed** | 9.1 | 4.2 | 8.8 |
| **County** | | | |
| Philadelphia | 42.5 | 30.9[a] | 43.3 |
| Bucks | 15.8 | 16.0 | 15.8 |
| Chester | 11.2 | 14.1 | 11.0 |
| Delaware | 13.2 | 15.5 | 12.9 |
| Montgomery | 17.3 | 23.5 | 17.0 |
| **Perceptions of neighborhood quality** | | | |
| Lack of neighborhood safety | 9.7 | 4.0 | 9.5 |
| Poor social environment | 58.1 | 49.3 | 57.7 |
| Difficulty accessing health food | 23.5 | 10.4[a] | 23.3 |

[a]Represent variables for which the absolute standardized mean difference (SMD) between the unaffordable housing group and the unweighted and propensity weighted versions of the affordable housing groups was >0.2. In this analysis, SMDs were only greater than 0.20 when comparing the unaffordable housing group to the unweighted affordable housing group. After propensity weighting, all SMDs were <0.20.

puted using Stata's ice command.[38] Results shown are reported across all 10 imputed data sets.

**Sensitivity analyses.** To assess the sensitivity of the current results to the specification of the key variable of housing affordability, responses to the question were reclassified so that the unaffordable category included only those respondents who said it was *very difficult* to afford housing costs and re-ran analyses.

## Results

Overall, 14.0% of the sample reported that paying housing costs was very difficult and 34.4% reported that it was somewhat difficult. Table 1 shows the sociodemographic characteristics of the sample for (1) the unaffordable housing group; (2) the unweighted affordable housing group; and (3) the propensity score–weighted affordable housing group. Before weighting, the unaffordable housing and affordable housing groups looked different on eight of the 11 independent variables included in the propensity score weights. The unaffordable housing group was younger, more likely to own a home, more likely to be women or minorities, less educated, more likely to be under the poverty level or unemployed, more likely to live in Philadelphia, and more likely to report having difficulty accessing health food. After weighting, the two groups look almost identical on all observed factors.

Table 2 shows the unadjusted associations between housing affordability and the outcome variables as well as the propensity score–adjusted associations (the unweighted and weighted affordable housing columns, respectively). Generally, respondents in unaffordable housing situations had a higher prevalence of each negative health outcome prior to weighting.

Table 3 reports the AORs from the weighted logistic regression models. As shown, housing unaffordability was significantly related to increased odds of poor self-

**Table 2.** Percentage of respondents reporting each health condition, healthcare utilization, and health-related behavior

| Health measures | Unaffordable housing group (*n*=4,850) | Unweighted affordable housing group (*n*=5156) | Weighted affordable housing group (*n*$_{weighted}$=1909) |
|---|---|---|---|
| **Fair or poor self-rated health (%)** | 26.3 | 13.1* | 16.4* |
| **Chronic conditions** | | | |
| Hypertension | 30.9 | 29.7 | 22.6* |
| Heart disease | 10.6 | 10.3 | 9.3 |
| Diabetes | 11.5 | 9.5* | 8.9 |
| Asthma | 16.5 | 11.8* | 13.5 |
| Arthritis | 25.7 | 20* | 13* |
| Psychiatric conditions | 22.6 | 13.3* | 16.9* |
| **Healthcare utilization** | | | |
| Uninsured | 12.0 | 4.5* | 13.5 |
| Emergency department visit in past year | 43.7 | 34.2* | 41.6* |
| Cost-related healthcare nonadherence | 19.7 | 4.0* | 9.1* |
| Cost-related prescription nonadherence | 24.7 | 6.9* | 11.9* |
| **Health-related behaviors** | | | |
| Current smoker | 25.8 | 15.3* | 25.2 |
| Obese | 28.4 | 22.3* | 24.1 |

*$p$<0.05 in bivariate analysis compared to unaffordable housing group

rated health (AOR=1.75, 95% CI=1.33, 2.29); hypertension (AOR=1.34, 95% CI=1.07, 1.69); arthritis (AOR=1.92, 95% CI=1.56, 2.35); cost-related healthcare nonadherence (AOR=2.94, 95% CI=2.04, 4.25); and cost-related prescription nonadherence (AOR=2.68, 95% CI=1.95, 3.70). There were no significant associations between housing affordability and heart disease, diabetes, asthma, psychiatric conditions, being uninsured, obesity, or being a current smoker.

Only two outcomes, fair or poor self-reported health and cost-related healthcare nonadherence, showed significant interaction effects between housing tenure and affordability (results not shown). In both cases, the effect of housing unaffordability among renters was greater than the effect of housing unaffordability among homeowners (for fair or poor self-reported health, AOR=2.55, 95% CI=1.93, 3.37, among renters and AOR=1.23, 95% CI=0.80, 1.90, among homeowners; for cost-related healthcare nonadherence, AOR=4.74, 95% CI=3.05, 7.35, among renters and AOR=1.99, 95% CI=1.15, 3.46, among homeowners).

**Table 3.** Effect of housing affordability on each outcome in doubly robust propensity score–weighted regression models

| Health measures | OR (95% CI) |
|---|---|
| **Fair or poor self-rated health** | 1.75 (1.33, 2.29) |
| **Chronic conditions** | |
| Hypertension | 1.34 (1.07, 1.69) |
| Heart disease | 1.04 (0.73, 1.49) |
| Diabetes | 1.17 (0.86, 1.60) |
| Asthma | 1.22 (0.94, 1.58) |
| Arthritis | 1.92 (1.56, 2.35) |
| Psychiatric conditions | 1.29 (0.98, 1.70) |
| **Healthcare utilization** | |
| Uninsured | 1.11 (0.77, 1.60) |
| Emergency department visit in past year | 1.22 (0.99, 1.49) |
| Cost-related healthcare nonadherence | 2.94 (2.04, 4.25) |
| Cost-related prescription nonadherence | 2.68 (1.95, 3.70) |
| **Health-related behaviors** | |
| Current smoker | 1.03 (0.81, 1.3) |
| Obese | 1.20 (0.97, 1.48) |

*Note:* Weighted models were controlled for age, gender, race, education, poverty, unemployment, county of residence and whether or not respondent thought neighborhood was safe, had adequate access to quality groceries, and a strong social environment.

In sensitivity analyses using very unaffordable housing as the key independent variable, results were similar in direction, with very unaffordable housing increasing a respondent's risk of most outcomes (Table 4). In addition to the significant associations found above, living in very unaffordable housing was significantly associated with two more outcomes (psychiatric conditions and current smoking). Inferences in these models utilize propensity scores that weight those in the comparison condition to look like those in very unaffordable housing, so it is not appropriate to compare the point estimates directly with those in Table 3.

## Discussion

People who live in unaffordable housing were more likely to report cost-related prescription drug and healthcare nonadherence, fair or poor self-reported health, and certain chronic conditions in comparison to similar people living in affordable housing. However, many chronic conditions, insurance, and health-related behaviors were not different between the two groups. The results were generally consistent among both homeowners and renters, but with stronger associations found among renters with respect to cost-related healthcare nonadherence and self-rated health, possibly reflecting lower wealth and lower SES among renters.[39,40]

The strongest associations were found between housing unaffordability and cost-related outcomes, supporting the mechanism that unaffordable housing is associated with financial trade-offs and reduced discretionary spending on health-related expenses. It is possible that, over time, these trade-offs may have a deleterious effect on health, for example, by reducing one's ability to successfully manage chronic conditions or decreasing the use of preventive services. Lack of housing affordability may be a sensitive marker for other forms of material deprivation such as food insecurity. Associations between housing affordability and self-reported health were also significant, which may be related to the underlying emotional stress of insecure housing.[16,17]

The finding that housing affordability is associated with some chronic conditions (hypertension and arthri-

**Table 4.** Effect of housing affordability (very unaffordable housing) on each outcome in doubly robust propensity score–weighted regression models

| Health measures | OR (95% CI) |
|---|---|
| **Fair or poor self-rated health** | 1.53 (1.15, 2.05) |
| **Chronic conditions** | |
| Hypertension | 1.54 (1.17, 2.02) |
| Heart disease | 1.49 (0.99, 2.25) |
| Diabetes | 1.35 (0.90, 2.01) |
| Asthma | 1.17 (0.85, 1.60) |
| Arthritis | 1.81 (1.36, 2.41) |
| Psychiatric conditions | 1.42 (1.07, 1.89) |
| **Healthcare utilization** | |
| Uninsured | 1.28 (0.90, 1.83) |
| Emergency department visit in past year | 1.23 (0.97, 1.58) |
| Cost-related healthcare nonadherence | 2.74 (2.03, 3.69) |
| Cost-related prescription nonadherence | 2.38 (1.81, 3.14) |
| **Health-related behaviors** | |
| Current smoker | 1.40 (1.06, 1.85) |
| Obese | 1.23 (0.94, 1.61) |

*Note:* Weighted models were controlled for age, gender, race, education, poverty, unemployment, county of residence, and whether or not respondent thought neighborhood was safe, had adequate access to quality groceries, and a strong social environment.

tis) but not others may reflect differing mechanisms based on the particular condition, or residual confounding. The results are consistent with prior research[9] suggesting an association between hypertension and financial strain. However, it is not possible to discern clear patterns among the types of chronic condition that were and were not significant. With people in unaffordable housing being more likely to delay or skip going to the doctor, it is possible that underdiagnosis may be more common among those living in unaffordable homes. The current findings differ from past studies showing an association between housing affordability and insurance status,[5,15] which may reflect differences in methodologies, populations studied, and/or temporal trends.

People who report unaffordable housing costs were also more likely to report worse perceived neighborhood quality. This suggests that the respondents were not choosing to live in homes with higher costs as a means to live in a better neighborhood. Instead, the problems of poor neighborhood quality and lack of access to affordable housing coexist, and the association between housing affordability and health is robust to potential confounding by perceptions of neighborhood quality.

Similarly, living in unaffordable housing is unlikely to guarantee better housing quality. Approximately one in ten households nationally live in poor-quality, inadequate housing, and nearly half of low-income families who live in poor-quality housing spend more than half their incomes on housing expenses.[1] It was not possible in the current study to control for the physical condition of the home, which may confound the relationship between housing affordability and health.

Well-validated survey measures of housing affordability with respect to health outcomes do not exist. Previous researchers have used a cut-off of spending greater than 30% of one's pre-tax household income as living in unaffordable housing. This measure, which was unavailable in the current study, has been criticized because the same percentage of income may represent different financial burdens depending on income. The subjective self-reported measure of housing affordability used here mitigates this concern, but may also suffer from differential item functioning across individuals.

This analysis has a number of other limitations. The survey was a telephone survey with a low level of response. It is not known whether nonresponse is correlated with housing affordability. If people living in unaffordable housing are less likely than those with affordable housing to respond to the survey (which may be the case if they lack telephone access), then the overall prevalence of unaffordable housing in the community would be higher than the present estimates. Because the survey was cross-sectional, it is not possible to assess causal relationships between housing affordability and health. Adjustment was made for unemployment to mitigate the concern that people with worse health may have greater difficulty affording their housing because of inability to work. Additional research is required to assess to what extent unaffordable housing causes ill health, and whether ill health or other correlates of ill health lead people to have difficulty meeting their housing costs. Health outcomes were all self-reported. No assessment was made of neighborhood change, and it is plausible that neighborhoods could have declined or improved at the same time that housing became more or less unaffordable. Further, this survey took place during a time of economic recession, which may increase the number of people reporting unaffordable housing, although the impact of recessions on population health is controversial.[41,42] This survey reflects the population of Philadelphia and the surrounding counties; findings may not be generalizable to other regions of the country where differences exist in the structure of the housing and healthcare markets. The 2008 homeownership level for the Philadelphia metropolitan area (71.8%) is higher than the national average for large metropolitan areas (67.8%)[43] although Philadelphia is estimated to have a higher prevalence of people living in unaffordable housing situations compared to other areas.[44]

## Conclusion

Like other forms of financial strain, lack of affordable housing is related to poor health outcomes. Tax benefits for homeowners and rental subsidies are perhaps the most prominent policy programs affecting housing affordability, although other programs exist (e.g., Low-Income Home Energy Assistance Program, LIHEAP).[13] Among homeowners experiencing the threat of home foreclosure, current mortgage foreclosure mitigation efforts may reduce the financial costs of unaffordable housing. Programs and policies that reduce housing costs and promote affordable housing may help lessen the potential trade-offs that individuals and families make between housing and health.

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