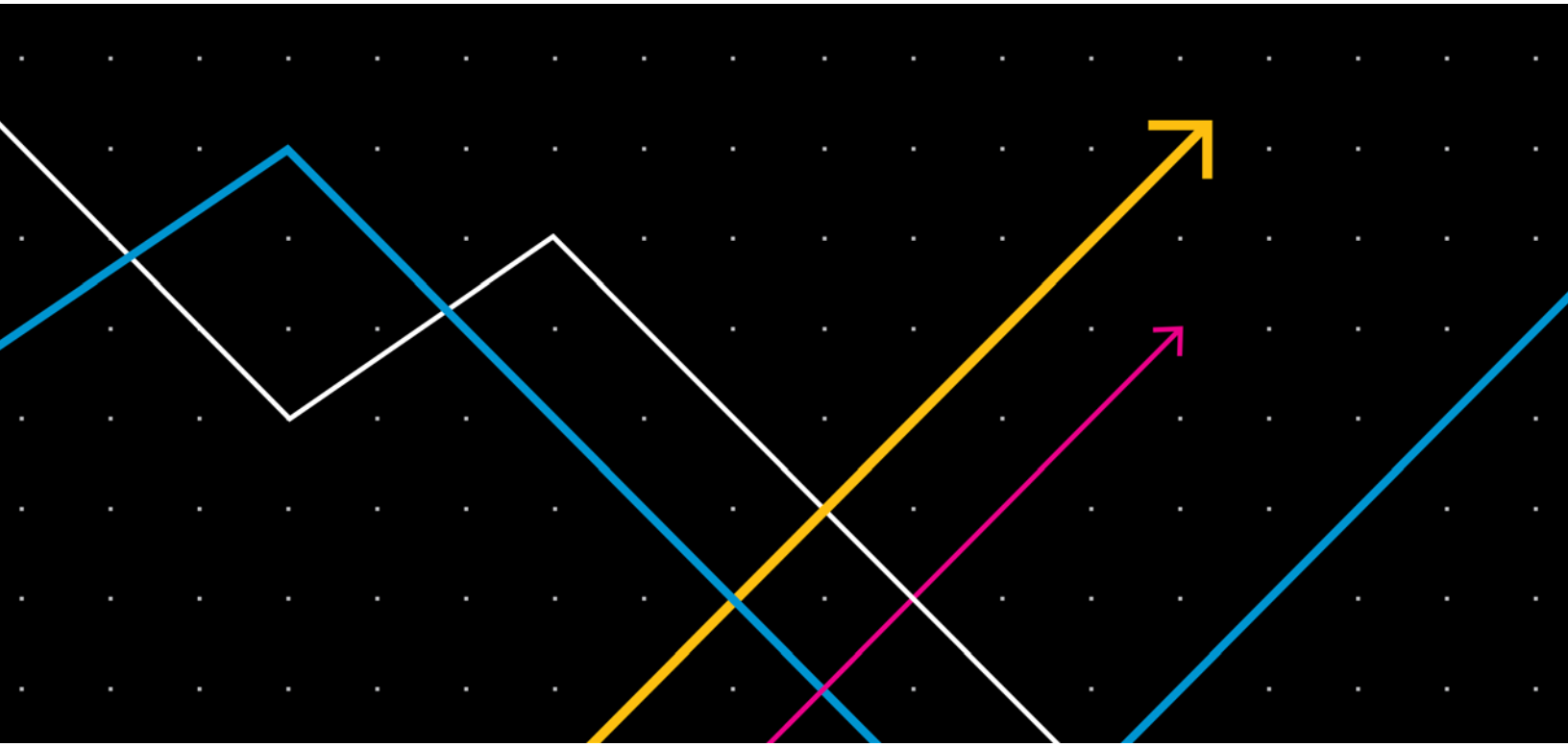

RESEARCH REPORT

Food Insecurity, Housing Hardship, and Medical Care Utilization

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Food Insecurity, Housing Hardship, and Medical Care Utilization

Social determinants of health can be related to health care spending, and they often reflect material hardships people face. However, research on the relationship between specific hardships and medical care utilization across the US adult population is limited. Using 2010–11 data from the Survey of Income and Program Participation (SIPP), we study three specific hardships—food insecurity, housing insecurity, and housing quality—and their relationship to annual medical care utilization and out-of-pocket spending. Regression models account for differences in demographics, health and health insurance status, and family resources. Adults who faced housing quality hardships had higher utilization and spending (14.9 percent more provider visits and 16.9 percent higher out-of-pocket spending), as did adults who faced housing insecurity (22.1 percent more provider visits and 28.5 percent higher out-of-pocket spending). We find less evidence of a relationship between food insecurity and medical care utilization, especially after accounting for the presence of multiple hardships.

Introduction

A growing literature focuses on how social determinants of health relate to population health and health care spending (Braveman, Egerter, and Mockenhaupt 2012; Marmot 2005; Woolf and Braveman 2011). These social determinants often reflect material hardships in a person's environment and cannot be captured by a single measure of deprivation such as the federal poverty level (Ouellette et al. 2004). Previous research has recognized that material hardship is multidimensional (e.g., Heflin, Sandberg, and Rafail 2009). For example, a person who experiences food insecurity may also live in substandard housing or have difficulty paying for housing costs, and none of these hardships are necessarily limited to people with low incomes.

Much research to date has focused on subgroups of the US population or on specific dimensions of material hardship. Studies have considered subgroups defined by low incomes (e.g., Kushel et al. 2006; Ma, Gee, and Kushel 2008) or attributes such as homelessness and/or residence in a specific geographical location (Flaming et al. 2013; Larimer et al. 2009; Meltzer and Schwartz 2016). Among the dimensions of material hardship that could be associated with health and health care, food insecurity has received the most attention, although the direction of the effect is unclear. For example, recent work by Berkowitz and colleagues (2017) demonstrated that food insecurity is associated with

significantly higher total medical spending among adults in the US, and Nielsen, Garasky, and Chatterjee (2010) found that households that had higher out-of-pocket medical spending were more likely to be food insecure. Material hardship may lead to increased need for medical care and spending through several distinct pathways. Food insecurity may physiologically affect health and health care use via inadequate nutrition (Berkowitz et al. 2017). Poor housing quality may directly affect physical health by exposing people to environmental conditions that can cause new medical problems or exacerbate existing ones. For example, increased exposure to moisture, rodents, or insects can exacerbate asthma, and fall hazards can result in unintentional injuries among older people (HUD 2009, appendix A). Housing insecurity may affect health via increased stress, or it may discourage voluntary moves from neighborhoods or environments, resulting in worse health outcomes (e.g., violence; Sanbonmatsu et al. 2011, 42–45). Relationships between specific dimensions of material hardship and medical care utilization may also reflect consumption decisions or trade-offs—for example, choosing between out-of-pocket medical spending or rent.

Focusing on a single dimension of hardship, such as food insecurity, may obscure the role of other important hardships or distort the perceived role of that single dimension. And because a given hardship may not be limited to people with low incomes or people in food insecure households, for example, it is important to study the relationship between each hardship and health care utilization across a full range of the population.

In this paper, we examine the relationship between three dimensions of material hardship—food insecurity, housing insecurity, and housing quality hardship—and medical care utilization and out-of-pocket spending across the entire noninstitutionalized US adult population. To our knowledge, this study is the first to simultaneously examine these hardship dimensions and medical care utilization among all adults in the US.

Data and Empirical Approach

Data from the Survey of Income and Program Participation

This work uses data from the 2008 panel of the Survey of Income and Program Participation, a longitudinal, nationally representative survey of the civilian noninstitutional population administered from 2008 through 2013. The SIPP includes a core set of questions administered to respondents every four months, or "wave," of a given panel, collecting monthly information to describe the overall economic circumstances of the population. The survey has a complex two-stage sample design, which is intended to produce an oversample of low-income households.[1] To obtain correct estimates using these data, it is necessary to incorporate survey weights and the survey's design features. Topical modules in the SIPP supplement information collected in the core survey, cover several themes, and rotate each wave. This analysis combines information from the core interviews and topical modules on medical utilization and assets in wave 10 (administered from September through December 2011) and the topical module on adult well-being in wave 9 (administered from May through August 2011). The final analytic sample includes 56,174 adult respondents ages 18 or older.

Measures of Food Insecurity, Housing Insecurity, and Housing Quality

Information on material hardship was collected in the SIPP adult well-being topical module. We created three measures of material hardship based on responses to a battery of survey questions. Summary statistics on responses to all relevant survey questions are presented in appendix table 1.

Food security status is measured by applying the US Department of Agriculture guidelines to the "six-item short form" questionnaire module in the SIPP, which has a four-month reference period, to identify households with low or very low food security status (USDA 2012).[2] Using this definition, 11.1 percent of adults ages 18 and older in the sample are food insecure.

Housing insecurity is defined as not paying the full amount of rent or mortgage and/or utility bills (gas, oil, or electricity) sometime in the previous 12 months. Approximately 14 percent of adults in the sample met this definition of housing insecurity.

Housing quality hardship is defined as an affirmative response to one or more questions related to problems with a respondent's physical dwelling at the time of interview. In our sample, 17 percent of adults resided in a household with one or more of these dwelling-related problems: pests and/or insects; leaking roof or ceiling; windows that are broken or cannot shut; exposed electrical wires;

broken plumbing (toilet, hot water, other); holes in walls, ceiling, or floor; no appliances (refrigerator or stove); and no phone (of any kind).

Though there is broad agreement on the detailed US Department of Agriculture guidelines for measuring food security status, there is more variation in the taxonomies used to study housing-related hardships. The Moving to Opportunity (MTO) demonstration evaluation provides useful guidance for hypothesized mechanisms through which housing may influence measures of well-being including health (e.g., physical and/or mental health, economic self-sufficiency, risky behavior). The MTO demonstration was specifically aimed at relocating people from high-poverty neighborhoods to lower-poverty neighborhoods and is not directly analogous to the hardship variation we observe in the SIPP, but its approach is useful for measuring specific concepts here.

First, MTO measured housing insecurity (called "housing instability" in the demonstration), which is hypothesized to result in reduced mobility (choice of physical residence or neighborhood), involuntary moves, or homelessness (Sanbonmatsu et al. 2011, 42–46). The evaluation posited that MTO-assisted moves could affect health by improving a participant's physical and social environments and access to health-related community resources (Sanbonmatsu et al. 2011, 79–85). Like our study, the MTO evaluation used surveys that tracked late rent or mortgage payments and late utility payments over the past 12 months to proxy for stability of housing and utility services.

Second, the MTO demonstration measured housing quality, reflecting the physical characteristics of a home. Poor housing quality is hypothesized to cause worse health. For example, rodents and insects can cause allergic reactions, excessive moisture or mold can exacerbate asthma, and holes in flooring may cause unintentional injuries especially among older adults (HUD 2009, appendix A). Our measure of housing quality is more expansive than that in the MTO evaluation, which focused on exposure to vermin, broken plumbing, and peeling paint/plaster, but follows in the same spirit.

Measures of Medical Care Utilization and Out-of-Pocket Spending

The SIPP topical module on medical care utilization collects information relevant to the 12 months before a given interview. From this module, we study (1) the number of medical provider visits, (2) the number of overnight hospital stays, (3) prescription drug use (any or daily), and (4) out-of-pocket spending. For each outcome, we study the likelihood of any utilization or spending, average utilization or spending, and "high" levels of utilization or spending. High is defined as values above the 90th percentile for out-of-pocket spending ($1,500) and medical provider visits (10 visits), and above the 95th percentile for overnight hospital stays (2 stays), which are less common.

Finally, the module includes questions about activities of daily living (ADL) and instrumental activities of daily living (IADL) at the time of interview; these measures are commonly used as a proxy for disability status. We incorporate information on ADLs and IADLs in this work to account for the possibility that the relationship between material hardship and medical care utilization or spending varies by disability status (discussed below).

Reference Periods

The reference periods for material hardship and medical utilization used in this analysis differ and have implications for the interpretation of results. For example, questions on health care utilization have a 12-month reference period with respect to the date of interview at wave 10 (administered from September through December 2011), but food insecurity status is based on a four-month reference period, housing insecurity is based on a 12-month reference period, and housing quality refers to the time of the wave 9 interview (administered from May through August 2011). (See the appendix for a more complete discussion.) Because of these differences in reference periods, we do not advise comparing the magnitude of the relationship across multiple concepts of material hardship and medical utilization; for a given material hardship measure, the longer the reference period, the greater the probability of an affirmative response. To make magnitude comparisons, each measure of material hardship should have the same overlapping reference period, but that is not possible because of the wording and timing of the survey questions.

Statistical Analysis

The relationship between material hardship and medical care utilization is complex; multiple factors influence material hardship and utilization independently or even jointly. This analysis uses a series of regression models to control for individual differences in basic health, demographic, and socioeconomic characteristics that may influence the association between a given hardship and medical care utilization and out-of-pocket spending. The models should not be interpreted to mean that hardships cause health care use, or vice versa. They simply are a useful approach for measuring the correlation between medical utilization or spending and multiple dimensions of material hardship, holding constant important observed characteristics or even the joint relationship between multiple hardships.

We estimate and present results from a series of multivariate regression models. All models define either medical utilization or out-of-pocket spending as the dependent variable, yet the coefficient estimates (or reported marginal effects) measure the correlation (not the causal relationship) between a

given measure of material hardship and the dependent variable. One of three models was used depending on the nature of the dependent variable. Logit models were estimated for binary outcomes: any OOP spending, high level of OOP spending, any medical professional visits, high level of medical provider visits, any overnight hospital stays, high level of overnight hospital stays, any prescription drug use, daily prescription drug use. Negative binomial models were used for counts: number of medical professional visits, number of overnight hospital stays. And a generalized linear model with a log link was estimated for medical out-of-pocket spending. For all outcomes except overnight hospital stays, "high" is above the 90th percentile; for overnight hospital stays, high is above the 95th percentile. Overnight stays are treated differently because they are relatively uncommon, observed in 8.5 percent of our adult sample.

All models include demographic controls for age, sex, race and ethnicity, urban residence, and census region. Controls for family structure include married couples without children, married couples with children, single parent, single person, and other multiperson families. Health-related controls include self-reported health status and any ADLs or IADLs (a proxy for disability status). Controls for health insurance status include private group insurance, private nongroup insurance, Medicaid, Medicare, military insurance, and uninsurance. Finally, we account for family income as a percentage of the federal poverty level and for net wealth (above or below $1,000).

In the first analysis, we estimate regression models that include the three dimensions of material hardship as independent variables in separate models, as well as the controls described above for a total of 33 models (11 dependent variables times three dimensions of material hardship). This approach aims to first establish the relationship between medical utilization and each dimension of material hardship independently, in part to replicate the findings by Berkowitz and colleagues (2017) on the relationship between food insecurity and medical care utilization using an alternative data source.

The second analysis includes results from models where all three dimensions of material hardship are included as independent variables simultaneously (11 models). This approach accounts for the joint relationship across food insecurity, housing insecurity, and housing quality.

Results

Descriptive Statistics

Table 1 summarizes the prevalence of material hardship among all adults in the US by age, race and ethnicity, income, and health status. Among all adults, 11.1 percent experienced food insecurity in the previous four months, 17.3 percent reported housing quality hardship related to their dwelling at the time of interview, and 13.8 percent experienced housing insecurity at some point during the previous 12 months.[3]

TABLE 1

Material Hardship by Age, Race/Ethnicity, Income, and Health Status

	Food insecurity	Housing quality hardship	Housing insecurity
Age			
18 and older	11.1%	17.3%	13.8%
18 to 49	12.9%***	18.9%***	17.6%***
50 to 64	10.8%***	16.9%***	12.4%***
65 and older (reference group)	5.8%	13.0%	4.7%
Race/Ethnicity			
White, non-Hispanic (reference group)	8.1%	15.2%	10.7%
Black, non-Hispanic	18.8%***	22.5%***	25.8%***
Hispanic	18.8%***	22.3%***	19.9%***
Other, non-Hispanic	12.3%***	20.2%***	13.6%***
Income			
Income above 300% of FPL (reference group)	4.4%	12.5%	6.7%
Income between 200% and 300% of FPL	11.7%***	17.3%***	14.8%***
Income between 100% and 200% of FPL	17.1%***	22.0%***	20.0%***
Income below 100% of FPL	25.0%***	27.5%***	29.0%***
Health status			
Excellent or very good health (reference group)	8.2%	14.6%	11.1%
Good health	12.6%***	19.2%***	16.0%***
Fair or poor health	20.1%***	25.1%***	21.5%***
Disability			
No disability (reference group)	10.0%	16.0%	13.1%
Disability	16.9%***	24.0%***	17.7%***

Source: Authors' calculations using the 2008 SIPP panel wave 10 merged with the wave 9 adult well-being topical module.
Notes: FPL = federal poverty level. Each row defines the denominator for a given cell. Food insecurity is defined as low or very low food security during a four-month reference period. Housing quality hardship refers to a respondent's physical dwelling at the time of interview (e.g., pests, broken windows). Housing insecurity is defined as not paying the full amount of rent/mortgage and/or utilities at any time during the previous 12 months. See the appendix for more details on definitions of material hardship.
*** Estimate differs significantly from the reference group at the 0.01 level, using a two-tailed test.

Older adults were significantly less likely than younger adults to report any type of hardship.[4] Non-Hispanic white respondents were less likely than any other race/ethnicity to experience any of the measured hardships. And people in worse health, measured by the self-reported health status scale (excellent, etc.) or disability status, were more likely to experience all hardships measured in this study.

Lower incomes were associated with higher rates of hardship, which is expected because higher incomes provide additional resources to purchase material needs. However, material hardship is not limited to people in low-income families (see, e.g., Ouellette et al. 2004). Among people with family incomes between 200 and 300 percent of the federal poverty level, 11.7 percent were food insecure, 17.3 percent reported housing quality hardship, and 14.8 percent faced housing insecurity. Thus, the relationship between specific dimensions of material hardship and medical utilization should not be interpreted simply as a link between poverty and medical care utilization. It is broader than that.

TABLE 2

Joint Relationship between Food Insecurity, Housing Quality Hardship, and Housing Insecurity

Panel A. Joint distribution of material hardships

	Food insecurity	Housing quality hardship	Housing insecurity
Food insecurity	100.0%	24.1%	41.3%
Housing quality hardship	37.7%	100.0%	37.9%
Housing insecurity	51.7%	30.3%	100.0%
Sample size	*6,284*	*9,906*	*7,638*

Panel B. Correlation matrix

	Food insecurity	Housing quality hardship	Housing insecurity
Food insecurity	1.000		
Housing quality hardship	0.192	1.000	
Housing insecurity	0.394	0.222	1.000
Sample size = 56,174			

Source: Authors' calculations using the 2008 SIPP panel wave 10 merged with the wave 9 adult well-being topical module.
Note: Each column identifies the denominator of a given cell.

Although some adults who experienced one type of hardship simultaneously experienced another, many did not experience multiple hardships. Table 2, panel A, shows that about one-half of people in food insecure households were also likely to face housing insecurity (51.7 percent), and the correlation (panel B) between food insecurity and housing insecurity was the highest (0.394). But the positive relationship between food security status and housing quality hardship (correlation of 0.192) or housing quality and housing insecurity (correlation of 0.222) was significantly smaller. Thus, although the material hardships are related, each dimension of material hardship is unique and not representative of a single latent construct, as has been argued elsewhere (Heflin, Sandberg, and Rafail 2009).

Regression Results: Food Insecurity, Housing Quality, and Housing Insecurity Studied Independently

The first column of table 3 presents summary statistics on medical care utilization and out-of-pocket spending among all adults. Approximately half of adults (55.6 percent) had some out-of-pocket spending during the past year, average spending was $469 per adult, and 8.8 percent experienced high spending (above $1,500). Overnight hospital stays were much less common; only 8.5 percent of adults experienced one or more overnight stays. Medical professional visits were more common. Over three quarters of respondents (77.1 percent) had one or more visits during the year, and 9.7 percent had a high number of visits (10 or more visits). Finally, more than half of adults reported some prescription drug use during the year, and over 40 percent reported daily use.

TABLE 3

Relationship between Material Hardship and Medical Care Utilization/Out-of-Pocket Spending among Adults Ages 18 and Older

		1	2	3	4	5	6	7
			One Hardship per Model			One Model with All Three Hardships		
		Summary statistics	Food insecurity	Housing quality hardship	Housing insecurity	Food insecurity	Housing quality hardship	Housing insecurity
Medical out-of-pocket spending per year	Any	55.6%	0.028***	0.063***	0.086***	-0.009	0.052***	0.079***
		[0.005]	[0.009]	[0.008]	[0.008]	[0.010]	[0.008]	[0.009]
	Mean	$469	$41	$79***	$134***	-$9	$62***	$123***
		[7]	[26]	[19]	[26]	[27]	[18]	[28]
	High	8.8%	0.006	0.013***	0.022***	-0.003	0.011***	0.021***
		[0.002]	[0.005]	[0.004]	[0.004]	[0.005]	[0.004]	[0.005]
Overnight hospital stays per year	Any	8.5%	0.002	0.000	0.010**	-0.001	-0.001	0.011**
		[0.001]	[0.005]	[0.003]	[0.005]	[0.005]	[0.003]	[0.005]
	Mean	0.6	-0.0712	-0.1*	0.121	-0.0967	-0.1*	0.163
		[0.0]	[0.0760]	[0.0533]	[0.0900]	[0.0822]	[0.0547]	[0.102]
	High	5.0%	-0.003	-0.002	0.003	-0.004	-0.002	0.005
		[0.001]	[0.003]	[0.002]	[0.003]	[0.003]	[0.002]	[0.004]
Medical professional visits per year	Any	77.1%	-0.004	0.013**	0.015**	-0.012*	0.012**	0.016**
		[0.004]	[0.006]	[0.006]	[0.006]	[0.007]	[0.006]	[0.006]
	Mean	4.6	0.244	0.7***	1.0***	-0.172	0.6***	1.0***
		[0.1]	[0.178]	[0.214]	[0.262]	[0.214]	[0.201]	[0.277]
	High	9.7%	0.007	0.014***	0.025***	-0.003	0.011***	0.023***
		[0.002]	[0.005]	[0.004]	[0.004]	[0.005]	[0.004]	[0.004]
Prescription drug use during the year	Any	51.4%	0.018**	0.039***	0.048***	-0.002	0.033***	0.042***
		[0.003]	[0.008]	[0.007]	[0.006]	[0.008]	[0.007]	[0.007]
	Daily	43.6%	0.007	0.015**	0.024***	-0.003	0.012**	0.023***
		[0.003]	[0.008]	[0.006]	[0.006]	[0.008]	[0.006]	[0.007]

Source: Authors' calculations using the 2008 SIPP panel wave 10 merged with the wave 9 adult well-being topical module.
Notes: Each row presents summary statistics and regression results corresponding to a given measure of medical out-of-pocket spending or utilization. Standard errors are reported in brackets. "High" values are above the 90th percentile for medical out-of-pocket spending ($1,500) and medical professional visits (10 visits), and above the 95th percentile for overnight hospital stays (2 stays). Results in columns 2 to 4 include only one material hardship measure per model as explanatory variables, as well as information on demographic characteristics, health status, health insurance status, family structure, family income, and wealth. Results in columns 5 to 7 include all three dimensions of material hardship in one regression model, in addition to the additional control variables. Food insecurity is defined as low or very low food security during a four-month reference period. Housing quality hardship refers to a respondent's physical dwelling at the time of interview (e.g., pests, broken windows). Housing insecurity is defined as not paying the full amount of rent/mortgage and/or utilities at any time during the previous 12 months. See the appendix for more details on regression model specifications and definitions of material hardship.
*/**/*** Estimate differs significantly from the reference group at the 0.10/0.05/0.01 level, using two-tailed tests.

Columns 2 through 4 summarize results from the regression analysis, where each hardship is studied in isolation—that is, each row presents results from three different models, where each model includes only one dimension of material hardship but controls for the other observable characteristics discussed above (not reported).[5] See appendix table 3 for an example of complete regression results from models that include food insecurity status as the only dimension of material hardship.

Table 3, column 3, reveals a consistent and positive relationship between housing quality hardship and most measures of medical care utilization and out-of-pocket spending. Compared with respondents who did not report a housing quality hardship, those who did were 6.3 percentage points (11.2 percent) more likely to have had any out-of-pocket spending, spent $79 (16.9 percent) more per year on average, and were 1.3 percentage points (15.2 percent) more likely to have high spending. Results for overnight hospital stays were less precisely measured, yet difficulty paying for basic housing needs related with a 0.1 (16.0 percent) decrease in average number of stays and was the only negative relationship measured here. Adults who faced housing quality hardship were 1.3 percentage points (1.7 percent) more likely to have seen a medical provider during the year, had 0.7 (14.9 percent) more medical provider visits per year, and were 1.4 percentage points (14.8 percent) more likely to have had a high number of visits. Finally, adults who experienced housing quality hardship were 3.9 percentage points more likely (7.6 percent) to report any prescription drug use, or 1.5 percentage points (3.5 percent) more likely to report daily use.

Housing insecurity was also consistently correlated with medical care utilization and spending (column 4). Compared with adults who did not experience housing insecurity, those who did were 8.6 percentage points (15.4 percent) more likely to have had any out-of-pocket spending, spent $134 (28.5 percent) more out of pocket per year on average, and were 2.2 percentage points (25.6 percent) more likely to have had high out-of-pocket spending. Adults who faced housing insecurity were also more likely to have had one or more overnight hospital stays (1.0 percentage points or 12 percent). Medical professional visits were also positively associated with housing insecurity. Adults who experienced housing insecurity where 1.5 percentage points (2.0 percent) more likely to have seen a medical provider, had 1.0 (22.1 percent) more visits per year on average, and were 2.5 percentage points (25.3 percent) more likely to have a high level of visits. Finally, adults who experienced housing insecurity were more likely to report any prescription drug use during the year (4.8 percentage points or 9.3 percent) and to report daily use (2.4 percentage points or 5.5 percent).

Evidence of a relationship between food insecurity and medical care utilization or spending (column 2) was more limited. Adults who faced food insecurity were 2.8 percentage points (5.1 percent) more likely to have had any out-of-pocket spending and were 1.8 percentage points (3.6 percent) more likely to use any prescription drugs. These two findings are somewhat consistent with recent work on the relationship between food insecurity and health care expenditures by Berkowitz and colleagues (2017). Their study found a positive association between food insecurity and *total* health care expenditures and prescription drug expenditures.

Regression Results: All Dimensions of Material Hardship Studied Simultaneously

Table 3, columns 5 through 7, report results where each row corresponds to one regression model in which all three dimensions of material hardship are included simultaneously. These results account for overlap in the relationship across the three material hardship measures and in their relationship with medical care utilization/out-of-pocket spending. Given the positive correlation across the three hardship measures (table 2, panel B) and the generally positive relationship between medical utilization and each of the individual hardships, the estimated relationships are expected to decrease in magnitude (or become insignificant/zero) compared with columns 2 through 4.

The precision of the estimated relationships between housing quality, housing insecurity, and medical care utilization do not change, measured by 10, 5, and 1 percent significance levels (columns 6 and 7 compared with 3 and 4). But, as expected, the magnitude of the estimated relationship between housing quality, housing insecurity, and medical utilization decreases.

Nonetheless, the relationship does not qualitatively change, where medical care utilization and out-of-pocket spending are higher for people who also experienced housing quality hardships and/or housing insecurity, after accounting for income, wealth, health insurance, health status, and other important characteristics. Finally, the observed relationship between food insecurity and medical spending is no longer significant after including all three dimensions of hardship simultaneously (column 5).

Discussion

Material hardships related to paying for basic housing costs and living in substandard housing are positively and consistently associated with medical care utilization and out-of-pocket spending, after controlling for an adult's income, assets, demographic characteristics, health status, and health insurance coverage. We also find a limited positive association between food insecurity and the likelihood of any out-of-pocket spending and between food insecurity and the likelihood of any prescription drug use, when we study food insecurity independent of other dimensions of hardship.

Our results for food insecurity, considered separately from other hardships, are somewhat consistent with those of Berkowitz and colleagues (2017, table 3), who found that food insecurity was associated with $780 more in prescription medication spending per year; and those of Nielsen, Garasky, and Chatterjee (2010), who reported a positive relationship between out-of-pocket spending and food insecurity. However, we find that these relationships do not persist when we consider all three dimensions of hardship jointly. That is, recognizing the multiple dimensions of hardship this way deemphasizes the role of food insecurity.

Although this study cannot determine causal relationships, it provides evidence of a complex interaction between certain material hardships and health care use and spending. It may be that spending more on health makes it difficult to pay for basic housing needs, or that the financial stress associated with acquiring basic housing needs affects physical health and the need for care. These two channels may operate simultaneously. The analytic challenges of this type of research may be seen in Nielsen, Garasky, and Chatterjee (2010), who tried to account for this potential simultaneity. They showed that higher out-of-pocket spending was associated with a higher likelihood of food insecurity, but not the reverse; food insecurity was not associated with higher out-of-pocket spending in their analytic framework. Unobserved factors also could jointly increase medical utilization, out-of-pocket spending, and material hardships.

Whatever mechanism is at play, the presence of material hardships could be related to expected health care spending and, as a result, may need to be considered when establishing payments to health plans and providers. Specifically, these aspects of the social determinants of health could be incorporated in risk adjustments used to protect health plans and capitated providers from losses associated with these measurable risks. Providers could be encouraged or even required to screen for social determinants of health while they are assessing health risks associated with family medical history or previous adverse health events. And trying to reduce health care utilization and spending through programs aimed at changing provider payment incentives, patient cost-sharing, or utilization

review may miss important pathways to better health through the broader social determinants of health, which may significantly influence utilization and spending. Additional efforts must be made to collect information that would allow for measurement of the relationship between health care utilization, health care spending, and relevant dimensions of material hardship among specific subgroups and across the US population.

Appendix

SIPP Reference Periods

The sample used in this work combines information from the wave 10 core questions and topical modules on medical utilization and assets and the wave 9 adult well-being module. The reference periods for the survey questions used in this study do not completely overlap, which affects measurement and interpretation of results.

Appendix table 2 illustrates the reference periods for relevant survey questions by topic. Wave 10 interviews were conducted from September through December 2011 for rotation groups one through four (one group per month). Similarly, wave 9 interviews were administered May through August 2011. Dates presented in appendix table 2 correspond to SIPP respondents from rotation group one, but the general pattern is the same for the remaining respondents from rotation groups two through four. Appendix table 2 shows that information on medical utilization and out-of-pocket spending includes the 12 months before the wave 10 interview. The reference periods for food security and housing quality hardship responses (from the wave 9 adult well-being module) fall within the reference period for medical utilization. Information on bill-paying hardship begins several months before the medical utilization data reference period but also spans 12 months.

The discrepancy of the reference periods for the material hardship categories and the medical utilization information affects interpretation of the correlations between these outcomes. For a given outcome, the longer the reference period, the more opportunity for a respondent to report an affirmative response. For example, the probability that someone did not pay their rent in the previous six months is less than or equal to the probability that the person did not pay their rent in the previous 12 months. Consequently, if questions about food security status and questions about housing quality hardship (point in time) had the same reference period of 12 months, the measured prevalence of these hardships likely would be higher, and the difference in prevalence would be higher for less persistent outcomes. For example, the likelihood that someone who reported a housing quality hardship at the time of interview also did so 12 months earlier is high (unless they moved). But food security status could be more variable. Because of the difference in reference periods, this work cannot be used to rank the prevalence of the observed hardships or their correlation with medical utilization.

Appendix table 3 presents complete regression results from the 11 models summarized in the main text, where food security status is the only dimension of material hardship included as an independent variable (table 3, column 2). Unlike the main text, appendix table 3 reports the coefficient estimates and corresponding standard errors for all independent variables from a given model.

APPENDIX TABLE 1

Summary of Material Hardship Information about Adults Ages 18 and Older

Material hardship measures based on survey questions below	
Food insecure household (low or very low food security, USDA definition)	11.1%
One or more housing quality hardships	17.3%
Housing insecurity	13.8%
Information used to define food security status (USDA algorithm applied, six-question short form)	
Sometimes/Often not enough to eat in household during last four months	2.7%
The food bought just didn't last and didn't have money to get more during the last four months	13.3%
Couldn't afford to eat balanced meals during last four months	12.3%
Cut size or skipped meals because there wasn't enough money for food (respondents with affirmative answer to one of first three questions)	33.2%
Ate less than you felt you should because there wasn't money to buy food (respondents with affirmative answer to one of first three questions)	35.8%
Did not eat for a day because there wasn't enough money for food (respondents with affirmative answer to fourth or fifth question above)	18.5%
Information used to define housing quality hardship status	
Problem with pests such as rats, mice, roaches, or other insects	9.0%
Leaking roof or ceiling	4.7%
Broken window glass or windows that can't shut	3.3%
Exposed electrical wires in the finished areas of your home	0.7%
Toilet, hot water heater, or other plumbing that doesn't work	2.1%
Holes in the walls or ceiling, or cracks wider than the edge of a dime	3.0%
Holes in the floor big enough for someone to catch their foot on	0.7%
No working refrigerator in household	0.6%
No working stove in household	1.1%
No phone (any) in household	1.0%
Information used to define housing insecurity status	
Did not pay the full amount of rent/mortgage sometime in last 12 months	7.8%
Did not pay the full amount of gas, oil, or electricity bills in last 12 months	10.3%
Sample size	*56,174*

Source: Authors' calculations using the 2008 SIPP panel wave 10 merged with the wave 9 adult well-being topical module.

APPENDIX TABLE 2

Overlapping Reference Periods for Medical Utilization, Assets, and Material Hardship Information from the 2008 SIPP Panel

													Wave 9 Interview				*Wave 10 Interview*
Reference period (MM/YY)	**5/10**	**6/10**	**7/10**	**8/10**	**9/10**	**10/10**	**11/10**	**12/10**	**1/11**	**2/11**	**3/11**	**4/11**	**5/11**	**6/11**	**7/11**	**8/11**	**9/11**
Medical utilization, assets, and liabilities topical modules (wave 10)																	
Medical utilization and out-of-pocket spending					12-month reference period[a]												
Assets and liabilities																	PIT
Adult well-being topical module (wave 9)																	
Food security status									4-month reference period								
Housing quality hardship													PIT				
Housing insecurity status	12-month reference period[a]																

Notes: PIT = point in time. The example above corresponds to a respondent in rotation group one, at the wave 10 (medical utilization and assets topical module) and wave 9 (adult well-being topical module) interviews. See appendix table 1 for more information on the questions from the adult well-being topical module and the survey questions used to define food security status, housing quality hardship, and housing insecurity status. [a] Survey questions refer to the previous 12 months, or previous month, with respect to the time of interview, which may be any date in the interview month.

APPENDIX TABLE 3

Complete Regression Model Results, Coefficient Estimates Reported

	Medical Out-of-Pocket Spending			Overnight Hospital Stays			Medical Professional Visits			Prescription Drug Use	
	1	2	3	4	5	6	7	8	9	10	11
	Any	Mean	High	Any	Mean	High	Any	Mean	High	Any	Daily
Food insecure household	0.128***	0.0842	0.0741	0.0306	-0.0952	-0.0633	-0.0274	0.0499	0.0875	0.101**	0.0427
	[0.0427]	[0.0512]	[0.0577]	[0.0628]	[0.105]	[0.0730]	[0.0451]	[0.0359]	[0.0570]	[0.0424]	[0.0452]
Ages 50–64	0.273***	0.413***	0.489***	-0.218***	-0.0818	-0.0692	0.351***	0.0346	-0.192***	0.615***	0.851***
	[0.0280]	[0.0240]	[0.0442]	[0.0471]	[0.101]	[0.0654]	[0.0322]	[0.0262]	[0.0461]	[0.0302]	[0.0338]
Ages 65 and older	0.111	0.315***	0.271***	0.121	0.329**	0.252**	0.550***	-0.0861	-0.493***	0.835***	1.104***
	[0.0751]	[0.0640]	[0.0932]	[0.0870]	[0.162]	[0.109]	[0.0962]	[0.0544]	[0.0863]	[0.0757]	[0.0753]
Female	0.253***	0.205***	0.192***	0.430***	0.365***	0.234***	0.793***	0.373***	0.424***	0.509***	0.470***
	[0.0167]	[0.0259]	[0.0372]	[0.0348]	[0.0812]	[0.0428]	[0.0269]	[0.0210]	[0.0307]	[0.0214]	[0.0211]
Black, non-Hispanic	-0.315***	-0.432***	-0.593***	-0.0392	0.187	0.0853	-0.0694	-0.237***	-0.384***	-0.360***	-0.337***
	[0.0446]	[0.0540]	[0.0729]	[0.0575]	[0.115]	[0.0702]	[0.0553]	[0.0352]	[0.0651]	[0.0483]	[0.0483]
Hispanic	-0.183***	-0.179***	-0.201***	-0.247***	-0.297**	-0.192**	-0.240***	-0.206***	-0.361***	-0.411***	-0.378***
	[0.0510]	[0.0465]	[0.0750]	[0.0705]	[0.127]	[0.0970]	[0.0555]	[0.0400]	[0.0802]	[0.0490]	[0.0516]
Other, non-Hispanic	-0.448***	-0.509***	-0.592***	-0.187***	0.0599	-0.156*	-0.468***	-0.318***	-0.392***	-0.566***	-0.539***
	[0.0468]	[0.0568]	[0.0786]	[0.0657]	[0.177]	[0.0847]	[0.0463]	[0.0368]	[0.0680]	[0.0449]	[0.0492]
Nonmetro	-0.228***	-0.132**	-0.228***	-0.0621	-0.0661	-0.134**	-0.197**	-0.0811*	-0.189***	0.0129	0.0582
	[0.0845]	[0.0573]	[0.0691]	[0.0522]	[0.104]	[0.0614]	[0.0876]	[0.0466]	[0.0653]	[0.0504]	[0.0466]
Metro status not identified	0.325***	0.211***	0.114	0.112	0.203	0.0822	0.0736	-0.0752	-0.0613	5.79e-05	0.0755
	[0.0613]	[0.0693]	[0.105]	[0.0754]	[0.143]	[0.100]	[0.0911]	[0.0492]	[0.0980]	[0.0659]	[0.0621]
South	0.00714	0.265***	0.338***	-0.0241	-0.258*	-0.0828	-0.186***	-0.167***	-0.220***	0.0970**	0.125***
	[0.0514]	[0.0441]	[0.0754]	[0.0587]	[0.134]	[0.0785]	[0.0599]	[0.0374]	[0.0580]	[0.0476]	[0.0454]
Midwest	0.233***	0.374***	0.456***	0.183***	0.0691	0.112	-0.0672	-0.0809*	-0.102	0.212***	0.203***
	[0.0515]	[0.0481]	[0.0808]	[0.0604]	[0.135]	[0.0854]	[0.0592]	[0.0454]	[0.0654]	[0.0469]	[0.0461]
West	0.196***	0.382***	0.474***	-0.113*	-0.341**	-0.132	-0.104*	-0.0503	-0.0227	0.114**	0.103**
	[0.0468]	[0.0442]	[0.0725]	[0.0647]	[0.153]	[0.0880]	[0.0548]	[0.0423]	[0.0613]	[0.0453]	[0.0461]
Very good health	0.116***	0.1000**	0.206***	0.207***	0.0323	0.253**	0.150***	0.253***	0.407***	0.475***	0.528***
	[0.0341]	[0.0425]	[0.0578]	[0.0644]	[0.122]	[0.113]	[0.0494]	[0.0371]	[0.0677]	[0.0355]	[0.0386]
Good health	0.257***	0.335***	0.573***	0.764***	1.001***	1.025***	0.449***	0.650***	1.186***	1.095***	1.152***
	[0.0345]	[0.0478]	[0.0656]	[0.0626]	[0.140]	[0.104]	[0.0487]	[0.0376]	[0.0648]	[0.0387]	[0.0409]
Fair health	0.439***	0.663***	1.032***	1.635***	2.075***	2.003***	1.156***	1.267***	2.087***	2.023***	2.041***
	[0.0468]	[0.0560]	[0.0841]	[0.0766]	[0.145]	[0.106]	[0.0697]	[0.0507]	[0.0820]	[0.0594]	[0.0575]
Poor health	0.639***	1.011***	1.552***	2.438***	2.882***	2.839***	1.898***	1.858***	2.915***	2.722***	2.830***
	[0.0753]	[0.0769]	[0.106]	[0.0895]	[0.168]	[0.119]	[0.177]	[0.0918]	[0.0994]	[0.147]	[0.127]
Disability	0.179***	0.236***	0.390***	0.389***	0.713***	0.483***	0.500***	0.367***	0.527***	0.698***	0.730***
	[0.0380]	[0.0344]	[0.0490]	[0.0466]	[0.0883]	[0.0515]	[0.0532]	[0.0329]	[0.0443]	[0.0388]	[0.0359]
Nongroup or other private insurance	0.0491	0.265***	0.380***	0.0827	0.120	0.122*	0.00969	0.0112	0.0600	0.0634	0.0560
	[0.0366]	[0.0324]	[0.0499]	[0.0517]	[0.127]	[0.0648]	[0.0581]	[0.0300]	[0.0477]	[0.0404]	[0.0436]
Medicaid	-0.927***	-0.805***	-1.023***	0.220***	0.492***	0.257***	0.00687	0.205***	0.264***	0.272***	0.301***
	[0.0459]	[0.0766]	[0.0989]	[0.0591]	[0.128]	[0.0683]	[0.0550]	[0.0431]	[0.0573]	[0.0566]	[0.0541]

	Medical Out-of-Pocket Spending			Overnight Hospital Stays			Medical Professional Visits			Prescription Drug Use	
	1	2	3	4	5	6	7	8	9	10	11
	Any	Mean	High	Any	Mean	High	Any	Mean	High	Any	Daily
Medicare	-0.132**	-0.111*	-0.177**	0.142**	0.451***	0.201**	0.363***	0.304***	0.445***	0.771***	0.867***
	[0.0640]	[0.0643]	[0.0810]	[0.0717]	[0.125]	[0.0848]	[0.0907]	[0.0480]	[0.0715]	[0.0731]	[0.0695]
Military insurance	-0.493***	-0.332***	-0.549***	0.359***	0.597***	0.405***	0.318***	0.229***	0.283***	0.404***	0.382***
	[0.0604]	[0.0687]	[0.115]	[0.0753]	[0.201]	[0.0986]	[0.0905]	[0.0454]	[0.0734]	[0.0734]	[0.0623]
Uninsured	-0.731***	-0.439***	-0.442***	-0.482***	-0.536***	-0.465***	-1.479***	-0.646***	-0.853***	-0.775***	-0.839***
	[0.0416]	[0.0474]	[0.0742]	[0.0634]	[0.113]	[0.0912]	[0.0465]	[0.0702]	[0.0797]	[0.0432]	[0.0425]
Married couple, no children	-0.0667*	0.0603*	0.0994*	0.110**	0.182	0.0571	0.134***	0.0226	0.0813	0.0248	0.119***
	[0.0361]	[0.0352]	[0.0519]	[0.0543]	[0.139]	[0.0644]	[0.0452]	[0.0430]	[0.0570]	[0.0388]	[0.0413]
Married couple with children	-0.243***	-0.0795**	-0.0805	0.148**	0.0770	0.0511	0.0115	-0.0618	-0.114**	-0.290***	-0.293***
	[0.0363]	[0.0329]	[0.0570]	[0.0568]	[0.146]	[0.0764]	[0.0383]	[0.0465]	[0.0534]	[0.0357]	[0.0369]
Single parent with children	-0.221***	-0.0752*	-0.0624	0.00839	-0.0214	0.0214	0.0234	-0.0725	-0.0802	-0.248***	-0.240***
	[0.0386]	[0.0440]	[0.0698]	[0.0564]	[0.133]	[0.0703]	[0.0477]	[0.0469]	[0.0584]	[0.0415]	[0.0423]
Other multiperson families	-0.221***	-0.0838	-0.204**	-0.0630	-0.250	-0.0956	-0.106	-0.125*	-0.124	-0.294***	-0.274***
	[0.0608]	[0.0687]	[0.0914]	[0.0924]	[0.178]	[0.109]	[0.0745]	[0.0632]	[0.0978]	[0.0636]	[0.0635]
100–200% of FPL	0.221***	0.239***	0.164*	-0.0853	-0.0524	-0.0396	0.0254	-0.00254	-0.100	0.168***	0.143***
	[0.0428]	[0.0596]	[0.0850]	[0.0663]	[0.133]	[0.0850]	[0.0509]	[0.0390]	[0.0668]	[0.0495]	[0.0466]
200–300% of FPL	0.393***	0.348***	0.387***	-0.143**	-0.156	-0.0226	0.117**	0.000181	-0.0900	0.201***	0.224***
	[0.0458]	[0.0526]	[0.0916]	[0.0677]	[0.134]	[0.0897]	[0.0503]	[0.0416]	[0.0727]	[0.0460]	[0.0488]
≥300% of FPL	0.562***	0.495***	0.643***	-0.0726	-0.186	0.0271	0.437***	0.193***	0.127*	0.448***	0.409***
	[0.0412]	[0.0531]	[0.0847]	[0.0656]	[0.140]	[0.0877]	[0.0501]	[0.0523]	[0.0668]	[0.0458]	[0.0462]
≥$1,000 total wealth	0.309***	0.254***	0.247***	0.0478	0.131	0.0541	0.264***	0.109***	0.111**	0.138***	0.135***
	[0.0379]	[0.0529]	[0.0768]	[0.0594]	[0.156]	[0.0742]	[0.0402]	[0.0323]	[0.0495]	[0.0380]	[0.0443]
Constant	-0.484***	4.826***	-3.989***	-3.419***	-2.176***	-4.348***	0.303***	0.609***	-3.374***	-1.732***	-2.381***
	[0.0632]	[0.0802]	[0.135]	[0.110]	[0.276]	[0.165]	[0.0805]	[0.0648]	[0.103]	[0.0668]	[0.0783]
ln(alpha) (negative binomial models only)					3.116***			0.181***			
					[0.0304]			[0.0213]			
N	56,174	56,174	56,174	56,174	56,174	56,174	56,174	56,174	56,174	56,174	56,174

Source: Authors' calculations using the 2008 SIPP panel wave 10 merged with the wave 9 adult well-being topical module.

Notes: Each column presents coefficient estimates from regression results corresponding to a given measure of medical out-of-pocket spending or utilization. Standard errors in brackets. "High" values are above the 90th percentile for medical out-of-pocket spending ($1,500) and medical professional visits (10 visits), and above the 95th percentile for overnight hospital stays (2 stays). "Any," "High," and "Daily" columns contain results from logistic models. Models 5 and 8 are results from negative binomial models, and results in column 2 are from a generalized linear model with a log link. See the text for more details on regression model specifications and definitions of material hardship.

*/**/*** Estimate differs significantly from the reference group at the 0.10/0.05/0.01 level, using two-tailed tests.

Notes

[1] "Sampling," US Census Bureau, last revised January 18, 2016, https://www.census.gov/programs-surveys/sipp/methodology/sampling.html.

[2] "Food Security in the US: Measurement," US Department of Agriculture, Economic Research Service, last updated October 4, 2017, https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/measurement.aspx.

[3] For an in-depth review of the information on material hardship collected in the SIPP, including the motivation behind the survey questions and summary statistics, see Ouellette and colleagues (2004).

[4] All comparisons of statistics in the text, explicit or implicit, are statistically significant at conventional levels (p-value < 0.10) unless indicated otherwise.

[5] Results reported in rows marked by "Any," "High," and "Daily" medical care utilization/spending represent the percentage-point difference with respect to a given hardship, compared with respondents who did not experience the given hardship. Similarly, results reported in rows marked by "Mean" represent the difference in the average corresponding to a given hardship with respect to those who did not report a given hardship.

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