



Unstable Housing and Diabetes-Related Emergency Department Visits and Hospitalization: A Nationally Representative Study of Safety-Net Clinic Patients

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Diabetes Care 2018;41:933–939 | <https://doi.org/10.2337/dc17-1812>

OBJECTIVE

Homelessness is associated with worse diabetes outcomes, but the relationship between other forms of unstable housing and diabetes is not well studied. We assessed whether unstable housing was associated with increased risk for diabetes-related emergency department use or hospitalization.

RESEARCH DESIGN AND METHODS

We used data from the 2014 Health Center Patient Survey (HCPS), a cross-sectional, nationally representative survey of patients who receive care at federally funded safety-net health centers. We included nonhomeless adults (aged ≥ 18 years) with self-reported diabetes. Unstable housing was defined as not having enough money to pay rent or mortgage, moving two or more times in the past 12 months, or staying at a place one does not own or rent. The primary outcome was self-report of diabetes-related emergency department visit or inpatient hospitalization in the last 12 months. We also examined use of housing assistance.

RESULTS

Of 1,087 participants, representing 3,277,165 adults with diabetes, 37% were unstably housed. Overall, 13.7% of participants reported a diabetes-related emergency department visit or hospitalization in the past year. In logistic regression analyses adjusted for multiple potential confounders, unstable housing was associated with greater odds of diabetes-related emergency department use or hospitalization (adjusted odds ratio 5.17 [95% CI 2.08–12.87]). Only 0.9% of unstably housed individuals reported receiving help with housing through their clinic.

CONCLUSIONS

Unstable housing is common and associated with increased risk of diabetes-related emergency department and inpatient use. Addressing unstable housing in clinical settings may help improve health care utilization for vulnerable individuals with diabetes.

Diabetes affected >30 million Americans (1) and was responsible for an estimated \$176 billion in direct medical expenditure in 2017 (2). A major reason for this is emergency department visits and hospitalizations: there are >21 million diabetes-related emergency department visits and hospitalizations annually (1). With proper

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Received 29 August 2017 and accepted 8 December 2017.

This article contains Supplementary Data online at <http://care.diabetesjournals.org/lookup/suppl/doi:10.2337/dc17-1812/-/DC1>.

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See accompanying articles, pp. 917, 929, 940, 949, 956, 963, 971, 979, 985, and e72.

care, most diabetes management can be conducted in the outpatient setting (3). As a result, reducing diabetes-associated emergency department and inpatient visits is a key goal of diabetes disease-management programs (4).

Because diabetes is heavily intertwined with social circumstances, diabetes guidelines recognize the role of helping patients meet basic needs as part of diabetes management (5). Prior work regarding unmet basic needs and diabetes has often focused on food insecurity (6–17), but housing is also an important issue. For example, homelessness has been associated with suboptimal diabetes control (18–20). However, less is known about the potential impact of other types of housing instability, such as frequent moves and evictions, not being able to afford rent, or doubling up (i.e., staying with friends or relatives in a house, apartment, or room they did not own or rent) because of not having one's own place to live. These types of housing instability may be less severe but are far more common than homelessness. Drawing from a conceptual model of health services use (21), stable housing can be viewed as an enabling resource that allows individuals to maintain health. When housing becomes unstable, this ability is impeded. Specifically, housing instability may make it difficult to adhere to the multiple components of care needed to manage both type 1 and type 2 diabetes, such as dietary modification, daily medications, clinic visit attendance, and, in some cases, self-monitoring of blood glucose. Housing instability may lower diabetes self-efficacy (22), exacerbate stress, and divert effort and resources toward competing priorities, all of which make diabetes management more difficult. These factors may contribute to an increased likelihood of emergency department use and hospitalization among people with diabetes and housing instability. Although single-site studies have suggested such an association (17,23), no nationally representative data have been available to investigate this relationship. This problem is exacerbated by the fact that standard methods of epidemiologic surveillance may miss socioeconomically vulnerable patients who receive care in safety-net clinics. Additionally, there is interest in linkage interventions that assess for unmet needs, such as housing instability, in clinical

care and navigate patients into community resources to meet these needs (24). However, whether this strategy is routinely used for individuals with diabetes is unclear.

For these reasons, we sought to determine whether housing instability was associated with greater diabetes-associated emergency department and inpatient health care use in a nationally representative survey of safety-net patients. We hypothesized that housing instability would be associated with greater likelihood of using the emergency department or being hospitalized for diabetes. Secondarily, we sought to characterize the use of social needs assistance in safety-net patients with diabetes.

RESEARCH DESIGN AND METHODS

Setting and Study Sample

Data for this study came from the 2014 Health Center Patient Survey (HCPS) (25). The HCPS is a nationally representative survey of patients who receive care at safety-net health centers funded by one of four types of federal Bureau of Primary Health Care grant programs: the Community Health Center Program, the Health Care for the Homeless Program, the Migrant Health Center Program, and the Public Housing Primary Care Program (26). The survey was fielded from September 2014 through April 2015, and participants were eligible if they had at least one visit at a health center that was a Bureau of Primary Health Care grantee in the previous 12 months. The HCPS was administered on behalf of the Health Resources and Services Administration, and the resulting de-identified data set is publicly available. The survey was conducted by trained interviewers in English, Spanish, Chinese (Mandarin and Cantonese), Korean, and Vietnamese. The survey had a participant response rate of 91%. The survey design and data collection methods are described in more detail in the data user's manual (26).

For this study, we included all adult respondents (aged ≥ 18 years at the time of interview) who reported being told by a doctor or health professional that they had diabetes or sugar diabetes (either type 1 or type 2 diabetes) (25).

The Human Research Committee of Partners Health Care exempted this secondary analysis of de-identified data.

Unstable Housing

As done in prior studies, we classified as unstably housed those who reported that they did not have enough money to pay rent or their mortgage, reported two or more moves in the past 12 months, or were doubled up (i.e., staying in a house, apartment, or room they did not own or rent) (17,27). Those who reported owning or renting a place without any of the above issues were classified as stably housed. Because issues of diabetes management for those who are homeless (living in a shelter, car, or outside) are quite different than for those who face other forms of unstable housing, we excluded those who reported homelessness from our analyses in order to focus on less well-studied areas of unstable housing.

Diabetes-Associated Emergency Department or Inpatient Utilization

Our primary outcome was self-report of a diabetes-associated emergency department visit or inpatient hospitalization in the preceding 12 months. To determine this, participants with diabetes were asked, "In the past 12 months, have you been in the hospital or visited an emergency room because of diabetes?" (25) This type of utilization represents clinical worsening, is expensive, and is generally considered to be avoidable, making it an ideal target for reduction in population health programs (3). Administrative confirmation of utilization was not available in the data set.

Use of Basic Needs Assistance

As recognition of the importance of unmet basic needs in health care has grown, there has been increasing interest in the role of social assistance programs such as section 8 housing or the Supplemental Nutrition Assistance Program (SNAP) to help patients with meeting these needs. Because health centers disproportionately serve those with unmet needs, they are an ideal place for linkage programs designed to connect patients with these services, but whether this assistance is actually occurring is unknown. To assess this, we examined whether participants reported receiving assistance from the clinic with 10 categories of unmet needs: help arranging medical appointments, applying for government benefits, transportation for medical appointments, housing, employment, childcare, food, clothing, affording medications, and receiving home health care.

For each of these, respondents could answer that they have not needed these services or that they had or had not received help. Because individuals living in poverty can face trade-offs between affording basic needs, resources made available through one program may offer other benefits. For example, food resources made available through SNAP may free up income to be used for housing. Therefore, we also assessed self-reported use of assistance programs (section 8 housing; SNAP; the Special Supplemental Nutrition Program for Women, Infants, and Children; Temporary Assistance for Needy Families; and any other government assistance).

Covariates

We considered several other factors that may confound the relationship between housing instability and diabetes-related emergency department or inpatient services use. These were: age (categories of 18–25, 26–34, 35–44, 45–54, 55–64, 65–74, or 75 years and older; continuous values were not available owing to privacy concerns), sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or non-Hispanic Asian/Pacific Islander/other), health insurance (nonexchange-based private, exchange-based private, Medicare, Medicaid or other public insurance, or uninsured), education (less than high school, high school/general equivalency diploma, or more than high school), income as a percentage of federal poverty level (which accounts for household size, divided into ordinal categories), primary language, nativity, and urban versus rural residence. We also considered the type of clinic program where participants received care. Insulin use can increase the likelihood of diabetes-associated emergency department visits or inpatient hospitalization (for example, by increasing the chance of severe hypoglycemia) and may be an indicator of more severe diabetes that could affect one's ability to work and lead to higher out-of-pocket health care expenses, thereby increasing the likelihood of housing instability. Therefore, we considered whether the participant used insulin or not. Mental health and substance use may confound the relationship between unstable housing and diabetes-associated emergency department visit or inpatient hospitalization by making unstable housing more likely by impairing one's ability to work

and making diabetes-associated emergency department visits or inpatient hospitalization more likely by affecting diabetes self-management. Therefore, we also examined history of serious mental illness (bipolar affective disorder or schizophrenia), alcohol use (based on the Alcohol, Smoking, and Substance Involvement Screening Test; score range 0–39, with lower scores indicating less alcohol use) (28), and drug use history.

Statistical Analysis

We first conducted descriptive analyses. We then made unadjusted comparisons using *t* tests and χ^2 tests for continuous and categorical variables, respectively. We used logistic regression to conduct adjusted analyses examining the association between unstable housing and the primary outcome while controlling for age, sex, clinic program type, rural residence, race/ethnicity, language, nativity, insurance, education, income, history of mental illness, history of drug use, alcohol use, and insulin use. An important consideration in studying unstable housing is whether other unmet needs also related to low income might confound any observed association. Because our analyses adjust for income, other unmet needs that are related to low income but that do not cause unstable housing (e.g., food insecurity) should be accounted for, but there may be residual confounding within levels of reported income owing to imprecision in income measurement. To account for the possibility that any observed association between unstable housing and diabetes-associated emergency department and inpatient use can be explained by residual confounding, we also conducted sensitivity analyses to determine the amount of unmeasured confounding that would be required to explain away the association (29). No missing data were imputed, as missingness was $\leq 2\%$ for all variables. All analyses included survey design information (weights, clustering, and strata) and were conducted in SAS, version 9.4 (SAS Institute, Cary, NC).

RESULTS

There were 1,199 adults with diabetes seen in safety-net clinics. Of these, 1.2% reported homelessness, 36.1% reported unstable housing, and 62.7% reported stable housing. After limiting our analysis to the subpopulation who did not report

homelessness, we included 1,087 participants, representing 3,277,165 housed adults with diabetes seen in safety-net clinics. Most participants (weighted percent: 94%) were seen in Community Health Centers. Demographic characteristics are presented in Table 1. Compared with those who were stably housed, those who reported unstable housing were more likely to be younger and uninsured.

Overall, 13.7% of participants reported having a diabetes-related emergency department visit or hospitalization in the past year. In unadjusted analyses, 26% of those who were unstably housed reported having a diabetes-related emergency department visit or hospitalization in the past year, compared with 7% of those who were stably housed ($P = 0.0005$) (results stratified by clinic program type in Supplementary Table 1). In logistic regression analyses adjusted for multiple potential confounders, unstable housing was associated with greater odds of diabetes-related emergency department visit or hospitalization (adjusted odds ratio: 5.17 [95% CI 2.08–12.87]) (Table 2 and full model in Supplementary Table 2). In sensitivity analyses designed to detect the amount of unmeasured confounding that would be needed to explain away this association (29), we found that an unmeasured confounder would need to have a minimum relative risk of 9.81 for both housing and diabetes-related emergency department or inpatient use in order to do so.

With regard to unmet needs, relatively high numbers (30–50%, depending on the category) of study participants reported receiving help with traditional medical needs such as appointment scheduling or affording medication (Table 3). However, fewer participants (<5%) reported receiving help with housing, food, or employment. Only 2.0% of participants overall reported receiving help with housing, and there were not clinically meaningful differences in participation for stably (2.6%) versus unstably (0.9%) housed participants ($P = 0.05$). We found variable rates of participation in government assistance programs, but in general, there was substantial underparticipation, and participation did not differ between those who were stably and unstably housed (Supplementary Table 3). For example, 6.4% of those who were stably housed reported participating in the section 8

Table 1—Demographic and clinical characteristics of nonhomeless adult participants with diabetes

	Overall (N = 1,087)	Stable housing (N = 702)	Unstable housing (N = 385)	P value
Age (years)				0.003
18–25	3.57	1.88	6.50	
26–34	5.21	2.08	10.64	
35–44	16.86	17.25	16.19	
45–54	22.39	19.90	26.71	
55–64	29.86	29.54	30.42	
65–74	13.87	19.58	3.97	
≥75	8.23	9.77	5.57	
Female	49.85	48.70	51.84	0.64
Clinic program type				0.52
Public Housing Primary Care	1.27	1.54	0.80	
Migrant Health Center	3.04	2.47	4.01	
Health Care for the Homeless	1.92	1.82	2.10	
Community Health Center	93.78	94.17	93.09	
Rural residence	62.3	61.72	63.38	0.83
Race/ethnicity				0.34
Non-Hispanic white	58.01	54.55	64.02	
Non-Hispanic black	17.18	18.99	14.05	
Hispanic	18.40	20.05	15.53	
Asian/Pacific Islander/other	6.40	6.41	6.39	
Non-English primary language	21.58	25.84	14.18	0.01
Born outside U.S.	15.62	17.99	11.51	0.09
Insurance				<0.0001
Uninsured	25.73	19.45	36.54	
Nonexchange-based private	15.41	21.75	4.52	
Medicare	10.83	11.03	10.49	
Medicaid and other public	43.82	43.55	44.28	
Exchange-based private	4.20	4.22	4.17	
Education				0.39
Less than high school	39.74	37.72	43.22	
High school diploma	24.72	27.74	19.52	
More than high school	35.54	34.54	37.26	
Income (as %FPL)				0.07
≤100	60.39	57.95	64.53	
101–138	16.00	14.99	17.71	
139–199	11.67	9.86	14.74	
200–299	4.30	6.60	0.40	
300–399	5.00	7.22	1.25	
≥400	2.64	3.39	1.38	
History of serious mental illness	15.29	11.97	21.04	0.15
History of drug use	45.44	40.16	54.58	0.02
Alcohol use score	2.0 (0.3)	2.1 (0.5)	1.9 (0.5)	0.75
Current insulin use	48.70	53.99	39.54	0.14

Data are weighted percentage or mean (SD) unless otherwise indicated. Unstably housed indicates those who reported that they did not have enough money to pay rent or their mortgage, reported two or more moves in the past 12 months, or were doubled up (i.e., staying in a house, apartment, or room they did not own or rent). Alcohol use score range 0–39, with lower scores indicating less alcohol use. FPL, federal poverty level.

housing program compared with 2.8% of those who were unstably housed ($P = 0.15$).

CONCLUSIONS

In this nationally representative study of adult patients with diabetes seen in safety-net clinics, we found that unstable housing was strongly associated with having a diabetes-related emergency department visit or inpatient hospitalization. Sensitivity analyses revealed that it

would take very strong unmeasured confounding to explain away this association. Further, we found generally low use of assistance for social needs: <1% of patients with unstable housing receiving clinic-based assistance with this. This represents an opportunity for improvement in the care of vulnerable patients with diabetes.

This study is consistent with and extends prior work. A prior study of patients with diabetes in a single urban center

suggested that unstable housing is associated with increased emergency department and inpatient use (17). A recent study of Massachusetts Medicaid programs showed that housing instability is an important predictor of health care spending (27). Our work demonstrates that in a large nationally representative sample of patients who use safety-net clinics, unstable housing is common among those with diabetes and strongly associated with reported hospital or

Table 2—Past year diabetes-related emergency department and hospital use by housing status

	Prevalence		Unadjusted model*		Adjusted model**	
	Weighted %	P value	OR (95% CI)	P value	OR (95% CI)	P value
Unstable housing	26.13	0.0005	5.05 (1.96–13.01)	0.0009	5.17 (2.08–12.87)	0.0005
Stable housing	6.55	n/a	Reference	n/a	Reference	n/a

n/a, not applicable; OR, odds ratio. *Results from unadjusted logistic regression model. **Results from logistic regression model adjusted for age, sex, clinic program type, rural residence, race/ethnicity, language, nativity, insurance, education, income, history of serious mental illness, history of drug use, alcohol use, and insulin use.

emergency department use. Perhaps more importantly, this study reveals that, although guidelines call for assessing social needs in the care of patients with diabetes,

most study participants do not report receiving help with these needs. It is important to note, however, that patients may be receiving assistance for these needs outside

Table 3—Report of help from clinic staff regarding unmet needs among individuals with diabetes

	Yes	No	Not applicable	P value*
Appointment help				0.84
Overall	53.16	44.17	2.67	
Stably housed	51.77	45.49	2.74	
Unstably housed	55.58	41.87	2.55	
Benefits help				0.54
Overall	21.32	76.08	2.61	
Stably housed	21.86	74.77	3.37	
Unstably housed	20.37	78.34	1.29	
Transportation help				0.56
Overall	11.12	84.40	4.48	
Stably housed	11.35	83.05	5.59	
Unstably housed	10.72	86.72	2.55	
Housing help				0.05
Overall	1.97	92.49	5.53	
Stably housed	2.60	90.50	6.90	
Unstably housed	0.89	95.95	3.15	
Job help				0.05
Overall	1.18	92.94	5.88	
Stably housed	1.24	91.20	7.56	
Unstably housed	1.07	95.95	2.98	
Childcare help				0.27
Overall	0.59	89.70	9.70	
Stably housed	0.85	87.86	11.29	
Unstably housed	0.14	92.91	6.96	
Food help				0.04
Overall	3.71	91.07	5.21	
Stably housed	4.50	88.73	6.77	
Unstably housed	2.35	95.14	2.52	
Clothes help				0.02
Overall	1.75	91.59	6.66	
Stably housed	1.97	89.16	8.87	
Unstably housed	1.37	95.82	2.82	
Medication help				<0.0001
Overall	36.64	59.24	4.12	
Stably housed	30.92	62.69	6.39	
Unstably housed	46.55	53.27	0.18	
Home visits				0.0008
Overall	3.42	93.06	3.51	
Stably housed	4.52	90.02	5.46	
Unstably housed	1.52	98.33	0.15	

Data are given as %. *P value represents comparison between stably and unstably housed groups using χ^2 tests.

of clinical settings. Further, without additional resources, safety-net clinics may have difficulty in putting these guidelines into practice.

This study has important implications. First, much of the current work on social risk in diabetes has focused on food insecurity. This study suggests that population-management programs might conduct a more comprehensive assessment of unmet social needs, including housing, rather than examining only a single issue, in order to better serve patients. Efforts to integrate action on social determinants of health into primary care have figured prominently into proposals for primary care redesign, including recommendations for systematic collection of social data (30). Indeed, such a goal may be seen as core to the mission of many care delivery settings, particularly health centers. It will be important, however, to not only collect this information but also make it useful for clinical care (31). The Homeless Patient Aligned Care Team initiative in the Veterans Health Administration is one example of how care can address both medical and social needs to improve health (32). Another example of the potential for linkage interventions is the ongoing Accountable Health Communities program from the Center for Medicare and Medicaid Innovation. This program seeks to screen patients for unmet needs in multiple contexts, particularly during the time of an emergency department or hospital visit (33). It is important to note that linkage interventions of all types often hinge on the quality of community resources available to meet patients' needs. Therefore, the results of this study should call attention to the need for sustainable and effective policy solutions to the problem of unstable housing. At the health policy level, these findings indicate that there may be an opportunity for strategic collaboration between the Department of Health and Human Services, which funds Medicaid and the programs studied in this work, and the Department of Housing and Urban Development, which oversees many American housing assistance programs. Aligning goals and incentives between these departments could be a powerful tool to address housing as a determinant of health.

This study has several implications for future research. Because this study was cross-sectional, the observed association

could be explained by reverse causation—in particular, worse health could lead to economic setbacks that increase the risk for housing insecurity. Moreover, a vicious cycle may be present in which housing instability leads to worse health, which in turn increases health care costs and reduces the ability to work, leading to worsening housing instability. To better assess this possibility and understand the potential mechanisms of the observed association between housing instability and diabetes-related health care use, an important next step would be a longitudinal study, ideally one with objective confirmation of health care use via electronic health records or health care claims. Because this study suggests that patients with diabetes who report unstable housing are at high risk for adverse health care utilization, investigating whether housing assistance translates into improved health care utilization in this population is warranted. Future studies should also better elucidate the mechanisms underlying the association between unstable housing and adverse health care use. Stress, lack of mental bandwidth to attend to disease self-management, and directing personal resources toward securing and maintaining housing rather than toward health management are all plausible mechanisms that could be tested in dedicated studies. Finally, a pressing research need is the development and implementation of a brief standardized housing instability assessment tool. Unlike food insecurity, in which a gold-standard assessment is in common use (34), such an instrument does not exist for housing instability. Having a standard tool would be valuable for future work investigating the health consequences of housing instability.

This study should be interpreted in light of several limitations. The study relied on self-reported data, and it is possible that respondents could not accurately identify the reason for their emergency department visit or hospitalization. Moreover, self-report of the data may have led to measurement error, which could bias the associations observed. However, many of the survey items used in this study have been previously validated and are widely used by government agencies to assess population-level health and service use (26). Further, there is no reason to suspect differential misreporting of health care use between those with and without stable

housing, though ultimately this is untestable. Next, the study is cross-sectional and thus susceptible to the possibility of reverse causation, particularly if worsening health leads to economic setbacks such as reduced working hours, job loss, or higher health care bills. Although we cannot conclude that housing instability causes adverse health care use, we believe it is still useful, from a diabetes disease-management perspective, to identify a high-risk group for whom interventions, such as linkages to housing services, should be made available. Next, because we studied individuals with diabetes, there may have been selection bias, which would tend to bias the association toward the null, if housing instability makes it more likely for an individual to develop diabetes. Finally, although we adjusted for a large set of potential confounders, unmeasured confounding remains a possibility. However, sensitivity analyses revealed that it would take very strong confounding to negate the associations observed in this study. These limitations are balanced by key strengths. The nationally representative data set captured a difficult-to-reach population with a high response rate, providing a comprehensive picture of the current state of diabetes care in a safety-net setting.

Housing instability is strongly associated with diabetes-related emergency department and inpatient health care use. Despite this, <1% of patients with housing instability report receiving assistance meeting their housing needs via their clinic. Assessing for and addressing housing instability, and other unmet needs more broadly, represent important opportunities to improve the care of vulnerable patients with diabetes.

Funding. S.A.B.'s role in the research reported in this study was supported by the National Institute of Diabetes and Digestive and Kidney Diseases of the National Institutes of Health under award K23-DK-109200. T.P.B.'s role in the research reported in this study was supported by the National Institute on Drug Abuse of the National Institutes of Health under award K23-DA-034008.

The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Duality of Interest. T.P.B. receives royalty payments from UpToDate for authorship of a topic review on providing health care to homeless people. No other potential conflicts of interest relevant to this article were reported.

Author Contributions. S.A.B. and T.P.B. conceived of the study and drafted the manuscript. S.K., S.T.E., and U.R.E. assisted with analysis and interpretation of the data and revised the manuscript critically for intellectual content. All authors gave approval of the manuscript version to be submitted. S.A.B. is the guarantor of this work and, as such, had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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