Impact of Rental Assistance on Modifiable Health Risk Factors and Behaviors in Adults

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Abstract

Objectives—Housing may influence health through various mechanisms and is recognized as a social determinant of health. This study investigated the influence of rental assistance on modifiable health risk factors and behaviors using data from the Panel Study of Income Dynamics (PSID). Participants receiving rental assistance were compared with participants not receiving rental assistance on body mass index (BMI), obesity, smoking, alcohol use and physical activity.

Methods—Participants (N=1374) were age 18 to 62, head of household, and had not received rental assistance for four years prior to baseline. Treatment group participants (N=116) received rental assistance between baseline and the two-year follow-up. Comparison group participants (N=1258) were eligible for rental assistance two years after baseline but did not receive assistance. Models estimated the average treatment effect on treated (ATET) for each health indicator in each follow-up year. Participants were matched on age, race-ethnicity, gender, education, disability status, employment, household income and number of children in the household.

Results—At the two-year follow-up, smoking was significantly higher among treatment group participants. A sensitivity analysis excluding permanently disabled participants showed significantly higher obesity in the treatment group two years after baseline. No significant differences were found four or six years after baseline on any outcome.

Conclusions—Rental assistance was associated with increased smoking and obesity two years after baseline, but did not influence BMI, alcohol consumption, or physical activity. Interventions to reduce smoking and obesity may improve the health of individuals who receive rental assistance.

INTRODUCTION

Rental assistance has been recognized as a mechanism for improving the lives of individuals through provision of better quality and more affordable housing (Shaw 2004). However, few studies have examined the influence of rental assistance on physical health risk factors and behaviors, and findings have shown both and positive and negative influences of various forms of rental assistance on health (Fauth, Leventhal and Brooks-Gunn, 2004; Fenelon et al., 2017; Fertig and Reingold, 2007).

Fauth, Leventhal and Brooks-Gunn (2004) studied Black and Latino adults in high poverty areas in Yonkers, New York, using data from the Yonkers Project. Adults randomly assigned by lottery to move to newly-built public housing facilities were compared with other adults who stayed in high-poverty areas on measures of well-being, including physical health and alcohol abuse symptoms. Adults who moved to new public housing facilities were found to have fewer reported health problems, such as diabetes and asthma, and were less likely to report alcohol abuse symptoms approximately two years after moving. Fenelon et al. (2017) linked National Health Interview Survey data and U. S. Department of Housing and Urban Development data to study the influence of rental assistance on adults' physical and mental health. Study participants living in public housing, and those in multi-family housing, had lower odds of fair or poor reported health status as compared to future public housing residents, controlling for demographic characteristics and neighborhood factors. On the contrary, Fertig and Reingold (2007) investigated the effect of self-reported data on living in a public housing project on health among mothers in the Fragile Families and Child Wellbeing Study, using a baseline measure from survey data obtained after the birth of a child and follow-up data one and three years later. Overall health status was found to be worse among mothers who reported moving into a public housing project between baseline and the one-year interview, and mothers in public housing projects were more likely to be overweight at the three-year interview.

These studies differed in design, definition of rental assistance, methods for assigning residents to treatment or control group, measured outcomes and analytic methods. Two of the studies used samples from nationally representative databases (Fenelon et al., 2017; Fertig and Reingold, 2007) while one studied residents in a local rental assistance program (Fauth, Leventhal and Brooks-Gunn, 2004). Although all of the studies were longitudinal, the study by Fauth, Leventhal and Brooks-Gunn (2004) lacked baseline data. However, all of the studies tested associations between rental assistance and one or more physical health indicators, and all compared residents who received rental assistance with similar residents who did not receive assistance.

This study focused on the effects of rental assistance on modifiable health risk factors and behaviors among adult participants in the Panel Study of Income Dynamics (PSID) which is a nationally representative panel study of individuals in the U. S. The aim of the study was to determine whether rental assistance influenced health as evidenced by changes in body mass index (BMI), obesity, alcohol consumption, smoking and physical activity from baseline to a subsequent wave, two, four or six years following baseline.

METHODS

Several data sources were used to construct a pooled analysis dataset. This dataset included three baseline years (1999, 2001 and 2003) and two-, four- and six-year follow-up waves for each baseline year. Data sources included PSID survey data, geospatial data, data on rental assistance, and HUD income limit data. The PSID survey data, geospatial data and data on rental assistance were merged with HUD income limit data to determine study eligibility. We used a pooled cross-sectional design with propensity score matching to estimate the influence of rental assistance on each health indicator two, four, and six years after baseline. The study was approved by our institutional review board.

Sample

PSID participants included in this study (N = 1374) were between 18 and 62 years of age at baseline and were identified as the same head of household from two years prior to baseline through the two-year follow-up time point. The baseline age limit of 62 years was used to exclude participants who might become eligible for senior housing at age 62. PSID participants included in the treatment group were receiving rental assistance two years after baseline but did not receive rental assistance from four years prior to baseline through the baseline year. The control group included PSID participants who were eligible for rental assistance two years after baseline but did not receive rental assistance from four years prior to baseline through six years after baseline.

The PSID Assisted Housing Database (AHD) data were used in part to determine whether a participant met criteria for inclusion in the treatment or control group (Panel Study of Income Dynamics, 2014). The PSID AHD was originally constructed by matching the addresses of PSID families with the street addresses of subsidized housing units including Section 8 and voucher programs. The AHD includes the PSID family identifier and study year as well as the type of rental assistance, using classifications from the U. S. Department of Housing and Urban Development. The AHD data for 1995 and later years classifies four categories of rental assistance: public housing; other project-based housing including low-income housing tax credit (LIHTC); tenant-based housing (primarily vouchers); and Farmers Home, State-assisted housing (U. S. Department of Housing and Urban Development, 2002, 2017). We combined all four of the assisted housing categories to create a rental assistance indicator, coded 1 if a participant was receiving any type of rental assistance in a given year and 0 if the participant was not receiving rental assistance. We used PSID family identifiers and study year in the AHD to link the rental assistance indicator to other PSID data on families and individuals (McGonagle & Sastry, 2016; Newman & Schnare, 1997). Each year of PSID data was linked to each year of AHD data from the first pre-baseline year through the last six-year follow-up. The match was restricted to participants identified as the same head of household from pre-baseline through two years after baseline for participants in the treatment group, and from pre-baseline through the six-year follow-up for participants in the control group. These constraints allowed us to match family data on receipt of rental assistance to the head of household across multiple years, as appropriate for each group. Data on rental assistance at four and six years after baseline were not used to define the treatment group, to maintain an adequate sample.

Control group participants were determined to be eligible for rental assistance at the two-year follow-up wave based on PSID total household income and number of people in the family unit, and U. S. Department of Housing and Urban Development (HUD) income limit data.[1] We used the 80 percent of area median income limit to determine eligibility for rental assistance. About half of the participants in the control group met criteria for inclusion in more than one of the samples (baseline years, 1999, 2001 and 2003). These participants were the same head of household over multiple years and were eligible for rental assistance in more than one baseline year but did not receive rental assistance during any pre-baseline or follow-up year. These participants were randomly assigned to one of the three sub-samples to balance the number of observations across time prior to merging (Table 1).

The resulting sample included 1405 adult PSID participants eligible for the treatment or control group. PSID participants included in the analysis sample (N = 1374) had complete data on all baseline covariates, with 116 participants in the treatment group and 1258 participants in the control group.

Measures

Data on participants' demographic characteristics and health status were obtained from PSID. Demographic variables measured at baseline included age, sex, race-ethnicity, education, permanent disability, employment status, hours worked in the previous year, total household income and number of children in the family (Table 2). Race-ethnicity was determined from two separate questionnaire items indicating race and ethnicity and was coded as non-Hispanic black, non-Hispanic white, Hispanic or non-Hispanic other. The questionnaire item on ethnicity was asked for the first time in 2005, thus it was extrapolated to earlier baseline years and combined with data on race to create the race-ethnicity variable.

Data on modifiable health risk factors and behaviors were obtained from PSID for baseline and the follow-up waves. These health-related variables, used as outcomes in separate models, included body mass index (BMI), obesity, smoking (any number of cigarettes), alcohol consumption (any alcohol, and number of drinks per day), light physical activity (frequency per week), and heavy physical activity (frequency per week). Body mass index (BMI) was calculated from self-reported height and weight measured in pounds and inches using the Centers for Disease Control formula for adults: weight (pounds) / [height (inches)]^2 x 703 (Centers for Disease Control, 2017). Obesity was defined as a BMI of 30 or higher (Centers for Disease Control, 2017). Smoking and alcohol consumption were determined from the PSID survey questions: "Do you smoke cigarettes?", "Do you ever drink any alcoholic beverages such as beer, wine, or liquor?" and "On average, do you have less than one drink a day, one or two drinks a day, three to four drinks a day, or five or more drinks a day?" The number of alcoholic drinks per day was coded as none (0), less than one (1), one to two (2), three to four (3) and five or more (4). Physical activity, coded as the number of times per week, was determined from survey items on light and heavy physical

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[1]PSID 2010 geospatial data and PSID public data obtained from the Panel Study of Income Dynamics (PSID) for this study were matched with Housing and Urban Development (HUD) income limit data for assisted housing programs for years 2001, 2003 and 2005 separately, using state, county and metropolitan statistical area (MSA) geocodes. Nearly all of the PSID locations were matched with HUD data (2001, 97.8%; 2003, 98.4%; 2005, 99.0%). These data were then merged with PSID Assisted Housing Database (AHD) data using a family identifier, for each year individually.

activity: "How often do you participate in light physical activity such as walking, dancing, gardening, golfing, bowling, etc.?" and "How often do you participate in vigorous physical activity or sports – such as heavy housework, aerobics, running, swimming, or bicycling?"

Analysis

Propensity score matching was used to estimate the effect of rental assistance on each health-related outcome in separate models predicting outcomes at two, four and six years following baseline. Participants included in each model had complete data across all waves for the health indicator being tested and complete data on baseline covariates. The propensity score for a given model included baseline covariates and the appropriate baseline health indicator (e.g., baseline BMI for the models predicting BMI following baseline). The propensity score is an estimate of the probability of treatment based on a set of observed covariates, obtained from a logit model, with scores ranging from 0 to 1. Matching is achieved by pairing similar subjects in the treatment and control groups based on their propensity scores. The average treatment effect on treated (ATET) is estimated by finding matches for participants in the treatment group from participants in the control group. For each matched case, and for each health indicator separately, the observed outcome for a matched participant in the control group was imputed for the treatment group participant. The ATET is estimated as the average of the differences between the observed and imputed outcomes of participants in the treatment group; it indicates the average effect of receiving rental assistance on the health of individuals in the treatment group at a given time point.[2] An assumption is made that matching on the propensity score, which is constructed from a set of covariates, is adequate to remove the influence of systematic differences between the non-randomized treatment and control groups (Rosenbaum & Rubin, 1983). We used one-to-one matching for all analyses.

The ATET coefficients for the two-, four- and six-year outcomes were estimated for each of the dependent variables using Stata's-teffects psmatch-command (StataCorp, 2015; Social Science Computing Cooperative, 2015; Garrido et al., 2014). Participants in the control group were matched with participants in the treatment group on a set of baseline covariates including baseline health measure, age, sex, race-ethnicity, education, employment status, number of hours worked in the previous year, permanent disability status, total household income and number of children in the family unit. Stata v. 15.0 was used for all analyses (StataCorp, 2017).

A sensitivity analysis was conducted using data for participants who were not permanently disabled (N = 1286; treatment group N = 102; control group N = 1184) as disabled

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[2]The average treatment effect on treated is estimated as

$$\tau = E[\bar{\mu}(1, p(X)) - \bar{\mu}(0, p(X))][W = 1]$$

Where τ is the treatment effect on treated, $p(X)$ is the propensity score, $\bar{\mu}(1, p(X))$ is the conditional mean under exposure to the treatment, $\bar{\mu}(0, p(X))$ is the conditional mean under no exposure to the treatment, and $W = 1$ indicates treatment group (Abadie & Imbens, 2016).

individuals may receive benefits not available to non-disabled individuals, and may have restrictions on physical mobility that can influence health.

RESULTS

The treatment and control groups differed significantly on all of the demographic characteristics at baseline (Table 2). Participants in the treatment group were younger, more likely to be female, Black, permanently disabled, less educated and unemployed; they had lower household incomes and more children on average as compared to participants in the control group.

Unadjusted descriptive statistics for the health indicators for participants included in propensity score matching are shown in Table 3. The ATET coefficients for each model are shown in Table 4. Smoking was significantly higher among participants in the treatment group at the two-year follow-up as compared to matched control group participants. At the two-year follow-up, BMI and obesity had moderate but not statistically significant increases relative to the matched control group participants. None of the differences for smoking, BMI or obesity were significant at the four- or six-year follow up time points. Alcohol consumption and physical activity did not differ between the treatment group and matched controls in any of the models estimated.

Results of the sensitivity analysis (not tabled) estimating the ATET for the sub-group of individuals who were not permanently disabled revealed significantly higher likelihood of obesity among treatment group participants at the two-year follow-up (*Coef.* = 0.14, *SE* = 0.07, *p* = .04). Differences in obesity between the groups were not statistically significant at the four-year or six-year follow-up time points. Results for smoking, alcohol consumption and physical activity showed no significant differences between the treatment group and matched controls in any of the models estimated.

DISCUSSION

Results of this study reveal significant treatment effects two years after baseline on smoking, and on obesity in a sensitivity analysis that excluded permanently disabled individuals. In contrast to the finding of no influence on smoking behavior in Fertig et al. (2007) at one year or three years after receiving rental assistance, our study did find a significant increase in smoking in the treatment group. In our study, the control group differed in many ways from the treatment group at baseline. Despite matching on propensity scores, the control group in our study may represent a different segment of the population than the control group in the study by Fertig et al. (2007) since all participants in that sample were drawn from the Fragile Families and Child Wellbeing Study. Also, in contrast to our finding of no differences in alcohol use, Fauth, Leventhal and Brooks-Gunn (2004) found a reduction in symptoms of alcohol abuse among participants who received rental assistance; the measures of alcohol use and alcohol abuse are dissimilar, which could explain this difference in part. However, the control sample in Fauth, Leventhal and Brooks-Gunn (2004) was drawn entirely from a population of adults living in a high poverty area, whereas our sample was not restricted in that way.

In the sensitivity analysis, we found that obesity increased in the treatment group. This finding is similar to the finding in Fertig et al. (2007) of an increase in overweight three years after receiving rental assistance. Measures of overall health status, such as the number of health symptoms in Fauth, Leventhal and Brooks-Gunn (2004) and general reported health status in Fenelon et al. (2017), are not directly comparable with the more specific health measures in our study. Both of those studies found improved health status among adults receiving rental assistance as compared to similar adults who did not receive rental assistance.

Limitations

The PSID AHD data were used to determine whether a participant received rental assistance at any time from two years prior to the baseline year through a six-year follow-up. We did not determine whether individuals received rental assistance more than four years prior to the baseline year, or whether treatment group participants received assistance after the two-year follow-up. A more restrictive sampling method would have resulted in excessive data loss in the treatment group. Thus results may include the influence of rental assistance beyond the two-year follow-up wave. Samples were combined across years in order to obtain a sufficient number of observations but combining data across years could bias the results of the study. However, combining data across years could provide a more robust sample, as time-dependent influences on outcomes that are omitted from the model may be attenuated by this method. The number of observations in the treatment group, even after combining the samples, ranged from 95 to 102 for the models estimated, limiting the power of the tests. In addition, PSID AHD data were available only through 2009, which limited the waves of data we included in the analysis. A set of baseline covariates controlled for in the analysis included a range of measures meant to capture potential confounding influences on outcomes, but unobserved covariates may also have influenced the findings. Multiple statistical tests were conducted, increasing the possibility of a false positive finding. The use of self-reported height and weight to determine BMI may have introduced error in the analysis to the extent that participants' self-reported height and weight data were inaccurate. The use of a variable indicating any smoking, rather than frequency or number of cigarettes per day, combines individuals who smoke less with those who smoke more. Yet this measure captures the increased likelihood of smoking and provides some indication of increased exposure of smokers and non-smokers in a housing unit to second-hand smoke, a known carcinogen.

The results of this study suggest that interventions to reduce smoking may be needed for the population of individuals receiving rental assistance as the proportion of people smoking increased within two years after rental assistance began. The findings support HUD's final rule on smoke-free housing which became effective in 2017 and will be fully implemented in 2018 (U. S. Department of Housing and Urban Development, 2016). Among individuals who receive rental assistance and who are not disabled, results of the sensitivity analysis suggest a need for targeted interventions to reduce obesity. Results of this study showed effects of rental assistance within a short time frame after assistance was received, but not in a longer time frame, at four to six years after baseline. Thus, interventions might be most effective if they occur soon after individuals receive rental assistance. Environmental factors

that may affect health were not examined in this study but might contribute to health risk factors and behaviors and should be investigated in further work.

CONCLUSION

In a sample of individuals from the Panel Study of Income Dynamics (PSID), a propensity score analysis showed increased likelihood of smoking among individuals who received rental assistance between baseline and a two-year follow-up. Body mass index, obesity, alcohol consumption, light and heavy physical activity were not significantly different in this matched case analysis. A sensitivity analysis showed increased obesity among non-disabled individuals. Results of the study suggest that interventions to reduce smoking and obesity may benefit individuals who receive rental assistance.

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Table 1

Longitudinal Samples

Sample	Pre-baseline	Baseline	2-year follow-up	4-year follow-up	6-year follow-up	Treatment N	Control N
1	1995–1997	1999	2001	2003	2005	22	431
2	1997–1999	2001	2003	2005	2007	34	413
3	1999–2001	2003	2005	2007	2009	60	414

Table 2

Demographic Characteristics at Baseline

	Treatment	Control	
	N = 116	N = 1258	t / χ^2
Age (years)	39.6 (10.7)	43.1 (10.7)	3.4***
Male gender	44.8	67.3	22.8***
Race-ethnicity			33.7***
Non-Hispanic black	61.2	39.3	
Non-Hispanic white	25.9	53.7	
Hispanic	7.8	4.5	
Non-Hispanic other	5.2	2.5	
Education			22.7***
Less than high school	37.9	21.4	
High school diploma	38.8	37.3	
Some college	19.0	37.1	
Missing	4.3	4.2	
Permanently disabled	12.1	5.9	6.8**
Employed	66.4	76.8	6.3*
Hours worked previous year	1474 (969)	1772 (943)	3.2**
Household income ($)	27360 (22785)	41553 (42986)	3.5***
Number of children in family	1.6 (1.6)	1.0 (1.2)	−4.8***

Tables display *M (SD)* with *t* from t-tests comparing the treatment and control groups, and percentages with χ^2.

*
$p < .05$,

**
$p < .01$,

***
$p < .001$.

Table 3

Average Health Measures by Treatment Group

Variable	Group	N	Baseline M (SD)	2-year follow-up M (SD)	4-year follow-up M (SD)	6-year follow-up M (SD)
BMI	Treatment	95	29.0 (6.3)	30.4 (7.0)	30.3 (6.3)	30.3 (6.9)
	Control	1162	28.0 (5.7)	28.2 (5.6)	28.6 (6.0)	29.0 (6.2)
Obesity (%)	Treatment	95	36.8 (4.8)	47.4 (5.0)	50.5 (5.0)	42.1 (5.0)
	Control	1162	29.1 (4.5)	31.9 (4.7)	33.0 (4.7)	34.9 (4.8)
Smoker (%)	Treatment	101	33.7 (4.7)	35.6 (4.8)	32.7 (4.7)	31.7 (4.7)
	Control	1212	31.9 (4.7)	30.3 (4.6)	28.5 (4.5)	27.8 (4.5)
Alcohol-any (%)	Treatment	102	58.8 (4.9)	54.9 (5.0)	50.0 (5.0)	55.9 (5.0)
	Control	1210	60.1 (4.9)	60.6 (4.9)	59.6 (4.9)	57.9 (4.9)
Alcohol-drinks/day	Treatment	100	0.8 (0.9)	1.1 (1.2)	1.1 (1.3)	1.4 (1.4)
	Control	1193	0.8 (0.9)	1.0 (1.1)	1.2 (1.2)	1.4 (1.3)
Light physical activity (times/week)	Treatment	99	3.7 (4.3)	4.3 (4.7)	3.5 (4.1)	3.1 (4.1)
	Control	1170	5.1 (6.7)	4.5 (6.0)	3.9 (4.9)	4.1 (5.9)
Heavy physical activity (times/week)	Treatment	102	2.0 (6.1)	1.5 (2.2)	2.0 (3.7)	2.2 (5.5)
	Control	1185	2.1 (4.2)	2.1 (5.2)	1.9 (3.2)	2.2 (3.2)

Note: Summary statistics are unadjusted for baseline covariates.

Table 4

Average Treatment Effect on Treated

	2-year follow-up		4-year follow-up		6-year follow-up	
	Coef. (SE)	p	Coef. (SE)	p	Coef. (SE)	p
BMI	1.03 (0.53)	.05	0.62 (0.66)	.35	0.27 (0.72)	.71
Obesity	0.11 (0.06)	.07	0.07 (0.06)	.23	0.02 (0.06)	.72
Smoking	0.11 (0.05)	.04	0.09 (0.05)	.06	0.04 (0.05)	.46
Alcohol-any	−0.05 (0.07)	.45	−0.02 (0.07)	.79	−0.01 (0.07)	.88
Alcohol-drinks/day	−0.08 (0.14)	.55	−0.07 (0.16)	.66	0.12 (0.18)	.51
Light physical activity	0.06 (1.16)	.96	−0.45 (0.58)	.43	−1.23 (0.95)	.20
Heavy physical activity	0.18 (0.33)	.59	0.45 (0.63)	.47	−0.02 (0.66)	.97

Note: 2-year follow-up p-value for BMI = .051.