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. 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 = 1,374) were ages 18 to 62, heads of household, and had not received rental assistance for 4 years prior to baseline. Treatment group participants (n = 116) received rental assistance between baseline and the 2-year followup. Control group participants (n = 1,258) were eligible for rental assistance 2 years after baseline but did not receive assistance. Models estimated the average treatment effect on the treated for each health indicator in each followup year. Participants were matched on age, race and ethnicity, gender, education, disability status, employment, household income, and number of children in the family unit.*
- *Results: At the 2-year followup, smoking was significantly higher among treatment-group participants. A sensitivity analysis excluding permanently disabled participants showed significantly higher obesity in the treatment group 2 years after baseline. No significant differences were found 4 or 6 years after baseline on any outcome.*
- *Conclusions: Rental assistance was associated with increased smoking and obesity 2 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 the 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 2 years after moving. Fenelon et al. (2017) linked National Health Interview Survey data and U.S. Department of Housing and Urban Development (HUD) data to study the influence of rental assistance on adults' physical and mental health. Study participants living in public housing, and those in multifamily housing, had lower odds of fair or poor reported health status as compared with future public housing residents, controlling for demographic characteristics and neighborhood factors. Fertig and Reingold (2007) investigated the effect of living in a public housing project (self-reported data) 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 followup data 1 and 3 years later. By contrast with Fenelon et al. (2017), the study found overall health status to be worse among mothers who reported moving into a public housing project between baseline and the 1-year interview, and mothers in public housing projects were more likely to be overweight at the 3-year interview.

These studies differ in design, definition of rental assistance, method 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) and one studied residents in a local rental assistance program (Fauth, Leventhal, and Brooks-Gunn, 2004). Although all the studies were longitudinal, the study by Fauth, Leventhal, and Brooks-Gunn (2004) lacked baseline data. However, all the studies tested associations between rental assistance and one or more physical health indicators, and they all compared residents who received rental assistance with similar residents who did not receive assistance.

This study focuses 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 United States. 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 2, 4, or 6 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 2-, 4- and 6-year followup 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 2, 4, and 6 years after baseline. The study was approved by our institutional review board.

Sample

PSID participants included in this study (N = 1,374) were between 18 and 62 years of age at baseline and were identified as the same head of household from 2 years prior to baseline through the 2-year followup point. The baseline age limit of 62 years was used to exclude participants who might become eligible for housing for seniors at age 62. PSID participants included in the treatment group were receiving rental assistance 2 years after baseline but did not receive rental assistance from 4 years prior to baseline through the baseline year. The control group included PSID participants who were eligible for rental assistance 2 years after baseline but did not receive rental assistance from 4 years prior to baseline through 6 years after baseline.

The PSID Assisted Housing Database (AHD) was used in part to determine whether a participant met criteria for inclusion in the treatment or control group (PSID, 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 HUD classifications. The AHD data for 1995 and later years classify four categories of rental assistance: public housing; other project-based housing, including low-income housing tax credits; tenant-based housing (primarily vouchers); and Farmers Home, state-assisted housing (HUD, 2017, 2002). 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 and Sastry, 2016; Newman and Schnare, 1997). Each year of PSID data was linked to each year of AHD data from the first prebaseline year through the final 6-year followup. The match was restricted to participants identified as the same head of household from prebaseline through 2 years after baseline for participants in the treatment group and from prebaseline through the 6-year followup for participants in the control group. These constraints enabled us to match family data on receipt of rental assistance to the head of household across multiple years, as appropriate for each group. To maintain an adequate sample, data on rental assistance at 4 and 6 years after baseline were not used to define the treatment group.

Control group participants were determined to be eligible for rental assistance at the 2-year followup wave based on PSID total household income, number of people in the family unit, and

HUD income limit data.[1] We used the 80 percent of Area Median Income limit to determine eligibility for rental assistance (HUD, 2001). About one-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 during multiple years and were eligible for rental assistance in more than one baseline year but did not receive rental assistance during any prebaseline or followup year. These participants were randomly assigned to one of the three subsamples to balance the number of observations across time prior to merging (exhibit 1).

The resulting sample included 1,405 adult PSID participants eligible for the treatment or control group. The 1,374 PSID participants included in the analysis sample had complete data on all baseline covariates, with 116 participants in the treatment group and 1,258 participants in the control group.

Exhibit 1

Longitudinal Samples

Sample	Prebaseline	Baseline	2-Year Followup	4-Year Followup	6-Year Followup	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

Measures

Data on participants' demographic characteristics and health status were obtained from PSID. Demographic variables measured at baseline included age, sex, race and ethnicity, education, permanent disability, employment status, hours worked in the previous year, total household income, and number of children in the family unit (exhibit 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 followup waves. These health-related variables, used as outcomes in separate models, included 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). BMI was calculated from self-reported height and weight measured in pounds and inches using the Centers for Disease Control and Prevention formula for adults: weight (pounds) / [height (inches)]^2 x 703 (CDC, 2017). Obesity was defined as a BMI of 30 or higher (CDC, 2017). Smoking and alcohol consumption were determined from the PSID survey questions—

[1] PSID 2010 geospatial data and PSID public data (PSID, 2017a, 2017b) obtained for this study were matched with HUD income limit data (HUD, 2005, 2003, 2001) for assisted housing programs for years 2001, 2003, and 2005 separately using state, county, and metropolitan statistical area geocodes. Nearly all the PSID locations were matched with HUD data (2001, 97.8 percent; 2003, 98.4 percent; 2005, 99.0 percent). These data were then merged with PSID AHD data using a family identifier for each year individually.

Exhibit 2

Demographic Characteristics at Baseline

	Treatment n = 116	Control n = 1,258	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	1,474 (969)	1,772 (943)	3.2**
Household income ($)	27,360 (22,785)	41,553 (42,986)	3.5***
Number of children in family unit	1.6 (1.6)	1.0 (1.2)	– 4.8***

* p < .05. **p < .01. *** p < .001.

Notes: Numbers in parentheses are standard deviations. Comparing the treatment and control groups, t *is for means and* χ^2 *is for percentages.*

- "Do you smoke cigarettes?"
- "Do you ever drink any alcoholic beverages such as beer, wine, or liquor?"
- "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 activity—

- "How often do you participate in light physical activity such as walking, dancing, gardening, golfing, bowling, etc.?"
- "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 2, 4, and 6 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 (for example, 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 the 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 nonrandomized treatment and control groups (Rosenbaum and Rubin, 1983). We used one-to-one matching for all analyses.

The ATET coefficients for the 2-, 4-, and 6-year outcomes were estimated for each of the dependent variables using Stata's -teffects psmatch- command (Garrido et al., 2014; Social Science Computing Cooperative, 2015; StataCorp, 2015). 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 = 1,286; treatment group n = 102 and control group n = 1,184), because disabled individuals may receive benefits not available to nondisabled individuals and may have restrictions on physical mobility that can influence health.

Results

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

Unadjusted descriptive statistics for the health indicators for participants included in propensity score matching are shown in exhibit 3. The ATET coefficients for each model are shown in exhibit 4. Smoking was significantly higher among participants in the treatment group at the 2-year followup as compared with matched control group participants. At the 2-year followup, BMI and obesity were moderately but not statistically significantly higher among the treatment group relative to the matched control group participants. None of the differences for smoking, BMI, or obesity were significant at the 4- or 6-year followup points. Alcohol consumption and physical activity did not differ between the treatment group and matched controls in any of the models estimated.

[2] ATET is estimated as $\tau=E[\bar{\mu}(1,p(X))-\bar{\mu}(0,p(X))[W=1]$, Where τ is the treatment effect on the 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 and Imbens, 2016).

Exhibit 3

Average Health Measures by Treatment Group

Variable	Group	n	Baseline M (SD)	2-Year Followup M (SD)	4-Year Followup M (SD)	6-Year Followup M (SD)
BMI	Treatment	95	29.0 (6.3)	30.4 (7.0)	30.3 (6.3)	30.3 (6.9)
	Control	1,162	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	1,162	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	1,212	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	1,210	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	1,193	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	1,170	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	1,185	2.1 (4.2)	2.1 (5.2)	1.9 (3.2)	2.2 (3.2)

BMI = body mass index. M = mean. SD = standard deviation.
Note: Summary statistics are unadjusted for baseline covariates.

Exhibit 4

Average Treatment Effect on the Treated

	2-Year Followup		4-Year Followup		6-Year Followup	
	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

BMI = body mass index. SE = standard error.
Note: 2-year followup p-value for BMI = .051.

Results of the sensitivity analysis (not shown) estimating the ATET for the subgroup of individuals who were not permanently disabled revealed significantly higher likelihood of obesity among treatment group participants at the 2-year followup (Coef. = 0.14, SE = 0.07, $p = .04$). Differences in obesity between the groups were not statistically significant at the 4- or 6-year followup 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 2 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 and Reingold (2007) at 1 or 3 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 and Reingold (2007) because 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 and Reingold (2007) of an increase in overweight participants 3 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 with similar adults who did not receive rental assistance.

The PSID AHD data were used to determine whether a participant received rental assistance at any time from 2 years prior to the baseline year through a 6-year followup. We did not determine whether individuals received rental assistance more than 4 years prior to the baseline year or whether treatment group participants received assistance after the 2-year followup. 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 2-year followup 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. This measure, however, captures the increased likelihood of smoking and provides some indication of increased exposure of smokers and nonsmokers 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, because the proportion of people smoking increased within 2 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.[3] 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 after assistance was received, but not in a longer timeframe, at 4 to 6 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 PSID, a propensity score analysis showed increased likelihood of smoking among individuals who received rental assistance between baseline and a 2-year followup. BMI, obesity, alcohol consumption, and 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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