

# The Long-Term Effects of Moving to Opportunity on Adult Health and Economic Self-Sufficiency

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*The contents of this article are the views of the authors and do not necessarily reflect the views or policies of the U.S. Department of Housing and Urban Development, the Congressional Budget Office, the U.S. government, or any state or local agency that provided data.*

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## Abstract

*Adults living in high-poverty neighborhoods often fare worse than adults in more advantaged neighborhoods on their physical health, mental health, and economic well-being. Although social scientists have observed this association for hundreds of years, they have found it difficult to determine the extent to which the neighborhoods themselves affect*

### **Abstract (continued)**

*well-being versus the extent to which people at greater risk for adverse outcomes live in impoverished neighborhoods. In this article, we examine neighborhood effects using data from the 10- to 15-year evaluation of the Moving to Opportunity (MTO) for Fair Housing demonstration, which offered randomly selected families a housing voucher. The experimental design of MTO allows us to isolate the effects of neighborhoods from selection bias. We find that, 10 to 15 years after enrolling participants, the program had very few detectable effects on economic well-being but had some substantial effects on the physical and mental health of adults. For adults whose families received the offer of a housing voucher that could be used to move only to a low-poverty neighborhood, we find health benefits in terms of lower prevalence of diabetes, extreme obesity, physical limitations, and psychological distress. For adults offered a Section 8 voucher, we find benefits in terms of less extreme obesity and lower prevalence of lifetime depression.*

## **Introduction**

Adults living in disadvantaged neighborhoods have worse health and economic outcomes than people living in less distressed areas. Previous research has shown that living in a high-poverty or high-crime neighborhood is associated with an increased risk of poor overall health status, premature mortality, heart disease, obesity, serious mental illness, suicide, unemployment, and dropping out of school (Bagley, Jacobson, and Palmer, 1973; Diez-Roux and Mair, 2010; Kawachi and Berkman, 2003; Macintyre and Ellaway, 2003; Pickett and Pearl, 2001; Rezaeian et al., 2005; Weinberg, Reagan, and Yankow, 2004; Whitley et al., 1999).

What remains less clear is the extent to which such variation in people's well-being across neighborhoods reflects the causal influence of the neighborhood environments themselves, beyond the variation explained by the nonrandom sorting of individuals among residential neighborhoods. People who are at elevated risk for adverse health or labor-market outcomes may face limited housing options and may be more likely to live in distressed neighborhoods. Observational (or nonexperimental) studies try to isolate the independent effects of neighborhoods on people's well-being by statistically controlling for observable risk and protective factors of individuals and their families. Studies that control for a larger number of individual factors tend to find smaller neighborhood effects than do other studies (Pickett and Pearl, 2001). In addition, substantial concerns remain that some of the key variables that directly affect both neighborhood selection and health or economic outcomes are missing from or are imperfectly measured in standard data sets. Observational studies may confound the influence of neighborhood environments with the effects of unmeasured individual or family attributes that directly affect outcomes and neighborhood selection, a problem that social scientists call selection bias.

The existence, magnitude, and nature of any causal neighborhood effects on economic and health outcomes are of great relevance to housing policies that affect the geographic concentration of poverty in America. An understanding of neighborhood effects can inform policy choices related to: (1) whether to help low-income families meet their housing needs through project-based housing or, instead, through housing vouchers; (2) the types of relocation assistance and support to provide voucher holders; (3) where to locate new public housing projects; and (4) the potential value of mixed-income housing projects that subsidize nonpoor families to live near poor families. The nature of neighborhood effects is also relevant to the design of other social policies, such as suburban zoning rules and education policies that sort children across different schools and influence how low-income families are distributed across social settings (Duncan and Murnane, 2011). These choices also have important implications for health policy decisions, such as the degree to which governments allocate public health investments for low-income areas to traditional safety-net health care instead of changing “the context to make individuals’ default decisions healthy” (Frieden, 2010: 590). For example, policymakers could allocate investments to creating safe green space for walking and sports, which might lead people to choose more physical activities over sedentary activities.

To more convincingly identify the effects of neighborhood environments on low-income families and to overcome selection bias concerns that may have compromised previous studies, the U.S. Department of Housing and Urban Development (HUD) launched the Moving to Opportunity (MTO) for Fair Housing demonstration, a residential mobility experiment, in the early 1990s. The MTO program targeted families living in public or project-based housing in highly impoverished neighborhoods. MTO was open to families living in Baltimore, Boston, Chicago, Los Angeles, and New York City. Between 1994 and 1998, more than 4,600 families enrolled in the MTO program (Goering, Feins, and Richardson, 2003; Goering et al., 1999). To be eligible, a family had to have at least one child younger than age 18 and live in public housing or project-based assisted housing in a high-poverty area, defined as a census tract in which the income of more than 40 percent of residents falls below the federal poverty threshold.

MTO randomly assigned eligible families to one of three groups:

- Families in the **experimental group** received Section 8 rental assistance certificates or vouchers that, initially, they could use only in low-poverty census tracts—those in which less than 10 percent of residents had incomes below the federal poverty threshold in 1990. Nonprofit organizations in each city provided mobility counseling to help families find and lease a unit in a low-poverty area. After 1 year in the low-poverty tract, families could use the voucher to live in any neighborhood. In addition to abiding by the geographic requirement, families had to abide by all of the regular rules of the Section 8 certificate and voucher programs.
- Families in the **Section 8 group** also received Section 8 certificates or vouchers to move into private-market housing but without any mobility counseling or additional locational constraints under the MTO program design.
- Families in the **control group** did not receive any housing vouchers or certificates through MTO but continued to be eligible for all programs and services to which they would be otherwise entitled.

Random assignment enables us to isolate the effects of different neighborhood and housing conditions on people's well-being by comparing the average outcomes of groups of families who are similar on average in every way at baseline except that some were subsequently offered the opportunity to use a housing voucher to move to a new neighborhood with different characteristics.

In this article, we compare adults in the two treatment groups with the adults in the control group on their health and economic self-sufficiency 10 to 15 years after they enrolled in the program. Before turning to the results of our analyses, we first discuss the hypothesized pathways through which moving to a lower poverty neighborhood might affect adult health and economic self-sufficiency. We then summarize the results of previous waves of MTO research and other studies. We describe our sample and analytic strategy and then present estimates of the long-term effects of MTO on selected mental health, physical health, and economic outcomes. (Ludwig et al., 2011, and Sanbonmatsu et al., 2011, present additional results for other health and economic outcomes.)

We find that, 10 to 15 years after random assignment, MTO moves had sizable effects on a number of important physical and mental health outcomes but no detectable effects on almost any measure of economic self-sufficiency. More specifically, in the area of mental health, we find that MTO moves led to lower levels of psychological distress and lower prevalence of depression. In the area of physical health, we find beneficial effects on severe obesity, diabetes, and physical limitations, although we do not detect effects on hypertension or overall self-rated health. Earnings and employment rates have risen for all random assignment groups since they initially joined the program, and very few statistically significant differences emerged across the randomized groups on economic outcomes. We conclude this article with a discussion of some of the limitations of our findings and their implications for future research and policy design.

## Hypothesized Pathways

The MTO program offered families in the two treatment groups a housing voucher that they could use to relocate from a public housing project to an apartment (or house) in another neighborhood. Families in both the experimental and Section 8 treatment groups could use the voucher to move to a low-poverty neighborhood, but for the experimental group, moving to a low-poverty area was an initial requirement of using the voucher at all. Exhibit 1 illustrates our hypothesis that moving to a lower poverty area might affect adults' outcomes by changing their social environment, the resources of their community, and their physical environment.

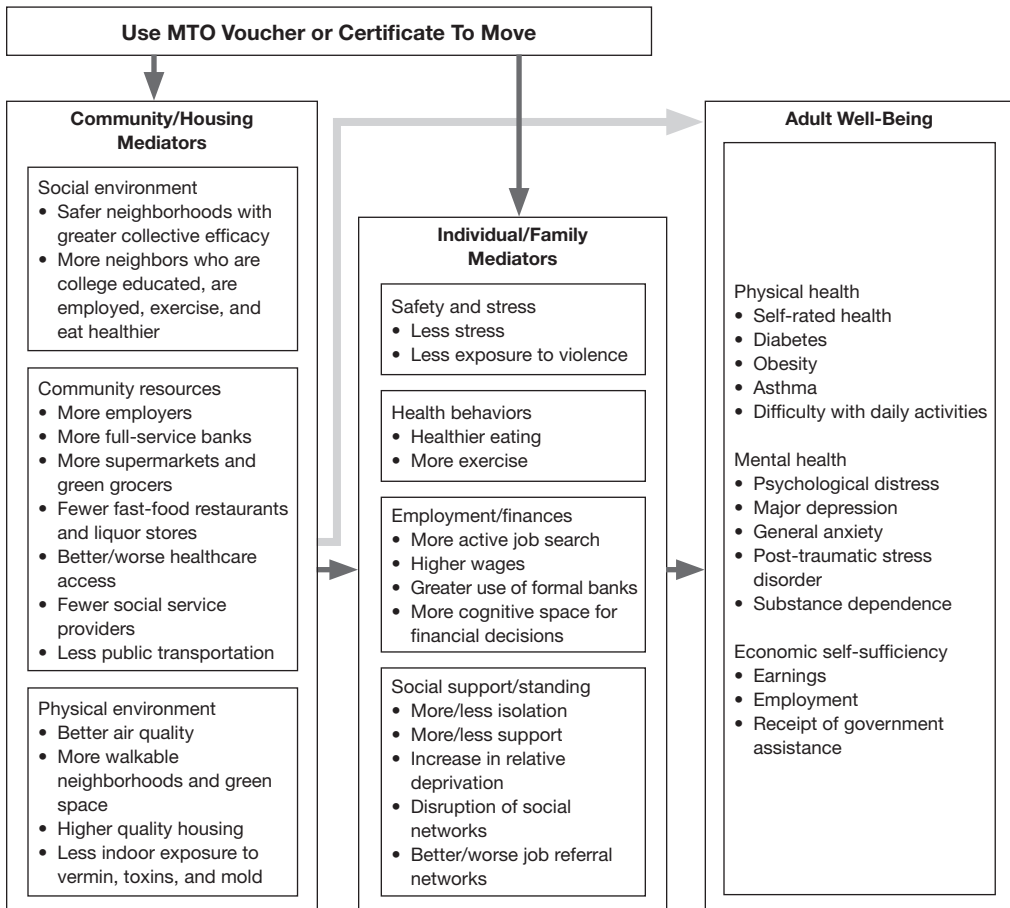
### Changes in the Social Environment

One set of potential pathways involves the *social environment*—the environment created by the people living in the neighborhood. Moving to a more affluent area may reduce exposure to violence because of a safer social environment, expose movers to higher socioeconomic status (SES) peers, and offer new social networks. At the same time, moving may disrupt social ties such as relationships with families, friends, service providers, and faith communities.

A safer environment could improve physical health directly by reducing the likelihood of injuries from assaults and indirectly by providing a safer environment for outdoor activity such as exercise.

**Exhibit 1**

**Hypothesized Pathways Through Which MTO May Affect Adult Well-Being**



MTO = Moving to Opportunity.

Note: This figure builds on the pathway diagrams shown in various chapters of the MTO interim impacts evaluation (see Orr et al., 2003).

Unsafe neighborhoods may discourage outdoor physical activity and exercise (Bennett et al., 2007; Harrison, Gemmell, and Heller, 2007). Lower likelihoods of being the victim of violence and of witnessing violence could also improve mental health, because these types of exposures are associated with higher levels of psychological distress, depression, generalized anxiety disorder (GAD), and post-traumatic stress disorder (PTSD) (Ross and Mirowsky, 2001; Silver, Mulvey, and Swanson, 2002; Zapata et al., 1992). Neighborhoods with lower crime may also generate higher levels of trust and greater *collective efficacy* (the willingness of neighbors to work together and support shared values), which may help serve as a buffer against other types of stressors (Berkman and Glass, 2000; Cohen, 2004; Sampson, Raudenbush, and Earls, 1997).

Any MTO effects on mental health may amplify effects on physical health, given the link between chronic stress and the regulation of physiological systems and behavior (McEwen and Stellar, 1993; Merkin et al., 2009). Previous research has associated higher stress levels with hypertension (Kornitzer, Dramaix, and De Backer, 1999; NIH, 1997) and asthma attacks (Bloomberg and Chen, 2005; Wright, Rodriguez, and Cohen, 1998). Stress may lead people to increase their intake of dense-calorie foods (Torres and Nowson, 2007) and to turn to alcohol, tobacco, or other substances in an effort to cope. The new social environment may also expose movers to neighbors with higher education levels who, at least on average, may have healthier lifestyles (Darmon and Drewnowski, 2008; Pampel, Krueger, and Denney, 2010).

Higher SES neighbors and less stress may improve economic prospects. Living in a neighborhood with a greater share of employed adults may provide more social support for work (for example, Maurin and Moschion, 2009) or more referrals for job openings (Bayer, Ross, and Topa, 2008). Moving out of a stressful environment may free up cognitive space for deliberative cognitive processes, such as financial planning (Porcelli and Delgado, 2009).

The degree to which having new neighbors translates into actual behavioral changes may depend on how much exposure adults have to their new neighbors and how well they connect with them (Christakis and Fowler, 2007). Similarly, new referral networks may not be helpful if new neighbors know mostly about jobs in occupations and industries that are not relevant for adults in the MTO program. Thus, moving to a more affluent area need not have any beneficial effects on behavior. Moving could even have negative effects if the move itself initially disrupted relationships and left adults feeling socially isolated, particularly if they do not have much in common with their new neighbors. MTO participants who move to lower poverty areas could also experience a decline in their socioeconomic standing relative to their new peers if their incomes do not rise with the move. Feelings of relative deprivation could negatively affect their physical and mental health (Staford, 2003). In addition, although higher income people tend to lead healthier lifestyles on some dimensions, other health-risk behaviors, such as drinking, may be more prevalent among more affluent people, at least over part of the SES distribution (Pollack et al., 2005; SAMHSA, 2010). For immigrant families in MTO, moving to a more affluent area could mean greater acculturation and a less healthy lifestyle (Lara et al., 2005).

## **Changes in Community Resources**

Part of the hope of mobility programs such as MTO is that higher SES communities can offer low-income families better access to community resources such as jobs, high-quality schools, high-speed broadband infrastructure, and supermarkets. Research studies generate mixed findings, however, as to whether more advantaged neighborhoods always offer low-income families greater access to resources.

Scholars hypothesize that geographic proximity to employers may be important for economic self-sufficiency. The spatial mismatch theory of John Kain (1968) suggests that a mismatch between the location of manufacturing and other jobs and the concentration of low-income families in urban areas might account for some of the lower employment levels observed. More recently, a series of studies in the late 1980s and early 1990s linked neighborhood poverty and job accessibility to labor force participation and wages for African-American and Hispanic workers (see Ihlanfeldt and

Sjoquist, 1998, for a review). If MTO moves enable access to a broader range of employment opportunities, they may also lead to increased wages and fringe benefits. Lower poverty areas, however, are not always closer than higher poverty areas to the sort of job opportunities that may be relevant for lower skilled MTO families (Anil, Sjoquist, and Wallace, 2010). Higher SES neighborhoods may offer increased access to formal banks as opposed to high-cost alternatives such as check cashers and payday lenders, who seem to target high-poverty areas (see Graves, 2003, for details), and thus neighborhoods may improve economic welfare through better personal finance management.

The types of retail stores, restaurants, and advertisements in a new neighborhood might affect the health of low-income people who move there. The presence of more grocery stores could improve diet by reducing the purchase price or transportation cost of healthy food (Morland et al., 2002). The presence of fewer liquor stores and fast-food restaurants could also affect diet and potentially reduce the consumption of high-caloric foods and alcohol (Dubowitz et al., 2008; Franco et al., 2008; Inagami et al., 2006; Zenk et al., 2005).

Living in a community with greater resources does not mean families will actually be able to take advantage of those resources or that those resources will be well suited to their needs. One reason low-income people may concentrate in urban cores is the availability of public transportation, which, in general, is more affordable than maintaining a private car (Glaeser, Kahn, and Rappaport, 2008). If new neighborhoods offer more limited public transportation options, MTO moves could reduce access to jobs, grocery stores, and other services. Furthermore, even if overall access to services remains the same or improves, access to certain types of social services could be worse if service providers for the poor are less common in higher income areas (Allard, 2004; Small and Stark, 2005).

For similar reasons, the effects of moves on healthcare access are hard to predict. The MTO demonstration took place in cities with some of the top-ranked hospitals in the country, many of them academic medical centers located, for historical reasons, near economically disadvantaged inner-city neighborhoods.<sup>1</sup> These academic medical centers may be more experienced in meeting the linguistic and cultural needs and daily realities of low-income patients than are the healthcare facilities located in more affluent areas. Moreover, free or very low-cost primary healthcare services may be concentrated in high-poverty areas, and so access to low-cost healthcare services could decrease with moves to better neighborhoods.

## **Changes in the Physical Environment**

Finally, moving to a less impoverished neighborhood may influence well-being through changes in the physical environment of the neighborhood and the housing unit. Higher SES neighborhoods may have lower pollution, trash, and vandalism levels; higher quality buildings and outdoor spaces; and built environments more conducive to exercise. The built environment of a neighborhood—its buildings, parks, and streets—may also affect health behaviors such as exercise. Studies have associated greater walkability of a neighborhood with greater physical activity and lower

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<sup>1</sup> Four of the five MTO cities are home to at least 1 of the top 14 honor-roll hospitals, as ranked by *U.S. News & World Report* on the basis of specialty rankings (Comarow, 2010).

rates of overweight and obesity (Lovasi et al., 2009; Mujahid et al., 2008; Sallis et al., 2009). Other studies have found green space buffers stress, especially in lower income socioeconomic groups (Maas et al., 2006), and have linked compromised outdoor air quality, which may be present in low-income neighborhoods, to coronary heart disease (Kan et al., 2008).

Poor housing quality can increase exposure to household dangers such as vermin, toxins, mold, and poor ventilation. These hazards may lead to a greater incidence of asthma (Bryant-Stephens, 2009). Poor-quality housing may also affect mental health: a study by Galea et al. (2005) links living in a neighborhood with dilapidated buildings to a greater incidence of depression after controlling for individual demographics and neighborhood median income. Poor-quality housing can also increase injuries from falls and fires and exposure to noise that can impair sleep. We expect to observe improvements in the health of participants who are able to move into better apartments using MTO vouchers.

### **Summary of Hypotheses**

We hypothesized that, compared with adults in the control group, adults offered the opportunity to move to lower poverty neighborhoods would have better mental health, physical health, and economic outcomes through improved neighborhood safety, less stressful environments, greater community resources, positive peer influences, and fewer environmental hazards. We expected to see lower incidences of mental illness such as depression, anxiety, and stress-related disorders as compared with the control group. We also expected to see physical health improvements in terms of lower rates of asthma, obesity, diabetes, and hypertension. We also hypothesized that families who moved to neighborhoods with improved conditions would have higher levels of employment and earnings and would receive less public assistance.

### **Previous Findings From MTO and Other Studies**

MTO was inspired by findings from the Gautreaux residential mobility program in Chicago, which was part of the legal settlement of a racial discrimination case. Gautreaux gave African-American families living in the inner city an opportunity to move to new neighborhoods. The initial Gautreaux findings suggested better employment outcomes for low-income African-American families living in public housing who moved to predominantly White suburbs compared with those of their counterparts who moved to predominantly African-American and urban neighborhoods (Rosenbaum, 1995). Gautreaux, however, was not a randomized study and the neighborhood preferences of Gautreaux families may, at least in part, have influenced where they ended up living (Votruba and Kling, 2009). Furthermore, over the long term, the program shows little in the way of gains in self-sufficiency for Gautreaux mothers, suggesting that one might not expect to see economic gains for MTO women (DeLuca et al., 2009).

HUD launched MTO to more systematically evaluate the types of neighborhood effects found in the Gautreaux study. An interim evaluation of MTO was conducted in 2002 by Abt Associates Inc. in partnership with researchers at the National Bureau of Economic Research (Orr et al., 2003). The evaluation examined effects an average of 4 to 7 years after the families joined MTO. These interim findings suggested that adults in the experimental group had lower levels of psychological



distress and felt calmer than adults in the control group. The results also hinted at lower levels of depression, although these results were sensitive to the construction of the depression measure. Based on self-reported height and weight, the treatment appeared to reduce obesity levels (Body Mass Index [BMI] of 30 or greater) for those in the experimental group (42.0 percent) in comparison with those in the control group (47.1 percent) and perhaps to increase rates of exercise and improve diet (Orr et al., 2003). The results, however, did not show significant effects on other health measures, such as self-rated health, hypertension, physical limitations, asthma, and a summary health index (Kling, Liebman, and Katz, 2007; Orr et al., 2003). Nor did the results show any statistically significant effects on economic outcomes, such as employment or earnings of the adults or youth.

Other studies of residential mobility programs have also yielded mixed findings on economic outcomes. Oreopoulos (2003) took advantage of the fact that public housing units in the city of Toronto were located in different types of neighborhoods to compare the outcomes of families living in different types of neighborhoods.<sup>2</sup> He found no evidence of improved economic outcomes for youth who grew up in higher SES neighborhoods. Studies of HUD's HOPE VI public housing demolition programs also yielded mixed results. Levy's (2010) study of families who relocated through HOPE VI suggested that families who relocated because of the demolition of their public housing projects experienced improved neighborhood conditions, but their economic self-sufficiency changed little. In contrast, Anil, Sjoquist, and Wallace (2010), studying the HOPE VI demolitions in the Atlanta area, found evidence of employment gains.

## **The 10- to 15-Year Evaluation**

Our 10- to 15-year followup with MTO families (Sanbonmatsu et al., 2011) extends beyond previous MTO research by studying the long-term effects of MTO; expanding the outcomes examined; and using objective measures of health in conjunction with self-reports on health. We expanded the MTO long-term data collection to include new outcomes, such as diabetes and PTSD. In addition, we replaced the brief questions on problems such as anxiety with more detailed and widely used structured diagnostic interview instruments, and we replaced self-reported height and weight measures with anthropometric measurements taken by the interviewers. For the first time, we gathered finger-stick dried blood spot samples from MTO respondents, enabling us to measure biological risk factors and undiagnosed disease.

The long-term survey for the final impacts evaluation enables us to examine how effects have changed over time. MTO's effects might have followed three very different trajectories. Program effects might have faded over time as the average neighborhood environments of the two treatment groups and the control group converged, which could occur if families in the two treatment groups moved back to their old neighborhoods, if families in the control group moved out of public housing on their own (and into similar low-poverty areas as the treatment groups), or if

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<sup>2</sup> The Toronto housing authority offered a housing unit with the necessary number of bedrooms to high-need families who reached the top of the waiting list on a first-available basis; families could not specify the housing project or type of housing project that they wanted to live in (Oreopoulos, 2003).

the neighborhoods themselves changed over time. Alternatively, MTO effects on families might have strengthened over time as the initial disruptions of moving diminished and families became increasingly connected to their new communities. Greater connections to neighbors in low-poverty areas might have produced continued changes in diet and exercise patterns or new job referrals. Over time, we might have seen even larger MTO effects on health and the emergence of MTO effects on economic self-sufficiency. Or, effects might have followed a more intermediate path, whereby families maintained the initial benefits from moving that reached a plateau in the early years of the program. This latter scenario might have occurred if the moves led to some initial change that persisted over time, even as families made additional moves, but that was a one-time change that did not continue to increase. For example, moving from public housing to private-market rentals might reduce the noise level in the home. This improvement might persist with subsequent moves and lead to greater mental calm or improved sleep, but it may be a one-time shift with no additional gains over time.

## Sample and Analytic Approach

Our sample draws on the adults from the original MTO households. To measure MTO's impacts over the long term, we selected up to one adult for interview in each MTO household.<sup>3</sup> The Institute for Social Research (ISR) at the University of Michigan interviewed adults using a computer-assisted survey between June 2008 and April 2010 (10 to 15 years after families were randomized in the program). Interviewers asked questions about the adult's health and economic circumstances, took physical measurements, and collected blood samples with a simple finger stick (McDade, Williams, and Snodgrass, 2007). ISR used a two-stage field design. In the first stage, ISR tried to interview as many adults in the survey sample as possible. After the response rate reached 75 percent for a site and sample release, ISR randomly selected 35 percent of the remaining, hard-to-reach respondents for the second stage of more intensive survey recruitment efforts. In all, ISR interviewed 3,273 adults and achieved an overall effective response rate of 90 percent (excluding deceased adults). In addition to collecting data from the survey, we gathered data from administrative records.

Exhibit 2 shows the baseline characteristics of the adults interviewed for the final impacts evaluation. At baseline, the vast majority (92 percent) of households were female headed and three-fourths of household heads were on welfare. The median household income of interviewed participants was \$10,614 (in 2009 dollars) in the year preceding entry into MTO. Only about one-fourth of adults were working. Slightly more than one-third of adults in MTO families had graduated from high school. Nearly two-thirds were African American and most of the rest were Hispanic. The average age of our interviewed sample adults at the time they joined the program was 32.9, and the average family size was about 3.7 members.

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<sup>3</sup> In selecting the adult survey sample, we prioritized female adults and household heads from the core family, adopting the same approach used for the interim impacts evaluation (Orr et al., 2003). We selected for interview one adult from each family in the experimental group and the control group. Because of funding constraints, we were unable to interview adults from all families in the Section 8 group and instead randomly selected a 68-percent subsample of these families for adult interviews.

**Exhibit 2**

**Baseline Characteristics of the Adult Analytic Sample, by Random Assignment Group**

	<b>Control Group</b>	<b>Experimental Group</b>	<b>Section 8 Group</b>	<b>All Groups</b>
<b>Household characteristics</b>				
Number of family members	3.7	3.7	3.7	3.7
Female head of household	92.1%	91.9%	93.6%	92.4%
<b>Employment status</b>				
Full-time	14.2%	14.1%	15.2%	14.5%
Part-time	9.4%	12.1%	11.0%	10.9%
<b>Received welfare benefits</b>				
Social Security or disability benefits	8.4%	9.0%	7.3%	8.4%
AFDC or TANF	76.3%	76.3%	73.6%	75.6%
<b>Takes more than 30 minutes to get to...</b>				
Grocery store	21.4%	21.5%	22.2%	21.7%
Doctor	45.0%	42.7%	43.6%	43.7%
<b>Household income (2009 dollars)</b>				
Average income	\$12,439	\$12,866	\$12,788	\$12,709
Median income	\$10,353	\$10,629	\$10,892	\$10,614
<b>Adults interviewed at 10 to 15 years</b>				
Age at baseline	32.8	32.9	33.1	32.9
Number interviewed	1,139	1,456	678	3,273

AFDC = Aid to Families with Dependent Children. TANF = Temporary Assistance for Needy Families.

Notes: Percentages are percent distributions and may not sum to 100 because of rounding and missing information. Data are weighted using the survey weights.

Source: Baseline surveys for adult respondents to the long-term surveys

HUD asked families applying to the program about their primary and secondary reasons for wanting to move. By far, the most common reason for signing up for MTO was to get away from drugs and gangs (77 percent of adults listed this reason first or second), followed by finding better schools (49 percent) and finding a better apartment (44 percent; Sanbonmatsu et al., 2011, Exhibit 1.2). The importance of safety in motivating families to participate in MTO is perhaps not surprising, given that more than two of every five baseline respondents said that someone in their household had been the victim of a crime during the 6 months preceding the baseline survey.

We present two types of estimates for how MTO affected the life outcomes of participating adults. The first estimate, the intention-to-treat (ITT) effect, represents the effect of being *offered* a housing voucher or certificate, which we generate by comparing the outcomes of all adults randomly assigned to the experimental or Section 8 group (regardless of whether those adults moved with a program voucher) with the outcomes of all adults assigned to the control group. We calculate the ITT estimate using an ordinary least squares regression in which the outcome of interest is the dependent variable being predicted on treatment group assignment and a series of baseline covariates. The basic regression equation is

$$Y_i = \alpha_0 + \alpha_1 \text{Exp}_i + \alpha_2 \text{S8}_i + \alpha_3 X_i + e_i, \tag{1}$$

where  $Y_i$  is an outcome for MTO program participant  $i$ ;  $\text{Exp}_i$  and  $\text{S8}_i$  are binary indicator variables equal to 1 if participant  $i$  was randomly assigned to the experimental or Section 8 group (the control

group is the omitted reference group); and  $X_i$  represents a series of baseline covariates that Sanbonmatsu et al. (2011) described and that is similar to the covariates Orr et al. (2003) used. The coefficients on  $Exp_i$  and  $S8_i$  capture the ITT estimates for the experimental and Section 8 groups, respectively. The equation weights the data to account for adjustments to the randomization ratios during the study enrollment period and the probability sampling.

If we are willing to assume that assignment to one of the treatment groups does not have much effect on those families who were offered a voucher but did not use it, we can also estimate the effect of actually moving using an MTO program voucher, known as the effect of treatment on the treated (TOT).<sup>4</sup> We can calculate the TOT effect by dividing the ITT effect by the share of the experimental or Section 8 group that relocated with an MTO voucher (Angrist, Imbens, and Rubin, 1996; Bloom, 1984). Because approximately one-half of the families in the experimental group used the MTO program voucher, the estimated TOT effect will be about twice as large as the ITT effect (that is,  $TOT \approx ITT/0.5 \approx ITT \times 2$ ). The statistical significance of both the ITT and TOT estimates are identical under this calculation, because we scale up the standard error and the impact estimate by the same factor (1/voucher use rate).

## Measures of Health and Economic Self-Sufficiency

### Mental Health Measures

To assess adult mental health outcomes, we used responses on the survey and the structured diagnostic interview within the survey. We measured psychological distress with the Kessler 6 scale (K6), which consists of questions about sadness, nervousness, restlessness, hopelessness, feeling that everything is an effort, and feelings of worthlessness (Kessler et al., 2003). The raw scores from the K6 can range from 0 (no distress) to 24 (highest level of distress). We assessed major depressive disorder, GAD, and PTSD using the World Health Organization's Composite International Diagnostic Interview (CIDI; Kessler and Üstün, 2004), which is designed to be consistent with the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition Task Force on DSM-IV (2000). To meet the criteria for major depression, a respondent's depressed mood or loss of interest had to last for a period of at least 2 weeks and be accompanied by at least five of the following symptoms: depressed mood, diminished interest or pleasure, unintentional weight loss or gain, insomnia, restlessness or slowing down, fatigue, feelings of worthlessness or excessive guilt, diminished ability to concentrate, and recurrent thoughts of death. Furthermore, these symptoms had to cause significant distress or impair the respondent's functioning at work or in social situations.

GAD required that the adult experience a period of at least 6 months in which they had excessive anxiety about multiple things and at least three of the following symptoms: restlessness, easy fatigue, difficulty concentrating, irritability, muscle tension, and sleep disturbance. In addition, the anxiety

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<sup>4</sup> Our TOT estimates assume that families who are offered a voucher but do not take up the offer (that is, do not use a program voucher to move) are not affected by the offer itself. This assumption may not be strictly true, because families may have changed some of their thinking or behaviors (such as looking at apartments) as a result of the offer. We think, however, that the effects of actually using the voucher are likely to be much larger than any effects of being offered the voucher and not using it, and that it is reasonable to assume that the ITT effects are driven strictly by effects on compliers.

had to cause significant distress or impair respondents' functioning. Our measure of PTSD used a subset of the CIDI questions and then imputed the probability of PTSD from those responses using data from a national study.<sup>5</sup> To be categorized as having PTSD, the respondent had to have experienced, witnessed, or been confronted by a traumatic event that involved actual or threatened death or serious injury to themselves or others,<sup>6</sup> and the trauma had to invoke at least three of the following symptoms: avoiding activities, places, or people that arouse recollections of the trauma; reduced interest in activities; feelings of detachment; restricted range of feelings; and a foreshortened sense of the future. PTSD also involves difficulty falling or staying asleep, an exaggerated startle response, and impairment of functioning.

We measured alcohol or drug dependence using the Severity of Dependence Scale (SDS). The SDS consists of five questions about out-of-control use, anxiety or worry about missing a fix or a drink, worry about use, frequency of desire to end use, and difficulty of going without use (Gossop et al., 1995). The SDS ranges from 0 to 15, and we consider a score of 3 or greater to indicate substance dependence.

## **Physical Health Measures**

We studied physical health outcomes using a combination of survey questions, physical measurements, and assays from dried blood spot samples. The survey asked adults if their health was excellent, very good, good, fair, or poor; if they had suffered an asthma or a wheezing attack in the past year; and if their health limited them in climbing several flights of stairs or lifting or carrying groceries (Wiener et al., 1990). To assess obesity, interviewers measured each respondent's height and weight.<sup>7</sup> We calculated BMI by dividing respondents' weight in kilograms by the square of their height in meters. We looked at effects stratified by three levels of obesity (BMI of 30 or greater, 35 or greater, and 40 or greater)<sup>8</sup> because of evidence that very high BMI values may be strongly associated with subsequent adverse health outcomes (NHLBI Obesity Education Initiative, 1998). A woman who is of average height in the United States (5 feet, 4 inches) would need to weigh 204 pounds to have a BMI of 35 and would need to weigh 233 pounds to have a BMI of 40. In addition to height and weight, interviewers took respondents' seated blood pressure using an automated cuff.<sup>9</sup> We used the average of two readings to assess hypertension<sup>10</sup> and considered individuals to be hypertensive if their average systolic pressure was 140 millimeters of mercury or higher or their average diastolic pressure was 90 millimeters of mercury or higher (Chobanian et al., 2003).

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<sup>5</sup> We used data from the National Comorbidity Survey Replication (Kessler and Merikangas, 2004) to calculate the likelihood of PTSD based on the questions asked in the MTO survey and taking into account age, gender, race, and ethnicity.

<sup>6</sup> The MTO survey asked about the following events: beaten up as a child by a primary caregiver, a spouse or romantic partner, or someone else; raped or sexually assaulted; mugged or threatened with a weapon; unexpected death of a loved one; traumatic event experienced by a loved one; witnessed physical fights at home; witnessed death or saw a dead body or someone seriously hurt; or some other traumatic event.

<sup>7</sup> We measured height and weight in accordance with the protocols developed for the Health and Retirement Survey (ISR, 2008).

<sup>8</sup> Ludwig et al. (2011) reported findings on MTO's effects on obesity and diabetes.

<sup>9</sup> The automated sphygmomanometer used was Omron model HEM-711DLX.

<sup>10</sup> We considered a reading valid if diastolic blood pressure (pressure when the heart is at rest between contractions) was more than 40 millimeters of mercury, the systolic blood pressure (pressure when the heart is contracting) was more than 60 millimeters of mercury, and the systolic was at least 10 points higher than the diastolic.

We measured diabetes using both survey questions and blood samples. Interviewers asked respondents whether they had diabetes (or high blood sugar) or had received treatment for it during the past year. Because many people with diabetes are unaware of their condition, we collected blood spot samples from respondents and measured glycosylated hemoglobin level as an indicator of diabetes.<sup>11</sup>

## Economic Measures

Our last set of measures focused on the economic self-sufficiency of adults. We measured employment, earnings, household income, and use of government assistance programs through both survey questions and administrative records. We drew on employment questions from the Current Population Survey and considered MTO respondents to be employed currently if they reported working for pay during the week prior to the interview (or reported being temporarily absent from their job because of illness or vacation). Interviewers asked respondents how much money they earned in the previous year, whether they were currently receiving food stamps or Temporary Assistance for Needy Families (TANF), and how much income their household (all members combined) received in the previous year. Information on household income enabled us to determine whether their household was above or below the U.S. Census Bureau's poverty threshold. For example, a family consisting of one mother and two children would be below the poverty threshold if they had an income of less than \$17,285 in 2009. We also matched the MTO sample to administrative data on quarterly earnings from state unemployment insurance (UI) agencies and to TANF and food stamps records from state (or county) agencies. We used the matched data to look at employment and earnings in 2007 and at receipt of TANF or food-stamp benefits over the 2-year period from July 2007 through June 2009.<sup>12</sup>

## MTO Effects on Adult Outcomes

In this section we present our estimates of MTO's effects on the mental health, physical health, and economic self-sufficiency of adults in the program. Our impact estimates are based on the regression model from equation 1.

### Mental Health Effects

Exhibit 3 shows evidence of beneficial MTO effects on the mental health of adults in terms of lower depression and levels of psychological distress, but the experimental group also shows an increase in substance dependence. All remaining exhibits are structured the same way as Exhibit 3. Each row presents the findings for the outcome listed in the left-hand column; the first outcome is depression. The second column, Control Mean, shows that approximately 20.3 percent of adults in the control group suffered from major depression during their lifetime. The third column displays the ITT effect of being offered an experimental voucher, estimated by comparing the entire experimental group with the entire control group. Adults in the experimental group met the criteria for major depression at a rate that was 3.2 percentage points less than the rate for adults in the

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<sup>11</sup> Glycosylated hemoglobin (HbA1c) captures the average glucose level in the blood during the past several months. The American Diabetes Association (2010) recommends using HbA1c levels of 6.5 percent or higher to diagnose diabetes.

<sup>12</sup> Data availability limits our analyses of TANF and food stamps to participants from Boston, Chicago, and Los Angeles.

**Exhibit 3**

**MTO Effects on Adult Mental Health, 10 to 15 Years After Random Assignment**

Outcome	Control Mean	Experimental vs. Control		Section 8 vs. Control		Respondents (N)
		ITT	TOT	ITT	TOT	
<b>Major depression with hierarchy, lifetime</b>	0.203	- 0.032~ (0.017)	- 0.066~ (0.035)	- 0.048* (0.021)	- 0.077* (0.034)	3,269
<b>GAD with hierarchy, lifetime</b>	0.065	- 0.003 (0.010)	- 0.005 (0.021)	- 0.020~ (0.011)	- 0.033~ (0.017)	3,273
<b>PTSD, lifetime</b>	0.219	- 0.012 (0.018)	- 0.024 (0.037)	0.004 (0.024)	0.006 (0.038)	3,269
<b>Psychological distress index (K6) z-score, past month (higher score indicates greater distress)</b>	0.000	- 0.107* (0.042)	- 0.221* (0.087)	- 0.097~ (0.056)	- 0.156~ (0.091)	3,273
<b>Dependence on drugs or alcohol, past month</b>	0.055	0.029* (0.011)	0.060* (0.022)	0.015 (0.015)	0.024 (0.023)	3,269

GAD = generalized anxiety disorder. ITT = intention to treat. MTO = Moving to Opportunity. PTSD = post-traumatic stress disorder. TOT = treatment on the treated.

\* =  $p < .05$ . ~ =  $p < .10$ .

Notes: Robust standard errors shown in parentheses. The control mean is unadjusted. Unless otherwise indicated, the control mean and effects are expressed as shares of the sample in the category (for example, a control mean of 0.250 for working would indicate that 25 percent of the control group was working). Experimental and Section 8 effects were estimated jointly using an ordinary least squares regression model controlling for baseline covariates (and field release) and applying weights. Psychological distress consists of six items (sadness, nervousness, restlessness, hopelessness, feeling that everything is an effort, worthlessness) scaled on a score from 0 (no distress) to 24 (highest distress) and then converted to z-scores using the mean and standard deviation of control group adults. Disorders with hierarchy take into account the comorbidity of other disorders: Major depression with hierarchy takes into account mania and hypomania; GAD with hierarchy takes into account depression and mania. Depression, GAD, and PTSD are measured using the World Health Organization's Composite International Diagnostic Interview (Kessler and Üstün, 2004), modified to include those sections used to diagnose. Substance dependence is developed from the Substance Abuse and Mental Health Services Administration's National Household Survey on Drug Use and Health and consists of five items about drug or alcohol use (use out of control, anxiety or worry about missing fix or drink, worry about use, frequency of desire to end use, difficulty of going without use) scaled on a score from 0 (no dependence) to 15 (highest level of dependence). A score of 3 or higher indicates dependence.

Source: Adult long-term survey

control group ( $p < .10$ , as indicated by the tilde). The standard error (shown in parentheses) is 1.7 percentage points.<sup>13</sup> In the fourth column, our estimates suggest that moving using an experimental voucher, or the TOT effect, reduces the prevalence of lifetime depression by 6.6 percentage points (about twice the size of the ITT effect). In the fifth and sixth columns, we turn to the effects (ITT and TOT) for the Section 8 group. Being offered a traditional Section 8 voucher reduces the prevalence of lifetime depression by 4.8 percentage points, and actually using the voucher reduces depression by an estimated 7.7 percentage points ( $p < .05$ ). The final column of the table shows the number of observations used in the analysis.

<sup>13</sup> The standard error indicates the estimate's precision. The effect plus or minus the standard error, multiplied by 1.96, captures the 95-percent confidence interval around the effect, in this case implying a confidence interval ranging from an increase of 0.1 percentage points to a decrease of 6.5 percentage points in depression.

Similar percentages (about 6.5 percent in each group) of adults in both the control group and the experimental group met the criteria for generalized anxiety disorder (lifetime). Adults in the Section 8 group were marginally less likely than adults in the control group to have had GAD ( $p = .057$ ). Of adults in the control group, 22 percent met the criteria for PTSD, and the prevalence for the voucher groups was not significantly different from this.

Turning to a more global measure of mental health—psychological distress—we find beneficial program effects. The average psychological distress levels of adults in the experimental and Section 8 groups are about one-tenth of a standard deviation less than adults in the control group. The impact estimate achieves statistical significance for the experimental group ( $p = .011$ ) but not the Section 8 group ( $p = .084$ ). (To make the K6 results easier to interpret, we standardized the units by subtracting off the control group mean and dividing by the control group standard deviation to create what is known as a z-score.)

We observe an adverse effect on substance dependence. About 5.5 percent of adults in the control group met the criteria for substance dependence during the past month and assignment to the experimental group was associated with a prevalence that was 2.9 percentage points higher than that of the control group. For the Section 8 group, we do not detect a statistically significant effect on dependence.

## Physical Health Effects

As shown in Exhibit 4, MTO appears to reduce the share of adults with diabetes and the likelihood of severe obesity, but we do not detect any treatment effects on several other health measures. About 56 percent of adults in the control group indicated that their current health was good or better; reports by adults in the experimental and Section 8 groups were similar. About 29 percent of adults in the control group reported having had an asthma attack in the past year. The rates were slightly lower for the two treatment groups, but the differences were not statistically significant. The average weight of adults in the control group was about 190 pounds, and about 58 percent of controls met the criteria for obesity (BMI of 30 or greater). Although we detect no statistically significant effects on the likelihood of having a BMI of 30 or more, we do detect beneficial program effects at more extreme obesity levels. The experimental and Section 8 groups are 4.6 and 5.3 percentage points, respectively, less likely to have had a BMI of 35 or greater compared with adults in the control group who had a prevalence of 35 percent ( $p < .05$ ). These estimates imply that actually moving using a voucher reduces the prevalence of a BMI of 35 or greater by about 9.5 percentage points for the experimental group and 8.6 percentage points for the Section 8 group. For a BMI of 40 or greater, the ITT effect was a 3.4-percentage-point reduction for adults in the experimental group ( $p < .05$ ) and a 2.9-percentage-point reduction for adults in the Section 8 group (not significant).

Both types of diabetes measures (self-reports and blood samples) point in the direction of lower diabetes rates among adults in the treatment groups compared with adults in the control group, although the exact magnitudes and levels of statistical significance vary. When we rely on respondent self-reports to measure diabetes, we find that the estimated decline in diabetes prevalence for adults in the experimental group relative to adults in the control group is not quite statistically significant, whereas adults in the Section 8 group have a significantly lower rate (ITT of 6.1 percentage points) compared with adults in the control group. Compared with self-reports, the blood test results



**Exhibit 4**

**MTO Effects on Adult Physical Health, 10 to 15 Years After Random Assignment**

Outcome	Control Mean	Experimental vs. Control		Section 8 vs. Control		Respondents (N)
		ITT	TOT	ITT	TOT	
<b>Self-rated health</b>						
Currently good or better health [SR]	0.564	0.002 (0.020)	0.004 (0.042)	- 0.005 (0.027)	- 0.009 (0.044)	3,269
<b>Asthma</b>						
Asthma or wheezing attack during the past year [SR]	0.293	- 0.018 (0.020)	- 0.038 (0.040)	- 0.042 (0.026)	- 0.066 (0.041)	3,267
<b>Obesity and height/weight measurements</b>						
Height, in feet [M, SR]	5.315	0.009 (0.010)	0.019 (0.020)	- 0.001 (0.013)	- 0.002 (0.021)	3,242
Weight, in pounds [M, SR]	189.985	- 3.163 (2.077)	- 6.521 (4.281)	- 2.852 (2.915)	- 4.615 (4.717)	3,222
Currently obese: BMI ≥ 30 [M, SR]	0.584	- 0.012 (0.022)	- 0.025 (0.044)	- 0.011 (0.029)	- 0.018 (0.046)	3,221
BMI ≥ 35 [M, SR]	0.351	- 0.046* (0.020)	- 0.095* (0.042)	- 0.053* (0.027)	- 0.086* (0.043)	3,221
BMI ≥ 40 [M, SR]	0.175	- 0.034* (0.016)	- 0.071* (0.032)	- 0.029 (0.021)	- 0.048 (0.034)	3,221
<b>Diabetes</b>						
HbA1c test detected diabetes (HbA1c ≥ 6.5%) [DBS]	0.204	- 0.052* (0.018)	- 0.108* (0.038)	- 0.011 (0.024)	- 0.017 (0.038)	2,737
Had diabetes or treated for it in the past year [SR]	0.160	- 0.024 (0.015)	- 0.049 (0.030)	- 0.061* (0.018)	- 0.098* (0.029)	3,251
<b>Physical limitations</b>						
Health limits respondent in climbing several flights of stairs or lifting and carrying groceries [SR]	0.510	- 0.048* (0.021)	- 0.100* (0.043)	- 0.023 (0.028)	- 0.038 (0.045)	3,270
<b>Hypertension</b>						
Currently has high blood pressure (systolic ≥ 140 mmHg or diastolic ≥ 90 mmHg) [M]	0.315	0.007 (0.020)	0.015 (0.042)	- 0.026 (0.027)	- 0.041 (0.043)	3,102

BMI = body mass index. DBS = dried blood spot assays. ITT = intention to treat. M = direct measurement. MTO = Moving to Opportunity. SR = self-reported. TOT = treatment on the treated. \* =  $p < .05$ . ~ =  $p < .10$ .

Notes: Robust standard errors shown in parentheses. The control mean is unadjusted. Unless otherwise indicated, the control mean and effects are expressed as shares of the sample in the category (for example, a control mean of 0.250 for working would indicate that 25 percent of the control group was working). Square brackets indicate the source of the outcome information. Experimental and Section 8 effects were estimated jointly using an ordinary least squares regression model controlling for baseline covariates (and field release) and applying weights. Height and weight were directly measured except for a very small percent of the sample for whom self-reported values are used. BMI is measured as weight in kilograms divided by height in meters squared. For diastolic and systolic blood pressure, data are the average of two readings if available; otherwise, data are from one reading.

Source: Adult long-term survey

show that a greater share of adults in the control group had diabetes. Using the blood test results, we find a statistically significant 5.2-percentage-point experimental ITT effect (and corresponding 10.8-percentage-point TOT effect), but we do not detect an effect for the Section 8 group. (We previously reported diabetes results for MTO adult women in Ludwig et al., 2011.)

The last two health measures we present are physical limitations and hypertension, on which we only detect an effect on health limitations among adults in the experimental group. Of adults in the control group, 51 percent reported that their health limited them in everyday activities, and adults in the experimental group were 4.8 percentage points less likely to report this type of limitation. The difference between the control group and the Section 8 group was not statistically significant. Nearly 32 percent of adults in the control group had hypertension, and the incidence of hypertension for adults in the experimental and Section 8 groups was similar to that of adults in the control group, with no significant differences detected.

## **Economic Effects**

In contrast to finding effects on health, we generally do not detect any beneficial effects on employment and earnings, household poverty, or reliance on government assistance programs. Exhibit 5 shows that slightly more than one-half of adults in the control group were employed at the time they were interviewed. Compared with controls, adults in the experimental group were not significantly more likely to be employed. Adults in the Section 8 group were 7.7 percentage points less likely than adults in the control group to report that they were working ( $p < .05$ ), but we interpret this result with caution because adults in the Section 8 group were interviewed slightly later in calendar time than adults in the control group, during a period of rising unemployment. Differences across groups may in part reflect different economic conditions at the time we surveyed the adults rather than effects on labor-market outcomes. (We think our mental and physical health measures are less susceptible to changes over short periods of time and that timing differences are less of a problem for those outcomes. One reason we think the Section 8 versus the control group difference in self-reported economic outcomes might be the result of the slight differences in when adults were surveyed comes from our analysis of administrative UI system data. The UI data enable us to compare employment for the Section 8 and control groups at the exact same point in time. When examining employment in 2007 for all three groups, we find no statistically significant differences across them.

We also do not detect differences in household income or receipt of food stamps and TANF, except for a slight increase in the amount of food stamps received by the experimental group. The average household income of adults in the control group was \$12,289 (in 2009 dollars),<sup>14</sup> and the averages for adults in the experimental and Section 8 groups were similar. The proportion of households at or below the poverty threshold was roughly equal across the three randomized groups, with 59 percent of adults in the control group living in poor households. Of adults in the control group, 47 percent reported currently receiving food stamps and 16 percent reported receiving TANF benefits. The corresponding rates for adults in the experimental and Section 8 groups were not significantly different. Using administrative records, we were also able to estimate the amount of food-stamp and

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<sup>14</sup> We adjusted the responses to 2009 dollars using the Consumer Price Index for All Urban Consumers provided by the U.S. Bureau of Labor Statistics.

**Exhibit 5**

**MTO Effects on Adult Economic Self-Sufficiency, 10 to 15 Years After Random Assignment**

Outcome	Control Mean	Experimental vs. Control		Section 8 vs. Control		Respondents (N)
		ITT	TOT	ITT	TOT	
<b>Employment</b>						
Currently employed [SR]	0.525	- 0.007 (0.021)	- 0.014 (0.042)	- 0.077* (0.028)	- 0.124* (0.045)	3,264
Employed in calendar year 2007 [UI]	0.465	- 0.004 (0.017)	- 0.009 (0.036)	0.000 (0.019)	0.000 (0.030)	4,194
<b>Earnings and household income</b>						
Earnings in previous calendar year (2009 dollars) [SR]	\$12,288.51	326.94 (583.44)	677.92 (1209.79)	- 613.60 (807.20)	- 982.43 (1292.40)	3,141
Earnings in calendar year 2007 (2009 dollars) [UI]	\$11,325.14	- 347.83 (523.80)	- 731.73 (1101.92)	112.93 (580.69)	180.50 (928.11)	4,194
Household income is at or below 100% of poverty line [SR]	0.590	- 0.032 (0.021)	- 0.067 (0.043)	0.036 (0.028)	0.059 (0.045)	3,258
<b>Food stamps</b>						
Currently receiving food stamps [SR]	0.470	0.016 (0.021)	0.032 (0.043)	0.029 (0.028)	0.046 (0.045)	3,253
Food-stamps benefits received during 2-year period from July 2007 to June 2009 (2009 dollars) [FS]	\$3,074.08	309.94* (156.50)	664.54* (335.54)	171.07 (184.98)	261.80 (283.09)	2,708
<b>Temporary Assistance for Needy Families (TANF)</b>						
Currently receiving TANF [SR]	0.158	0.010 (0.015)	0.021 (0.031)	0.026 (0.021)	0.041 (0.033)	3,262
TANF benefits received during 2-year period from July 2007 to June 2009 (2009 dollars) [TANF]	\$1,402.33	56.10 (114.48)	120.29 (245.44)	- 94.47 (123.82)	- 144.57 (189.49)	2,708

FS = food stamps records. ITT = intention to treat. MTO = Moving to Opportunity. SR = self-reported. TANF = Temporary Assistance for Needy Families records. TOT = treatment on the treated. UI = unemployment insurance administrative records.

\* =  $p < .05$ . ~ =  $p < .10$ .

Notes: Robust standard errors shown in parentheses. The control mean is unadjusted. Unless otherwise indicated, the control mean and effects are expressed as shares of the sample in the category (for example, a control mean of 0.250 for working would indicate that 25 percent of the control group was working). Square brackets indicate the source of the outcome information. Experimental and Section 8 effects were estimated jointly using an ordinary least squares regression model controlling for baseline covariates and applying weights. Analyses of survey measures also control for field release. Annual earnings are adjusted to 2009 dollars using the Consumer Price Index for All Urban Consumers. Poverty is the U.S. census 2009 poverty threshold and adjusts for head of household's age, household size, and number of children. TANF outcomes are at the family level and represent the total amount of benefits received during those 12 months for all family members' cases. This family-level measure does not restrict to active months in order to capture all benefits received by the family and dependents. For example, a payment could have been made to a child even though the adult on the case was sanctioned.

Source: Adult long-term survey

TANF benefits received during the 2-year period from July 2007 through June 2009. We observed no significant difference across the three randomized groups in the amount of TANF benefits received but did observe a higher level of food-stamp receipt (by \$310 over 2 years, or an average of \$13 per month) for adults in the experimental group compared with adults in the control group.

## Discussion

As Ludwig (2012) discussed, MTO generated large differences in neighborhood disadvantage and other conditions between the two treatment groups and the control group in the period immediately following random assignment. Over time, these differences narrowed, in large part because of improvements in the neighborhood conditions of the control group, but even with this narrowing the differences are sizable between groups over the entire 10- to 15-year period.

Our 10- to 15-year followup evaluation shows that MTO-induced changes in neighborhood conditions were associated with beneficial impacts on a number of key mental and physical health outcomes but with few, if any, effects on different economic self-sufficiency measures. Specifically, we found that adults in the experimental group had lower levels of psychological distress than did adults in the control group and that adults in the Section 8 group had lower levels of lifetime depression. The results also suggest, however, an increase in substance dependence for the experimental group relative to the control group. On physical health, we detect beneficial effects on diabetes, severe obesity, and health limitations, but we do not detect effects on self-rated health, asthma, or hypertension. The voucher offer reduced the prevalence of diabetes by 5.2 percentage points for the experimental group.

Effects on some key outcomes are of a clinically relevant magnitude. For example, MTO generated very large reductions in diabetes that might be comparable to those found in studies or programs designed to prevent diabetes. In comparing MTO to medical interventions, keep in mind that most clinical trials in medicine usually enroll study samples that are more socioeconomically advantaged than the low-income families who enrolled in MTO, often enroll individuals at high risk for a particular health problem, and may measure the outcome differently. In addition, reproductive-age women are disproportionately underrepresented in these studies. With those qualifications in mind, MTO's effects on diabetes appear to be similar in magnitude to those found in the Diabetes Prevention Program (DPP) randomized trial of lifestyle interventions designed to prevent diabetes that took place in clinical centers across the United States (Knowler et al., 2009). In DPP, a case manager met with participants for 16 initial sessions (and monthly afterwards) to help them modify their diet and exercise habits, with the goal of reducing body weight by 7 percent and engaging in 2.5 hours of moderate physical activity per week. Over a 10-year period, the lifestyle intervention reduced the incidence of new cases of diabetes by about 34 percent relative to the incidence in the placebo group, an effect of similar magnitude to the experimental group treatment.<sup>15</sup> MTO diabetes

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<sup>15</sup> Under the assumption that about 5 percent of MTO adults may have had diabetes at the start of the program, we estimate that the incidence of new cases among adults in the control group was about 1.22 per 100 person years (where  $1.22 = [0.204 \text{ final prevalence} - 0.05 \text{ assumed baseline prevalence}] \times [1/12.67 \text{ years}] \times 100 \text{ years}$ ) and was about 0.81 per 100 person years (where  $0.81 = [0.204 \text{ final control prevalence} - 0.052 \text{ effect} - 0.05 \text{ assumed baseline prevalence}] \times [1/12.67 \text{ years}] \times 100 \text{ years}$ ) for the MTO treatment group. Thus, we estimate about a 34-percent reduction in the incidence of new cases ( $0.34 = [0.81 - 1.22]/1.22$ ).

effects are also noteworthy because of the costs associated with the disease; Trogon and Hylands (2008) estimate that the annual medical expenditures of people with diabetes are 239 percent greater than those of people without diabetes (after adjusting for demographic differences).

The results we report here from our long-term (10- to 15-year) survey of MTO adults for the final impacts evaluation suggest that the lack of MTO effect on economic outcomes found in the followup (4- to 7-year) survey for the interim impacts evaluation was not simply because of the disruptive effects of moving itself or of the fact that families may not have been in their new neighborhoods long enough to fully adapt and take advantage of any new opportunities in those areas. Given the previous nonexperimental research literature suggesting that neighborhood environments affect labor market outcomes, what might explain why we do not observe beneficial effects on adult self-sufficiency? That MTO may have had only modest effects on the mechanisms that affect employment and earnings is one explanation. For example, the areas to which families moved through MTO may not have offered more plentiful job opportunities. At 4 to 7 years after baseline, the interim impacts evaluation showed little effect of moves on local job availability as measured by employment growth by residential ZIP Code (Kling, Liebman, and Katz, 2007). In addition, although MTO moves appear to have increased the likelihood that adults in the experimental group had a college-educated friend, qualitative work with MTO families suggests that new neighbors may not have known about the types of job openings that MTO adults were seeking (Turney et al., 2006).

Our findings suggest that housing mobility programs similar to MTO are unlikely, by themselves, to be panaceas for the labor-market difficulties of disadvantaged families living in public housing projects in inner-city neighborhoods. Investing in high-quality training and employment services may be a more promising way to improve labor-market outcomes for very disadvantaged adult samples of the sort that enrolled in MTO. For example, the Jobs-Plus demonstration produced sustained (7-year) earnings gains for adult public housing residents without disabilities through employment and training services, changes in rent rules to increase work incentives, and neighbor-to-neighbor outreach centering on work (Riccio, 2010). Several training programs that prepare underskilled workers for skilled positions in a specific industry and connect them to employers with job openings have also produced substantial earnings gains for disadvantaged adults in large U.S. cities, and these gains applied to women and African-American adults in the study (Maguire et al., 2010).

For very disadvantaged adults like those who participated in MTO, policies that directly increase skills, help with the acquisition of work experience, assist with job searches, and provide workplace supports may be necessary to improve economic self-sufficiency. The MTO findings suggest that housing mobility programs could help improve the physical health and mental well-being of disadvantaged adults. Our hope is that future work helps illuminate the mechanisms through which community environments influence health outcomes to help guide the design of community-level interventions that can improve health without having to rely on relocating families to new areas.

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