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ABSTRACT

BACKGROUND

Using data from a large social experiment (Moving to Opportunity), which offered low-income women the chance to move from high-poverty to lower-poverty neighborhoods, this study estimates the association of the randomized intervention with obesity and diabetes.

METHODS

In 1994-1998, 4,498 women who had children and who were residents in public housing in high-poverty census tracts (≥40% poor) in five U.S. cities were randomized to three groups--a low-poverty voucher group (n=1,788), which received mobility counseling and housing vouchers redeemable only in low-poverty census tracts (<10% poor); a traditional voucher group (n=1,312), which received unrestricted vouchers; and a control group (n=1,398). In 2008-10 we measured health outcomes including height, weight, and glycosylated hemoglobin (HbA1c).

RESULTS

We obtained BMI data on 84.2% of base-line respondents and HbA1c data on 71.3%. Response rates were similar across randomized groups. Compared to controls, the low-poverty voucher group had lower prevalence of BMI ≥35 kg/m^2 (-4.61 percentage points, 95% confidence interval [CI] -8.54 to -0.69), BMI ≥40 kg/m^2 (-3.38 points, 95% CI -6.39 to -0.36), and HbA1c ≥6.5% (-4.31 points, 95% CI -7.82 to -0.80). Differences between traditional voucher and control groups were not significant.

CONCLUSIONS

The opportunity to move from high- to lower-poverty neighborhoods was associated with modest but potentially important reductions in the prevalence of extreme obesity and diabetes. The mechanisms behind these associations remain unclear, but warrant further investigation to guide the design of community-level interventions to improve health.

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Many observational studies find that neighborhood attributes such as poverty or racial segregation, are associated with risk of obesity and of diabetes, even after controlling for observed individual- and family-level factors.[1-4] In response, the Surgeon General has called for efforts to "create neighborhood communities that are focused on healthy nutrition and regular physical activity, where the healthiest choices are accessible for all citizens."[5]

Previous studies hypothesize several pathways through which neighborhoods may influence health. Changes in the built environment (e.g., grocery stores, opportunities for exercise) might change health behaviors and outcomes such as obesity.[4,6-8] Proximity to health-care providers might influence detection or management of health problems. Neighborhood safety might influence exercise, diet, or stress.[4,9] Social norms about health-related behaviors may vary across neighborhoods.[10,11]

Whether neighborhood environments directly contribute to the development of obesity and diabetes remains uncertain. People living in high-poverty neighborhoods differ in many ways from those in lower-poverty areas, only some of which can be adequately measured in observational studies. These unmeasured individual characteristics may be responsible for between-neighborhood variations in health. Inference concerning the influence of neighborhood may become more credible if randomization is used to encourage otherwise similar people to live in different types of neighborhoods. The social experiment reported here examines how randomly-assigned variation in neighborhood conditions is associated with obesity and diabetes.

METHODS

Design, Setting, and Participants

The Moving to Opportunity (MTO) experiment was designed and implemented by the U.S. Department of Housing and Urban Development (HUD) with the primary purpose of understanding the effects of residential location on "employment, income, education and well-being."[12] Families with children (<18 years) in Baltimore, Boston, Chicago, Los Angeles, and New York in selected government housing developments in census tracts with 1990 poverty rates ≥40% were eligible. From 1994-1998 families were invited by local housing authorities to participate in a randomized lottery to receive a rent-subsidy voucher.[13] One-quarter of eligible families applied.[13]

The analysis reported here focuses on one adult woman from each family, usually the household head, interviewed in 2008-2010. This research was approved by the federal Office of Management and Budget and Institutional Review Boards at HUD, National Bureau of Economic Research, and relevant universities.

All authors contributed to the design, analysis and interpretation of the data reported here, made the decision to publish the manuscript, and vouch for the accuracy and completeness of the data and analysis. Dr. Ludwig had complete access to all data and wrote the first draft.

Interventions

Applicants were randomly assigned to one of three groups. In the *low-poverty voucher group*, families were offered a standard rent-subsidy voucher but with the restriction that it could only be used in a low-poverty census tract (<10% residents poor in 1990). Vouchers provide

subsidies for private-market housing, equal to the difference between a rent threshold minus the family's rent contribution (30% of income, identical to public housing).[14] Families remained eligible for vouchers so long as they met income and other criteria. Census tracts contain 2,500-8,000 people and were defined by the Census Bureau to be "homogeneous with respect to population characteristics, economic status, and living conditions."[15] Families also received short-term housing counseling for their initial housing search.[16,17] After one year families could use their voucher to relocate to a different tract, including those with higher poverty rates. In the *traditional voucher group*, families were offered a standard voucher but with no special restrictions or counseling. This group was included to distinguish the effects of moving with a voucher from the effects of moving to a lower-poverty area specifically. In the *control group*, families were offered no new assistance.

Random Assignment

Randomization was conducted for HUD by Abt Associates, using a computerized random number generator.[16] HUD selected MTO sample sizes for power to detect effects on the primary outcomes (i.e., employment, income, education).[17] During the study Abt adjusted random assignment rates of later cohorts based on acceptance rates in earlier cohorts to equalize the statistical power of different cross-group comparisons.[18]

Data Collection

MTO applicants completed a base-line survey asking "about the people who live with you, your housing, your neighborhood, and your work experiences."[19] Among the few base-line

measures related to health was receipt of Supplemental Security Income (SSI), a program for aged and disabled people.

After randomization and the base-line survey, HUD engaged our team to follow families to assess long-term outcomes, including some related to health. Outcomes were collected by the University of Michigan's Survey Research Center (SRC) from June 2008 to April 2010, on average 12.6 years after randomization (range 10.0 to 15.4). The sample frame included one adult from each low-poverty voucher and control group family and from a random two-thirds of the traditional voucher families (under-sampled for budgetary reasons).

Target respondents were offered $50 to complete our surveys,[19] and another $25 to provide physical and biological measures. Informed consent was obtained before beginning interviews, which usually occurred in the respondent's home and took 2 hours. Interviewers were blinded to MTO group assignments. The survey design employed two-phase sampling. In phase 1, SRC sought to interview everyone in the survey sample frame. After reaching a response rate of 75-80%, SRC began phase 2, which involved trying to reach a probability subsample of 35% of the cases that could not be reached in phase 1.[20]

Obesity Assessment

Height and weight were measured using protocols modified from the Health and Retirement Survey.[21] Respondents removed heavy outer clothing and pocket items and stood with heels and shoulders against the wall. Height was marked on the wall using a rafter's square and measured to the nearest quarter inch with a metal tape-measure. Weight was measured to the nearest half-pound using a HealthOMeter model 800KL digital electronic floor scale with a

maximum capacity of 390 pounds.[22] If weight or height could not be measured, it was obtained by self-report.

Diabetes Assessment

Up to 5 drops of whole blood capillary samples were collected on Whatman #903 specimen collection paper via finger stick using an auto-retractable lancet[23] from participants after it was determined that there was no history of coagulopathy or taking of medications affecting coagulation. Samples were assayed for hemoglobin A1C (HbA1c) at a CLIA-certified laboratory (Flexsite Diagnostics, Palm City, FL) using a Roche Cobas Integra immunochemical method validated for use with dried blood spots and certified by the National Glycohemoglobin Standardization Program. A single HbA1c measure provides an integrated assessment of average blood glucose levels over the past several months and does not require respondents to fast beforehand.[24]

Response Rates

To account for two-phase sampling, we calculated effective response rates.[20] Phase 1 and 2 response rates (R1 and R2) were calculated as the number of participants with data from each phase, divided by the sum from that phase of the numbers with data and with missing data (declines, incapacitated, deceased, or not contacted). Response rates were calculated using the American Association for Public Opinion Research's definition RR1w.[25] If P1 and P2 equal the share of the total sample from phase 1 and 2, our response rate equals P1×R1 + P2×R2.

Outcome Measures

We created dichotomous measures for obesity by applying commonly-used thresholds for body mass index (BMI) ($\geq$30 kg/m^2, $\geq$35 kg/m^2, $\geq$40 kg/m^2).[26] To measure diabetes we used the HbA1c$\geq$6.5% threshold recommended by the American Diabetes Association.[27,28]

HUD tracked MTO participant addresses between base-line and our long-term follow-up. To illustrate how MTO changed where participants lived, we geocoded addresses and linked them to Census tract attributes. Additionally, our long-term surveys asked about access to health care, neighborhood safety, and "collective efficacy" (social cohesion).[29]

Statistical Analysis

We first carried out an omnibus F-test of whether differences across randomized MTO groups in the set of base-line characteristics are jointly zero.[30]

Our main analyses used the intention-to-treat (ITT) method in which differences in average outcomes were compared for controls versus all members of the low-poverty voucher (or traditional voucher) group, regardless of whether they moved through MTO. We used linear regression for continuous outcomes and logistic regression for binary outcomes (presented as average marginal effects), adjusting for base-line covariates to improve precision. All estimates weighted individuals by the inverse of the probability of assignment to their group, and (for phase 2 respondents) the inverse of the likelihood of selection for phase 2 subsampling.[20] We present Huber-White robust standard errors to adjust for heteroskedasticity.

We also used instrumental variables methods to try to estimate the association between health and moving with an MTO voucher (the complier average causal effect, or CACE, which

in MTO equals the treatment on the treated estimate, or TOT),[31] and to estimate a "dose-response" model.[32] (See Supplementary Tables 1-9, which also include selected means by randomization group and compliance status.) Analyses were performed using Stata 11.0 Special Edition.[33] Statistical significance was set at a 2-sided p-value of <.05, with no adjustment for multiple comparisons.

RESULTS

Study Population

Between 1994 and 1998, 4,498 eligible families were randomly assigned (Fig. 1). The effective response rates in our 2008-2010 follow-up study for the low-poverty voucher, traditional voucher, and control groups for BMI were 84.7%, 82.8%, and 84.4%, and for HbA1c were 70.1%, 73.7%, and 71.3%.

Table 1 presents base-line characteristics for respondents with valid BMI or HbA1c data. Most women are unmarried, and either African-American or Hispanic. There was no statistically significant difference in the 57 base-line characteristics (those in Table 1, plus Table 1 in the Supplementary Appendix) that we examined as a set between the low-poverty voucher vs. control group (*p*=.93) or traditional voucher vs. control group (*p*=.35).

Characteristics of the Study Intervention

Of women assigned to the low-poverty voucher group, 48% used the MTO voucher; 63% of the traditional voucher group used MTO vouchers.

The association between the MTO treatment and neighborhood poverty rates was significant. One year after random assignment the census tract poverty rate for adults assigned to

the low-poverty voucher group was 17.1 percentage points lower than the control group's mean

tract poverty rate of 50 percent (95% CI -18.6 to -15.6) (Table 2), a 1.4 standard deviation

change in the national tract poverty distribution (Table 2 in the Supplementary Appendix). This

association attenuated over time, in part because control families moved to lower-poverty areas

over time without MTO assistance. Ten years after randomization the poverty rate was 4.9

percentage points (95% CI -6.2 to -3.5) lower than the control mean of 33.0. TOT estimates for

those who moved through MTO were twice as large as the ITT estimates for the low-poverty

voucher group, and 1.5 times as large for traditional vouchers (see Supplementary Appendix).

Differences across groups in the 25th percentile of tract poverty were even larger (Fig. 2).

MTO assignments also had large associations with other neighborhood attributes,

including safety and collective efficacy. However MTO had no significant association with

whether adults reported a regular place to go for routine medical care.

Primary Outcomes

At our follow-up 10-15 years after base-line, the low-poverty voucher intervention was

associated with decreased risk of extreme obesity and diabetes. Of the women in the control

group, 58.6% had BMI≥30, and 35.5% had BMI≥35, 17.7%, BMI≥40, and 20.0%,

HbA1c≥6.5%. Compared to controls, the low-poverty voucher group had lower prevalence of

BMI≥35 kg/m^2 (ITT of -4.61 percentage points, 95% CI -8.54 to -0.69, p=.02, calculated without

adjustment for multiple comparisons) and BMI≥40 kg/m^2 (-3.38 points, 95% CI -6.39 to -0.36,

p=.03), reductions equal to 13.0% and 19.1% of the control group prevalence, respectively

(Table 3). The low-poverty voucher group also had lower prevalence of HbA1c≥6.5% (ITT

equal to -4.31 percentage points, 95% CI -7.82 to -0.80, p=.02), a reduction of 21.6% from the control prevalence.

The contrasts in body mass and diabetes outcomes between the traditional voucher and control groups were not significant at the 0.05 level. The difference in outcomes between the low-poverty and traditional voucher groups was not significant for any BMI thresholds, but trended to significance for HbA1c≥6.5% (p= 0.050).

We find no statistically significant differences in MTO impacts on health in *post hoc* analysis of subgroups including base-line age or demonstration site (Tables 6-7 in the Supplementary Appendix).

Our dose-response model revealed that adults spending more time in lower-poverty tracts exhibited larger improvements on diabetes and BMI outcomes (Table 9 in the Supplementary Appendix). We tested for non-linear relationships between neighborhood attributes and these health outcomes, but these tests had low statistical power.

DISCUSSION

The randomly assigned opportunity to move from high- to lower-poverty neighborhoods with a low-poverty voucher was associated with reduced prevalence of BMI≥35 kg/m², BMI≥40 kg/m² and HbA1c≥6.5% equal to 13.0%, 19.1% and 21.6% of the control group's prevalence rate. The magnitudes of the associations with health are larger for those who moved with an MTO voucher, and are consistent with effect sizes from previous observational studies.[3] Because we generate estimates for several different BMI cut-points, our estimates for the associations of the MTO program with extreme obesity may be marginally significant.

Around half of subjects randomized to the low-poverty group used MTO vouchers, and many MTO control families later moved to lower-poverty areas. Neither imperfect program compliance nor cross-over compromise the internal validity of our ITT estimates, but may reduce statistical power.

Although we could not reject the null hypotheses that the traditional voucher's association with obesity is equal to either zero or that of the low-poverty voucher, the difference in prevalence of HbA1c$\geq$6.5% between the low-poverty voucher and traditional voucher groups was nearly significant. This is consistent with previous MTO studies of non-health outcomes suggesting changes in neighborhood environments rather than moving *per se* are responsible for these impacts,[32] and with our findings that the low-poverty and traditional voucher treatments had different associations with neighborhood attributes that may affect health (Table 2).

A previous study of MTO measuring self-reported outcomes 4-7 years after randomization found a lower prevalence of obesity (BMI$\geq$30 kg/m^2) for adults assigned to the low-poverty voucher group (42.0%) versus controls (46.8%).[32] Use of self-reported measures raises concerns about Hawthorne effects, or that neighborhood environments could affect self-reporting. That previous study was not informative about long-term health effects because "fade out" is pervasive with social experiments. Nor were results reported for the most costly morbidity of obesity – diabetes.

The present study has several strengths, including use of a large social experiment to overcome concerns with selection bias that arise with epidemiological studies, and collection of physical measurements for health outcomes 10-15 years after randomization. MTO resulted in a relatively homogenous group living in a wider range of neighborhoods than usual for epidemiological studies. Because MTO moves led to changes in "neighborhoods" defined by

commonly-used geographic levels (e.g., tracts, ZIP codes), MTO overcomes potential measurement error from mis-defining "neighborhood."[34]

Our study also has several limitations. First, it is possible those for whom outcomes are not available in our long-term study could have differed systematically across the randomized MTO groups in unobservable attributes. Second, our measure for HbA1c≥6.5% misses people with successfully treated diabetes. Third, the base-line surveys collected by HUD included little information about health. This limits our ability to determine whether MTO affects obesity and diabetes by changing onset versus persistence, but does not impact the internal validity of our ITT estimates.

A further limitation is that participants volunteered for MTO. Over 90% of MTO households were headed by an African-American or Hispanic female, all with children. Among all 1.2 million public-housing households nationwide, 50% are non-white; 38% are female household heads with children.[35] Our sample is also more obese than national samples.

While care should be taken in applying these results to populations with different attributes, our findings that neighborhood environments are associated with obesity and diabetes may have implications for understanding U.S. health trends and disparities. Rising U.S. residential income segregation in recent decades[36] suggests increased population exposure to distressed neighborhood environments. Minorities are also more likely than whites to live in distressed areas.[37]

Our results, together with previous studies documenting the large social costs of obesity[38] and diabetes,[39] raise the possibility that clinical or public-health interventions ameliorating community-environment effects on obesity and diabetes could generate substantial social

benefits. The mechanisms accounting for these associations remain unclear, but warrant further

investigation to guide the design of community-level interventions to improve health.

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Figure Legends

Figure 1. Participant Flow in the Moving to Opportunity Long-Term Evaluation.

Figure 2. Distribution of Census Tract Poverty by Randomly Assigned MTO Group and Years Since Random Assignment (RA).

> Light gray = "Low-poverty Voucher"
>
> Medium gray = "Traditional Voucher"
>
> Dark gray = "Control"

Figure 2 footnote text:

"The horizontal line in the middle of each box indicates the median of the census tract poverty rates within each randomly assigned group, the borders of the box mark the 75th and 25th percentiles, and the whiskers mark the 90th and 10th percentiles. Census tracts are small geographic areas that usually contain between 2,500 and 8,000 people, and were defined by the United States Census Bureau to correspond to local communities that have relatively homogenous population characteristics. For additional information see www.census.gov/geo/www/cen_tract.html. The tract poverty rate for 1, 5, or 10 years after the family was randomly assigned is linearly interpolated from the 1990 and 2000 decennial Censuses, as well as the 2005-2009 American Community Survey. The sample includes female adults with a valid Body Mass Index (BMI) or a valid glycosylated hemoglobin (HbA1c) measurement as well as valid address data at the base-line survey and at the three time points shown (N=3,026)."

Table 1. Base-line Characteristics of Study Sample, by Randomized MTO Mobility Group*							
		Low-poverty housing voucher			Traditional housing voucher		Control
		(n = 1425)			(n = 657)		(n = 1104)
		No.	(%)		No.	(%)	No.	(%)
Age †, y								
	≤ 35	196	(14.6)		94	(13.5)	163	(14.7)
	36-40	310	(21.5)		156	(23.9)	253	(23.3)
	41-45	347	(23.5)		143	(21.7)	257	(23.2)
	46-50	273	(18.6)		124	(20.5)	194	(17.1)
	> 50	299	(21.7)		140	(20.4)	237	(21.7)
Race ‡								
	African-American	973	(65.0)		393	(63.9)	706	(66.1)
	Other non-white	339	(28.1)		194	(27.6)	288	(26.8)
	White	92	(6.7)		52	(8.1)	88	(6.8)
Hispanic ethnicity ‡		404	(31.5)		235	(33.0)	346	(30.3)
Never married		874	(62.6)		395	(63.5)	692	(64.3)
Under age 18 at birth of first child		347	(25.1)		163	(28.0)	265	(25.0)
Working		368	(27.1)		176	(26.0)	258	(23.9)
Enrolled in school		216	(16.0)		113	(17.7)	172	(16.9)
High school diploma		565	(38.3)		233	(34.3)	407	(35.9)
General Education Development (GED)		235	(16.2)		124	(18.7)	204	(19.9)
Receiving Supplemental Security Income §		221	(15.9)		107	(17.1)	171	(16.3)

* No. unweighted. % calculated using sample weights to account for changes in random assignment ratios across randomization cohorts and for subsample interviewing. Sample is female adults with valid Body Mass Index (BMI) or valid glycosylated hemoglobin (HbA1c). An omnibus F-test fails to reject null hypothesis that the set of base-line characteristics reported above are the same across MTO random assignment groups (p-value for the low-poverty housing voucher vs. control comparison is p=.41; p-value for the traditional housing voucher vs. control comparison is p=.77; p-values from replicating the omnibus F-test adding in the base-line characteristics in Supplemental Table 1 are p=.93 and p=.35, respectively).

† Age as of December 31, 2007, just prior to the start of the long-term follow-up began in June 2008.

‡ Race and Hispanic ethnicity were reported by the –base-line head of household upon applying for the MTO program. Race categories do not sum to 100% because of missing information. For more on variable construction, see Appendix B in Orr et al.[18]

§ Supplemental Security Income (SSI) is a federal assistance program for aged, blind, and disabled people.

Table 2. Association between MTO Randomized Intervention and Residential Mobility and Neighborhood Conditions during Study Period *

	Control Mean	Low-poverty housing voucher vs. control group						Traditional housing voucher vs. control group					
		Intention to Treat [ITT]† (95% CI)				*P* Value	N	Intention to Treat [ITT]† (95% CI)				*P* Value	N
Total Number of Moves from Random Assignment (RA) to Long-Term Follow-up‡													
Number of moves	2.1	0.57	(0.42	to	0.71)	<0.01	2404	0.58	(0.38	to	0.79)	<0.01	1673
Percent Poor in Census Tract at: §													
Base line	53.1	-0.37	(-1.23	to	0.50)	0.41	2404	-0.37	(-1.55	to	0.81)	0.54	1673
1 year after RA	50.0	-17.06	(-18.57	to	-15.56)	<0.01	2404	-13.50	(-15.33	to	-11.67)	<0.01	1673
5 years after RA	39.9	-9.78	(-11.25	to	-8.31)	<0.01	2404	-6.26	(-8.41	to	-4.11)	<.01	1673
10 years after RA	33.0	-4.86	(-6.23	to	-3.48)	<0.01	2404	-2.87	(-4.80	to	-0.95)	<0.01	1673
Average Census Tract Characteristics from Random Assignment through Long-Term Follow-up; percent tract that is: ‖													
Poor	39.6	-9.14	(-10.26	to	-8.02)	<0.01	2404	-6.07	(-7.53	to	-4.61)	<0.01	1673
Minority	88.0	-6.23	(-7.58	to	-4.89)	<0.01	2404	-0.99	(-2.88	to	0.90)	0.30	1673
Female-headed	54.3	-7.95	(-9.08	to	-6.82)	<0.01	2404	-5.03	(-6.55	to	-3.51)	<0.01	1673
College graduates	16.1	4.49	(3.68	to	5.30)	<0.01	2404	1.41	(0.29	to	2.52)	0.01	1673
Collective Efficacy: Neighbors are Likely to Do Something about Kids Spraying Graffiti on Local Building ¶													
Interim survey **	54.0	10.61	(6.46	to	14.76)	<0.01	2377	5.30	(0.53	to	10.07)	0.03	1927
Long-term survey	58.9	8.20	(4.20	to	12.21)	<0.01	2516	0.80	(-5.16	to	6.76)	0.79	1752
Safety: Respondent Feels Safe/Very Safe on Streets Near Home During the Day ¶													
Interim survey **	74.9	9.14	(5.77	to	12.52)	<0.01	2482	8.95	(5.16	to	12.73)	<0.01	2023
Long-term survey	80.7	3.70	(0.52	to	6.87)	0.02	2522	5.00	(0.50	to	9.50)	0.03	1756
Social Networks: Respondent has At Least One Friend who Graduated from College ¶													
Interim survey **	40.8	6.90	(2.63	to	11.17)	<0.01	2414	4.55	(-0.22	to	9.33)	0.06	1963
Long-term survey	53.4	6.90	(2.74	to	11.06)	<0.01	2478	-2.11	(-8.33	to	4.11)	0.51	1723
Access to Local Health Services: Has a Place to Go for Routine Care (Excluding Emergency Room) ¶													
Interim survey **	89.7	-1.35	(-4.13	to	1.43)	0.34	2490	-0.21	(-3.15	to	2.73)	0.89	2022
Long-term survey	93.4	-1.36	(-3.49	to	0.77)	0.21	2526	0.64	(-2.11	to	3.40)	0.65	1755

* The analysis sample for long-term follow-up measures consists of female adults with valid BMI or valid HbA1c. Analyses of number of moves and census tract characteristics are further limited to those who have valid address data at base-line and years 1, 5, and 10.

† Intention to treat (ITT) estimates compare average outcomes of everyone assigned to treatment group with average outcomes of controls, adjusting for the set of base-line covariates shown in Table 1 and indicators for survey sample release, site, and random assignment periods. Impacts on continuous dependent variables are calculated using linear regression. Impacts on dichotomous variables are calculated using logistic regression and presented as average marginal effects.

‡ Random assignment date ranged from 1994 to 1998, and long-term follow-up began in June 2008.

§ Census tract characteristics are as of the time when the MTO family lived in the tract, interpolated using 1990 and 2000 decennial census and the 2005-09 American Community Survey data.

‖ Average duration-weighted census tract characteristics give more weight to tracts in which MTO families spent relatively more time during the study period.

¶ Adults reports on the interim (4-7 years) and long-term follow-up (10-15 years after random assignment). See Sampson et al. for more on collective efficacy.[29]

** Analysis of interim survey measures use that study's sample and weights, limited to female adults and adjusting for the same covariates as the long-term.

Table 3. Association between MTO Randomized Intervention and Body Mass Index and Glycosylated Hemoglobin at Long-Term Follow-Up *													
			Low-poverty housing voucher vs. control group						**Traditional housing voucher vs. control group**				
	Control Prevalence (%)		**Intention to Treat [ITT]† (95% CI)**			***P* Value**	**N**		**Intention to Treat [ITT]† (95% CI)**			***P* Value**	**N**
Body Mass Index (BMI)‡													
BMI ≥ 30 kg/m2	58.6		-1.19	(-5.41 to	3.02)	0.58	2508		-0.14	(-6.27 to	5.98)	0.96	1747
BMI ≥ 35 kg/m2	35.5		-4.61	(-8.54 to	-0.69)	0.02	2508		-5.34	(-11.02 to	0.34)	0.07	1747
BMI ≥ 40 kg/m2	17.7		-3.38	(-6.39 to	-0.36)	0.03	2508		-3.58	(-7.95 to	0.80)	0.11	1747
Glycosylated Hemoglobin (HbA1c)§													
HbA1c ≥ 6.5%	20.0		-4.31	(-7.82 to	-0.80)	0.02	2092		-0.08	(-5.18 to	5.02)	0.98	1516

* The analysis sample consists of female adults with valid BMI (for the BMI measures) or valid HbA1c (for the HbA1c measure) in the long-term follow-up data collection.

† Intention to treat (ITT) estimates compare average outcomes of everyone assigned to treatment group with average outcomes of controls, adjusting for the set of base-line covariates shown in Table 1 and indicators for survey sample release and random assignment periods. Impacts are calculated using logistic regression and are presented as average marginal effects.

‡ BMI was calculated from measured height and weight for most adults (a small number self-reported) as part of the long-term follow-up data collection.

§ HbA1c was assayed from dried blood spots collected as part of the long-term follow-up data collection.