Supplementary Online Content

Pollack CE, Blackford AL, Du S, Deluca S, Thornton RLJ, Herring B. Association of receipt of a housing voucher with subsequent hospital utilization and spending. *JAMA*. doi:10.1001/jama.2019.17432

eAppendix A. Overview of Data Sources and Cohort Derivation
eAppendix B. Coding of Outcome Variables
eAppendix C. Coding of Covariates
eAppendix D. Statistical Analyses/Methodology
eAppendix E. Additional Results: Primary/Secondary Analyses
eAppendix F. Results for Sensitivity Analyses
eReferences

This supplementary material has been provided by the authors to give readers additional information about their work.

Table of Contents

eAppendix A. Overview of Data Sources and Cohort Derivation 3
A.1. California All-Payer Data 3
A.2. Massachusetts All-Payer Data 3
A.3. New York All-Payer Data 3
A.4. Medicaid Claims Data 3
A.5. Incorporating Deaths in the All-Payer and Medicaid Data 4
A.6. Study Cohort 4
A.7. Out of State Moves 4
A.8. Payer Distribution 4
eAppendix B. Coding of Outcome Variables 14
B.1. Coding of Types of Hospital Use 14
B.1.A. Pregnancy-Related Inpatient Visits 14
B.1.B. Inpatient Admissions Arising in the ED 14
B.2. Coding of Spending Outcomes 15
B.2.A. All-Payer Data and Cost to Charge Ratios 15
B.2.B. Medicaid Data and Imputing Managed Care Payments 16
B.2.C. Inflation of Spending to 2015 Dollars 16
B.3. Top-Coding of Hospital Use Outcomes 16
eAppendix C. Coding of Covariates 17
C.1. Incorporating Medicaid Churning 17
C.2. Incorporating Medicaid FFS vs. MCO Enrollment 17
C.3. Examining Differential Medicaid and MCO Enrollment by Study Groups 17
eAppendix D. Statistical Analyses/Methodology 19
D.1. Functional Form of the Dependent Variables 19
D.2. Subgroup Analyses for Children by Age and by Sex 19
D.3. Differences over Time and Identifying Early vs. Middle vs. Late Time Periods 20
D.4. Methodology for Presenting the Findings by Differences by Neighborhood Poverty 20
D.5. Treatment-on-Treated (TOT) Methodology 21
eAppendix E. Additional Results: Primary/Secondary Analyses 27
eAppendix F. Results for Sensitivity Analyses 40
eReferences 60

eAppendix A. Overview of Data Sources and Cohort Derivation

eAppendix A provides additional details regarding the claims data received for the five states: all-payer data from California, Massachusetts, and New York; and the Medicaid claims data for Illinois and Maryland. Data were obtained after the establishment of a partnership with the U.S. Department of Housing and Urban Development (HUD) and research agreements with the appropriate state and federal entities. The appendix then delineates the study sample and cohort derivation.

A.1. California All-Payer Data

California's Office of Statewide Health Planning and Development provided 4,939 inpatient discharge records covering the years 1995 to 2015. The California data was linked to MTO participants based on an exact match of participant Social Security number, date of birth, and gender. A total of 64 inpatient records that did not match to any of the MTO participants' unique identifier (MTO variable PPID) were excluded, as were an additional 56 records that belonged to MTO participants randomized to one of the other four sites (MA, MD, IL, or NY). This yielded a total of 4,819 inpatient discharge records for California. Because the first participant in CA was randomized in 1995, we only used data from 1996 (representing the first year since randomization) to 2015 in the analyses.

A.2. Massachusetts All-Payer Data

Massachusetts' Center for Health information and Analysis provided 3,297 inpatient discharge records for the years 2004 to 2014. The Massachusetts data was linked to MTO participant based on Social Security number, date of birth, and gender. A total of 19 records which matched to MTO participants randomized to one of the other 4 sites (CA, MD, IL, or NY) were excluded. This yielded a total of 3,278 inpatient discharge records for Massachusetts.

A.3. New York All-Payer Data

New York's Statewide Planning and Research Cooperative System (SPARCS) provided 5,587 inpatient records for the years 1995 to 2015. The New York data was linked to MTO participants based on the last four digits of Social Security number, date of birth, and gender. A total of 7 duplicate records and 505 records belonging to MTO participants randomized to one of the other 4 sites (CA, MA, MD, or IL) were removed. This yielded a total of 5,082 records for New York.

A.4. Medicaid Claims Data

The Research Data Assistance Center (ResDAC) provided Personal Summary (PS), Inpatient, and Other Therapy files. Data was matched to MTO participants by Social Security number, date of birth, and gender for calendar years 1999 to 2009 in California, Illinois, Maryland, and New York. The Medicaid data for California and New York do not provide additional person-years beyond the all-payer data for those two states in the main analyses, but these data were used for sensitivity analyses comparing the results from the all-payer data versus the Medicaid data.

A total of 78,244 PS records at the person-year level (22,873 for California, 21,800 for Illinois, 13,482 for Maryland, 43 for Massachusetts, and 20,046 for New York), 10,169 inpatient discharge records (1,468 for California, 2,435 for Illinois, 1,775 for Maryland, and 4,491 for New York), and 2,047,384 Other Therapy claims (797,469 for California, 322,603 for Illinois, 330,026 for Maryland, and 597,286 for New York) were obtained. A total of 43 PS records were excluded from Massachusetts. A total of 39,940 emergency department claims were obtained from the Other Therapy data. These Other Therapy data were used to identify hospitalizations that originated in the ED (see eAppendix Section B.1.B).

For each set of records, person-years of data where an individual was dually eligible for Medicaid and Medicare were excluded due to the potential for incomplete record ascertainment. Differences in dual enrollment between study group were not observed (eAppendix Table A1).

Inpatient records were additionally excluded that: (1) were neither fee-for-service (FFS) (TYPE_CLM_CD =1) nor managed care organization (MCO) (TYPE_CLM_CD=3) claims, (2) had a delivery code = 2, which represents a duplicate inpatient record assigned to the newborn for childbirth delivery-related records, (3) did not match to someone in the MTO cohort or were from a different state than the state in which the participant was originally randomized, and (4) were duplicate records (based on SRVC_BGN_DT, prioritizing those with ADJUST_CD = 0 or 1 over 2). This yielded a total of 7,925 inpatient records (N=5,344 FFS and N=2,690 MCO).

Similar to the inpatient records, Other Therapy records were excluded which were neither FFS nor MCO, did not match to the MTO cohort within the state of randomization, or were duplicate ED visits based on the service date (SRVC_BGN_DT).

A.5. Incorporating Deaths in the All-Payer and Medicaid Data

Data on the year of death was obtained for participants up to and including 2010. For the all-payer data, person-years after the year of death were excluded from the analyses. For the Medicaid data, a small number of person-year enrollment/hospital use observations (N=35 person-years for N=15 participants) that occurred after the year of death were excluded. Mortality was not differential between study groups (weighted logrank p value=0.81).

A.6. Study Cohort

The consort diagram for the study cohort is shown in eAppendix Figure A1. A comparison of participants who were and were not included in the final analytic sample is presented in eAppendix Table A2. There was no significant difference in the distribution of participants who were and were not included by study group for either the adult sample or for children at the time of randomization. Baseline characteristics for the experimental low-poverty voucher group, the traditional Section 8 voucher group, and the control group are presented in eAppendix Table A3. (The main paper's Table 1 shows baseline characteristics for the voucher groups combined.) eAppendix Table A4 shows the range of years for the study, including both the years of enrollment/randomization for each state and the years of follow-up data from the all-payer and Medicaid data sources for each state (if applicable).

A.7. Out of State Moves

Health records were only available for participants during the times which they resided in the state in which they were randomized. Residential address was collected by HUD on participants through 2009, and HUD provided data on their state of residence during 2009. eAppendix Table A5 shows the proportion of participants who resided out of state in 2009 by study group. The proportion who lived out of state in 2009 significantly varied across study groups for adults, with adults in the voucher groups more likely to reside out of state compared to the control group (odds ratio (OR)=1.33, 95% CI 1.02, 1.72, p=0.04). In the children's sample, the proportion who lived out of state in 2009 did not significantly vary by study group (OR=1.23, 95% CI 0.93, 1.62, p=0.14). Because data were not available on moves that may have occurred either prior to 2009 or after 2009, the main analyses for the association of the housing voucher intervention on hospital use do not incorporate these 2009 data for out of state moves. Sensitivity analyses regarding the potential impact of out of state moves on outcomes is presented in eAppendix Section F.

A.8. Payer Distribution

For the 54,569 adult person-years used in the analyses, 46,159 (85%) were from the all-payer data and 8,410 (15%) were from the Medicaid data. For the 122,128 children person-years used in the analyses, 96,510 (79%)

were from the all-payer data and 25,618 (21%) were from the Medicaid data. For the person-years from the all-payer data, insurance status is only observed for those who have a claim in the year, so insurance status is unknown for those who do not have a hospital claim within a given year, which is the case for most MTO participants. (The baseline MTO survey conducted by HUD only had about 20% of MTO families respond to the question about insurance coverage.) In the all-payer discharge records, Medicaid was the listed as the source of payment for 61% of adults' records and 52% of children's records. Private or other insurance were listed for the remaining 12% and 27% of adults' records and 23% and 25% of children's records, respectively.

eAppendix Table A1. Medicare/Medicaid Dually Eligible by Study Group in the California, Illinois, Maryland, and New York Medicaid Sample

	Voucher Groups		Control Group		P Value*
Adult Characteristics† (Age ≥18 at Randomization)	(N = 1,873)		(N = 792)		**Voucher vs Control**
Ever Dual Eligible	152	8%	54	7%	0.39
Dual Eligible Years - mean [range]‡	4	[1,10]	4	[1,10]	0.25
Child Characteristics† (Age <18 at Randomization)	(N = 4,679)		(N = 2,036)		**Voucher vs Control**
Ever Dual Eligible	35	1%	19	1%	0.30
Dual Eligible Years - mean [range]‡	4	[1,8]	4	[1,9]	0.88

* The p-values denote the significance of the difference for each dual eligibility measure between the voucher and control groups. These were estimated using OLS regressions of each of the two dual eligibility outcomes on indicators for being assigned to the voucher group as well as indicators for randomization site.
† Adult age ≥18 at randomization; children <18 at randomization;
‡ Among those ever dual eligible.

eAppendix Table A2. Comparison of Baseline Characteristics of MTO Participants Who Were and Were Not Included in Final Analytic Sample

	Participants Included in Final Analytic Sample	Participants Not Included in Final Analytic Sample
Adult Sample's Characteristics (Age ≥18 at Randomization)	N = 4072	N = 530
Study arm – no. (%)		
Low poverty voucher	1590 (39)	227 (43)
Traditional voucher	1216 (30)	130 (25)
Control	1266 (31)	173 (33)
Age – median (Q1, Q3)†	32 (26, 38)	34 (29, 40)
Race – no. (%)‡		
Black	2540/3996 (64)	363/521 (70)
White	311/3996 (8)	46/521 (9)
Other	1145/3996 (29)	112/521 (21)
Hispanic ethnicity – no. (%)‡	1285 (32)	152 (29)
Sex – no. (%)		
Female	3979 (98)	517 (98)
Male	93 (2)	13 (2)
Study site – no. (%)		
Baltimore	476 (12)	160 (30)
Boston	916 (22)	41 (8)
Chicago	700 (17)	194 (37)
Los Angeles	916 (22)	118 (22)
New York City	1064 (26)	17 (3)
Never Married	2479 (63)	272 (54)
Age <18 at first childbirth	983 (25)	127 (26)
Employed	999 (25)	150 (30)
Enrolled in school	653 (17)	70 (14)
High-school diploma	1504 (37)	227 (43)
GED certificate	736 (18)	69 (13)
Child Sample's Characteristics (Age <18 at Randomization)	N = 9118	N = 2172
Study arm – no. (%)		
Low poverty voucher	3589 (39)	844 (39)
Traditional voucher	2658 (29)	643 (30)
Control	2871 (31)	685 (32)
Age – median (Q1, Q3)†	8 (4, 12)	7 (3, 12)
Race – no. (%)‡		
Black	5815/8893 (65)	1289/2088 (62)
White	598/8893 (7)	164/2088 (8)
Other	2480/8893 (28)	635/2033 (30)
Hispanic ethnicity – no. (%)‡	2809 (31)	731 (34)
Sex – no. (%)		
Female	4526 (50)	1010 (47)
Male	4592 (50)	1159 (53)
Study site – no. (%)		
Baltimore	1266 (14)	206 (9)
Boston	1858 (20)	299 (14)
Chicago	1874 (21)	555 (26)
Los Angeles	2100 (23)	586 (27)
New York City	2020 (22)	526 (24)

eAppendix Table A2. Comparison of Baseline Characteristics of MTO Participants Who Were and Were Not Included in Final Analytic Sample (Continued)

* Numbers are unweighted data. Percentages were calculated with sample weights accounting for differences in random-assignment ratios across randomized study groups and for subsample interviews. Percentages include imputed values. All variables were entered into a single logistic regression model to estimate differences between participants who were included/not included in the final analytic sample, separately for adults and children. Among adults, the distributions of age, black race, Hispanic ethnicity, sex, study site, marital status, employment indicator, and high school diploma were all significantly different at $p < 0.05$. Among children, the distributions of site ($p < 0.001$) and sex ($p = 0.01$) were different between participants who were included/not included in the final analytic sample. There was no significant difference in the distribution of study groups between participants who were including/not included for either adults or children.

† Imputed Age at randomization in whole years.

‡ Race categories do not sum to the total number because of missing data. The "other" race category includes American Indians, Asian/Pacific Islanders, and other races. A Hispanic person could be a member of any race.

Employment and current education status at baseline were self-reported by each adult head of household in the year of randomization. Being employed is defined as working either full-time or part-time for pay.

eAppendix Table A3. Baseline Characteristics of the Matched MTO Study Population With Low-Poverty Voucher and Traditional Voucher Groups Separate

	Control	Low-Poverty Voucher	Traditional Voucher
Adult Sample's Characteristics (Age ≥18 at Randomization)	(N = 1266)	(N = 1590)	(N = 1216)
Age – median (Q1, Q3)†	32 (26, 38)	32 (26, 38)	32 (27, 39)
Race – no. (%)‡			
Black	794/1239 (64)	1033/1569 (66)	713/1188 (60)
White	103/1239 (8)	106/1569 (7)	102/1188 (9)
Other	342/1239 (28)	430/1569 (27)	373/1188 (31)
Hispanic ethnicity – no. (%)‡	397 (32)	466 (30)	422 (35)
Sex – no. (%)			
Male	38 (3)	24 (2)	31 (3)
Female	1228 (97)	1566 (98)	1185 (97)
Study site – no. (%)			
Baltimore	141 (11)	188 (12)	147 (12)
Boston	309 (24)	350 (22)	257 (21)
Chicago	180 (14)	359 (23)	161 (13)
Los Angeles	345 (27)	301 (19)	270 (22)
New York City	291 (23)	392 (25)	381 (31)
Never Married	780 (63)	970 (63)	729 (62)
Age <18 at first childbirth	296 (25)	391 (26)	296 (26)
Employed[#]	303 (25)	392 (25)	304 (26)
Enrolled in school[#]	197 (16)	251 (16)	205 (17)
High-school diploma[#]	458 (36)	608 (38)	438 (36)
GED certificate[#]	234 (18)	268 (17)	234 (19)
Take-up of voucher – no. (%)	n/a	779 (48)	744 (61)
Neighborhood Poverty Years 1-3 – mean (SD)	47 (14)	36 (17)	38 (13)
Years of data – median (Q1, Q3)^	11 (11, 18)	11 (9, 18)	11 (11, 18)
Years of Medicaid data – median (Q1, Q3)^	6 (3, 10)	6 (3, 10)	6 (3, 9)
Years of All-Payer data – median (Q1, Q3)^	18 (11, 19)	18 (11, 19)	18 (11, 19)
Child Sample's Characteristics (Age <18 at the Time of Randomization)	(N = 2871)	(N = 3589)	(N = 2658)
Age – median (Q1, Q3)†	7 (4, 11)	7 (4, 12)	8 (4, 12)
Race – no. (%)‡			
Black	1788/2785 (64)	2439/3526 (69)	1588/2582 (62)
White	207/2785 (7)	200/3526 (6)	191/2582 (7)
Other	790/2785 (28)	887/3526 (25)	803/2582 (31)
Hispanic ethnicity – no. (%)‡	935 (33)	980 (27)	894 (34)
Sex – no. (%)			
Male	1459 (51)	1786 (50)	1347 (51)
Female	1412 (49)	1803 (50)	1311 (49)
Study site – no. (%)			
Baltimore	389 (14)	490 (14)	387 (15)
Boston	661 (23)	695 (19)	502 (19)
Chicago	456 (16)	968 (27)	450 (17)
Los Angeles	775 (27)	708 (20)	617 (23)
New York City	590 (21)	728 (20)	702 (26)
Take-up of voucher – no. (%)	n/a	1670 (47)	1658 (62)
Neighborhood Poverty Years 1-3 – mean (SD)	47 (14)	37 (18)	39 (13)
Years of data – median (Q1, Q3)^	11 (11, 18)	11 (10, 18)	11 (11, 18)
Years of Medicaid data – median (Q1, Q3)^	8 (5, 10)	8 (5, 11)	8 (5, 11)
Years of All-Payer data – median (Q1, Q3)^	18 (11, 19)	18 (11, 19)	18 (11, 18)

eAppendix Table A3. Baseline Characteristics of the Matched MTO Study Population With Low-Poverty Voucher and Traditional Voucher Groups Separate (Continued)

* Numbers are unweighted data. Percentages are calculated with sample weights accounting for changes in random-assignment ratios across randomized study groups and for subsample interviews. Percentages include imputed values. Omnibus Chi-square tests failed to reject the null hypothesis that baseline characteristics are the same across the three study groups (P = 0.65 for the low-poverty voucher v. control for adults, P = 0.77 for the traditional voucher v. control for adults, P = 0.48 for the low-poverty voucher v. control for children, P = 0.26 for the traditional voucher v. control for children).
† Imputed age at randomization in whole years.
‡ Race categories do not sum to the total number because of missing data (denominators are shown). The "other" race category includes American Indians, Asian/Pacific Islanders, and other races. A Hispanic person could be a member of any race.
^ For the all-payer samples from CA, NY, and MA, this is the number of years potentially in the data, incorporating deaths. For the Medicaid samples from IL and MD, this is the number of years actually enrolled in Medicaid. For the 54,569 adult person-years used in the analyses, 46,159 (85%) were from the all-payer data and 8,410 (15%) were from the Medicaid data. For the 122,128 children person-years used in the analyses, 96,510 (79%) were from the all-payer data and 25,618 (21%) were from the Medicaid data.
# Employment and current education status at baseline were self-reported by each adult head of household in the year of randomization. Being employed is defined as working either full-time or part-time for pay.
^ For the all-payer samples from CA, NY, and MA, this is the number of years potentially in the data, incorporating deaths. For the Medicaid samples from IL and MD, this is the number of years actually enrolled in Medicaid. For the 54,569 adult person-years in the analyses, 46,159 (85%) were from the all-payer data and 8,410 (15%) were from the Medicaid data. Of the person-years of adult Medicaid data, 5,911 (70%) was full-year enrollment and 4,210 (50%) was managed care. For the 122,128 person-years for children at the time of randomization, 96,510 (79%) were from the all-payer data and 25,618 (21%) were from the Medicaid data. Of the person-years of children Medicaid data, 20,099 (78%) was full-year enrollment and 14,994 (59%) was managed care.

eAppendix Table A4. Timeline of Years of Study Randomization, Data Sources, and Years Since Randomization

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	First YSR	Last YSR
Randomization																								
CA																								
IL																								
MA																								
MD																								
NY																								
All-payer data																								
CA[1]																							1	17-20
IL																							n/a	n/a
MA																							7-10	17-20
MD																							n/a	n/a
NY																							1	17-21
Medicaid																								
CA																							1-5	11-14
IL																							2-5	11-14
MA																							n/a	n/a
MD																							3-5	11-15
NY																							2-5	11-15

YSR= Years Since Randomization. Calendar years of data represent different years since randomization depending on the year a household was randomized.

[1] Because randomization did not begin in California until 1995, all-payer data from 1995 did not contribute to follow-up.

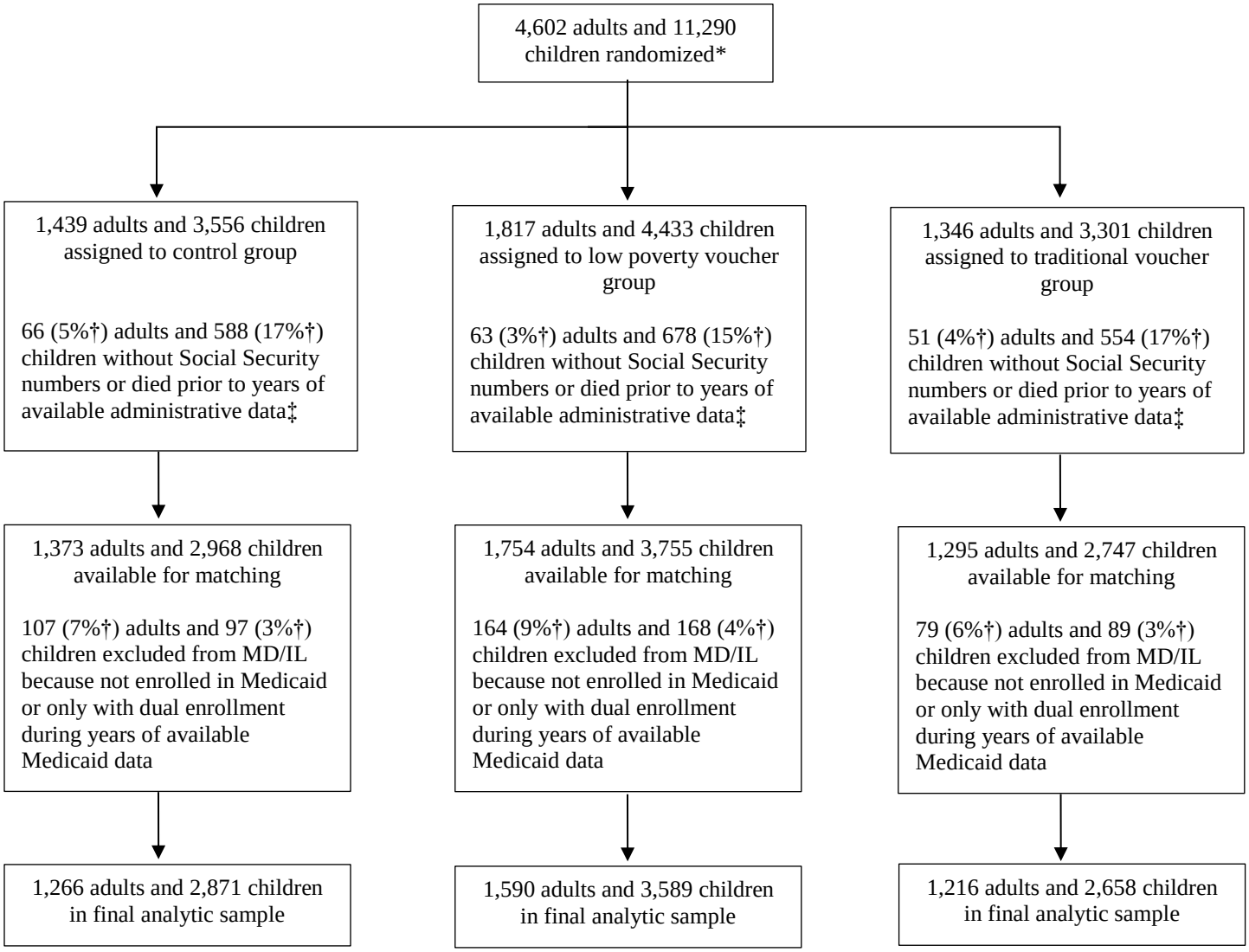
eAppendix Table A5. Proportion of Participants Who Lived in a Different State in 2009 Than Their Original State at Randomization

Adults (Age ≥18 at Randomization)*	N Living in Different State / Total N (%)	Odds Ratio† (95% CI)	P Value
Low-Poverty Voucher	141/1316 (10.7%)	1.25 [0.94, 1.67]	0.12
Traditional Voucher	113/910 (12.4%)	1.46 [1.07, 1.98]	0.02
Control Group	89/1034 (8.6)	1 (ref)	
Voucher Groups	254/2226 (11.4%)	1.33 [1.02, 1.72]	0.04
Control Group	89/1034 (8.6)	1 (ref)	
Children (Age <18 at Randomization)			
Low-Poverty Voucher	288/2546 (11.3%)	1.25 [0.93, 1.69]	0.14
Traditional Voucher	173/1601 (10.8%)	1.19 [0.84, 1.69]	0.32
Control Group	184/2001 (9.2%)	1 (ref)	
Voucher Groups	461/4147 (11.1%)	1.23 [0.94, 1.62]	0.14
Control Group	184/2001 (9.2%)	1 (ref)	

* The 2009 address data were unavailable on 812 adults and 2,970 children in the analytic sample.

† Odds ratios were estimated from logistic regression models for the probability of living in a different state in 2009 than the state where the participant lived at the time of randomization as a function of study arm. The first model includes terms for the separate voucher groups relative to controls. The second model includes both voucher groups combined. Results are for the sub-sample of MTO participants in the main analyses (N=3,260 for adults and N=6,148 for children). All models included study sample weights and adjustments for the set of baseline covariates described in the text.

eAppendix Figure A1. Study Cohort



* 1,241 participants who were not the primary adult respondent (e.g., male spouses and adult children at baseline) were excluded from matching due to incomplete baseline data
† These are the percentages based on the full cohort of adults and children randomized to each study group
‡ Based on confidentiality restrictions and the small number of participants who died prior to the years of available administrative data, these participants were grouped with those who did not have a Social Security number available for matching

eAppendix B. Coding of Outcome Variables

eAppendix B provides additional details regarding outcomes variables. The first section provides details relevant to the coding of all hospital use outcomes, while the second section provides details specific to coding the spending outcomes. The third section describes the approach to top-coding the outliers in these two sets of outcomes.

B.1. Coding of Types of Hospital Use

Primary outcomes were the total number of hospitalizations, the total number of hospital days, and total hospital spending. The secondary measures identified pregnancy-related inpatient visits and inpatient visits originating from the ED.

B.1.A. Pregnancy-Related Inpatient Visits

One set of secondary outcomes for hospital use distinguished between pregnancy-related inpatient visits versus non-pregnancy-related visits. For the all-payer and Medicaid data sources, hospitalizations were classified as pregnancy-related if they had a major diagnostic code or diagnostic related group flag equal to "14" indicating "Pregnancy, childbirth, and puerperium". In California, the specific variable used was the Major Diagnostic Category (HCFA-MDC); in Massachusetts, the All Patient Refined (APR) Diagnostic Related Groups (DRGs) were used; and in New York, the Federal Diagnostic Major Diagnostic Category was used. For the Medicaid data, primary and secondary diagnosis codes were used to determine the Major Diagnostic Category (MDC) for each record, using the Agency for Healthcare Research and Quality (AHRQ) v6.0.2 Patient Safety Indicator (PSI) software based on CMS' official MS-DRG Grouper.[1]

B.1.B. Inpatient Admissions Arising in the ED

An additional set of secondary outcomes for hospital use distinguished between inpatient visits originating from the ED versus inpatient visits not originated from the ED. In the California all-payer data, ED encounters that resulted in a same-hospital admission were identified using the inpatient's source of admissions route for ED (variable called "SOURCE" with route code = 1, representing "Your ER"). There may be some inpatient admissions that began in a different hospital's ED for which classifying as originating in an ED was not feasible. In the Massachusetts all-payer data, records were categorized as originating in the ED if either: (1) the EDFlag variable equaled '2', (2) the AdmissionSourceCode1 or AdmissionSourceCode2 variables were equal to '7' or 'R', or (3) the revenue code equaled '450'. In the New York all-payer data, the variable "EDI" or Emergency Department Indicator based on the submitted revenue center codes was used. If the record contained an ED revenue code of 045X, then the admission was coded as arising in the ED.

For the Medicaid data, Revenue Center codes in the inpatient claims were used to identify ED facility services, which are part of the inpatient hospital bill. The revenue center codes used were 450, 451, 452, 456, 459, and 981, and revenue code charges were required to be greater than $0. Additional inpatient admissions that originated in the ED were also identified using the Other Therapy (OT) data. In particular, whether any of the ED visits identified in the OT data matched to the IP data records by PPID and SRVC_BGN_DT was determined. ED visits were identified in the OT file using three criteria based on suggestions from ResDAC: (1) Place of Service code = 23, (2) Revenue Center Codes = 450, 451, 456, 459, or 981, or (3) Procedure Codes = 99281, 99282, 99283, 99284, 99285, and G0380. Records were allowed to match if the SRVC_BGN_DT matched exactly, or if the ED visit occurred one day before the inpatient admission beginning date.

B.2. Coding of Spending Outcomes

B.2.A. All-Payer Data and Cost to Charge Ratios

The all-payer hospital claims data from California, Massachusetts, and New York included dollar charges for each admission. However, insurers make actual payments that are quite different than those charges. Medicare and Medicaid set their own administered prices, and private insurers negotiate varying discounts off each hospital's charges. Because the actual payments made in these three state's all-payer claims databases were not observed, each claim's charge in the claims data was converted to the underlying cost of that services using a hospital-level cost-to-charge ratio (CCR) from CMS' Healthcare Cost Report Information System (HCRIS)[2]; the HCRIS data were for all hospital patients (rather than Medicare and/or Medicaid administered by CMS), provided hospital cost amounts which combine both inpatient and outpatient care, and were available for 1995 through 2016 at the time these data were analyzed. Each claim's charge in the all-payer claims database was converted to that claim's cost by simply multiplying the charge by the relevant CCR for that hospital/year.

The all-payer hospital claims data from Massachusetts and New York included state-specific hospital identifiers (i.e., variable IDORGHOSP for Massachusetts and variable PFI for New York), while the all-payer hospital claims data from California only included a five-digit zip code for the hospital facility. The hospital-level CCR data was therefore used to produce costs for claims in Massachusetts and New York hospitals and compute zip code-level mean CCRs to produce costs for claims in California hospitals.

The HCRIS CCR data included the Medicare Provider Number, but the all-payer hospital data for Massachusetts and New York did not include this Medicare Provider Number identifier. In order to merge the HCRIS CCR data to the all-payer hospital data for Massachusetts and New York, two intermediary crosswalk files were created with the state-specific hospital identifiers and the American Hospital Association (AHA) identifiers[3] (based on visually reviewing the hospital names and zip codes), as the AHA data do include Medicare Provider Numbers. Specifically, one crosswalk file was created for Massachusetts with the identifier variable IDORGSITE, IDORGFILER, and IDORGHOSP from the all-payer data and the identifier variable ID from the AHA data, and a second crosswalk file was created for New York with the identifier variable PFI from the all-payer data and the identifier variable ID from the AHA data. The New York and Massachusetts all-payer identifier variables were then added to the HCRIS CCR data (by merging on the crosswalk's Medicare Provider Number) and then merged the hospital-specific CCRs to each of these two state's all-payer claims data by hospital and year.

A small number of hospitals had incomplete CCR data for all years 1995-2016, so CCRs were interpolated or extrapolated for that time period based on the available data for that hospital. Another small number of hospitals did not have any CCR data in the HCRIS. For these Massachusetts and New York claims, a weighted-mean CCR from all the hospitals in that five-digit zip code and year (using each hospital's number of beds as the weight) was estimated. A weighted-mean CCR for all hospitals in the three-digit zip code and year and a mean CCR for all hospitals in the state and year (where each hospital was weighted by its total days from the AHA data) were also estimated. The CCR for the smallest area available was then applied to a given a claim's charge. Two of the 148 hospitals in the New York claims had a hospital identifier that could not found within the HCRIS CCR data, and 70 of the New York claims (1.4% out of 5,082) did not have a PFI hospital identifier or zip code; for both of these types of claims, the state/year's mean CCR was used. All of Massachusetts claims could be linked to the HCRIS CCR data.

For California, the all-payer hospital claims database did not include hospital identifiers but instead included the hospital's five-digit zip code for each claim. The HCRIS data for California was therefore used to create a weighted-mean CCR for all hospitals in each five-digit zip code and year, where each hospital was weighted by its total days per year from the AHA data. The mean CCR for the three-digit zip code was used if CCRs based on five-digit zip codes were not feasible. For the 4,939 records in California, 4,767 (96.5%) matched using a five-digit zip code, and 172 (3.5%) matched using a three-digit zip code.

B.2.B. Medicaid Data and Imputing Managed Care Payments

Because Medicaid managed care payments were not reported in the data, the FFS records were used to impute Medicaid payments for the MCO records. For each of the FFS inpatient records, a mean cost per day of a hospital stay was calculated by dividing the total Medicaid payments by the number of Medicaid covered days (LOS): MDCD_PYMT_AMT/MDCD_CVRD_IP_DAYS. These records were then divided into 4 categories: (1) non-pregnancy related among adults (≥18 years at baseline), (2) non-pregnancy related among youth (< 18 years at baseline), (3) pregnancy-related (all ages), and (4) LOS = 0 whether pregnancy-related or not. The median of the mean cost per day was calculated by stratifying by state, year, and these 4 categories based on age, pregnancy-relatedness, and LOS. However, due to the relatively small number of FFS records with LOS = 0 and that 144 of the 149 LOS=0 records came from Illinois in the years 2006 to 2009, imputations for this category were not performed and instead charges for MCO records with LOS = 0 were set to missing.

B.2.C. Inflation of Spending to 2015 Dollars

Costs from the all-payer data and payments from the Medicaid data were inflated to 2015 US dollars using the following Personal Health Care Expenditure (PHCE) Inflator ratios derived from AHRQ.[4]

B.3. Top-Coding of Hospital Use Outcomes

Because the distribution of annual healthcare hospital use was heavily skewed to the right, the extent to which outliers might drive the empirical results was a concern. Annual hospital use outcomes were therefore top-coded (rather than having the observations from the analyses dropped entirely). For each outcome at the person-year level (i.e., annual hospitalizations, annual hospital days, and annual hospital spending, as well as each of the classifications for the types of hospitalization), the 99th percentile of all nonzero annual values during the follow-up period was calculated separately for each state and by adults and children at randomization (10 strata). For instance, the 99th percentile for the annual number of nonzero admissions was 7 admissions for adults in the California data (range: 1 to 7); all values greater than 7 (N=13) were then top-coded to be equal to 7. Because the Medicaid data included partial-year enrollees, spending was first annualized for these partial-year person-year records using the observed spending in the months enrolled for that given year before top-coding. However, neither the count of hospitalizations nor inpatient days was adjusted for partial-year enrollees prior to top-coding. For sensitivity analyses, results were produced both from values which were not top-coded and from values which were top-coded at the 90th percentile of nonzero annual hospital use.

eAppendix C. Coding of Covariates

eAppendix C provides details regarding certain additional covariates included beyond the baseline demographics to account for the underlying differences in the all-payer versus Medicaid data. Some of the baseline covariates (race, ethnicity, never married, age less than 18 at the birth of first child, being employed, and currently enrolled in school) were missing for a small share (<5%) of participants. As with prior MTO analyses, the missing values for these covariates were imputed by site, voucher group, age, and gender.[5]

C.1. Incorporating Medicaid Churning

While the all-payer data were available for participants regardless of insurance status, the Medicaid data was only available while participants were enrolled in Medicaid. The analyses used the person-year as the unit of observation, such that yearly movement in and out of Medicaid was accounted for. However, partial-year enrollment in Medicaid (within any given person-year observation) posed two empirical issues. The first was that the observed hospital use measures reflected a period of less than one year. The regression models therefore included an offset term equal to the months of available data during the year. For the all-payer data, this was set to 12 for all observations. For the Medicaid data, this measure of the number of months enrolled in Medicaid was extracted from the Personal Summary (PS) data file. The second empirical issue was that differences in hospital use may occur with churn into and out of Medicaid, as enrollee hospital use may be higher during the time enrolled in Medicaid than the time not enrolled in Medicaid.[6] An indicator variable set to 1 if a participant had between 1 and 11 months of Medicaid enrollment in a given calendar year and set to 0 if the participant had a full 12 months of enrollment was therefore created and included in the empirical models. For person-years of data from the all-payer datasets, this indicator variable was set to 0.

C.2. Incorporating Medicaid FFS vs. MCO Enrollment

A covariate to control for whether the hospital use outcome was from a Medicaid Managed Care Organization (MCO) was also included in the models. Monthly enrollment was extracted using the MC_COMBO_MO_X variable where X has values 1 to 12 for each month of the year. Participants in the Medicaid data were assigned to FFS enrollment in a given month if the MC_COMBO_MO_X variable was equal to 02, 03, 04, 10, 11, 13, 14 or 16. Participants in the Medicaid data were assigned to MCO enrollment if the variable was equal to 01, 05, 06, 07, 08, 09, 12, or 15. Values of 99 or 00 were not considered to be FFS nor MCO. An indicator variable set to 1 for any MCO enrollment in a given year and 0 for only FFS enrollment during the year was also included in the empirical models. This indicator variable was also set to 0 for all-payer data.

C.3. Examining Differential Medicaid and MCO Enrollment by Study Groups

To test whether there was differential enrollment into either Medicaid, one logit model for any Medicaid enrollment during the year (among all MTO participants in the four states with Medicaid data) and a second logit model for partial-year Medicaid enrollment (conditional on being in Medicaid) were examined. These results are shown in eAppendix Table C1 and indicate there was not differential selection into Medicaid by study group. To test whether there was differential enrollment into a Medicaid MCO, a logit model for any MCO Medicaid enrollment during the year (conditional on being in Medicaid) was also examined; these results are also shown in eAppendix Table C1 and indicate there was not differential MCO enrollment by study group.

eAppendix Table C1. Medicaid Enrollment for MTO Voucher Versus Control Groups

	Logit for Any Medicaid Enrollment During the Year*		Logit for Partial-Year Medicaid (Conditional on Being in Medicaid)*		Logit for MCO Enrollment (Conditional on Being in Medicaid)*	
	Odds Ratio	**P Value**	**Odds Ratio**	**P Value**	**Odds Ratio**	**P Value**
Adults†	1.12 (0.99, 1.27)	0.07	1.03 (0.93, 1.15)	0.58	1.10 (0.95, 1.28)	0.19
Children	0.98 (0.88, 1.10)	0.75	1.02 (0.94, 1.11)	0.59	1.10 (0.96, 1.26)	0.18
Younger Children	0.99 (0.87, 1.14)	0.91	1.02 (0.93, 1.13)	0.64	1.13 (0.97, 1.31)	0.12
Older Children	0.95 (0.80, 1.13)	0.55	1.03 (0.89, 1.19)	0.71	0.99 (0.80, 1.23)	0.92
Girls	0.93 (0.80, 1.08)	0.35	0.93 (0.84, 1.02)	0.14	1.12 (0.96, 1.31)	0.13
Boys	1.03 (0.89, 1.19)	0.66	1.15 (1.03, 1.29)	0.02	1.07 (0.90, 1.28)	0.44

* The odds ratios from the logit analyses for the association of the housing voucher receipt with the Medicaid enrollment outcomes compare the outcomes for the sub-sample of MTO participants from MD, IL, CA, and NY in 1999-2009. The models included adjustments for the set of baseline covariates described in the text. The adult sample had a total of 38,555 person-year observations in the full sample (first column) and 20,634 person-year observations in the adult subsample enrolled in Medicaid (second and third columns). The children sample had a total of 83,776 person-year observations in the full sample (first column) and 55,260 person-year observations in the children subsample enrolled in Medicaid (second and third columns).
† Adult age ≥18 at randomization; children <18 at randomization; younger children age <13 at randomization; older children age 13-17 at randomization; girls and boys <18 at randomization.

eAppendix D. Statistical Analyses/Methodology

eAppendix D provides details regarding the statistical analyses. The first section describes issues related to the functional form of the dependent variables. The second section describes the analyses to test for differential associations of the housing voucher intervention and children's hospital use for younger versus older children and for boys versus girls. The third section describes the analyses to test for differential associations of the housing voucher intervention over time. The fourth section describes the methodology to express the magnitude of the findings as the association of neighborhood poverty with hospital use (instead of the housing voucher receipt with hospital use). The fifth section describes the Treatment-on-Treated (TOT) methodology to express the magnitude of the main findings (for the association between the housing voucher intervention and hospital use) among those who actually used the voucher to move.

D.1. Functional Form of the Dependent Variables

Two types of dependent variables were examined. One was a count of use (i.e., number of hospitalizations, number of hospital days). The other was total spending. Both modeling approaches had the person-year as the unit of observation.

Utilization counts were modeled using a negative binomial model in which the total count over a person-year was the dependent variable and the log-scale length of time at risk was included as a right-hand side offset/exposure independent variable.[7] For the all-payer data, the offset was set to 12, representing 12 calendar months. For the Medicaid data, the offset represented the months of enrollment in a given calendar year. A negative binomial model was used instead of a Poisson model due to significant overdispersion in the data found from the likelihood ratio tests on the Poisson model. The models were also fit using generalized estimating equations (GEE) to produce robust standard errors given the longitudinal structure of the data. Because GEE uses subject-to-subject measures to estimate the variance instead of a model-based variance estimation, it was also useful in adjusting for overdispersion.[8] The results from the negative binomial models were expressed as incidence rate ratios (i.e., the relative change in total utilization associated with the intervention).

Hospital spending was modeled using the standard two-part model, in which the first part was a logistic regression for any spending and the second part was a generalized linear model with a log link and gamma distribution for nonzero spending.[7] The results from this two-part model were combined to show a marginal effect of the intervention on overall spending. The marginal effect essentially multiplied the probability of having any hospital spending in the first part of the model with the predicted hospital spending from the second part of the model. An offset term was used to account for exposure time in the sample for the first part of the two-part model, as the length of exposure time would affect the likelihood that an individual incurs any hospital spending.

D.2. Subgroup Analyses for Children by Age and by Sex

In addition to examining models for the full sample of all children, models also examined subgroups of younger children and older children and subgroups of boys and girls. Prior analyses of MTO observed different findings for earnings for younger children (<13 years old at the time of randomization) compared to older children and observed different findings for mental health for boys compared to girls, thereby justifying the main analyses which presents stratified subgroups of children by age and by sex (as opposed to forming post-hoc subgroup to examine). Nevertheless, formal tests for differential associations between the housing voucher intervention and hospital use by subgroup were performed by including an interaction term within a model for the full sample of children. Specifically, one model for the full sample of children included terms for an indicator for the voucher group, an indicator for being a younger child (<13 years old) and their interaction. Likewise, a second model for the full sample of children included an indicator for being a girl and interacted that term with the voucher group indicator.

D.3. Differences over Time and Identifying Early vs. Middle vs. Late Time Periods

In addition to examining models for annual hospital use over the entire time period, models also examined whether there were differences in the association of the housing voucher intervention with hospital use over time to try to distinguish MTO's short-term effects from its longer-term effects. One of these approaches included an interaction between the number of years since randomization and study group (which essentially assumes a linear relationship between the effect size and time). The second approach included a set of interactions for three different time periods (early vs. middle vs. late) to try to capture nonlinear relationships between the effect size and time (e.g., increasing early and then decreasing late). For the latter, the approach to selecting cut-points for the different time periods reflected several considerations. One consideration was a goal to have time periods that roughly corresponded with prior evaluations of the MTO data. The interim MTO evaluation was performed about 5.9 years after randomization (with a range of 4.1 to 7.9 years). The final evaluation occurred on about 12.7 years after randomization (with a range of 10.0 to 15.3 years). A second consideration was a goal of having a roughly even division of person-year observations across three time periods (eAppendix Table D1). A set of indicator variables representing an "early" time period of 1 through 7 years since randomization, a "middle" time period of 8 through 12 years since randomization, and a "late" time period of 13 through 21 years since randomization were therefore created.

D.4. Methodology for Presenting the Findings by Differences by Neighborhood Poverty

Additional analyses present the magnitude of the findings as the relationship between hospital use and neighborhood poverty rates. Following the approach of prior MTO studies,[9] a two-stage model was estimated in which the first stage was an ordinary least squares (OLS) model for the person's mean neighborhood poverty rate and the second stage for hospital use included the person's predicted neighborhood poverty rate as the key independent variable. While the study design ensures a random assignment to different neighborhoods (and would, in turn, not be confounded by a family's choice of where to live), this design cannot isolate neighborhood poverty from other neighborhood attributes associated with poverty (e.g., supermarket quality, crime rates), so these poverty-based estimates should be interpreted accordingly (as opposed to an alternative "instrumental variables" approach to attempt to isolate the direct effect of neighborhood poverty while controlling for the variation in all of the neighborhood poverty attributes associated with poverty).

The neighborhood poverty rate was defined as the mean actual neighborhood poverty exposure in the time since randomization, where that annual neighborhood poverty rate was based on the proportion of households in a Census tract with total family income below the federal poverty line, and the duration weights were based on the amount of time a given person's household resides in each Census tract. Data on annual, person-level poverty rates from 1994-2009 for MTO participants were provided by the National Bureau of Economic Research.

The first-stage model for these poverty-based estimates used an OLS regression with mean duration-weighted rate of families in the census tract with income above the poverty from years 1 through 3 since randomization as the dependent variable and baseline characteristics and sites as controls. The rationale for examining the percent of families above the poverty line was so that the subsequent analyses for hospital use could be interpreted as a ten-percentage-point decrease in neighborhood poverty and thus consistent with the direction of the voucher intervention to reduce poverty. (The second-stage model examined hospital use from year 4 onward.) The indicator variables for the voucher groups (i.e., low-poverty voucher group relative to the control group, traditional Section 8 voucher group relative to the control group) and interaction terms between the voucher groups and site were the key identifying independent variables in the first-stage predicted-poverty regression. Like the prior MTO studies, an interaction between the voucher study group and the different MTO sites was included in the first-stage model, as the subsequent change in poverty associated with receipt of the voucher varied significantly across sites.

eAppendix Table D2 presents the results for the first-stage neighborhood poverty regressions; these regression results for adults and children are shown separately. eAppendix Figure D1 shows the mean neighborhood poverty rates over the entire time period for the control group, low-poverty voucher group, and

Section 8 voucher group. eAppendix Figure D2 shows the mean neighborhood poverty rates from years 1 through 3 since randomization by MTO site and study group. The mean neighborhood poverty rate during the first three years after randomization was 37% for the voucher groups compared to 47% for the control group for the adult sample. There is much variation in neighborhood poverty within the study groups. Of note, only 14.1% of adults and 13.5% of children at the time of randomization in the voucher groups had a mean neighborhood poverty exposure of less than 20% during years 1 through 3 since randomization. The corresponding rates among the control group were 2.4% and 3.0% among adults and children respectively.

D.5. Treatment-on-Treated (TOT) Methodology

The main analyses used an indicator for being assigned to either of the voucher groups relative to the control group, and the magnitude of those results can therefore be interpreted as an "Intention-to-Treat" (ITT) estimate. Because not everyone who was eligible for the vouchers used them, analogous "Treatment-on-Treated" (TOT) estimates were also produced to present an alternative magnitude for the association of the housing voucher intervention with hospital use. Following the approach of prior MTO studies, a two-stage model was estimated in which the first stage was a linear probability model for take-up of either voucher and the second stage for hospital use includes predicted take-up of either voucher as the key independent variable (instead of the main ITT approach's indicator for receipt of either voucher).[9] The primary analyses combined the experimental low-poverty voucher with the traditional Section 8 voucher, so this first-stage linear probability model predicted the take-up of either voucher. Separate indicators for the experimental low-poverty voucher and the traditional Section 8 voucher were included as the key predictor variables in the first-stage model, along with interactions between these two vouchers and the different MTO sites (as take-up of the vouchers varied across the sites). The covariates in the first stage model included the full set of person-level baseline demographics. eAppendix Table D3 presents the results for the first-stage take-up equation; take-up for adults and children are shown separately.

Sensitivity analyses (described in eAppendix F) separately examined the association of the experimental low-poverty voucher intervention with hospital use and the association of the traditional Section 8 voucher intervention with hospital use. For these TOT estimates of these analyses considering the voucher groups separately, the first-stage regression was limited to a subsample of the applicable voucher group and control group combined (excluding the non-applicable voucher group subsample) and included the applicable voucher indicator and the MTO site indicators alone with no interaction between the two.

eAppendix Table D1. Person-Years of Observations Across Time Periods and States

	Early: 1 to 7 YSR*	Middle: 8 to 12 YSR*		Late: 13 to 21 YSR*	Total
Adults†					
NY all-payer person-years	7,429	5,233		6,961	19,623
CA all-payer person-years	6,407	4,543		5,623	16,573
MA all-payer person-years	231	4,064		5,668	9,963
IL Medicaid person-years	2,797	2,199		322	5,318
MD Medicaid person-years	1,321	1,280		491	3,092
Total adult person-years	18,185	17,319		19,065	54,569
Children					
NY all-payer person-years	14,128	10,069		13,563	37,760
CA all-payer person-years	14,684	10,433		13,261	38,378
MA all-payer person-years	396	8,150		11,826	20,372
IL Medicaid person-years	8,350	6,412		881	15,643
MD Medicaid person-years	4,169	4,324		1,482	9,975
Total child person-years	41,727	39,388		41,013	122,128

* YSR=Years Since Randomization
† Adult age ≥18 at randomization; children <18 at randomization

eAppendix Table D2. Poverty-Based Model's First-Stage Results for Predicting the Percent of Families With Income Above the Poverty Line

	Adults (Age ≥18 at Randomization)		Children (Age <18 at Randomization)	
	OLS Estimate† (95% CI)	P Value	OLS Estimate† (95% CI)	P Value
Low Poverty Voucher	1.11 (0.78, 1.45)	<0.001	1.10 (0.78, 1.42)	<0.001
Section 8 Voucher	1.22 (0.88, 1.57)	<0.001	1.56 (1.24, 1.88)	<0.001
MD	1.20 (0.84, 1.56)	<0.001	1.67 (1.33, 2.01)	<0.001
MA	2.21 (1.94, 2.48)	<0.001	2.46 (2.20, 2.73)	<0.001
CA	1.04 (0.75, 1.34)	<0.001	1.29 (0.99, 1.58)	<0.001
NY	1.39 (1.13, 1.66)	<0.001	1.66 (1.40, 1.92)	<0.001
LPV x MD	0.29 (-0.19, 0.77)	0.24	0.09 (-0.36, 0.55)	0.69
LPV x MA	-0.22 (-0.59, 0.15)	0.24	-0.30 (-0.67, 0.07)	0.11
LPV x CA	0.35 (-0.065, 0.77)	0.10	0.44 (0.02, 0.86)	0.04
LPV x NY	-0.01 (-0.39, 0.36)	0.94	0.05 (-0.33, 0.42)	0.81
Sec. 8 x MD	-0.05 (-0.54, 0.44)	0.85	-0.67 (-1.13, -0.22)	0.00
Sec. 8 x MA	-0.54 (-0.92, -0.16)	0.01	-0.88 (-1.25, -0.51)	<0.001
Sec. 8 x CA	0.20 (-0.20, 0.60)	0.32	-0.06 (-0.46, 0.34)	0.76
Sec. 8 x NY	-0.78 (-1.15, -0.40)	<0.001	-1.1 (-1.46, -0.74)	<0.001
Age	-0.01 (-0.02, -0.009)	<0.001	-0.01 (-0.02, -0.003)	0.01
Never Married	-0.09 (-0.19, 0.011)	0.08	-0.09 (-0.20, 0.02)	0.12
GED certificate	0.06 (-0.06, 0.18)	0.36	0.004 (-0.14, 0.15)	0.95
High-school diploma	0.12 (0.02, 0.22)	0.03	0.10 (-0.02, 0.21)	0.09
Enrolled in school	0.16 (0.04, 0.28)	0.01	0.15 (0.02, 0.28)	0.03
Employed	0.11 (0.007, 0.21)	0.04	0.1 (-0.02, 0.22)	0.09
Hispanic	0.14 (-0.02, 0.30)	0.08	0.15 (-0.02, 0.32)	0.08
Black	-0.12 (-0.32, 0.08)	0.24	-0.08 (-0.30, 0.14)	0.47
Other Race	-0.15 (-0.32, 0.02)	0.09	-0.08 (-0.27, 0.10)	0.37
Age<18 at first childbirth	-0.07 (-0.18, 0.04)	0.23	0.02 (-0.11, 0.14)	0.80
Female	-0.16 (-0.47, 0.15)	0.31	0.01 (-0.05, 0.07)	0.70
Randomized in 1994	-0.03 (-0.18, 0.12)	0.70	-0.001 (-0.16, 0.16)	0.99
Randomized in 1995	0.02 (-0.09, 0.13)	0.76	0.02 (-0.11, 0.14)	0.82
Randomized in 1997	-0.16 (-0.28, -0.04)	0.01	-0.22 (-0.36, -0.07)	0.00
Randomized in 1998	-0.5 (-0.74, -0.26)	<0.001	-0.58 (-0.87, -0.30)	<0.001

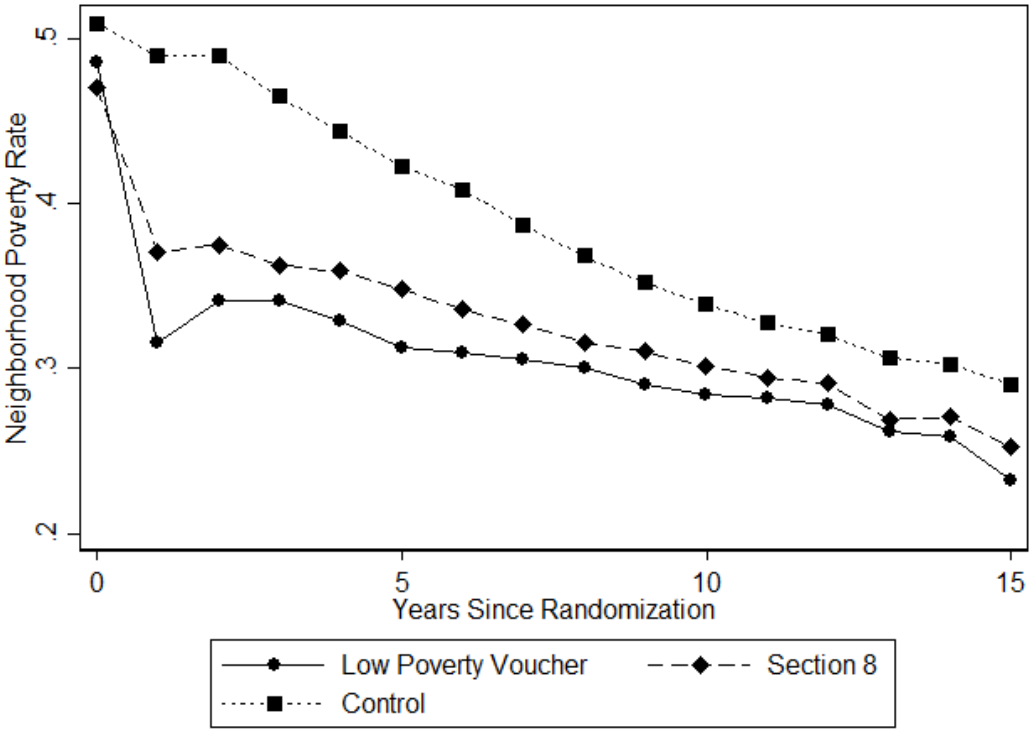
† The OLS estimates for the poverty-based model's first stage results used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL). The two samples had 4,072 adults and 9,118 children, respectively. The dependent variable in this first-stage regression was the mean duration-weighted rate of families in the census tract with incomes above the poverty line during the first three years since randomization, (ranging from 0 to 100) divided by 10, so that the coefficients in the second-stage models for utilization/spending could be interpreted as the association of a 10 percentage point decrease in mean duration-weighted neighborhood poverty exposure on hospital use. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

eAppendix Table D3. Treatment-on-Treated (TOT) Model's First-Stage Results for Voucher Take-Up

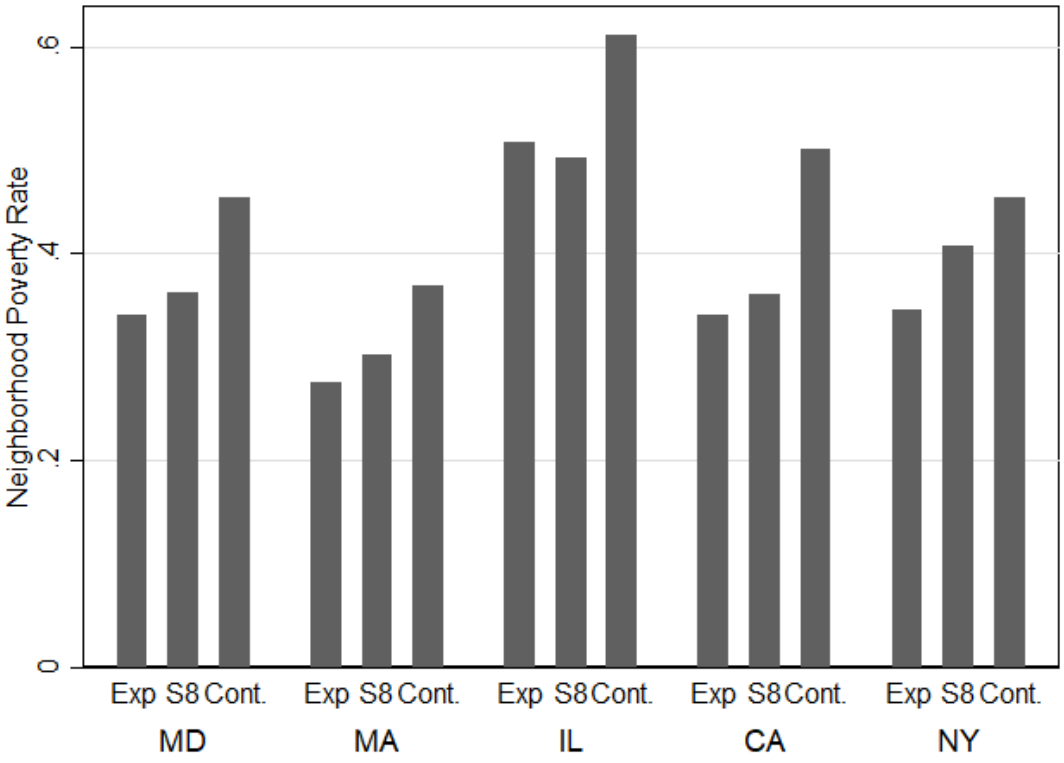
	Adults (Age ≥18 at Randomization)		Children (Age <18 at Randomization)	
	OLS Estimate† (95% CI)	**P Value**	**OLS Estimate† (95% CI)**	**P Value**
Low Poverty Voucher	0.38 (0.32, 0.44)	<0.001	0.33 (0.28, 0.39)	<0.001
Section 8 Voucher	0.73 (0.65, 0.80)	<0.001	0.72 (0.64, 0.79)	<0.001
MD	-0.020 (-0.058, 0.018)	0.30	-0.032 (-0.07, 0.003)	0.08
MA	0.04 (0.013, 0.067)	0.00	0.03 (0.002, 0.059)	0.038
CA	0.087 (0.059, 0.11)	<0.001	0.08 (0.051, 0.11)	<0.001
NY	0.048 (0.025, 0.071)	<0.001	0.044 (0.021, 0.067)	<0.001
LPV x MD	0.19 (0.086, 0.29)	<0.001	0.21 (0.11, 0.32)	<0.001
LPV x MA	0.066 (-0.014, 0.15)	0.11	0.055 (-0.028, 0.14)	0.19
LPV x CA	0.22 (0.14, 0.30)	<0.001	0.28 (0.20, 0.36)	<0.001
LPV x NY	0.094 (0.019, 0.17)	0.015	0.13 (0.050, 0.22)	0.0016
Sec. 8 x MD	0.071 (-0.041, 0.18)	0.21	0.064 (-0.044, 0.17)	0.25
Sec. 8 x MA	-0.21 (-0.31, -0.11)	<0.001	-0.18 (-0.28, -0.073)	<0.001
Sec. 8 x CA	0.057 (-0.035, 0.15)	0.23	0.067 (-0.029, 0.16)	0.17
Sec. 8 x NY	-0.25 (-0.35, -0.16)	<0.001	-0.25 (-0.35, -0.15)	<0.001
Age	-0.007 (-0.009, -0.006)	<0.001	-0.007 (-0.009, -0.004)	<0.001
Never Married	-0.010 (-0.043, 0.023)	0.54	0.014 (-0.020, 0.049)	0.42
GED certificate	0.037 (-0.003, 0.076)	0.07	0.04 (-0.005, 0.085)	0.08
High-school diploma	0.013 (-0.019, 0.045)	0.43	0.017 (-0.018, 0.051)	0.34
Enrolled in school	0.058 (0.021, 0.095)	0.002	0.051 (0.011, 0.091)	0.01
Employed	0.019 (-0.014, 0.052)	0.26	0.009 (-0.027, 0.044)	0.64
Hispanic	-0.035 (-0.087, 0.017)	0.19	-0.023 (-0.082, 0.036)	0.45
Black	-0.0005 (-0.064, 0.063)	0.99	0.021 (-0.050, 0.092)	0.56
Other Race	-0.029 (-0.085, 0.028)	0.32	-0.011 (-0.073, 0.051)	0.73
Age<18 at first childbirth	-0.007 (-0.040, 0.028)	0.71	0.018 (-0.018, 0.053)	0.33
Female	0.029 (-0.061, 0.12)	0.53	0.004 (-0.014, 0.023)	0.64
Randomized in 1994	0.075 (0.014, 0.14)	0.02	0.096 (0.033, 0.16)	0.003
Randomized in 1995	0.008 (-0.030, 0.046)	0.69	0.007 (-0.035, 0.048)	0.76
Randomized in 1997	0.017 (-0.021, 0.056)	0.38	0.003 (-0.039, 0.046)	0.88
Randomized in 1998	-0.09 (-0.15, -0.029)	0.004	-0.1 (-0.17, -0.029)	0.006
Constant	0.16 (0.029, 0.30)	0.02	-0.03 (-0.11, 0.052)	0.46

† The OLS estimates for the TOT first-stage results used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL). The two samples had 4,072 adults and 9,118 children, respectively. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

eAppendix Figure D1. Yearly Neighborhood Poverty Rates Over Time by Study Group



eAppendix Figure D2. Mean Poverty Rates by Site and Study Group in the 1 to 3 Years Since Randomization



eAppendix E. Additional Results: Primary/Secondary Analyses

eAppendix E presents additional results from the analyses of the primary outcomes (i.e., hospitalizations, inpatient days, and hospital spending) and the secondary outcomes (i.e., these three hospital outcomes when classified as either admitted via ED vs. not admitted via ED and pregnancy-related vs. non-pregnancy-related) with the voucher study groups combined and all five states combined. (eAppendix F below presents the results from models with the voucher study groups separated and with the all-payer and Medicaid data separated, as well as other sensitivity analyses.)

eAppendix Figures E1 and E2 show the annual rate of hospital days and mean hospital spending, respectively. These are analogous to the main paper's Figure 1 for hospitalizations. eAppendix Figure E3 shows the annual rates of hospitalizations for younger versus older children, and eAppendix Figure E4 shows the annual rate of hospitalizations for girls versus boys.

The full set of regression coefficients from the model for the number of hospitalizations per year is presented first (eAppendix Table E1). This is the underlying regression for the results shown in the main paper's Table 2. A table showing the results for whether the association of the housing voucher intervention and hospital use for children varied for younger versus older children and for boys versus girls (based on including an interaction term between the voucher group and the subgroup) is presented next (eAppendix Table E2). A table showing the results for whether the association of the housing voucher intervention and hospital use varied over time is then presented next (eAppendix Table E3).

Next, the main results, the TOT model's results, and the poverty-based model's results are presented for the primary and secondary hospital use outcomes for adults and all children (eAppendix Table E4), for younger children and older children (eAppendix Table E5), and for boys and girls (eAppendix Table E6). The main results shown in the first column for hospitalizations (in these eAppendix Tables E4, E5, and E6) are the same as those shown in the main paper's Figure 2. The forest plot results for hospital days and for hospital spending are shown in eAppendix Figure E5 and eAppendix Figure E6, respectively. These are analogous to the main paper's Figure 2 for hospitalizations.

Finally, for descriptive purposes, the distribution of the Major Diagnostic Categories for hospitalizations are shown separately by study group, for adults and children (eAppendix Table E7 and eAppendix Table E8). Also for descriptive purposes, the payer for hospitalizations found in the all-payer data sets is shown, separately by state (eAppendix Table E9).

eAppendix Table E1. Full Regression Results for the Association of a Housing Voucher With Hospitalizations

	Adults (Age ≥18 at Randomization)*		Children (Age <18 at Randomization)*	
	Estimate† (95% CI)	P Value	Estimate† (95% CI)	P Value
Voucher Groups vs. Controls	0.95 (0.84, 1.08)	0.45	0.85 (0.73, 0.99)	0.03
MD	2.19 (1.50, 3.18)	<0.001	1.49 (1.20, 1.85)	<0.001
MA	0.85 (0.67, 1.07)	0.17	0.65 (0.52, 0.82)	<0.001
CA	0.73 (0.59, 0.91)	0.004	0.49 (0.40, 0.61)	<0.001
NY	0.81 (0.66, 1.00)	0.05	0.43 (0.36, 0.52)	<0.001
Age	1.02 (1.01, 1.03)	<0.001	1.10 (1.09, 1.11)	<0.001
Never Married	1.12 (0.97, 1.29)	0.13	0.98 (0.85, 1.12)	0.78
GED certificate	0.86 (0.73, 1.01)	0.06	0.91 (0.80, 1.05)	0.20
High-school diploma	0.96 (0.84, 1.10)	0.56	0.91 (0.78, 1.07)	0.27
Enrolled in school	0.98 (0.84, 1.13)	0.75	0.89 (0.78, 1.02)	0.08
Employed	0.76 (0.65, 0.88)	<0.001	0.89 (0.78, 1.02)	0.10
Hispanic	0.76 (0.62, 0.94)	0.01	1.23 (0.98, 1.55)	0.08
Black	0.89 (0.67, 1.20)	0.46	1.06 (0.78, 1.43)	0.71
Other Race	0.78 (0.62, 0.99)	0.04	0.81 (0.65, 1.01)	0.07
Age<18 at first childbirth	1.11 (0.96, 1.29)	0.15	1.01 (0.91, 1.12)	0.90
Female	1.12 (0.75, 1.69)	0.57	2.74 (2.40, 3.14)	<0.001
Randomized in 1994	1.00 (0.75, 1.32)	0.98	0.83 (0.69, 0.99)	0.04
Randomized in 1995	0.92 (0.78, 1.07)	0.27	1.15 (0.95, 1.40)	0.16
Randomized in 1997	1.04 (0.89, 1.22)	0.59	1.05 (0.92, 1.19)	0.46
Randomized in 1998	0.98 (0.74, 1.30)	0.89	0.97 (0.79, 1.19)	0.75
Year 1995	0.91 (0.36, 2.34)	0.85	3.21 (1.14, 9.01)	0.03
Year 1996	1.54 (1.15, 2.06)	0.004	1.53 (1.03, 2.27)	0.03
Year 1997	1.28 (0.98, 1.66)	0.07	1.42 (1.02, 1.97)	0.04
Year 1998	0.98 (0.79, 1.23)	0.89	0.95 (0.70, 1.28)	0.73
Year 1999	1.20 (0.98, 1.46)	0.08	0.94 (0.77, 1.15)	0.57
Year 2000	1.14 (0.94, 1.38)	0.17	1.02 (0.85, 1.22)	0.86
Year 2001	1.2 (1.00, 1.45)	0.05	0.98 (0.83, 1.17)	0.84
Year 2002	1.11 (0.90, 1.36)	0.33	1.03 (0.87, 1.22)	0.74
Year 2003	1.09 (0.91, 1.31)	0.36	1.02 (0.87, 1.20)	0.78
Year 2004	1.06 (0.89, 1.25)	0.51	1.01 (0.88, 1.17)	0.88
Year 2005	0.89 (0.76, 1.05)	0.17	0.93 (0.81, 1.07)	0.32
Year 2007	1.05 (0.91, 1.23)	0.50	1.03 (0.91, 1.18)	0.61
Year 2008	0.99 (0.84, 1.16)	0.87	0.90 (0.78, 1.03)	0.11
Year 2009	0.95 (0.81, 1.12)	0.55	0.95 (0.83, 1.08)	0.42
Year 2010	0.97 (0.81, 1.15)	0.70	0.88 (0.75, 1.04)	0.13
Year 2011	0.99 (0.82, 1.19)	0.89	0.78 (0.66, 0.92)	0.004
Year 2012	0.91 (0.75, 1.10)	0.31	0.72 (0.61, 0.85)	<0.001
Year 2013	0.79 (0.65, 0.96)	0.02	0.60 (0.50, 0.72)	<0.001
Year 2014	0.76 (0.63, 0.92)	0.005	0.52 (0.44, 0.62)	<0.001
Year 2015	0.80 (0.64, 0.99)	0.04	0.44 (0.36, 0.55)	<0.001
Any Medicaid MCO Enrollment	0.54 (0.42, 0.70)	<0.001	0.65 (0.56, 0.76)	<0.001
Partial Year Medicaid Enrollment	1.14 (0.90, 1.45)	0.29	1.51 (1.30, 1.75)	<0.001

* Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL) and combined the low-poverty and Section 8 voucher groups. The adult sample had a total of 54,569 person-year observations, and the child sample had a total of 122,128 person-year observations. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

eAppendix Table E2. Differential Associations of a Housing Voucher With Hospital Use for Children Subgroups: Full Five-State Sample

Children (Age <18 at Randomization)*		
Study Group Interacted with Older/Younger^	**Estimate† (95% CI)**	**P Value**
Hospitalizations		
Voucher indicator	0.98 (0.81, 1.18)	0.83
Younger indicator	1.60 (1.24, 2.06)	<0.001
Voucher*Younger interaction	0.85 (0.66, 1.09)	0.19
Inpatient Days		
Voucher indicator	1.17 (0.79, 1.72)	0.43
Younger indicator	1.27 (0.85, 1.88)	0.24
Voucher*Younger interaction	0.74 (0.48, 1.15)	0.18
Hospital Spending		
Voucher indicator	$80 (-122, 281)	0.40
Younger indicator	$303 (64, 542)	0.01
Voucher*Younger interaction	-$299 (-544, -53)	0.02
Study Group Interacted with Boys/Girls^	**Estimate† (95% CI)**	**P Value**
Hospitalizations		
Voucher indicator	0.82 (0.62, 1.11)	0.20
Girl indicator	2.65 (2.11, 3.33)	<0.001
Voucher*Girl interaction	1.05 (0.79, 1.40)	0.72
Inpatient Days		
Voucher indicator	1.04 (0.76, 1.43)	0.79
Girl indicator	1.76 (1.34, 2.31)	<0.001
Voucher*Girl interaction	0.80 (0.56, 1.14)	0.22
Hospital Spending		
Voucher indicator	-$18 (-225, 190)	0.87
Girl indicator	$415 (219, 610)	<0.001
Voucher*Girl interaction	-$162 (-411, 86)	0.20

* Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL). The child sample had a total of 122,128 person-year observations.
† Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates described in the text. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.
^ These models tested for whether an interaction between the housing voucher group and the relevant subgroup indicator (i.e., older vs. younger children and boys vs. girls) was significant.

eAppendix Table E3. Differential Associations of a Housing Voucher With Hospital Use Over Time

	Adults (Age ≥18 at Randomization)*		Children (Age <18 at Randomization)*	
Study Group Interacted with Time as a Continuous Variable^	**Estimate† (95% CI)**	**P value**	**Estimate† (95% CI)**	**P value**
Hospitalizations				
Voucher indicator	0.88 (0.72, 1.08)	0.23	0.96 (0.79, 1.17)	0.70
Time variable (continuous)	0.97 (0.96, 0.99)	0.001	0.97 (0.95, 0.99)	0.001
Voucher*Time interaction	1.01 (0.99, 1.03)	0.44	0.99 (0.97, 1.01)	0.31
Inpatient Days				
Voucher indicator	0.85 (0.64, 1.12)	0.25	1.19 (0.83, 1.71)	0.35
Time variable (continuous)	0.96 (0.93, 0.98)	0.001	0.97 (0.94, 1.00)	0.03
Voucher*Time interaction	1.01 (0.98, 1.04)	0.50	0.98 (0.95, 1.01)	0.12
Hospital Spending				
Voucher indicator	-$96 (-753, 562)	0.78	$25 (-233, 283)	0.85
Time variable (continuous)	-$103 (-164, -41)	0.001	-$31 (-52, -11)	0.003
Voucher*Time interaction	$3 (-59, 64)	0.93	-$16 (-37, 6)	0.16
Study Group Interacted with Time as a Categorical Variable‡	**Estimate† (95% CI)**	**P value**	**Estimate† (95% CI)**	**P value**
Hospitalizations				
Voucher indicator	0.90 (0.77, 1.05)	0.17	0.93 (0.78, 1.09)	0.36
Time indicator (8-12 years)	0.83 (0.70, 0.98)	0.03	1.04 (0.88, 1.23)	0.64
Time indicator (12-21 years)	0.74 (0.60, 0.91)	0.004	0.81 (0.64, 1.02)	0.07
Voucher*Time (8-12) Interaction	1.09 (0.90, 1.33)	0.38	0.90 (0.73, 1.10)	0.31
Voucher*Time (13-21) Interaction	1.10 (0.87, 1.38)	0.44	0.90 (0.68, 1.17)	0.43
Inpatient Days				
Voucher indicator	0.90 (0.71, 1.13)	0.35	1.11 (0.83, 1.47)	0.48
Time indicator (8-12 years)	0.80 (0.61, 1.06)	0.12	1.03 (0.79, 1.36)	0.81
Time indicator (12-21 years)	0.58 (0.42, 0.81)	0.001	0.81 (0.58, 1.13)	0.22
Voucher*Time (8-12) Interaction	0.98 (0.72, 1.33)	0.91	0.83 (0.60, 1.16)	0.27
Voucher*Time (13-21) Interaction	1.15 (0.82, 1.62)	0.41	0.73 (0.51, 1.05)	0.09
Hospital Spending				
Voucher indicator	$49 (-453, 551)	0.85	-$81 (-283, 122)	0.43
Time indicator (8-12 years)	-$467 (-1,097, 163)	0.15	-$76 (-295, 143)	0.5
Time indicator (12-21 years)	-$1,200 (-1,948, -452)	0.002	-$300 (-535, -65)	0.01
Voucher*Time (8-12) Interaction	-$306 (-1,055, 443)	0.42	-$27 (-286, 232)	0.84
Voucher*Time (13-21) Interaction	-$102 (-866, 663)	0.79	-$139 (-393, 116)	0.29

* Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL) and combined the low-poverty and Section 8 voucher groups. The adult sample had a total of 54,569 person-year observations, and the child sample had a total of 122,128 person-year observations. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects.

† Estimates compare hospital use for everyone assigned to the voucher groups with hospital use for everyone assigned to the control group, with adjustments made for the set of baseline covariates described in the text and a study group by time interaction term. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

^ Time was modeled here as a continuous variable as years since randomization. The estimate represents the ratio of the mean association of the housing voucher intervention with hospital use for an additional year since randomization.

‡ Time was modeled here as a set of categorical variables defined as 1-7, 8-12, and 13-21 years since randomization. One estimate represents the ratio of the association of the voucher in years 8-12 versus years 1-7 since randomization, and the other estimate represents the ratio of the association of the voucher in years 13-21 versus years 1-7 since randomization.

eAppendix Table E4. Main, TOT, and Poverty-Based Results for Primary and Secondary Hospital Use Outcomes: Adults and Children in Full Five-State Sample

	Estimate† (95% CI)	P Value	TOT Estimate‡ (95% CI)	P Value	Poverty Estimate+ (95% CI)	P Value
Adults*						
Hospitalizations	0.95 (0.84, 1.08)	0.45	0.89 (0.72, 1.10)	0.29	0.95 (0.85, 1.08)	0.45
Inpatient Days	0.93 (0.77, 1.13)	0.46	0.87 (0.64, 1.18)	0.38	0.94 (0.80, 1.11)	0.46
Hospital Spending	-$129 (-497, 239)	0.49	-$230 (-898, 438)	0.49	-$68 (-424, 288)	0.71
Admitted via ED						
Hospitalizations	0.90 (0.76, 1.07)	0.24	0.90 (0.67, 1.21)	0.49	0.93 (0.80, 1.08)	0.31
Inpatient Days	0.81 (0.65, 1.02)	0.07	0.73 (0.50, 1.07)	0.10	0.88 (0.74, 1.08)	0.22
Hospital Spending	-$118 (-328, 93)	0.27	-$181 (-572, 209)	0.36	-$85 (-300, 131)	0.44
Not Admitted via ED						
Hospitalizations	0.97 (0.84, 1.12)	0.69	0.86 (0.68, 1.08)	0.20	0.97 (0.85, 1.10)	0.64
Inpatient Days	1.01 (0.81, 1.25)	0.94	1.00 (0.71, 1.40)	0.99	1.00 (0.83, 1.19)	0.97
Hospital Spending	$40 (-169, 250)	0.71	$97 (-314, 507)	0.65	$99 (-99, 297)	0.33
Pregnancy^						
Hospitalizations	0.93 (0.80, 1.09)	0.39	0.91 (0.69, 1.20)	0.50	0.98 (0.84, 1.15)	0.83
Inpatient Days	0.94 (0.77, 1.16)	0.57	0.93 (0.63, 1.36)	0.70	1.01 (0.83, 1.23)	0.93
Hospital Spending	-$36 (-86, 15)	0.17	-$15 (-115, 85)	0.77	-$9 (-55, 37)	0.72
Non-Pregnancy						
Hospitalizations	0.94 (0.81, 1.10)	0.47	0.91 (0.69, 1.20)	0.50	0.94 (0.82, 1.09)	0.40
Inpatient Days	0.90 (0.71, 1.13)	0.35	0.84 (0.56, 1.26)	0.40	0.91 (0.75, 1.10)	0.30
Hospital Spending	-$81 (-461, 300)	0.68	-$17 (-723, 689)	0.96	-$62 (-423, 299)	0.74
Children*						
Hospitalizations	0.85 (0.73, 0.99)	0.03	0.76 (0.61, 0.94)	0.01	0.88 (0.80, 0.99)	0.03
Inpatient Days	0.92 (0.77, 1.11)	0.41	0.83 (0.61, 1.12)	0.21	0.93 (0.79, 1.10)	0.41
Hospital Spending	-$143 (-256, -31)	0.01	-$252 (-454, -50)	0.01	-$133 (-237, -28)	0.01
Admitted via ED						
Hospitalizations	0.78 (0.62, 0.97)	0.02	0.68 (0.49, 0.95)	0.03	0.87 (0.74, 1.02)	0.09
Inpatient Days	0.79 (0.62, 1.00)	0.05	0.67 (0.46, 0.98)	0.04	0.93 (0.77, 1.12)	0.47
Hospital Spending	-$101 (-171, -31)	0.01	-$178 (-309, -47)	0.01	-$76 (-142, -11)	0.02
Not Admitted via ED						
Hospitalizations	0.90 (0.81, 1.00)	0.04	0.79 (0.67, 0.94)	0.01	0.89 (0.83, 0.97)	0.01
Inpatient Days	0.97 (0.79, 1.20)	0.80	0.88 (0.62, 1.25)	0.49	0.93 (0.77, 1.14)	0.48
Hospital Spending	-$66 (-128, -4)	0.04	-$123 (-232, -14)	0.03	-$76 (-133, -18)	0.01
Pregnancy^						
Hospitalizations	0.91 (0.84, 1.00)	0.05	0.88 (0.75, 1.03)	0.11	0.92 (0.85, 0.98)	0.02
Inpatient Days	0.85 (0.76, 0.96)	0.01	0.81 (0.66, 0.99)	0.04	0.86 (0.79, 0.94)	0.001
Hospital Spending	-$94 (-170, -18)	0.02	-$128 (-263, 7)	0.06	-$88 (-165, -11)	0.03
Non-Pregnancy						
Hospitalizations	0.82 (0.67, 1.02)	0.07	0.69 (0.48, 0.98)	0.04	0.88 (0.75, 1.03)	0.12
Inpatient Days	0.92 (0.72, 1.18)	0.51	0.81 (0.52, 1.25)	0.33	0.93 (0.76, 1.16)	0.55
Hospital Spending	-$128 (-242, -13)	0.03	-$230 (-442, -19)	0.03	-$111 (-218, -4)	0.04

eAppendix Table E4. Main, TOT, and Poverty-Based Results for Primary and Secondary Hospital Use Outcomes: Adults and Children in Full Five-State Sample (Continued)

* Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL) and combined the low-poverty and Section 8 voucher groups. The adult sample had a total of 54,569 person-year observations and the child sample had a total of 122,128 person-year observations. All models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects.
† Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates described in the text.
‡ Treatment on the treated (TOT) results were estimated by predicting MTO voucher take-up as a function of study group indicators (separate indicators for the low-poverty and traditional vouchers), interactions between the study groups and sites, and the baseline covariates in the first stage and then modeling each outcome as a function of predicted voucher take-up in the second stage.
+ These models used predicted reductions in neighborhood poverty as the key explanatory variable for hospital utilization/spending in a two-stage model, with these estimates specifically showing the change in outcomes associated with a 10 percentage point decrease in predicted neighborhood poverty exposure (to be consistent with the housing voucher intervention's association with reductions in neighborhood poverty compared to the control group). The first-stage regression was an ordinary least squares model with the mean duration-weighted percent of households in the census tract with incomes above the poverty line as the dependent variable (so that differences in this first-stage outcome and subsequent predictions can be interpreted as a reduction in poverty), the study-group voucher indicators and the site and study-group voucher interactions as the main predictors, and the baseline characteristics and sites as controls. For the main analyses, the second-stage regression uses the predicted duration-weighted percent of families above the poverty line from years 1 through 3 since randomization as the key explanatory variable and hospital utilization/spending from years 4 through 21 since randomization as the dependent variable, adjusting for baseline covariates..
^ Pregnancy-related hospitalizations are only for female MTO participants.

eAppendix Table E5. Main, TOT, and Poverty-Based Results for Primary and Secondary Hospital Use Outcomes: Younger and Older Children in Full Five-State Sample

	Estimate† (95% CI)	P Value	TOT Estimate‡ (95% CI)	P Value	Poverty Estimate+ (95% CI)	P Value
Younger Children (Age <13 at Randomization)*						
Hospitalizations	0.82 (0.70, 0.98)	0.02	0.74 (0.58, 0.95)	0.02	0.88 (0.79, 1.00)	0.05
Inpatient Days	0.87 (0.71, 1.07)	0.18	0.78 (0.57, 1.08)	0.13	0.93 (0.79, 1.11)	0.45
Hospital Spending	-$196 (-307, -84)	<0.001	-$323 (-518, -128)	0.001	-$152 (-256, -49)	0.004
Admitted via ED						
Hospitalizations	0.71 (0.57, 0.90)	0.004	0.6 (0.42, 0.85)	0.004	0.82 (0.69, 0.97)	0.02
Inpatient Days	0.70 (0.55, 0.90)	0.005	0.6 (0.40, 0.89)	0.01	0.88 (0.72, 1.06)	0.20
Hospital Spending	-$132 (-205, -59)	<0.001	-$239 (-373, -106)	<0.001	-$96 (-164,-29)	0.01
Not Admitted via ED						
Hospitalizations	0.92 (0.82, 1.04)	0.17	0.86 (0.71, 1.04)	0.12	0.93 (0.85, 1.02)	0.14
Inpatient Days	0.94 (0.75, 1.18)	0.60	0.90 (0.63, 1.28)	0.56	0.95 (0.78, 1.16)	0.63
Hospital Spending	-$74 (-131, -17)	0.01	-$116 (-216, -15)	0.02	-$67 (-120, -14)	0.01
Pregnancy^						
Hospitalizations	0.93 (0.84, 1.03)	0.18	0.91 (0.76, 1.10)	0.32	0.92 (0.85, 1.00)	0.06
Inpatient Days	0.81 (0.71, 0.93)	0.003	0.73 (0.58, 0.93)	0.01	0.85 (0.76, 0.94)	0.003
Hospital Spending	-$98 (-169, -28)	0.01	-$156 (-281, -31)	0.01	-$91 (-162, -20)	0.01
Non-Pregnancy						
Hospitalizations	0.78 (0.63, 0.98)	0.03	0.63 (0.43, 0.92)	0.02	0.88 (0.75, 1.04)	0.15
Inpatient Days	0.83 (0.63, 1.09)	0.18	0.68 (0.42, 1.08)	0.10	0.94 (0.76, 1.18)	0.63
Hospital Spending	-$152 (-269, -36)	0.01	-$266 (-473, -59)	0.01	-$109 (-216, -2)	0.05
Older Children (Age 13-17 at Randomization)*						
Hospitalizations	0.97 (0.80, 1.18)	0.75	0.84 (0.59, 1.20)	0.34	0.90 (0.78, 1.05)	0.20
Inpatient Days	1.11 (0.77, 1.61)	0.58	1.06 (0.51, 2.19)	0.88	0.83 (0.61, 1.15)	0.27
Hospital Spending	$121 (-160, 401)	0.40	$262 (-335, 860)	0.39	-$23 (-287, 242)	0.87
Admitted via ED						
Hospitalizations	1.18 (0.87, 1.60)	0.28	1.23 (0.71, 2.11)	0.46	1.08 (0.85, 1.37)	0.53
Inpatient Days	1.24 (0.82, 1.85)	0.31	1.20 (0.54, 2.67)	0.66	0.99 (0.70, 1.41)	0.96
Hospital Spending	$105 (-44, 253)	0.17	$252 (-66, 569)	0.12	$81 (-56, 219)	0.25
Not Admitted via ED						
Hospitalizations	0.86 (0.72, 1.03)	0.10	0.68 (0.48, 0.96)	0.03	0.82 (0.70, 0.96)	0.02
Inpatient Days	1.04 (0.73, 1.49)	0.83	0.96 (0.47, 1.99)	0.92	0.81 (0.59, 1.12)	0.22
Hospital Spending	-$48 (-221, 124)	0.58	-$86 (-468, 295)	0.66	-$144 (-304, 16)	0.08
Pregnancy^						
Hospitalizations	0.92 (0.80, 1.06)	0.23	0.83 (0.62, 1.10)	0.19	0.94 (0.84, 1.06)	0.35
Inpatient Days	0.91 (0.78, 1.07)	0.25	0.86 (0.62, 1.19)	0.36	0.92 (0.81, 1.05)	0.21
Hospital Spending	-$40 (-250, 170)	0.71	$28 (-406, 462)	0.9	-$31 (-221, 159)	0.75
Non-Pregnancy						
Hospitalizations	1.05 (0.75, 1.48)	0.76	1.08 (0.57, 2.05)	0.81	0.85 (0.65, 1.12)	0.26
Inpatient Days	1.26 (0.79, 1.99)	0.33	1.64 (0.62, 4.33)	0.32	0.88 (0.60, 1.30)	0.52
Hospital Spending	$41 (-221, 303)	0.76	$129 (-432, 691)	0.65	-$49 (-308, 210)	0.71

eAppendix Table E5. Main, TOT, and Poverty-Based Results for Primary and Secondary Hospital Use Outcomes: Younger and Older Children in Full Five-State Sample (Continued)

* Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL) and combined the low-poverty and Section 8 voucher groups. The younger children sample had a total of 96,983 person-year observations and the older children sample had a total of 25,145 person-year observations. All models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects.
† Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates as described in the text.
‡ Treatment on the treated (TOT) results were estimated by predicting MTO voucher take-up as a function of study group indicators (separate indicators for the low-poverty and traditional vouchers), interactions between the study groups and sites, and the baseline covariates in the first stage and then modeling each outcome as a function of predicted voucher take-up in the second stage.
+ These models used predicted reductions in neighborhood poverty as the key explanatory variable for hospital utilization/spending in a two-stage model, with these estimates specifically showing the change in outcomes associated with a 10 percentage point decrease in predicted neighborhood poverty exposure (to be consistent with the housing voucher intervention's association with reductions in neighborhood poverty compared to the control group). The first-stage regression was an ordinary least squares model with the mean duration-weighted percent of households in the census tract with incomes above the poverty line as the dependent variable (so that differences in this first-stage outcome and subsequent predictions can be interpreted as a reduction in poverty), the study-group voucher indicators and the site and study-group voucher interactions as the main predictors, and the baseline characteristics and sites as controls. For the main analyses, the second-stage regression uses the predicted duration-weighted percent of families above the poverty line from years 1 through 3 since randomization as the key explanatory variable and hospital utilization/spending from years 4 through 21 since randomization as the dependent variable, adjusting for baseline covariates.
^ Pregnancy-related hospitalizations are only for female MTO participants.

eAppendix Table E6. Main, TOT, and Poverty-Based Results for Primary and Secondary Hospital Use Outcomes: Girls and Boys in Full Five-State Sample

	Estimate† (95% CI)	P Value	TOT Estimate‡ (95% CI)	P Value	Poverty Estimate+ (95% CI)	P Value
Girls*						
Hospitalizations	0.86 (0.75, 0.98)	0.03	0.79 (0.65, 0.96)	0.02	0.89 (0.81, 0.98)	0.02
Inpatient Days	0.84 (0.70, 1.01)	0.07	0.75 (0.56, 1.01)	0.06	0.88 (0.76, 1.01)	0.08
Hospital Spending	-$213 (-370, -56)	0.01	-$329 (-617, -40)	0.03	-$188 (-335, -42)	0.01
Admitted via ED						
Hospitalizations	0.76 (0.59, 0.96)	0.02	0.66 (0.45, 0.98)	0.04	0.85 (0.71, 1.03)	0.09
Inpatient Days	0.72 (0.55, 0.93)	0.01	0.61 (0.39, 0.94)	0.03	0.93 (0.76, 1.14)	0.47
Hospital Spending	-$87 (-175, 2)	0.06	-$111 (-284, 62)	0.21	-$46 (-130, 38)	0.28
Not Admitted via ED						
Hospitalizations	0.92 (0.83, 1.01)	0.07	0.85 (0.72, 0.99)	0.03	0.91 (0.84, 0.98)	0.01
Inpatient Days	0.91 (0.76, 1.09)	0.29	0.83 (0.62, 1.11)	0.21	0.85 (0.75, 0.98)	0.03
Hospital Spending	-$127 (-218, -37)	0.01	-$231 (-393, -69)	0.01	-$132 (-217, -47)	0.002
Pregnancy						
Hospitalizations	0.91 (0.84, 1.00)	0.05	0.88 (0.75, 1.03)	0.11	0.92 (0.85, 0.98)	0.02
Inpatient Days	0.85 (0.76, 0.96)	0.01	0.81 (0.66, 0.99)	0.04	0.86 (0.79, 0.94)	0.001
Hospital Spending	-$94 (-170, -18)	0.02	-$128 (-263, 7)	0.06	-$88 (-165, -11)	0.03
Non-Pregnancy						
Hospitalizations	0.80 (0.62, 1.02)	0.08	0.65 (0.42, 1.00)	0.05	0.86 (0.71, 1.05)	0.14
Inpatient Days	0.78 (0.58, 1.06)	0.11	0.61 (0.35, 1.06)	0.08	0.85 (0.67, 1.09)	0.20
Hospital Spending	-$159 (-295, -23)	0.02	-$252 (-500, -5)	0.05	-$142 (-271, -12)	0.03
Boys*^						
Hospitalizations	0.86 (0.67, 1.11)	0.24	0.74 (0.50, 1.09)	0.13	0.90 (0.74, 1.10)	0.30
Inpatient Days	1.02 (0.75, 1.38)	0.92	0.92 (0.54, 1.55)	0.75	1.00 (0.76, 1.30)	0.98
Hospital Spending	-$20 (-159, 118)	0.77	-$89 (-336, 158)	0.48	-$38 (-170, 94)	0.57
Admitted via ED						
Hospitalizations	0.81 (0.61, 1.08)	0.16	0.72 (0.46, 1.11)	0.14	0.88 (0.71, 1.11)	0.28
Inpatient Days	0.89 (0.64, 1.24)	0.49	0.79 (0.46, 1.37)	0.41	0.93 (0.70, 1.22)	0.60
Hospital Spending	-$92 (-182, -3)	0.04	-$216 (-385, -46)	0.01	-$105 (-194, -16)	0.02
Not Admitted via ED						
Hospitalizations	0.89 (0.67, 1.18)	0.42	0.69 (0.42, 1.13)	0.14	0.91 (0.70, 1.16)	0.45
Inpatient Days	1.09 (0.74, 1.61)	0.65	0.97 (0.48, 1.96)	0.94	1.08 (0.76, 1.52)	0.67
Hospital Spending	$50 (-32, 133)	0.23	$67 (-77, 211)	0.36	$33 (-44, 110)	0.40

eAppendix Table E6. Main, TOT, and Poverty-Based Results for Primary and Secondary Hospital Use Outcomes: Girls and Boys in Full Five-State Sample (Continued)

* Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL) and combined the low-poverty and Section 8 voucher groups. The boys sample had a total of 60,841 person-year observations and the girls sample had a total of 61,287 person-year observations. All models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects.
† Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates as described in the text.
‡ Treatment on the treated (TOT) results were estimated by predicting MTO voucher take-up as a function of study group indicators (separate indicators for the low-poverty and traditional vouchers), interactions between the study groups and sites, and the baseline covariates in the first stage and then modeling each outcome as a function of predicted voucher take-up in the second stage.
+ These models used predicted reductions in neighborhood poverty as the key explanatory variable for hospital utilization/spending in a two-stage model, with these estimates specifically showing the change in outcomes associated with a 10 percentage point decrease in predicted neighborhood poverty exposure (to be consistent with the housing voucher intervention's association with reductions in neighborhood poverty compared to the control group). The first-stage regression was an ordinary least squares model with the mean duration-weighted percent of households in the census tract with incomes above the poverty line as the dependent variable (so that differences in this first-stage outcome and subsequent predictions can be interpreted as a reduction in poverty), the study-group voucher indicators and the site and study-group voucher interactions as the main predictors, and the baseline characteristics and sites as controls. For the main analyses, the second-stage regression uses the predicted duration-weighted percent of families above the poverty line from years 1 through 3 since randomization as the key explanatory variable and hospital utilization/spending from years 4 through 21 since randomization as the dependent variable, adjusting for baseline covariates.
^ Pregnancy-related hospitalizations are only for female MTO participants.

eAppendix Table E7. Major Diagnostic Categories for Hospitalization Records for MTO Adults

	Adults (Age ≥18 at Randomization)		
	Control N†=2581	**Low-Poverty Voucher** N†=2858	**Traditional Voucher** N†=2373
Major Diagnostic Category – n (%)+			
01 Diseases and Disorders of Nervous System	117 (4.5)	127 (4.4)	144 (6.1)
02 Diseases and Disorders of the Eye	- *	- *	- *
03 Diseases and Disorders of Ear, Nose, Mouth and Throat	25 (1.0)	42 (1.5)	34 (1.4)
04 Diseases and Disorders of Respiratory System	240 (9.3)	299 (1.5)	224 (9.4)
05 Diseases and Disorders of Circulatory System	369 (14.3)	366 (12.8)	264 (11.1)
06 Diseases and Disorders of Digestive System	170 (6.6)	268 (9.4)	226 (9.5)
07 Diseases and Disorders of Hepatobiliary System and Pancreas	91 (3.5)	129 (4.5)	79 (3.3)
08 Diseases and Disorders of Musculoskeletal System and Connective Tissue	127 (4.9)	172 (6.0)	145 (6.1)
09 Diseases and Disorders of Skin, Subcutaneous Tissue and Breast	72 (2.8)	67 (2.3)	68 (2.9)
10 Diseases and Disorders of Endocrine, Nutritional and Metabolic System	122 (4.7)	136 (4.8)	109 (4.6)
11 Diseases and Disorders of Kidney and Urinary Tract	130 (5.0)	134 (4.7)	117 (4.9)
12 Diseases and Disorders of Male Reproductive System	- *	- *	- *
13 Diseases and Disorders of Female Reproductive System	153 (5.9)	140 (4.9)	128 (5.4)
14 Pregnancy, Childbirth and Puerperium	439 (17.0)	461 (16.1)	407 (17.2)
15 Newborn and Other Neonates (Perinatal Period)	- *	- *	- *
16 Diseases and Disorders of the Blood and Blood Forming Organs and Immunological Disorders	48 (1.9)	51 (1.8)	66 (2.8)
17 Myeloproliferative DDs (Poorly Differentiated Neoplasms)	- *	- *	- *
18 Infectious and Parasitic DDs (Systemic or Unspecified Sites)	51 (2.0)	85 (3.0)	52 (2.2)
19 Mental Diseases and Disorders	155 (6.0)	150 (5.3)	143 (6.0)
20 Alcohol/Drug Use or Induced Mental Disorders	135 (5.2)	38 (1.3)	37 (1.6)
21 Injuries, Poison and Toxic Effect of Drugs	28 (1.1)	60 (2.1)	33 (1.4)
22 Burns	- *	- *	- *
23 Factors Influencing Health Status and Other Contacts with Health Services	29 (1.1)	28 (1.0)	36 (1.5)
24 Multiple Significant Trauma	- *	- *	- *
25 Human Immunodeficiency Virus Infection	41 (1.6)	25 (0.9)	17 (0.7)
MDC Category Missing	20 (0.8)	38 (1.3)	20 (0.8)

+ Numbers and percentages are raw, unweighted estimates using all hospitalization records from adults (at randomization) in all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL).
† Number of hospitalizations
* Frequency and proportions suppressed from rows to protect confidentiality from small cell sizes (any cell size < 11 in a given row)

eAppendix Table E8. Major Diagnostic Categories for Hospitalization Records for MTO Children

	Children (Age <18 at Randomization)		
	Control N†=2859	Low-Poverty Voucher N†=3072	Traditional Voucher N†=2152
Major Diagnostic Category – N (%)+			
01 Diseases and Disorders of Nervous System	59 (2.1)	96 (3.1)	55 (2.6)
02 Diseases and Disorders of the Eye	- *	- *	- *
03 Diseases and Disorders of Ear, Nose, Mouth and Throat	42 (1.5)	49 (1.6)	29 (1.4)
04 Diseases and Disorders of Respiratory System	194 (6.8)	185 (6.0)	124 (5.8)
05 Diseases and Disorders of Circulatory System	44 (1.5)	57 (1.9)	30 (1.4)
06 Diseases and Disorders of Digestive System	138 (4.8)	120 (3.9)	95 (4.4)
07 Diseases and Disorders of Hepatobiliary System and Pancreas	29 (1.0)	71 (2.3)	41 (1.9)
08 Diseases and Disorders of Musculoskeletal System and Connective Tissue	75 (2.6)	102 (3.3)	73 (3.4)
09 Diseases and Disorders of Skin, Subcutaneous Tissue and Breast	86 (3.0)	68 (2.2)	61 (2.8)
10 Diseases and Disorders of Endocrine, Nutritional and Metabolic System	37 (1.3)	95 (3.1)	44 (2.0)
11 Diseases and Disorders of Kidney and Urinary Tract	53 (1.9)	54 (1.8)	33 (1.5)
12 Diseases and Disorders of Male Reproductive System	- *	- *	- *
13 Diseases and Disorders of Female Reproductive System	32 (1.1)	38 (1.2)	26 (1.2)
14 Pregnancy, Childbirth and Puerperium	1345 (47.0)	1518 (49.4)	1140 (53.0)
15 Newborn and Other Neonates (Perinatal Period)	- *	- *	- *
16 Diseases and Disorders of the Blood and Blood Forming Organs and Immunological Disorders	257 (9.0)	126 (4.1)	13 (0.6)
17 Myeloproliferative DDs (Poorly Differentiated Neoplasms)	- *	- *	- *
18 Infectious and Parasitic DDs (Systemic or Unspecified Sites)	35 (1.2)	26 (0.9)	19 (0.9)
19 Mental Diseases and Disorders	260 (9.1)	258 (8.4)	217 (10.1)
20 Alcohol/Drug Use or Induced Mental Disorders	28 (1.0)	25 (0.8)	24 (1.1)
21 Injuries, Poison and Toxic Effect of Drugs	31 (1.1)	37 (1.2)	38 (1.8)
22 Burns	- *	- *	- *
23 Factors Influencing Health Status and Other Contacts with Health Services	16 (0.6)	16 (0.5)	29 (1.4)
24 Multiple Significant Trauma	- *	- *	- *
25 Human Immunodeficiency Virus Infection	- *	- *	- *
MDC Category Missing	61 (2.1)	74 (2.4)	32 (1.5)

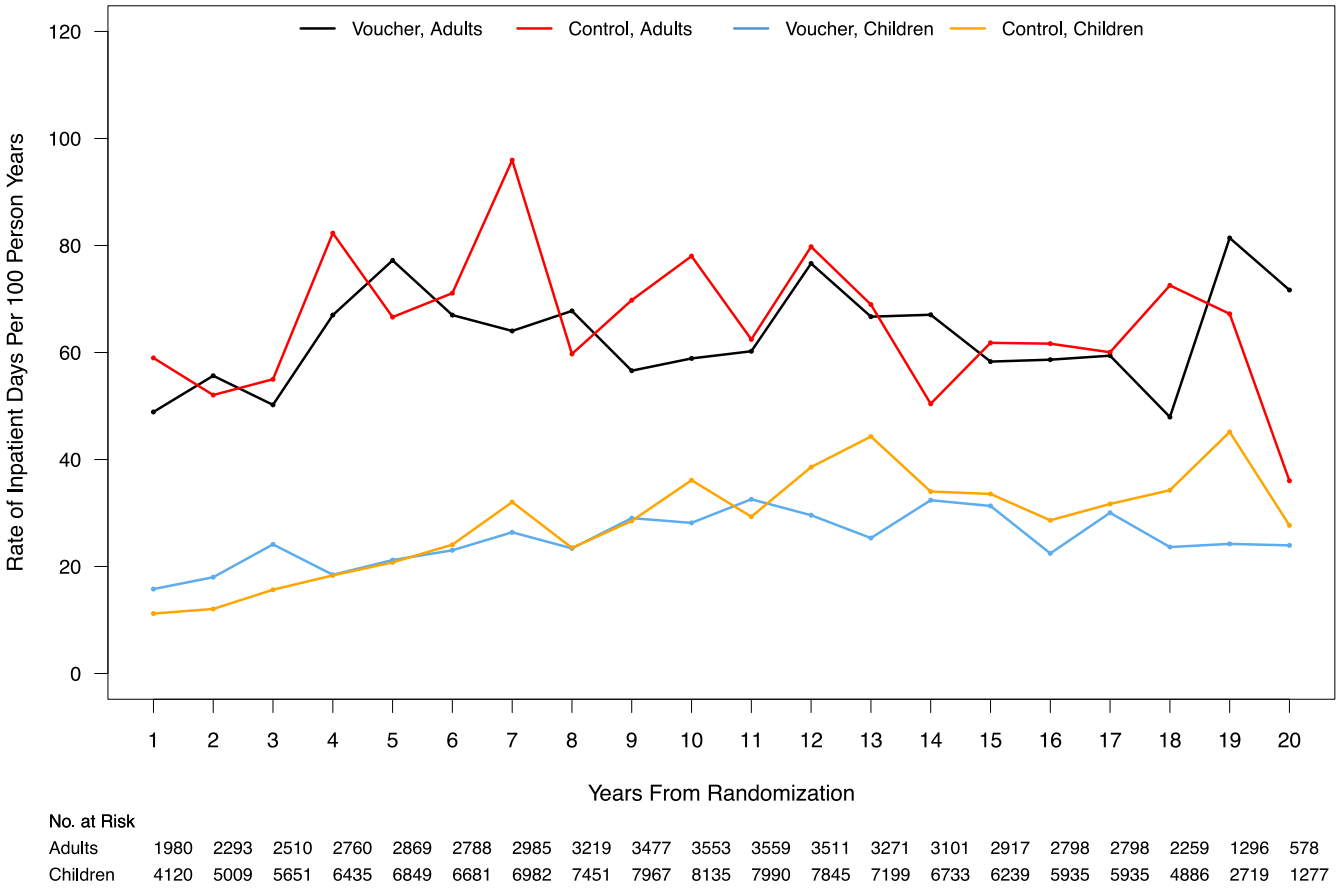
+ Numbers and percentages are raw, unweighted estimates using all hospitalization records from children (at randomization) in all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL).
† Number of hospitalizations
* Frequency and proportions suppressed from rows to protect confidentiality from small cell sizes (any cell size < 11 in a given row)

eAppendix Table E9. Payer Type for All-Payer Hospital Discharges by State*

	CA	MA	NY
Adults - number of hospitalizations (%)			
Medicaid	1256 (58%)	615 (43%)	1444 (52%)
Private payer +	414 (20%)	288 (20%)	860 (17%)
Other payer, including self-pay†	502 (23%)	532 (37%)	452 (31%)
Children - number of hospitalizations (%)			
Medicaid	1509 (70%)	965 (52%)	1134 (59%)
Private payer +	398 (19%)	550 (30%)	620 (9%)
Other insurance, including self-pay†	240 (11%)	327 (18%)	162 (32%)

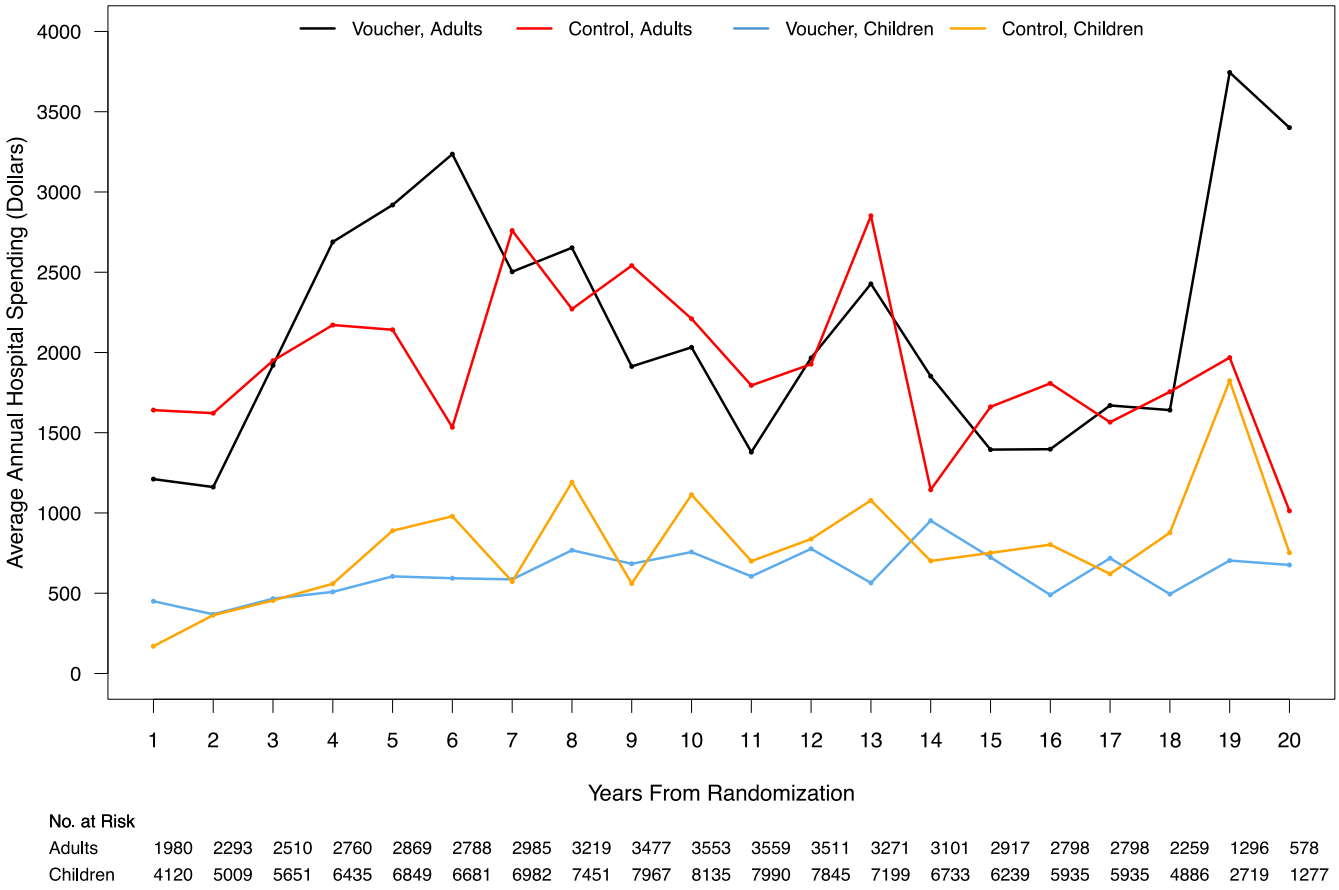
* The CA all-payer data identifies the following categories: Medi-Cal, HMO, PPO, private insurance, self-pay, Medicare, county indigent programs, other government programs, and Blue Cross/Blue Shield. The MA all-payer identifies the following categories: Medicaid, Medicare, worker's compensation, Blue Cross, other commercial insurance, HMO, PPO, self-pay and Health Safety Net. The NY all-payer data identifies the following categories: Medicaid, self-pay, worker's compensation, CHAMPUS, Blue Cross/Blue Shield, private insurance, and Medicare.
+ Private payers include private commercial insurance, Blue Cross/Blue Shield, HMO, and PPO.
† Other payers include self-pay, worker's compensation, Medicare, other government payments, other non-government payments, no charge, CHAMPUS (NY only), and CommCare (MA only).

eAppendix Figure E1. Annual Rates of Hospital Days for Adults and Children



eAppendix Figure E1 Legend.
Rates per 100 person years were estimated according to study group separately for adults and children from intercept-only negative binomial models for each year since randomization with an offset term for the total months of available data for the given year and survey sample weights to account for varying sample probabilities over the accrual period. The available data in year 21 after randomization was limited to 47 and 90 observations for adults and children, respectively, and their corresponding rates are not included in the figure.

eAppendix Figure E2. Mean Annual Hospital Spending for Adults and Children

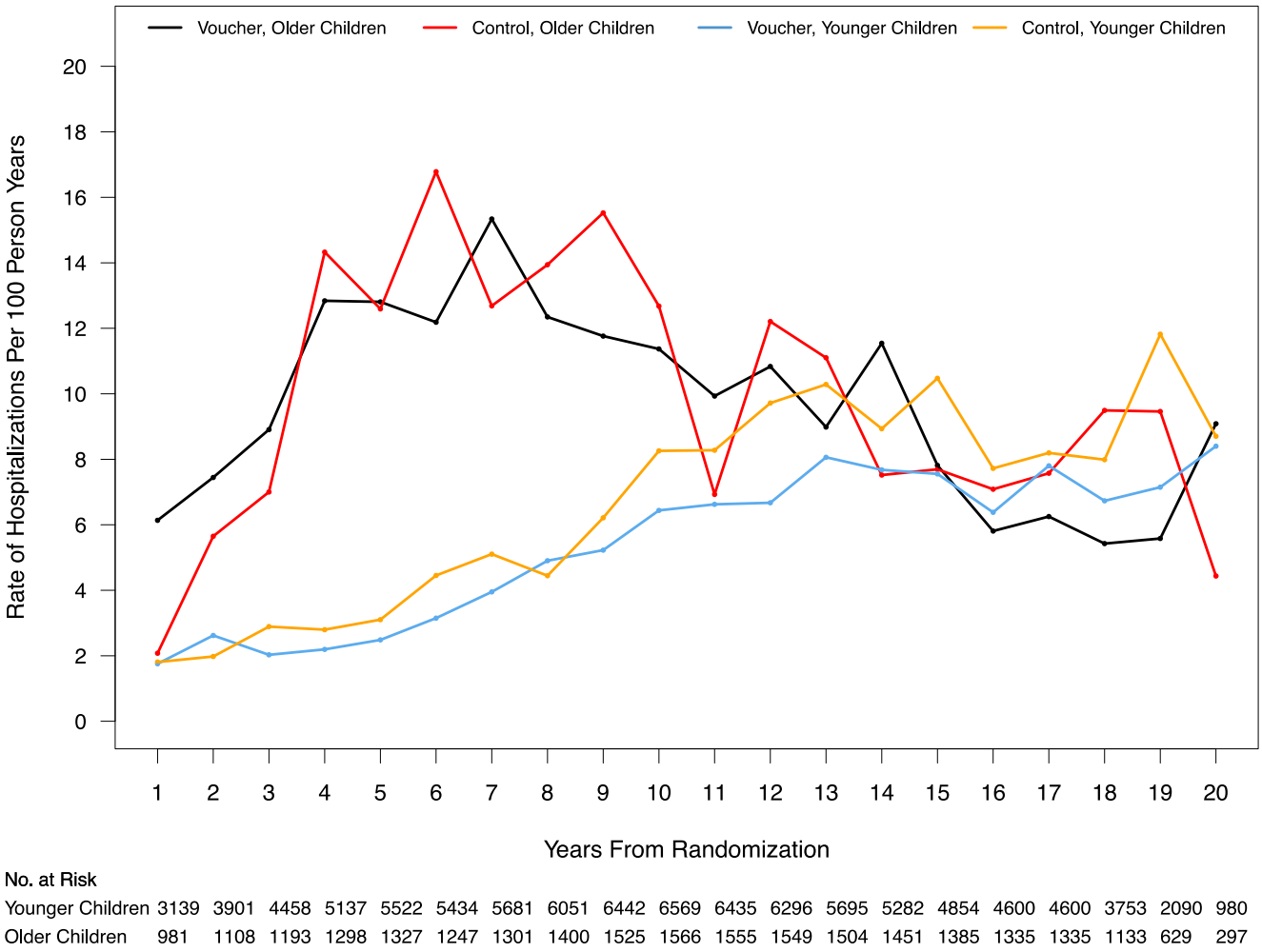


No. at Risk

Adults	1980	2293	2510	2760	2869	2788	2985	3219	3477	3553	3559	3511	3271	3101	2917	2798	2798	2259	1296	578
Children	4120	5009	5651	6435	6849	6681	6982	7451	7967	8135	7990	7845	7199	6733	6239	5935	5935	4886	2719	1277

eAppendix Figure E2 Legend.
Weighted mean annual hospital spending per person year was estimated according to study group separately for adults and children using the survey sample weights to account for varying sample probabilities over the accrual period. The available data in year 21 after randomization was limited to 47 and 90 observations for adults and children, respectively, and their corresponding rates are not included in the figure.

eAppendix Figure E3. Annual Rates of Hospitalizations for Younger and Older Children

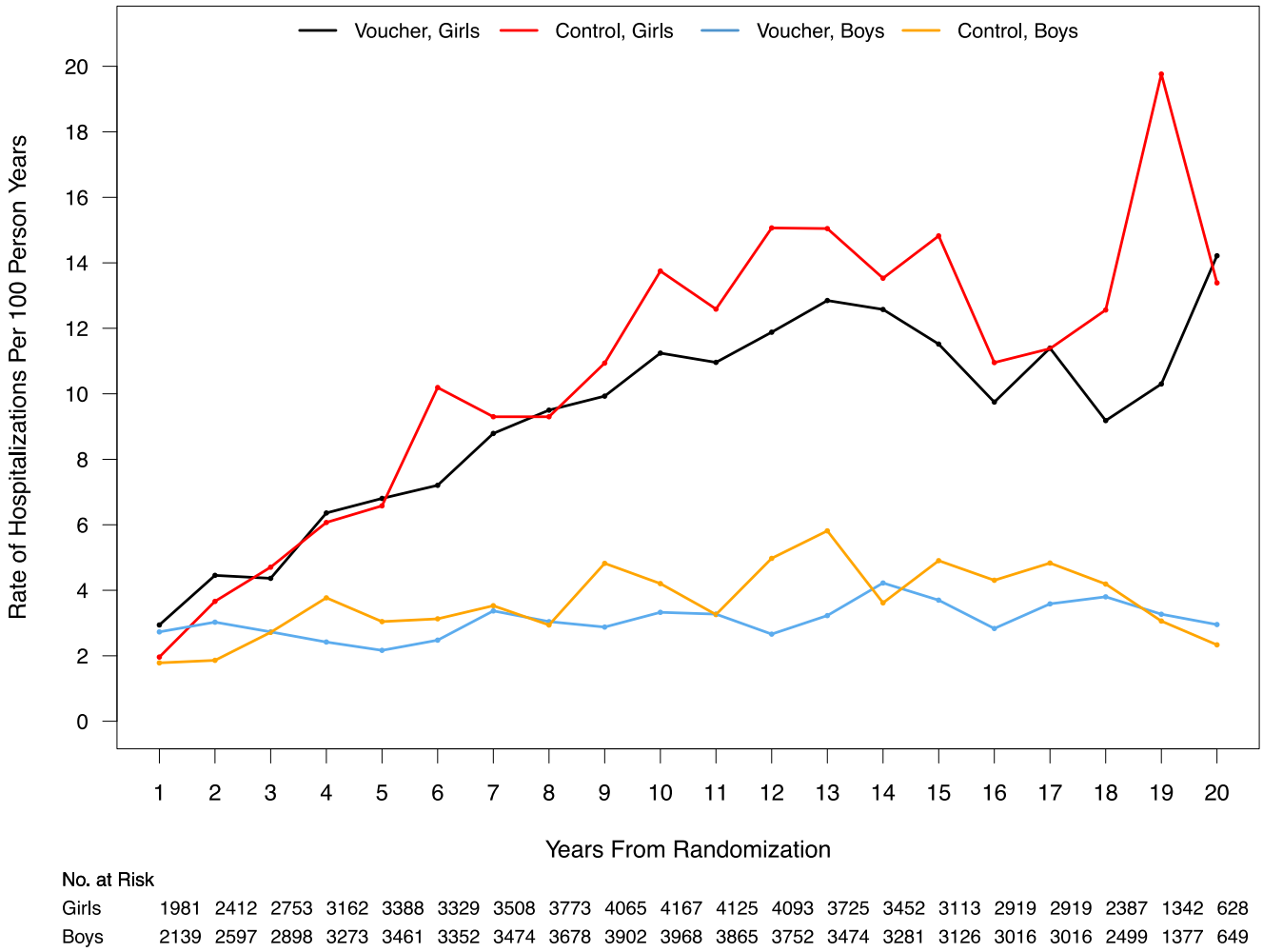


No. at Risk

Younger Children	3139	3901	4458	5137	5522	5434	5681	6051	6442	6569	6435	6296	5695	5282	4854	4600	4600	3753	2090	980
Older Children	981	1108	1193	1298	1327	1247	1301	1400	1525	1566	1555	1549	1504	1451	1385	1335	1335	1133	629	297

eAppendix Figure E3 Legend.
Rates per 100 person years were estimated according to study group separately for younger and older children from intercept-only negative binomial models for each year since randomization with an offset term for the total months of available data for the given year and survey sample weights to account for varying sample probabilities over the accrual period. The available data in year 21 after randomization was limited and not included in the figure.

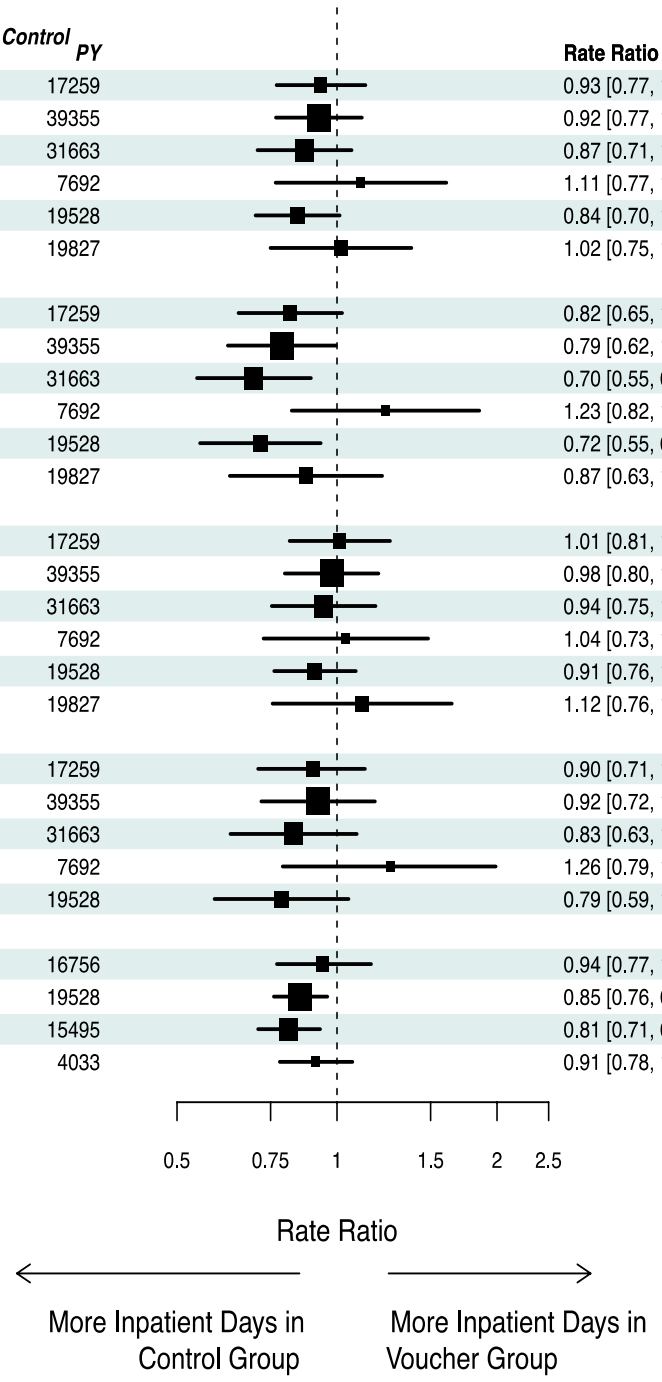
eAppendix Figure E4. Annual Rates of Hospitalizations for Girls and Boys



eAppendix Figure E4 Legend.
Rates per 100 person years were estimated according to study group separately for boys and girls from intercept-only negative binomial models for each year since randomization with an offset term for the total months of available data for the given year and survey sample weights to account for varying sample probabilities over the accrual period. The available data in year 21 after randomization was limited and not included in the figure.

eAppendix Figure E5. Forest Plot of Primary and Secondary Hospital Days Outcomes

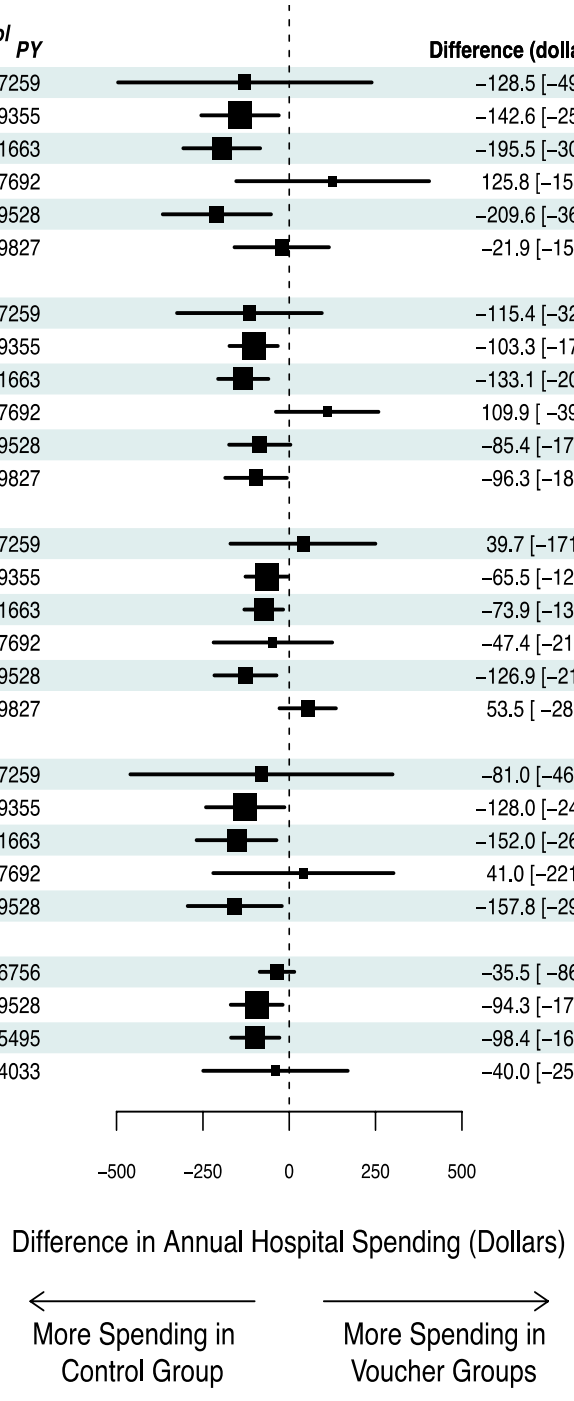
All Inpatient Days	*Voucher Days*	*Voucher PY*	*Control Days*	*Control PY*	Rate Ratio [95% CI]
Adults	22962	37310	10709	17259	0.93 [0.77, 1.13]
All Children	21298	82773	10810	39355	0.92 [0.77, 1.12]
Younger Children	13351	65320	7861	31663	0.87 [0.71, 1.07]
Older Children	7947	17453	2949	7692	1.11 [0.77, 1.61]
Girls	12439	41759	6918	19528	0.84 [0.70, 1.01]*
Boys	8859	41014	3892	19827	1.02 [0.75, 1.38]
Days For Emergency Department Admissions					
Adults	10646	37310	5354	17259	0.82 [0.65, 1.02]*
All Children	8909	82773	4850	39355	0.79 [0.62, 1.00]**
Younger Children	5540	65320	3790	31663	0.70 [0.55, 0.89]***
Older Children	3369	17453	1060	7692	1.23 [0.82, 1.85]
Girls	3986	41759	2583	19528	0.72 [0.55, 0.93]**
Boys	4923	41014	2267	19827	0.87 [0.63, 1.22]
Days For Admissions Not From Emergency Department					
Adults	12265	37310	5423	17259	1.01 [0.81, 1.26]
All Children	12619	82773	6148	39355	0.98 [0.80, 1.20]
Younger Children	7817	65320	4187	31663	0.94 [0.75, 1.18]
Older Children	4802	17453	1961	7692	1.04 [0.73, 1.49]
Girls	8505	41759	4415	19528	0.91 [0.76, 1.09]
Boys	4114	41014	1733	19827	1.12 [0.76, 1.65]
Days For Hospitalizations Not For Pregnancy/Childbirth					
Adults	20865	37310	9631	17259	0.90 [0.71, 1.13]
All Children	15477	82773	7390	39355	0.92 [0.72, 1.18]
Younger Children	9494	65320	5576	31663	0.83 [0.63, 1.09]
Older Children	5983	17453	1814	7692	1.26 [0.79, 1.99]
Girls	5419	41759	3363	19528	0.79 [0.59, 1.05]
Days For Pregnancy/Childbirth–Related Hospitalizations					
Female Adults	2303	36512	1209	16756	0.94 [0.77, 1.16]
Girls	6958	41759	3722	19528	0.85 [0.76, 0.96]***
Younger Girls	4380	32479	2484	15495	0.81 [0.71, 0.93]***
Older Girls	2578	9280	1238	4033	0.91 [0.78, 1.07]



eAppendix Figure E5 Legend.
Hospitalizations were categorized according to whether or not they originated in the emergency department or were pregnancy/childbirth related. Incidence Rate Ratios are expressed as the voucher groups relative to the control group and were derived from negative binomial regression models for the count of hospital days with the person-year as the unit of observation and adjustments made for the set of covariates described in the text. The models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family. The size of square point is proportional to the number of person-years of data available.
* P < 0.10; ** P < 0.05; *** P < 0.01

eAppendix Figure E6. Forest Plot of Primary and Secondary Hospital Spending Outcomes

All Inpatient Spending	*Dollars**	*Voucher PY*	*Dollars**	*Control PY*	Difference (dollars) [95% CI]
Adults	74735	37310	34500	17259	−128.5 [−496.3, 239.3]
All Children	54152	82773	32092	39355	−142.6 [−255.5, −29.8]**
Younger Children	33058	65320	23342	31663	−195.5 [−307.4, −83.6]***
Older Children	21094	17453	8749	7692	125.8 [−154.1, 405.8]
Girls	32423	41759	21149	19528	−209.6 [−366.9, −52.3]***
Boys	21729	41014	10943	19827	−21.9 [−159.4, 115.7]
Spending For Emergency Department Admissions					
Adults	32724	37310	17958	17259	−115.4 [−326.0, 95.1]
All Children	24832	82773	16804	39355	−103.3 [−174.1, −32.5]***
Younger Children	15437	65320	13327	31663	−133.1 [−206.5, −59.8]***
Older Children	9395	17453	3476	7692	109.9 [−39.5, 259.2]
Girls	13362	41759	8911	19528	−85.4 [−174.9, 4.1]*
Boys	11470	41014	7892	19827	−96.3 [−186.2, −6.3]**
Spending For Admissions Not From Emergency Department					
Adults	44354	37310	16377	17259	39.7 [−171.0, 250.4]
All Children	28946	82773	15965	39355	−65.5 [−127.5, −3.5]**
Younger Children	17312	65320	10620	31663	−73.9 [−130.9, −17.0]**
Older Children	11634	17453	5346	7692	−47.4 [−219.8, 124.9]
Girls	19420	41759	12451	19528	−126.9 [−217.7, −36.0]***
Boys	9526	41014	3514	19827	53.5 [−28.9, 135.8]
Spending For Hospitalizations Not For Pregnancy/Childbirth					
Adults	69541	37310	30903	17259	−81.0 [−461.0, 300.0]
All Children	37184	82773	23710	39355	−128.0 [−242.0, −13.0]**
Younger Children	23762	65320	18566	31663	−152.0 [−269.0, −36.1]***
Older Children	13422	17453	5144	7692	41.0 [−221.0, 303.0]
Girls	14408	41759	11312	19528	−157.8 [−294.7, −20.8]**
Spending For Pregnancy/Childbirth–Related Hospitalizations					
Female Adults	7353	36512	3838	16756	−35.5 [−86.2, 15.2]
Girls	17997	41759	10740	19528	−94.3 [−170.0, −18.2]**
Younger Girls	10539	32479	6867	15495	−98.4 [−169.0, −27.8]***
Older Girls	7458	9280	3874	4033	−40.0 [−250.0, 170.0]



eAppendix Figure E6 Legend.
Dollars shown for each subgroup are per $1,000. Hospitalizations were categorized according to whether or not they originated in the emergency department or were pregnancy/childbirth related. Differences in annual hospital spending (in dollars) are expressed as the voucher groups relative to the control group and were derived from two-part models for spending, where the first part is a logistic regression for any spending, the second part is a generalized linear model with a log link and gamma distribution for nonzero spending, and the person-year was the unit of observation and adjustments made for the set of covariates described in the text. The models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family. The size of square point is proportional to the number of person-years of data available.
* P < 0.10; ** P < 0.05; *** P < 0.01

eAppendix F. Results for Sensitivity Analyses

The first set of sensitivity analyses are analyses using separate indicators for the housing voucher study groups (instead of one combined voucher group indicator in the main analyses). Across outcomes, the associations of the traditional Section 8 voucher with hospital use (compared to the control group) and the association of the experimental low poverty voucher with hospital use (compared to the control group) were similar in magnitude and not statistically different from one another (eAppendix Table F1 and F2). For participants who were children at the time of randomization, reductions in hospitalization were similar in both the traditional and low-poverty voucher groups relative to the control (incidence rate ratios = 0.83 and 0.87, respectively); that said, reductions in hospitalizations reached statistical significance only in the traditional voucher group relative to the control. Annual reductions in hospital spending were also similar for both groups (-$156 and -$134, respectively); these reductions in hospital spending were statistically significant for each voucher group versus the control group.

The second set of sensitivity analyses uses different combinations of the data. These analyses are motivated by the heterogeneous mix of data across calendar years, states, and data sources used in the primary analyses. eAppendix Tables F3 through F6 present the results of analyses performed separately using only Medicaid data and using only all-payer data. The tables present the results using the combined voucher groups followed by separate indicator variables for the traditional Section 8 voucher and the experimental low poverty voucher group. When examining the all-payer and Medicaid data separately for children at the time of randomization, the differences in hospitalizations for the voucher groups relative to the control were not statistically significant in either dataset and the reductions in hospital spending for the voucher groups relative to the control reached statistical significance only in the all-payer data for the main models (eAppendix Table F3) and the poverty-based models (eAppendix Table F6).

Delving deeper into the heterogeneity across data sets, eAppendix Table F7 presents the results from a sequence of models that starts with the Medicaid data and subsequently incorporates the all-payer data in stages. Specifically, the first column repeats the results from the Medicaid data alone (i.e., the four states from 1999 to 2009). The next column then introduces all-payer data for two of the four states, keeping the study years limited to 1999 to 2009. By keeping the time period and states fixed, the comparison of these first two sets of results helps distinguish differences related solely to the inclusion of all-payer data which include hospital admissions regardless of insurance coverage. The third combination of data keeps the same four states (with data available from Medicaid) but includes all of the available years of all-payer data, allowing for greater statistical power and a longer follow-up period (while holding the composition of states constant). The fourth column expands the sample to include all available data from all five states; this is the data used in the primary analyses because of its greatest statistical power and widest geographic coverage. Qualitatively comparing the results across these different combinations, the point estimates for the hospitalizations and hospital day outcomes seemed consistent, with confidence intervals generally overlapping each other. The absolute difference in hospital spending was larger in models that included the all-payer data. The reason for this, however, is unclear. It is possible that this reflects differences in the ways spending was estimated; i.e., the level of Medicaid payments vary across states due to state Medicaid policy, while the all-payer data reflect underlying hospital costs. A second possibility is that the association of the housing intervention with hospital use and spending is different for those eligible for Medicaid compared to those covered by different payers (e.g., differences in income across payers). A third possibility is that the association of the housing intervention with hospital use and spending differed across states due to other factors.

The third set of sensitivity analyses used alternative approaches to top-coding hospital use (eAppendix Table F8) and Medicaid payment imputation (eAppendix Table F9). The results were robust to these alternative specifications.

The fourth set of sensitivity analyses examined the potential for out of state moves to bias the study's findings (eAppendix Table F10). In the main analyses, participants who, in a given calendar year, were eligible for linkage to all-payer data but who did not have any inpatient discharge records for that year were assumed to

have no hospital utilization. If the participant was residing out of state during that year, then they may have had hospital use that was not captured by the all-payer records. The extent to which out of state moves are differential across study arms, which was found for adults but not children (eAppendix Table A5), may bias the study's findings for the association of the housing intervention on hospital use. The study team only had access to information on a participant's out of state move for 2009; the exact timing of the participant's out of state moves prior to 2009 was unknown, as was any information for out of state moves occurring after 2009. Thus, for participants known to reside in a different state in 2009 than the one they lived in at the time of randomization, a first set of sensitivity analyses excluded all of their person-years of all-payer data. A second set of sensitivity analyses excluded all person-years of all-payer data for participants known to live in a different state in 2009 only after their last known healthcare use within their original state was observed. For example, a participant randomized in California who lived out of state in 2009 and had a hospital discharge identified in the all-payer data in 2005 (but no discharge observed in any year thereafter) had their person-years of data up to and including 2005 retained but had their person-years of data for 2006 onward excluded. These adjustments were only made to the all-payer data, as the Medicaid data's enrollment file enables the proper identification of those with zero utilization in a given person-year. Main results for the association of the housing intervention with hospital use were robust to both approaches.

The fifth set of sensitivity analyses varied the length of time for the exposure in the poverty-based models. The first-stage model uses an OLS regression with mean duration-weighted percent of families in the census tract with incomes above the poverty line from years 1 through 7 since randomization (corresponding to the entire "early" time period) as the dependent variable. (The main models used years 1 through 3 for the exposure period.) The second-stage examines hospital use from year 8 onward as the dependent variable with the predicted percent of families above the poverty line for years 1-7 as the main explanatory variable (eAppendix Table F11). Results of these models for the association of a decrease in neighborhood poverty with hospital use were similar to the main analyses.

A sixth set of sensitivity analyses (eAppendix Table F11) used the two stage residual inclusion (2SRI) with bootstrapped standard errors[10] as an alternate way of estimating the models for the association of decreases in neighborhood poverty with hospital use. The bootstrapped 2SRI results are shown for hospitalizations and hospital days (but not for hospital spending, which uses the combined marginal effects of a two part model). The 2SRI estimator's results were similar to the results from the more common two-stage model approach of including the first-stage model's predicted poverty into the second-stage model for utilization. The key difference is that the first stage residuals were included as an additional regressor in the second stage, and that the endogenous variable (poverty exposure) in the second stage was not replaced by first-stage predictors.[11] Instead, first-stage residuals were included as additional regressors. When combined with bootstrapped standard errors, this approach generates unbiased causal estimates with non-linear first and second stage specifications.[12] Results were consistent with the main models.

eAppendix Table F1. Results for Hospital Use With MTO Study Groups Separated: Full Five-State Sample

	Low Poverty Voucher (LPV) Relative to Control*		Section 8 Voucher Relative to Control*		LPV vs. Sec. 8^
	Estimate† (95% CI)	P Value	Estimate† (95% CI)	P Value	P Value
Adults					
Hospitalizations	0.94 (0.81, 1.09)	0.40	0.97 (0.84, 1.12)	0.67	0.66
Inpatient Days	0.93 (0.76, 1.15)	0.52	0.92 (0.74, 1.16)	0.49	0.90
Hospital Spending	-$95 (-498, 308)	0.65	-$179 (-599, 242)	0.41	0.28
Children					
Hospitalizations	0.87 (0.74, 1.03)	0.10	0.83 (0.71, 0.96)	0.02	0.38
Inpatient Days	1.00 (0.80, 1.24)	0.97	0.83 (0.68, 1.02)	0.08	0.10
Hospital Spending	-$134 (-259, -8)	0.04	-$156 (-289, -22)	0.02	0.38
Younger children					
Hospitalizations	0.84 (0.71, 1.01)	0.06	0.80 (0.67, 0.96)	0.02	0.42
Inpatient Days	0.96 (0.76, 1.23)	0.77	0.75 (0.59, 0.94)	0.01	0.04
Hospital Spending	-$162 (-284, -39)	0.01	-$241 (-374, -109)	<0.001	0.27
Older children					
Hospitalizations	1.00 (0.79, 1.28)	0.98	0.92 (0.77, 1.11)	0.39	0.46
Inpatient Days	1.05 (0.69, 1.60)	0.82	1.18 (0.80, 1.75)	0.39	0.50
Hospital Spending	$68 (-250, 386)	0.68	$182 (-138, 502)	0.27	0.71
Girls					
Hospitalizations	0.86 (0.75, 1.00)	0.05	0.86 (0.74, 0.99)	0.04	0.88
Inpatient Days	0.89 (0.72, 1.10)	0.27	0.79 (0.64, 0.96)	0.02	0.22
Hospital Spending	-$213 (-388, -38)	0.02	-$213 (-397, -29)	0.02	0.91
Boys					
Hospitalizations	0.90 (0.68, 1.21)	0.49	0.80 (0.60, 1.06)	0.12	0.38
Inpatient Days	1.13 (0.79, 1.62)	0.51	0.88 (0.62, 1.24)	0.47	0.18
Hospital Spending	$12 (-142, 167)	0.88	-$68 (-237, 101)	0.43	0.12

* Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL) and included separate indicators for the low-poverty and Section 8 voucher groups (in comparison to the primary analyses which pool the voucher groups). The adult sample had a total of 54,569 person-year observations, and the child sample had a total of 122,128 person-year observations.

† Estimates compare the outcomes for everyone assigned to each of the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates as described in the text. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects.

^ Paired t-tests were used to test for whether the associations of the two study groups (LPV and Section 8) with hospital use were significantly different from each other. These p-values are shown in the last column.

eAppendix Table F2. Treatment on the Treated Results for Hospital Use With MTO Study Groups Separated: Full Five-State Sample

	Low Poverty Voucher (LPV) Relative to Control*		Section 8 Voucher Relative to Control*		LPV vs. Sec. 8^
	Estimate† (95% CI)	P Value	Estimate† (95% CI)	P Value	P Value
Adults					
Hospitalizations	0.86 (0.65, 1.13)	0.27	0.94 (0.75, 1.18)	0.61	0.50
Inpatient Days	0.90 (0.61, 1.32)	0.58	0.93 (0.68, 1.27)	0.66	0.93
Hospital Spending	-$643 (-2,490, 1,204)	0.49	-$127 (-836, 582)	0.73	
Children					
Hospitalizations	0.78 (0.58, 1.05)	0.10	0.75 (0.60, 0.92)	0.01	0.73
Inpatient Days	1.01 (0.66, 1.54)	0.97	0.78 (0.57, 1.06)	0.11	0.11
Hospital Spending	-$625 (-1,315, 65.5)	0.08	-$283 (-510, -55.8)	0.02	
Younger children					
Hospitalizations	0.75 (0.55, 1.01)	0.06	0.72 (0.57, 0.92)	0.01	0.59
Inpatient Days	0.98 (0.63, 1.53)	0.94	0.71 (0.51, 0.98)	0.04	0.16
Hospital Spending	-$529 (-1,188, 130)	0.12	-$402 (-623, -181)	<0.001	
Older children					
Hospitalizations	1.01 (0.54, 1.87)	0.98	0.81 (0.60, 1.10)	0.18	0.25
Inpatient Days	0.94 (0.37, 2.38)	0.89	0.86 (0.49, 1.51)	0.60	0.37
Hospital Spending	$234 (-1,857, 2,324)	0.83	$105 (-478, 688)	0.72	
Girls					
Hospitalizations	0.77 (0.59, 1.00)	0.05	0.78 (0.65, 0.95)	0.01	0.60
Inpatient Days	0.80 (0.54, 1.18)	0.26	0.68 (0.52, 0.90)	0.01	0.66
Hospital Spending	-$980 (-2,003, 43.7)	0.06	-$361 (-690, -31.6)	0.03	
Boys					
Hospitalizations	0.85 (0.50, 1.42)	0.53	0.73 (0.49, 1.10)	0.13	0.66
Inpatient Days	1.31 (0.63, 2.70)	0.47	0.93 (0.54, 1.59)	0.78	0.08
Hospital Spending	-$93 (-892, 707)	0.82	-$162 (-435, 111)	0.25	

* Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL) and included separate indicators for the low-poverty and Section 8 voucher groups (in comparison to the primary analyses which pool the voucher groups). The adult sample had a total of 54,569 person-year observations, and the child sample had a total of 122,128 person-year observations. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects.

† Treatment on the treated (TOT) results were estimated by predicting MTO voucher take-up as a function of study group indicators (i.e., models were separately run pair-wise for the low-poverty versus control groups and traditional vouchers versus control groups), interactions between the study groups and sites, and the baseline covariates in the first stage and then modeling each outcome as a function of predicted voucher take-up with adjustments made for the set of baseline covariates as described in the text. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

^ Seemingly unrelated estimation (SUEST) models were run on each analogous pair of low-poverty-control and traditional-control groups above. T-tests on the resulting SUEST models were used to test for whether the association of voucher take-up on the respective outcome in the two study groups (LPV and Section 8) were significantly different from each other. These p-values are shown in the last column.

eAppendix Table F3. Results for Hospital Use With MTO Study Groups Combined and All-Payer and Medicaid Samples Separated

	All Payer Data: CA, NY, and MA				Medicaid Data: CA, IL, NY, and MD			
	Control Mean*	Voucher Mean*	Estimate† (95% CI)	P Value	Control Mean*	Voucher Mean*	Estimate† (95% CI)	P Value
Adults	**(N = 2896 , PY = 46159)**				**(N = 2752, PY = 18262)**			
Hospitalizations	0.138	0.130	0.95 (0.82, 1.10)	0.51	0.202	0.191	0.94 (0.79, 1.12)	0.50
Inpatient Days	0.622	0.605	0.96 (0.78, 1.19)	0.73	0.740	0.662	0.94 (0.75, 1.18)	0.62
Hospital Spending	$3945	$3866	-$99 (-518, 321)	0.64	$1169	$1190	$40 (-213, 292)	0.758
Children	**(N = 5978, PY = 96510)**				**(N = 6863, PY = 49588)**			
Hospitalizations	0.063	0.056	0.90 (0.76, 1.06)	0.21	0.095	0.087	0.91 (0.79, 1.04)	0.16
Inpatient Days	0.263	0.244	1.00 (0.81, 1.24)	0.99	0.331	0.328	0.95 (0.76, 1.18)	0.63
Hospital Spending	$1336	$1248	-$142 (-279, -5)	0.04	$535	$532	-$21 (-128, 87)	0.71
Younger children	**(N = 4626, PY = 74346)**				**(N = 5481, PY = 42530)**			
Hospitalizations	0.058	0.048	0.86 (0.71, 1.04)	0.12	0.076	0.067	0.86 (0.74, 1.00)	0.05
Inpatient Days	0.239	0.208	0.97 (0.76, 1.23)	0.78	0.272	0.230	0.83 (0.66, 1.05)	0.13
Hospital Spending	$1266	$1089	-$179 (-313, -44)	0.01	$442	$380	-$73 (-167, 21)	0.13
Older children	**(N = 1352, PY = 22164)**				**(N = 1382, PY = 7058)**			
Hospitalizations	0.081	0.082	1.03 (0.82, 1.31)	0.78	0.214	0.203	0.97 (0.76, 1.23)	0.79
Inpatient Days	0.355	0.364	1.08 (0.72, 1.63)	0.71	0.695	0.854	1.23 (0.88, 1.71)	0.22
Hospital Spending	$1598	$1762	$50 (-250, 351)	0.74	$1100	$1336	$102 (-296, 500)	0.62
Girls	**(N = 2928, PY = 47121)**				**(N = 3427, PY = 26742)**			
Hospitalizations	0.094	0.083	0.88 (0.76, 1.02)	0.10	0.134	0.125	0.95 (0.84, 1.08)	0.45
Inpatient Days	0.356	0.288	0.87 (0.71, 1.07)	0.19	0.394	0.361	0.99 (0.82, 1.19)	0.89
Hospital Spending	$1932	$1625	-$247 (-450, -44)	0.02	$649	$594	-$64 (-198, 69)	0.34
Boys	**(N = 3050, PY = 49389)**				**(N = 3436, PY = 22846)**			
Hospitalizations	0.033	0.030	0.95 (0.72, 1.27)	0.75	0.051	0.041	0.82 (0.62, 1.08)	0.15
Inpatient Days	0.175	0.202	1.09 (0.78, 1.53)	0.62	0.257	0.289	0.88 (0.59, 1.32)	0.55
Hospital Spending	$765	$884	$19 (-133, 172)	0.81	$408	$457	$57 (-121, 236)	0.53

* Hospitalizations and inpatient days are per 100 person-years, and hospital spending is in annual dollars inflated to 2015$. For the number of hospitalizations and inpatient days, means were estimated from intercept-only negative binomial regression models with an offset term for the total months of available data for a person year and survey sample weights to account for varying sample probabilities over the accrual period; for hospital spending, means were weighted mean annual spending using the survey sampling weights to account for varying sampling probabilities during accrual.

† Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates as described in the text. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

eAppendix Table F4. Results for Hospital Use With MTO Study Groups Separated and All-Payer Sample Separate

	All Payer Data:* CA, NY, and MA			
	Low Poverty Voucher		Section 8 Voucher	
	Estimate† (95% CI)	P Value	Estimate† (95% CI)	P Value
Adults				
Hospitalizations	0.93 (0.78, 1.09)	0.36	0.98 (0.83, 1.17)	0.86
Inpatient Days	0.96 (0.76, 1.22)	0.76	0.96 (0.75, 1.23)	0.74
Hospital Spending	-$49 (-510, 413)	0.84	-$170 (-647, 307)	0.49
Children				
Hospitalizations	0.93 (0.77, 1.12)	0.43	0.86 (0.72, 1.03)	0.09
Inpatient Days	1.06 (0.82, 1.37)	0.66	0.91 (0.72, 1.16)	0.46
Hospital Spending	-$103 (-255, 48)	0.18	-$198 (-359, -36)	0.02
Younger children				
Hospitalizations	0.89 (0.73, 1.09)	0.25	0.83 (0.67, 1.02)	0.08
Inpatient Days	1.06 (0.80, 1.41)	0.69	0.84 (0.65, 1.10)	0.21
Hospital Spending	-$116 (-261, 30)	0.12	-$264 (-427, -102)	0.001
Older children				
Hospitalizations	1.08 (0.79, 1.47)	0.64	0.98 (0.79, 1.21)	0.83
Inpatient Days	1.00 (0.62, 1.59)	0.99	1.20 (0.78, 1.85)	0.41
Hospital Spending	$35 (-314, 385)	0.84	$67 (-271, 406)	0.70
Girls				
Hospitalizations	0.89 (0.76, 1.06)	0.19	0.86 (0.73, 1.01)	0.07
Inpatient Days	0.93 (0.73, 1.19)	0.58	0.78 (0.63, 0.98)	0.03
Hospital Spending	-$219 (-444, 5)	0.06	-$285 (-520, -49)	0.02
Boys				
Hospitalizations	0.99 (0.71, 1.37)	0.93	0.91 (0.66, 1.25)	0.56
Inpatient Days	1.15 (0.77, 1.72)	0.49	1.01 (0.69, 1.48)	0.96
Hospital Spending	$74 (-99, 246)	0.40	-$63 (-249, 124)	0.51

* The adult sample for the all-payer data had a total of 46,159 person-year observations, and the child sample for the all-payer data had a total of 96,510 person-year observations. The estimates included separate indicators for the low-poverty and Section 8 voucher groups (in comparison to the primary analyses which pool the voucher groups).
† Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates as described in the text. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

eAppendix Table F5. Results for Hospital Use With MTO Study Groups Separated and Medicaid Sample Separate

	Medicaid Data:* CA, IL, NY and MD			
	Low Poverty Voucher		Section 8 Voucher	
	Estimate† (95% CI)	P Value	Estimate† (95% CI)	P Value
Adults				
Hospitalizations	0.91 (0.75, 1.10)	0.33	0.98 (0.80, 1.19)	0.82
Inpatient Days	0.90 (0.70, 1.15)	0.38	0.94 (0.72, 1.21)	0.61
Hospital Spending	-$27 (-312, 257)	0.85	$1 (-286, 288)	1.00
Children				
Hospitalizations	0.91 (0.79, 1.05)	0.18	0.86 (0.75, 0.98)	0.02
Inpatient Days	0.91 (0.71, 1.16)	0.44	0.78 (0.60, 1.00)	0.05
Hospital Spending	-$47 (-157, 63)	0.40	$21 (-103, 145)	0.74
Younger children				
Hospitalizations	0.89 (0.76, 1.04)	0.14	0.83 (0.71, 0.97)	0.02
Inpatient Days	0.86 (0.65, 1.13)	0.27	0.70 (0.53, 0.94)	0.02
Hospital Spending	-$71 (-169, 27)	0.16	-$49 (-156, 58)	0.37
Older children				
Hospitalizations	1.06 (0.82, 1.37)	0.68	0.94 (0.75, 1.20)	0.64
Inpatient Days	1.20 (0.84, 1.71)	0.33	1.51 (1.04, 2.17)	0.03
Hospital Spending	$152 (-245, 548)	0.45	$395 (-48, 839)	0.08
Girls				
Hospitalizations	0.93 (0.82, 1.06)	0.29	0.95 (0.83, 1.08)	0.41
Inpatient Days	0.87 (0.68, 1.12)	0.29	0.89 (0.66, 1.18)	0.41
Hospital Spending	-$86 (-218, 47)	0.20	$0 (-148, 149)	1.00
Boys				
Hospitalizations	0.88 (0.66, 1.17)	0.36	0.70 (0.52, 0.94)	0.02
Inpatient Days	0.98 (0.66, 1.47)	0.93	0.73 (0.48, 1.11)	0.14
Hospital Spending	$38 (-138, 214)	0.67	$27 (-174, 228)	0.79

* The adult sample for the Medicaid data had a total of 20,639 person-year observations, and the child sample for the Medicaid data had a total of 55,270 person-year observations. The estimates included separate indicators for the low-poverty and Section 8 voucher groups (in comparison to the primary analyses which pool the voucher groups).
† Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates as described in the text. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

eAppendix Table F6. Association of a 10 Percentage Point Decrease in Neighborhood Poverty With Hospital Use: All-Payer and Medicaid Separate

	All Payer Data:* CA, NY, and MA		Medicaid Data:* CA, IL, NY, and MD	
	Poverty Estimate† (95% CI)	P Value	Poverty Estimate† (95% CI)	P Value
Adults				
Hospitalizations	0.96 (0.85, 1.08)	0.50	0.97 (0.83, 1.12)	0.70
Inpatient Days	0.99 (0.84, 1.16)	0.87	0.93 (0.77, 1.12)	0.45
Hospital Spending	$11 (-325, 346)	0.95	-$54 (-280, 171)	0.64
Children				
Hospitalizations	0.9 (0.79, 1.03)	0.12	0.92 (0.83, 1.01)	0.09
Inpatient Days	0.94 (0.8, 1.12)	0.54	0.88 (0.74, 1.05)	0.17
Hospital Spending	-$140 (-253, -27)	0.02	-$18 (-108, 71)	0.69
Younger children				
Hospitalizations	0.88 (0.77, 1.03)	0.11	0.89 (0.80, 1.01)	0.06
Inpatient Days	0.97 (0.81, 1.18)	0.78	0.85 (0.70, 1.03)	0.09
Hospital Spending	-$129 (-237, -21)	0.02	-$42 (-119, 34)	0.28
Older children				
Hospitalizations	0.96 (0.81, 1.14)	0.62	1.03 (0.85, 1.23)	0.75
Inpatient Days	0.82 (0.6, 1.12)	0.22	1.14 (0.87, 1.49)	0.34
Hospital Spending	-$124 (-386, 138)	0.35	$244 (-98, 587)	0.16
Girls				
Hospitalizations	0.89 (0.79, 1)	0.06	0.94 (0.85, 1.04)	0.24
Inpatient Days	0.88 (0.76, 1.03)	0.12	0.90 (0.75, 1.08)	0.24
Hospital Spending	-$224 (-394, -54)	0.01	-$41 (-150, 67)	0.45
Boys				
Hospitalizations	0.93 (0.74, 1.16)	0.49	0.85 (0.68, 1.05)	0.13
Inpatient Days	0.97 (0.75, 1.27)	0.85	0.90 (0.68, 1.19)	0.46
Hospital Spending	-$16 (-136, 104)	0.80	$14 (-127, 155)	0.85

* The adult sample for the all-payer data had a total of 46,159 person-year observations, and the child sample for the all-payer data had a total of 96,510 person-year observations. The adult sample for the Medicaid data had a total of 20,639 person-year observations, and the child sample for the Medicaid data had a total of 55,270 person-year observations.
† These models used predicted reductions in neighborhood poverty as the key explanatory variable for hospital utilization/spending in a two-stage model, with these estimates specifically showing the change in outcomes associated with a 10 percentage point decrease in predicted neighborhood poverty exposure (to be consistent with the housing voucher intervention's association with reductions in neighborhood poverty compared to the control group). The first-stage regression was an ordinary least squares model with the mean duration-weighted percent of households in the census tract with incomes above the poverty line as the dependent variable (so that differences in this first-stage outcome and subsequent predictions can be interpreted as a reduction in poverty), the study-group voucher indicators and the site and study-group voucher interactions as the main predictors, and the baseline characteristics and sites as controls. For the main analyses, the second-stage regression uses the predicted duration-weighted percent of families above the poverty line from years 1 through 3 since randomization as the key explanatory variable and hospital utilization/spending from years 4 through 21 since randomization as the dependent variable, adjusting for baseline covariates. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects. The models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

eAppendix Table F7. Results for Hospital Use With MTO Study Groups Combined and Sequential Combinations of Data

	Medicaid Data Only 4 state sample, 1999-2009 CA: Medicaid 1999-2009 IL: Medicaid 1999-2009 MA: No Data Included MD: Medicaid 1999-2009 NY: Medicaid 1999-2009		**Medicaid/All-Payer Data 4 state sample, 1999-2009** CA: All-Payer 1999-2009 IL: Medicaid 1999-2009 MA: No Data Included MD: Medicaid 1999-2009 NY: All-Payer 1999-2009		**Medicaid/All-Payer Data 4 state sample, expanded years of all-payer data, 1995-2015** CA: All-Payer 1996-2015 IL: Medicaid 1999-2009 MA: No Data Included MD: Medicaid 1999-2009 NY: All-Payer 1995-2015		**Medicaid/All-Payer Data 5 state sample, expanded years of all-payer data 1995-2015** CA: All-Payer 1996-2015 IL: Medicaid 1999-2009 MA: All-Payer 2004-2014 MD: Medicaid 1999-2009 NY: All-Payer 1995-2015	
	Estimate† (95% CI)	**P Value**	**Estimate† (95% CI)**	**P Value**	**Estimate† (95% CI)**	**P Value**	**Estimate† (95% CI)**	**P Value**
Adults	**(N = 2752, PY = 18262)**		**(N = 3156 PY = 30015)**		**(N = 3156 PY = 44606)**		**(N = 4072, PY = 54569)**	
Hospitalizations	0.94 (0.79, 1.12)	0.50	0.94 (0.82, 1.09)	0.42	0.93 (0.81, 1.07)	0.31	0.95 (0.84, 1.08)	0.45
Inpatient Days	0.94 (0.75, 1.18)	0.62	0.87 (0.71, 1.07)	0.19	0.89 (0.71, 1.11)	0.30	0.93 (0.77, 1.13)	0.46
Hospital Spending	$40 (-213, 292)	0.758	-$195 (-676, 287)	0.43	-$229 (-673, 214)	0.31	-$129 (-497, 239)	0.49
Children	**(N = 6863, PY = 49588)**		**(N = 7259 PY = 70792)**		**(N = 7260 PY = 101756)**		**(N = 9118, PY = 122128)**	
Hospitalizations	0.91 (0.79, 1.04)	0.16	0.88 (0.79, 0.98)	0.02	0.92 (0.83, 1.02)	0.11	0.85 (0.73, 0.99)	0.03
Inpatient Days	0.95 (0.76, 1.18)	0.63	0.88 (0.71, 1.11)	0.28	0.98 (0.81, 1.18)	0.84	0.92 (0.77, 1.11)	0.41
Hospital Spending	-$21 (-128, 87)	0.71	-$127 (-272, 19)	0.09	-$118 (-242, 6)	0.06	-$143 (-256, -31)	0.01
Younger children	**(N = 5481, PY = 42530)**		**(N = 5756 PY = 57085)**		**(N = 5757 PY = 80657)**		**(N = 7244, PY = 96983)**	
Hospitalizations	0.86 (0.74, 1.00)	0.05	0.87 (0.76, 0.98)	0.02	0.91 (0.81, 1.02)	0.12	0.82 (0.70, 0.98)	0.02
Inpatient Days	0.83 (0.66, 1.05)	0.13	0.82 (0.64, 1.05)	0.11	0.91 (0.74, 1.12)	0.39	0.87 (0.71, 1.07)	0.18
Hospital Spending	-$73 (-167, 21)	0.13	-$190 (-316, -64)	0.003	-$181 (-301, -61)	0.003	-$196 (-307, -84)	<0.001
Older children	**(N = 1382, PY = 7058)**		**(N = 1503 PY = 13707)**		**(N = 1503 PY = 21099)**		**(N = 1874, PY = 25145)**	
Hospitalizations	0.97 (0.76, 1.23)	0.79	0.94 (0.76, 1.16)	0.57	0.96 (0.78, 1.19)	0.72	0.97 (0.80, 1.18)	0.75
Inpatient Days	1.23 (0.88, 1.71)	0.22	1.21 (0.83, 1.75)	0.31	1.21 (0.82, 1.77)	0.33	1.11 (0.77, 1.61)	0.58
Hospital Spending	$102 (-296, 500)	0.62	$103 (-359, 565)	0.66	$168 (-183, 519)	0.35	$121 (-160, 401)	0.4
Girls	**(N = 3427, PY = 26742)**		**(N = 3579 PY = 35938)**		**(N = 3579 PY = 50887)**		**(N = 4526, PY = 61287)**	
Hospitalizations	0.95 (0.84, 1.08)	0.45	0.89 (0.80, 1.00)	0.04	0.92 (0.83, 1.01)	0.09	0.86 (0.75, 0.98)	0.03
Inpatient Days	0.99 (0.82, 1.19)	0.89	0.81 (0.63, 1.03)	0.09	0.87 (0.72, 1.06)	0.17	0.84 (0.70, 1.01)	0.07
Hospital Spending	-$64 (-198, 69)	0.34	-$170 (-369, 30)	0.10	-$172 (-338, -6)	0.04	-$213 (-370, -56)	0.01
Boys	**(N = 3436, PY = 22846)**		**(N = 3680 PY = 34854)**		**(N = 3681 PY = 50869)**		**(N = 4592, PY = 60841)**	
Hospitalizations	0.82 (0.62, 1.08)	0.15	0.88 (0.69, 1.12)	0.31	0.95 (0.75, 1.19)	0.63	0.86 (0.67, 1.11)	0.24
Inpatient Days	0.88 (0.59, 1.32)	0.55	1.05 (0.73, 1.51)	0.81	1.16 (0.84, 1.59)	0.36	1.02 (0.75, 1.38)	0.92
Hospital Spending	$57 (-121, 236)	0.53	$2 (-182, 186)	0.99	-$33 (-204, 139)	0.71	-$20 (-159, 118)	0.77

eAppendix Table F7. Results for Hospital Use With MTO Study Groups Combined and Different Combinations of Data (Continued)

† Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates as described in the text. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

eAppendix Table F8. Results for Hospital Use: Alternative Top Coding

	Main Analyses:* 99th Percentile of Nonzero Values		Alternative Analyses:* Without Any Top Coding		Alternative Analyses:* 90th Percentile of Nonzero Values	
	Estimate† (95% CI)	P Value	Estimate† (95% CI)	P Value	Estimate† (95% CI)	P Value
Adults						
Hospitalizations	0.95 (0.84, 1.08)	0.45	0.92 (0.78, 1.09)	0.34	0.95 (0.85, 1.06)	0.33
Inpatient Days	0.93 (0.77, 1.13)	0.46	0.93 (0.75, 1.15)	0.51	0.94 (0.82, 1.08)	0.40
Hospital Spending	-$129 (-497, 239)	0.49	-$106 (-556, 345)	0.645	-$106 (-263, 51)	0.18
Children						
Hospitalizations	0.85 (0.73, 0.99)	0.03	0.84 (0.72, 0.99)	0.03	0.90 (0.82, 0.98)	0.02
Inpatient Days	0.92 (0.77, 1.11)	0.41	0.94 (0.77, 1.16)	0.58	0.89 (0.78, 1.02)	0.08
Hospital Spending	-$143 (-256, -31)	0.01	-$209 (-369, -49)	0.01	-$51 (-95, -8)	0.02
Younger children						
Hospitalizations	0.82 (0.70, 0.98)	0.02	0.81 (0.68, 0.97)	0.02	0.88 (0.79, 0.98)	0.02
Inpatient Days	0.87 (0.71, 1.07)	0.18	0.87 (0.70, 1.09)	0.22	0.86 (0.74, 1.00)	0.05
Hospital Spending	-$196 (-307, -84)	<0.001	-$291 (-454, -128)	<0.001	-$67 (-111, -23)	0.003
Older children						
Hospitalizations	0.97 (0.80, 1.18)	0.75	0.97 (0.78, 1.20)	0.75	0.96 (0.83, 1.12)	0.63
Inpatient Days	1.11 (0.77, 1.61)	0.58	1.19 (0.82, 1.72)	0.37	0.96 (0.73, 1.26)	0.77
Hospital Spending	$121 (-160, 401)	0.40	$198 (-162, 558)	0.28	$23 (-91, 137)	0.69
Girls						
Hospitalizations	0.86 (0.75, 0.98)	0.03	0.85 (0.73, 0.98)	0.03	0.90 (0.83, 0.99)	0.03
Inpatient Days	0.84 (0.70, 1.01)	0.07	0.84 (0.69, 1.03)	0.09	0.87 (0.77, 0.99)	0.03
Hospital Spending	-$213 (-370, -56)	0.01	-$239 (-438, -39)	0.02	-$76 (-140, -13)	0.02
Boys						
Hospitalizations	0.86 (0.67, 1.11)	0.24	0.86 (0.67, 1.11)	0.26	0.90 (0.74, 1.10)	0.31
Inpatient Days	1.02 (0.75, 1.38)	0.92	1.07 (0.78, 1.47)	0.69	0.90 (0.71, 1.14)	0.38
Hospital Spending	-$20 (-159, 118)	0.77	-$108 (-303, 86)	0.28	-$25 (-83, 33)	0.40

* Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL) and combined the low-poverty and Section 8 voucher groups. The adult sample had a total of 54,569 person-year observations and the child sample had a total of 122,128 person-year observations.

† Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates as described in the text. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

eAppendix Table F9. Results for Hospital Spending: Alternative Payment Imputation Approach

	All Five States:* CA, IL, NY, MA, and MD			
	Main Analyses: Imputed Values for MCO Only		Alternative Analyses: Imputed values for both FFS and MCO	
	Estimate† (95% CI)	P Value	Estimate† (95% CI)	P Value
Adults	-$129 (-497, 239)	0.49	-$128 (-529, 273)	0.53
Children	-$143 (-256, -31)	0.01	-$127 (-239, -15)	0.03
Younger children	-$196 (-307, -84)	<0.001	-$178 (-287, -68)	0.002
Older children	$121 (-160, 401)	0.40	$117 (-164, 398)	0.42
Girls	-$213 (-370, -56)	0.01	-$181 (-340, -23)	0.03
Boys	-$20 (-159, 118)	0.77	-$55 (-195, 86)	0.45
	Medicaid Data:* CA, IL, NY, and MD			
	Main Analyses: Imputed Values for MCO Only		Alternative Analyses: Imputed values for both FFS and MCO	
	Estimate† (95% CI)	P Value	Estimate† (95% CI)	P Value
Adults	$40 (-213, 292)	0.76	-$38 (-277, 201)	0.75
Children	-$21 (-128, 87)	0.71	-$13 (-110, 84)	0.79
Younger children	-$73 (-167, 21)	0.13	-$65 (-148, 17)	0.12
Older children	$102 (-296, 500)	0.62	$176 (-209, 561)	0.37
Girls	-$64 (-198, 69)	0.34	-$44 (-161, 72)	0.46
Boys	$57 (-121, 236)	0.53	$24 (-150, 197)	0.79

* The adult sample for the five-state sample had a total of 54,569 person-year observations, and the child sample for the five-state sample had a total of 122,128 person-year observations. The adult sample for the Medicaid data has a total of 20,639 person-year observations, and the child sample for the Medicaid data has a total of 55,270 person-year observations.
† Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates as described in the text. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects. All models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.

eAppendix Table F10. Results Excluding Data From Participants Who Lived in a Different State in 2009 Than Their Original State at Randomization

	Original Sample		Sub-Sample Excluding All Years of All-Payer Data for Participants Known to Live Out of State in 2009*		Sub-Sample Excluding Years of All-Payer Data Following Last Known Hospital Discharge for Participants Known to Live Out of State in 2009†	
	Estimate^ (95% CI)	**P Value**	**Estimate^ (95% CI)**	**P Value**	**Estimate^ (95% CI)**	**P Value**
Adults	**N=4072, PY= 54569‡**		**N=3795, PY=49952**		**N=3892, PY=50608**	
Hospitalizations	0.95 (0.84, 1.08)	0.45	0.97 (0.85, 1.10)	0.65	0.96 (0.85, 1.09)	0.54
Inpatient Days	0.93 (0.77, 1.13)	0.46	0.95 (0.79, 1.15)	0.61	0.94 (0.78, 1.14)	0.53
Hospital Spending	-$129 (-497, 239)	0.49	-$72 (-466, 322)	0.72	-$115 (-508, 278)	0.57
Children	**N=9118, PY=122128**		**N=8632, PY=114058**		**N=8718, PY=114918**	
Hospitalizations	0.85 (0.73, 0.99)	0.03	0.85 (0.73, 0.99)	0.03	0.86 (0.74, 0.99)	0.04
Inpatient Days	0.92 (0.77, 1.11)	0.41	0.92 (0.76, 1.11)	0.36	0.93 (0.77, 1.12)	0.44
Hospital Spending	-$143 (-256, -31)	0.01	-$153 (-272, -34)	0.01	-$151 (-270, -31)	0.01
Younger children	**N=7244, PY=96983**		**N=6830, PY=90149**		**N=6894, PY=90800**	
Hospitalizations	0.82 (0.70, 0.98)	0.02	0.83 (0.70, 0.98)	0.03	0.84 (0.71, 0.98)	0.03
Inpatient Days	0.87 (0.71, 1.07)	0.18	0.86 (0.70, 1.06)	0.15	0.87 (0.71, 1.07)	0.19
Hospital Spending	-$196 (-307, -84)	<0.001	-$210 (-329, -92)	0.001	-$202 (-320, -83)	0.001
Older children	**N=1874, PY=25145**		**N=1802, PY=23909**		**N=1824, PY=24118**	
Hospitalizations	0.97 (0.80, 1.18)	0.75	0.97 (0.79, 1.18)	0.76	0.96 (0.79, 1.17)	0.67
Inpatient Days	1.11 (0.77, 1.61)	0.58	1.11 (0.76, 1.62)	0.58	1.10 (0.76, 1.58)	0.62
Hospital Spending	$121 (-160, 401)	0.40	$138 (-157, 433)	0.36	$111 (-181, 403)	0.46
Girls	**N=4526, PY=61287**		**N=4294, PY=57502**		**N=4351, PY=58138**	
Hospitalizations	0.86 (0.75, 0.98)	0.03	0.86 (0.75, 0.98)	0.03	0.86 (0.76, 0.98)	0.03
Inpatient Days	0.84 (0.70, 1.01)	0.07	0.85 (0.71, 1.02)	0.08	0.85 (0.71, 1.02)	0.08
Hospital Spending	-$213 (-370, -56)	0.01	-$230 (-395, -65)	0.01	-$224 (-389, -59)	0.01
Boys	**N=4592, PY=60841**		**N=4338, PY=56556**		**N=4367, PY=56780**	
Hospitalizations	0.86 (0.67, 1.11)	0.24	0.86 (0.67, 1.12)	0.26	0.86 (0.67, 1.11)	0.25
Inpatient Days	1.02 (0.75, 1.38)	0.92	1.00 (0.73, 1.38)	0.98	1.01 (0.75, 1.38)	0.93
Hospital Spending	-$20 (-159, 118)	0.77	-$17 (-165, 130)	0.82	-$18 (-166, 129)	0.81

* All-person years of data eligible for matching to all-payer data were excluded for participants known to live in a different state in 2009 than the state in which they were originally randomized.

† Person-years of all-payer data for participants known to live in a different state in 2009 were retained up through the calendar year of the participant's last known hospital discharge in their randomization state. Subsequent person-years of all-payer data were excluded for these participants.

^ Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL) and combined the low-poverty and Section 8 voucher groups. All models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects. Estimates compare the outcomes for everyone assigned to the voucher groups with the outcomes for everyone assigned to the control group, with adjustments made for the set of baseline covariates described in the text.

eAppendix Table F11. Association of a 10 Percentage Point Decrease in Neighborhood Poverty With Hospital Use: Alternative Length of Exposure Time and Alternative 2SRI Approach

	Main Analyses:* Predicted Percent of Families above Poverty Line for 1 to 3 Years Since Randomization		Alternative Analyses:* Predicted Percent of Families above Poverty Line for 1 to 7 Years Since Randomization		Alternative Analyses:* Two Stage Residual Inclusion (2SRI) Approach for Percent Above Poverty Line for 1 to 3 Years Since Randomization	
	Poverty Estimate† (95% CI)	P Value	Poverty Estimate† (95% CI)	P Value	2SRI Poverty Estimate^ (95% CI)	P Value
Adults						
Hospitalizations	0.95 (0.85, 1.08)	0.45	0.96 (0.83, 1.11)	0.6	0.95 (0.84, 1.06)	0.42
Inpatient Days	0.94 (0.8, 1.11)	0.46	0.94 (0.77, 1.15)	0.57	0.93 (0.83, 1.15)	0.47
Hospital Spending	-$68 (-424, 288)	0.71	-$181 (-619, 256)	0.42	n/a	n/a
Children						
Hospitalizations	0.88 (0.8, 0.99)	0.03	0.88 (0.77, 1.01)	0.06	0.89 (0.77, 0.97)	0.03
Inpatient Days	0.93 (0.79, 1.1)	0.41	0.94 (0.78, 1.14)	0.53	0.93 (0.78, 1.15)	0.52
Hospital Spending	-$133 (-237, -28)	0.01	-$156 (-291, -21)	0.02	n/a	n/a

* Estimates used data from all five sites (all-payer samples from CA, NY, and MA and Medicaid samples from MD and IL). The adult sample had a total of 54,569 person-year observations and the child sample had a total of 122,128 person-year observations.
† These models used predicted reductions in neighborhood poverty as the key explanatory variable for hospital utilization/spending in a two-stage model, with these estimates specifically showing the change in outcomes associated with a 10 percentage point decrease in predicted neighborhood poverty exposure (to be consistent with the housing voucher intervention's association with reductions in neighborhood poverty compared to the control group). The first-stage regression was an ordinary least squares model with the mean duration-weighted percent of households in the census tract with incomes above the poverty line as the dependent variable (so that differences in this first-stage outcome and subsequent predictions can be interpreted as a reduction in poverty), the study-group voucher indicators and the site and study-group voucher interactions as the main predictors, and the baseline characteristics and sites as controls. For the main analyses, the second-stage regression uses the predicted duration-weighted percent of families above the poverty line from years 1 through 3 since randomization as the key explanatory variable and hospital utilization/spending from years 4 through 21 since randomization as the dependent variable, adjusting for baseline covariates. For the models using utilization count data (i.e., the total number of annual hospitalizations and the total number of annual hospital days), incidence rate ratios were estimated from negative binomial models with an offset term indicating the total months of available data for the person. For the models using total annual hospital spending data, a difference in dollars was estimated from two-part spending models, where the first part is a logistic regression for any spending and the second part is a generalized linear model with a log link and gamma distribution for nonzero spending; the two-part model's results are presented as combined average marginal effects. For the alternative analyses, the second-stage regression uses the predicted duration-weighted percent of families above the poverty line from years 1 through 7 since randomization as the key explanatory variable and hospital utilization/spending from years 8 through 21 since randomization as the dependent variable, adjusting for baseline covariates. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family.
^ In the two stage residual inclusion (2SRI) model, the first-stage regression was an OLS model with mean duration-weighted percent of households in the census tract with incomes above the poverty line as the dependent variable (from years 1 through 3 since randomization), the study-group voucher indicators and the site and study-group voucher interactions as the main predictors, and the baseline characteristics and sites as controls. The second-stage regression modeled the respective outcome (in years 4 through 21 since randomization) as a function of the actual mean duration-weighted percent of households in the census tract with incomes above the poverty line as the key explanatory variable and includes the residuals from the first-stage model along with adjustments for baseline covariates. Models included survey sample weights to account for varying sampling probabilities over the accrual period, and accounted for the family unit by clustering all standard errors by family. The 2SRI models were each bootstrapped (200 repetitions) to correct for bias in the standard errors.

eReferences

1. AHRQ Quality Indicators. Agency for Healthcare Research and Quality. https://www.qualityindicators.ahrq.gov/Archive/Software.aspx#sas.

2. Healthcare Cost Report Information System. Centers for Medicare & Medicaid Services. https://www.cms.gov/Research-Statistics-Data-and-Systems/Downloadable-Public-Use-Files/Cost-Reports/. Published October 26, 2018.

3. AHA Annual Survey Database. American Hospital Association. http://www.ahadata.com/aha-annual-survey-database-asdb/. Published 2018.

4. Agency for Healthcare Research and Quality. Using Appropriate Price Indices for Analyses of Health Care Expenditures or Income Across Multiple Years. 2016. https://meps.ahrq.gov/about_meps/Price_Index.shtml.

5. Sanbonmatsu L, Katz LF, Ludwig J, et al. *Moving to Opportunity for Fair Housing Demonstration Program - Final Impacts Evaluation*. U.S. Department of Housing and Urban Development; 2012:330. https://www.huduser.gov/portal/publications/pubasst/MTOFHD.html. Accessed November 2, 2017.

6. Roberts ET, Pollack CE. Does Churning in Medicaid Affect Health Care Use? *Med Care*. 2016;54(5):483-489. doi:10.1097/MLR.0000000000000509

7. Deb P, Norton E, Manning W. *Health Econometrics Using Stata*. 1st ed. College Station, TX: Stata Press; 2017.

8. Koch G, Stokes M, Davis C. *Categorical Data Analysis Using SAS®, Third Edition*. 3rd ed. SAS Institute; 2012.

9. Kling J, Liebman J, Katz L. Experimental Analysis of Neighborhood Effects. *Econometrica*. 2007;75(1):83-119.

10. Terza JV, Basu A, Rathouz PJ. Two-Stage Residual Inclusion Estimation: Addressing Endogeneity in Health Econometric Modeling. *J Health Econ*. 2008;27(3):531-543. doi:10.1016/j.jhealeco.2007.09.009

11. Terza JV. Two-stage residual inclusion estimation: A practitioners guide to Stata implementation. *Stata J*. 2017;17(4):916-938.

12. Terza JV. Two-Stage Residual Inclusion Estimation in Health Services Research and Health Economics. *Health Serv Res*. 2018;53(3):1890-1899. doi:10.1111/1475-6773.12714