

Supplemental Appendix for “Geographic Variation in Mental Health Treatment Utilization: Evidence from Migration”

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A Movers and Moving Patterns

The movers sample used in the analysis consists of 141,740 individuals, covering all 306 Hospital Referral Regions (HRRs) as both origins and destinations, and a total of 32,853 origin-destination HRR pairs. Appendix Figure A15 shows the distribution of the number and share of movers across HRRs. The top three most popular moving routes are from East Long Island, NY to Fort Lauderdale, FL; from Newark, NJ to Camden, NJ; and from Houston, TX to Austin, TX. At the state level, Florida, California, and New York see the most people moving out, while Florida, Texas, and North Carolina see the most people moving in. Appendix Figure A16 shows the distribution of moving distances, with an average distance of 597 miles.

Table 1 presents summary statistics for movers and non-movers in terms of basic demographics and healthcare utilization levels. Additionally, Table A3 shows further characteristics among people aged 65 and older from the American Community Survey (ACS) during 2006–2018. Movers tend to have higher education levels, higher household incomes, and are more likely to be divorced, widowed, and out of the labor force. This is consistent with findings by Finkelstein et al. (2016) using data from the Health and Retirement Study (HRS). In particular, Appendix Table A4 indicates that being divorced, losing a partner, and retiring in the last year are strong predictors of moving.

Although these major life events predict the decision and timing to move, they do not significantly correlate with the direction of moving in terms of mental health treatment utilization rates. Using the cross-state movers sample from the ACS, Appendix Table A5 shows that differences in mental health service and drug utilization rates between destination and origin states are not significantly different among people who have recently experienced divorce, the death of a spouse, or retirement. This is likely because the majority of elderly individuals move to be closer to children or relatives or due to living cost considerations, while only a small share move and choose destinations for health reasons Finkelstein et al. (2016).

B Mental Health Service Use in Claim Data

Mental health service use is identified in claims data for inpatient, outpatient, and physician services based on the diagnosis code. These diagnosis codes are recorded using ICD-9 codes during 2006–2015Q3 and ICD-10 codes since 2015Q4. ICD codes for different types of mental health conditions are reported in Appendix Table A1.

When identifying claims related to mental health services, only the primary diagnosis code is considered. According to the Medicare Coding Manual, the primary diagnosis should reflect the condition chiefly responsible for the admission or service (CMS, 2024). In addition to the primary code, inpatient and outpatient claim data can include up to 24 additional

conditions, and physician claim data can include up to 12. These secondary codes record conditions that coexist with the primary one.

When a mental health disorder is recorded as the second-order diagnosis, 43.1% of cases also have the primary diagnosis related to a mental health disorder (see Appendix Figure A17). The share decreases further as the diagnosis order increases. Among claims that list mental illness as non-primary diagnosis, common primary diagnoses include essential hypertension (13.4%), diabetes mellitus (6.2%), and general symptoms (6.1%). These claims likely reflect healthcare visits for other conditions with mental health recorded as a comorbidity, rather than involving mental health treatment. This is supported by Appendix Figure A18 panel (a), which shows that 99.3% of claims with the primary mental health diagnosis involve mental health-related procedures, whereas fewer than 5% of claims with only non-primary mental health diagnoses involve such services.¹ Panel (b) shows that around 45% of claims with a primary mental health diagnosis involve psychotherapy, compared to 2.3% of claims with only a second-order mental health diagnosis or even lower in higher-order diagnoses.

Taken together, including all diagnoses will capture services for other conditions where mental health is only coded as a comorbidity, rather than true mental health service use. Moreover, the variability in coding practices for comorbidities among providers can introduce additional measurement error, further supporting the decision to focus on primary diagnoses.

For completeness, I replicated the main result for service use by identifying services using two or more diagnosis codes. As shown in Appendix Figure A19, the estimated place effect decreases when higher-order diagnoses are considered. One explanation, following the reasoning above, is that the measurement focuses more on mental illness as comorbidities rather than its treatment, so patient-side factors, such as health status, can play a more significant role. However, given the measurement error related to higher-order diagnosis codes, it is not recommended to draw any definitive conclusions from these results.

Another issue to notice when constructing mental health service use measurements is that cognitive disorders, such as dementia, are not included. Although they are listed under “Mental Disorders” section in the ICD, they are generally considered neurological disorders rather than mental illnesses. Moreover, treatment differs significantly from that of typical mental illnesses such as mood disorders, focusing mainly on pharmacological management of symptoms. Therefore, I do not consider visits for cognitive disorders as mental health care visits. However, since service use is identified based on the primary diagnosis, there might be a concern if patients with dementia are more likely to have dementia as the primary diagnosis and other mental illnesses as secondary diagnoses when the visit is actually for those other mental conditions. To address this, I tested the sensitivity of the results using two alternative definitions of mental health service visits: 1) claims with primary diagnoses of cognitive disorders or the current list of mental illnesses; 2) claims with primary diagnoses in the current list of mental illnesses and no cognitive disorders as secondary diagnoses. Appendix Table A16 shows that both measurements produce essentially the same place effect, similar to the baseline. Moreover, when patients with cognitive disorders are entirely excluded from the sample (both the movers sample and the baseline sample for calculating

¹Procedures related to mental health can be identified in Medicare physician service data, which report all procedures provided during each visit and the diagnosis supporting each procedure. This level of detail is not available in inpatient and outpatient claims, so these types of claims are not included in this analysis.

the regional utilization rates), the results are only moderately reduced. This could be because people with cognitive disorders are more likely to rely on caregivers for healthcare decisions. When they move to new places and are cared for by local caregivers, they may converge more to the local utilization pattern.

C Additional Data Sources

American Community Survey (ACS) The ACS dataset is used for two purposes: measuring population demographic characteristics and examining potential moving reasons across migration flows. Key metrics from the ACS include median household income and the share of population with a high school degree, both among people above age 65. These measurements are taken from ACS’s 5-year estimates for 2010 and 2015, and are aggregated from county to HRR level using the Dartmouth Atlas county-to-HRR crosswalk (Fisher et al., 2020; Nanda et al., 2021). Migrations are identified using individual data during 2006–2018 from IPUMS (Ruggles et al., 2024). Only people above age 65 are considered, and only address changes across states are identified as a move. Information on age group, gender, marital status, labor force participation status, and life event in the past year (i.e. divorce, loss of spouse, retirement) are included in models predicting moving direction.

Behavioral Risk Factor Surveillance System (BRFSS) survey data The BRFSS survey is used to measure public attitude toward mental illness across different geographic areas. This telephone-based survey collects health-related data from U.S. residents, including their risk behaviors, chronic health conditions, and use of preventive services. Two questions specifically related to mental health attitudes were posed in 2007, 2009, 2012 and 2013, in 40 states combined. The first question asked whether you agree or disagree with the statement that *“People are generally caring and sympathetic to people with mental illness”*. The second question asked whether you agree or disagree with the statement that *“Treatment can help people with mental illness lead normal lives”*. The answer was in 5-point scale, with “1” representing strongly agree and “5” being strongly disagree. From the responses to these questions, two variables are constructed to gauge average level of perceived sympathy and belief in treatment efficacy by HRR (identified based on zip code).

CDC Underlying Cause of Death database This database provides suicide rates across different geographic areas, gender, and age groups. Derived from death certificates for U.S. residents in 1999–2019, the dataset reports number of deaths, crude death rates and age-adjusted death rates for selected causes-of-death and for different sub-populations. Suicide rates are computed starting with county-level suicides and population counts, then aggregating to the HRR level based on the Dartmouth Atlas county-to-HRR crosswalk (Fisher et al., 2020; Nanda et al., 2021). Due to privacy regulations, data representing 0–9 deaths are suppressed. To circumvent an excess of missing values, all available years are included when deriving the suicide rate.

Provider of Services (POS) Files—Hospital & Non-Hospital Facilities data The POS file provides information on the characteristics of hospitals and other health care facili-

ties. Taking the average across datasets from 2006–2018, I compute the number of psychiatric hospitals, the number of psychiatric units in general hospitals, the number of psychiatric beds (per 1,000 Medicare recipients), and the number of all hospital beds (per 1,000 Medicare recipients) for each HRR based on facility’s zip code.

U.S. Air Quality Data This dataset, provided by the Environmental Protection Agency (EPA), contains air quality data from outdoor monitors across the U.S. Using annual summary data from 2006–2018, I calculate the average daily PM2.5 level for each HRR based on the county code of each monitor and the Dartmouth Atlas county-to-HRR crosswalk (Fisher et al., 2020; Nanda et al., 2021).

U.S. Monthly Climate Normals This dataset, provided by the National Centers for Environmental Information (NCEI), contains information on typical climate conditions collected from 2006–2020. Four metrics are constructed to capture local climate characteristics: average annual temperature, the number of days with minimum temperature below 32 °F annually, the number of days with maximum temperature above 90 °F annually, and average monthly precipitation. All these measurements are aggregated at the HRR level based on the zip code of each weather station.

D Selection on unobservables

In this section, I follow the method developed by Oster (2019) to adjust for selection on unobservables. The intuition of this empirical analysis is to use the sensitivity of the treatment effects when including observed controls to infer the bias due to omitted unobserved controls. In this specific setting, selection on unobservables may come from time-varying factors correlated with both changes in local utilization rates and changes in individual treatment use behavior upon moving, while all time-invariant individual characteristics are controlled by fixed effects.

This method is further developed by Finkelstein et al. (2021) in the use of movers design in identifying the place effect on mortality. However, unlike Finkelstein et al. (2021), who examines an outcome that cannot be measured repeatedly (i.e., death) and therefore can only use the selection on the observables and unobservables of the origin to infer those of the destination, the outcome measures in this paper are recorded annually. This enables me to include individual fixed effects to control for all individual-level time-invariant characteristics and use this as a way to bound the potential selection on other unobservables.

Appendix Table A11 presents the results of the adjustment. Column (1) reports the coefficient and R-squared estimated in models without individual fixed effects. What remains controlled are the origin HRR fixed effects, year relative to move fixed effects, calendar year fixed effects, and age-group fixed effects. It is essentially the same if we first residualize all outcomes, as well as the change in local utilization rate, by regressing them on these fixed effects and then run the regression using these residuals. Column (2) reports the coefficient and R-squared with individual fixed effects, which is also the baseline result in the main text.

Column (3) reports the adjusted coefficient under two benchmark assumptions suggested by Oster (2019): i) $R_{max} = 1.3 * R2_c$, where $R2_c$ is the R-squared of the model with the full set of controls (i.e., the model in column (2)); and ii) $\delta = 1$, which implies that the observed and unobserved variables have the same relative degree of selection. The adjusted coefficients are only modestly lower than the baseline result (e.g., 0.377 for service use and 0.107 for prescription drugs).

Note that these two assumptions are quite conservative. The R_{max} assumption assumes that with a hypothetical full set of unobservables controlled, we can explain 56% of the variation in mental health service use (82% for drugs). However, models controlled for the past year mental health treatment usage, including whether there is any claim and total payment in log for both service and drugs, together with all the fixed effects, only has an R-squared of 46% (69% for drugs). If we use the latter R-squared as the R_{max} , the adjusted coefficient, as shown in Column (4), is even closer to the baseline (0.439 for service and 0.138 for drugs).

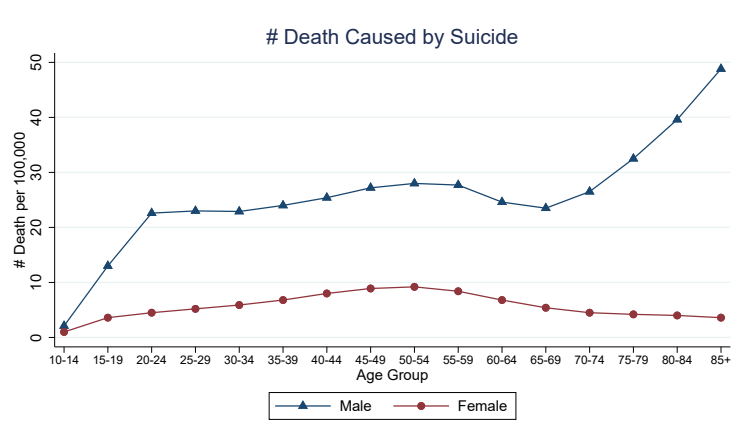
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Schell, Terry L, Samuel Peterson, Brian Garrett Vegetabile, Adam Scherling, Rosanna Smart, and Andrew R Morral, “State-level estimates of household firearm ownership,” 2020. RAND Santa Monica, CA.

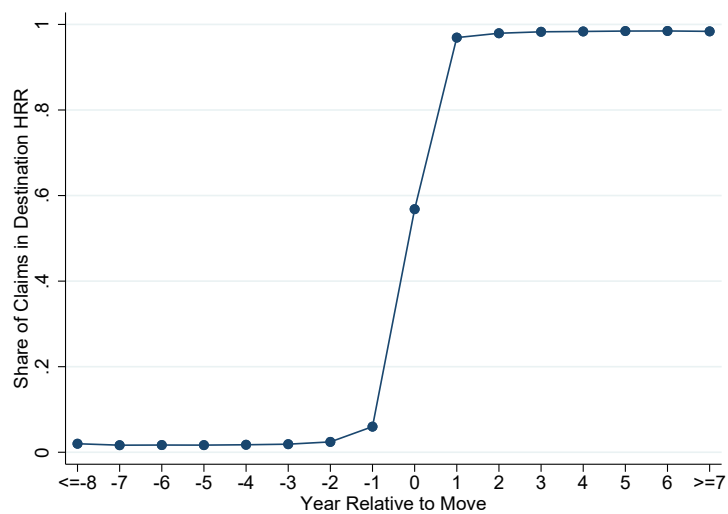
Appendix Figures

Figure A1: Suicide Rates by Gender and Age



Notes: This figure depicts the suicide rate by gender and five-year age group, using data from the CDC Underlying Cause of Death database, 1999–2019.

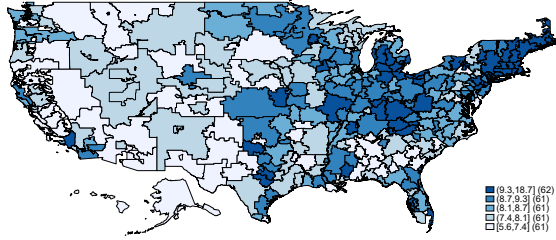
Figure A2: Share of Claims in Destination HRR by Years Relative to Moving



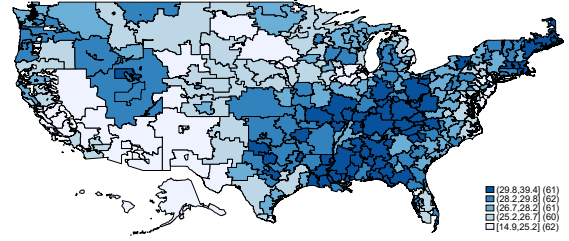
Notes: This figure shows the average share of medical claims from movers' destination HRRs out of all medical claims from either their origin or destination HRRs, by number of years relative to moving.

Figure A3: Mental Health Treatment Utilization Rate and Average Spending by HRR

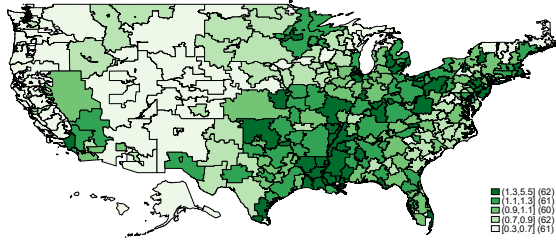
(a) Service (% , including people not covered by Part D)



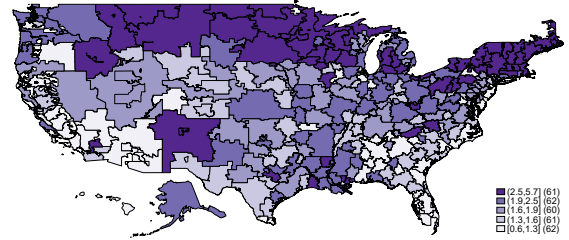
(b) Service or Drug (%)



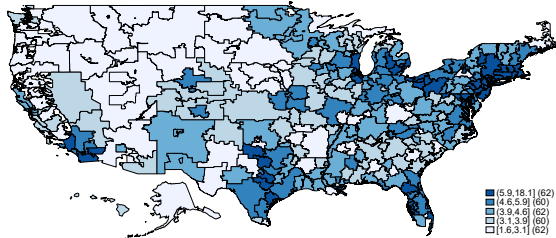
(c) Service — Inpatient (%)



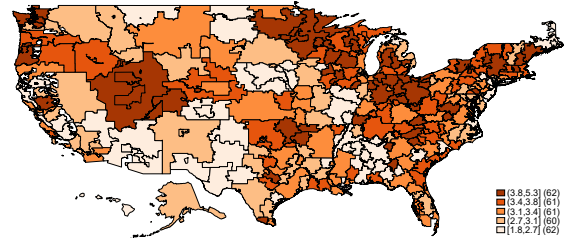
(d) Service — Outpatient (%)



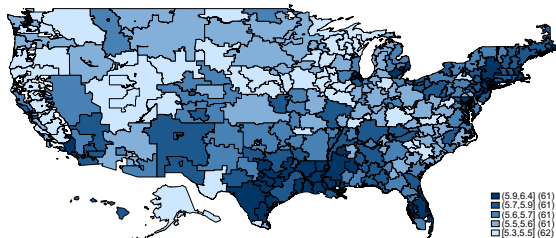
(e) Service — Mental Health Professionals (%)



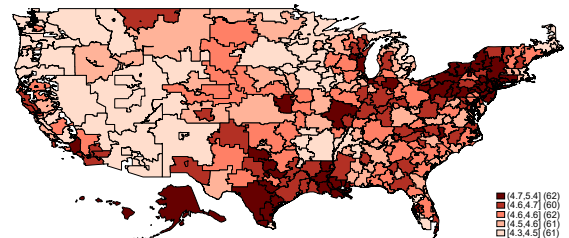
(f) Service — Primary Care Providers (%)



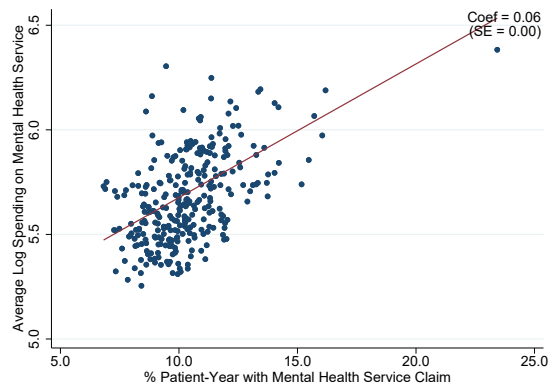
(g) Mental health service spending conditional on service use



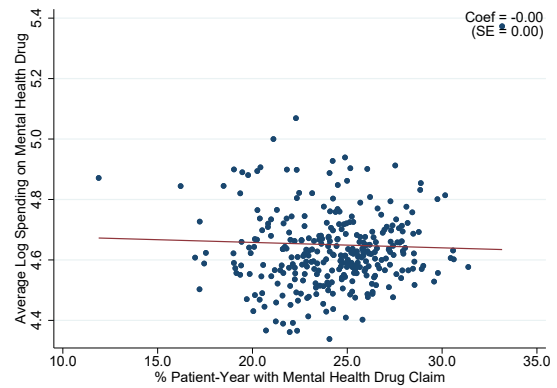
(h) Mental health drug spending conditional on drug use



(i) Correlation between mental health service use rate and average spending conditional on use



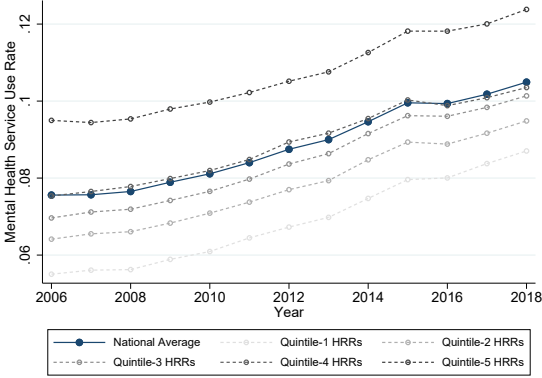
(j) Correlation between mental health drug use rate and average spending conditional on use



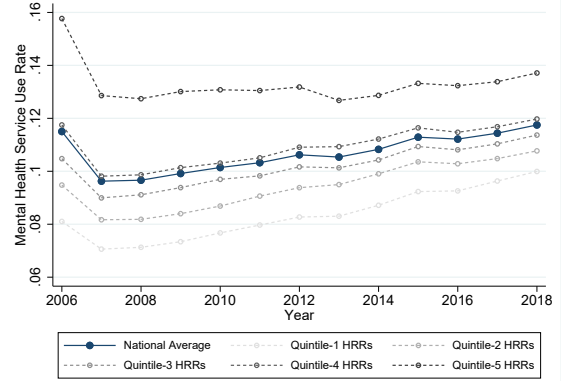
Notes: These figures plot the distributions of mental health treatment utilization rates by HRR. The sample includes Medicare Fee-for-Service (FFS) beneficiaries aged 65–99, with full coverage under Parts A, B, and D (except in Panel (a) where Part D coverage is not required) in each year, drawn from 20% Medicare FFS claims data, 2006–2018. Panel (a) plots the mental health service use rate, defined as the share of patient-year observations with any medical claim having a primary diagnosis related to mental illnesses. Panel (b) plots the share of patient-year observations with either mental health service or drug claim. Panel (c)–(f) plots HRR mental health service utilization rates from specific providers, i.e., hospital inpatient department, hospital outpatient department, mental health professionals (including psychiatrists, psychologists and clinical social workers), and primary care physicians. Panel (g) plots average mental health service spending conditional on use, and Panel (h) plots average mental health drug spending conditional on use. Panel (i) and (j) show scatter plots for HRR mental health service or drug utilization rate and average spending conditional on usage. The fitted lines, coefficients, and standard errors are derived from regressions weighted by the number of patient-year observations in each HRR.

Figure A4: Mental Health Treatment Utilization Rate over Time

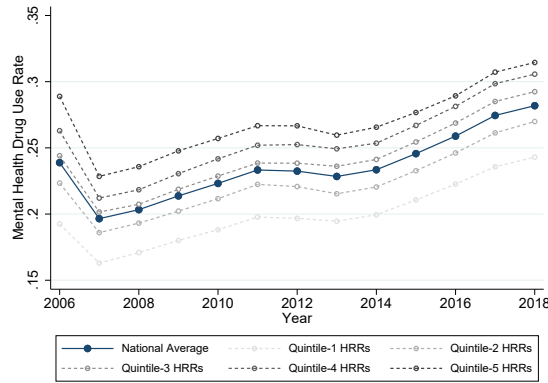
(a) Service (% , including people not covered by Part D)



(b) Service (% , only people covered by Part D)

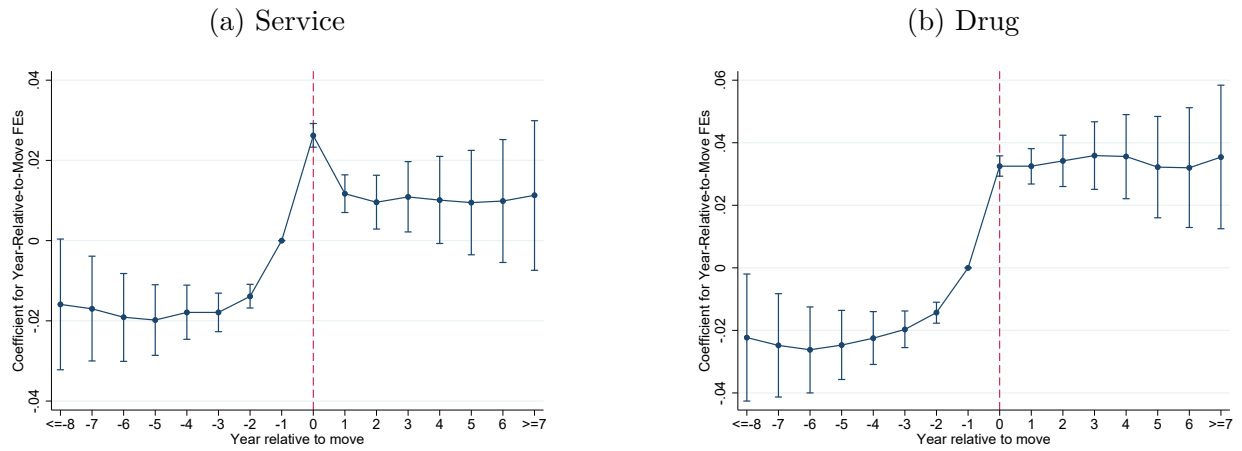


(c) Drug (% , only people covered by Part D)



Notes: These figures show the change in mental health treatment rates over time. The sample includes Medicare Fee-for-Service (FFS) beneficiaries aged 65–99, with full coverage under Parts A, B, and D (except in Panel (a) where Part D coverage is not required), drawn from 20% Medicare FFS claims data, 2006–2018. Panels (a) and (b) show rates of mental health service use, and Panel (c) shows rates of mental health drug use. In each panel, the solid line displays the population-weighted average utilization rate at the national level. The dashed lines display the averages among five fixed groups of HRRs, categorized based on their 2006 utilization rates.

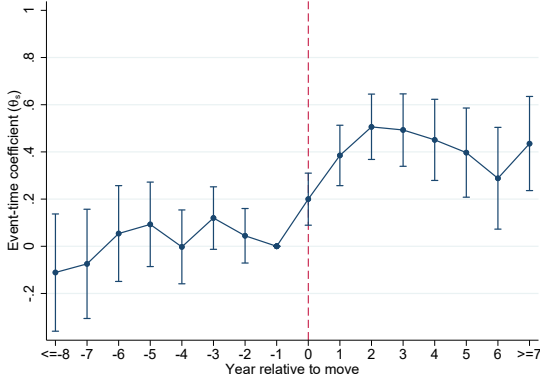
Figure A5: Year-Relative-to-Move Fixed Effects



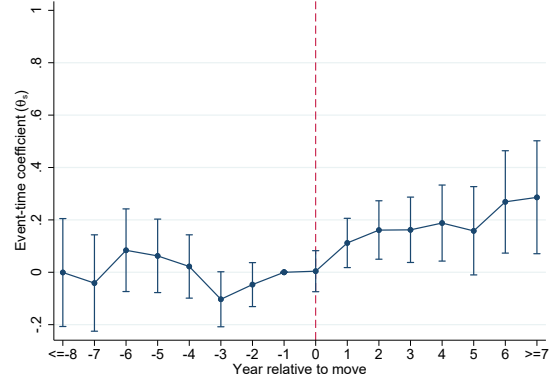
Notes: These figures show coefficients for the year-relative-to-move fixed effects (ρ_s) estimated from Equation (1). The sample includes 1,150,872 patient-year observations. The dependent variable is a binary indicator for whether patient i had any mental health service claim in year t (Panel (a)) or any mental health drug claim (Panel (b)). The dashed lines represent the upper and lower bounds of the 95% confidence interval, based on standard errors clustered at the individual level.

Figure A6: Place Effect by the Share of Claims from Destination HRRs in Year 0

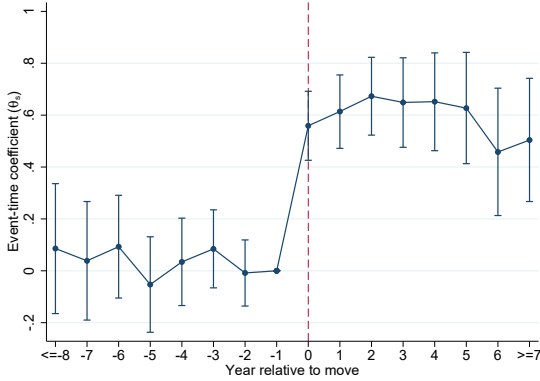
(a) Service — Below Median



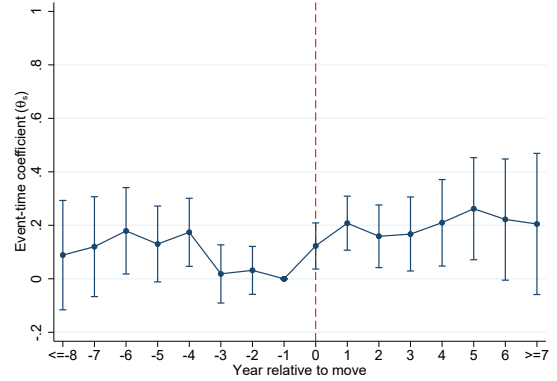
(b) Drug — Below Median



(c) Service — Above Median

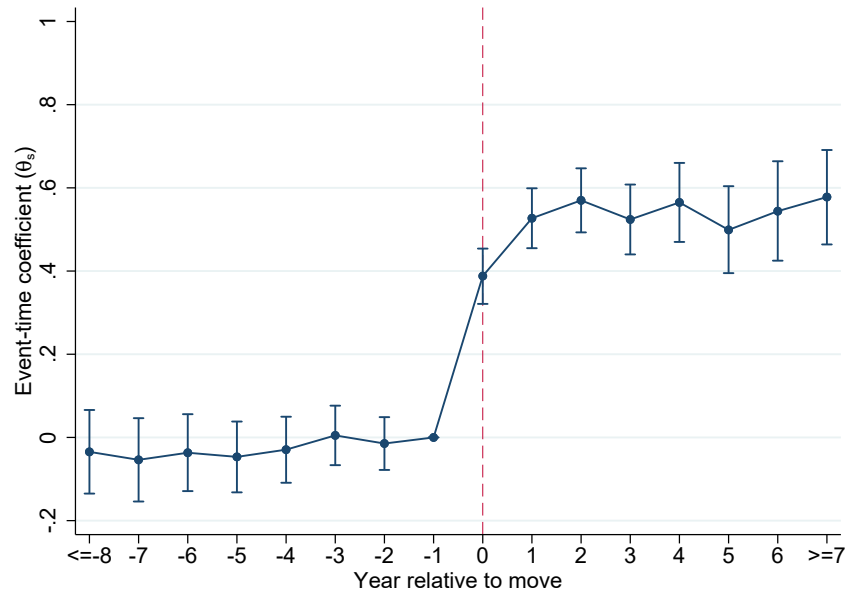


(d) Drug — Above Median



Notes: These figures replicate the event study estimation from Figure 3 using subsets of movers based on the share of claims received from the destination HRR in year 0. Panel (a) and (b) include individuals with a below-median destination claim share in year 0 (499,640 mover-year observations, 60,815 movers). Panel (c) and (d) include individuals with an above-median destination claim share in year 0 (491,616 mover-year observations, 60,210 movers).

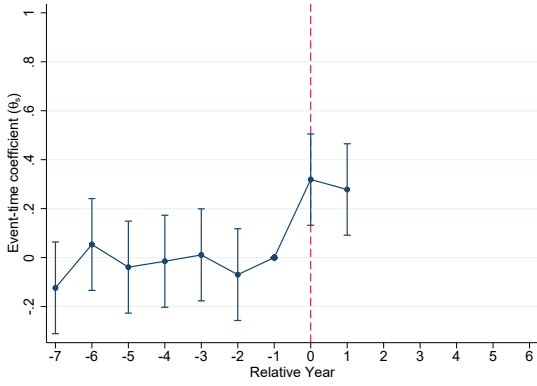
Figure A7: Place Effect: Mental Health Service Use (not conditional on Part D coverage)



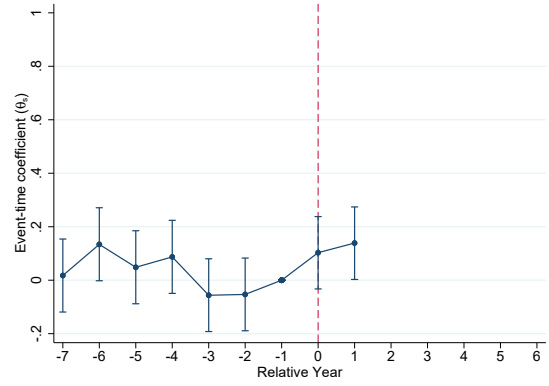
Notes: This figure replicates the event study estimation in Figure 3. The sample does not require Part D coverage and includes 2,840,919 patient-year observations. The dependent variable is a binary indicator for whether patient i had any mental health service claim in year t . The HRR mental health service utilization rate (δ_i) is also calculated among all non-movers, regardless of Part D coverage.

Figure A8: Place Effect: Balanced Panel

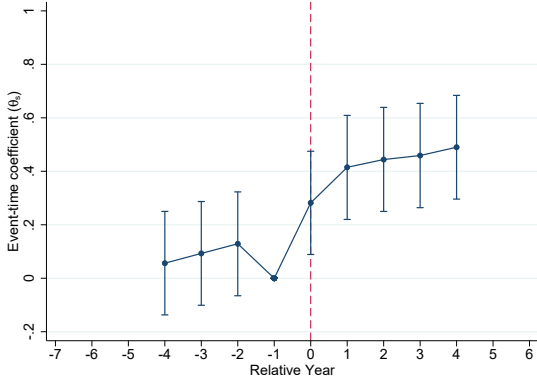
(a) Service — Relative year [-7,1]



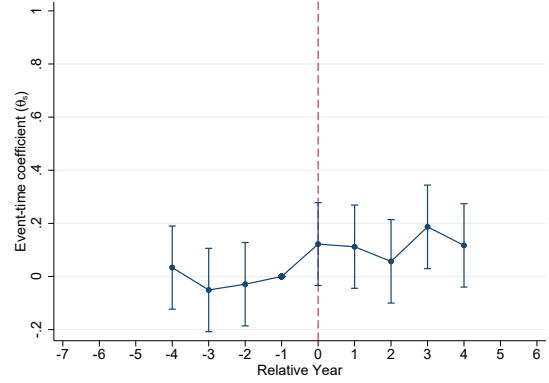
(b) Drug — Relative year [-7,1]



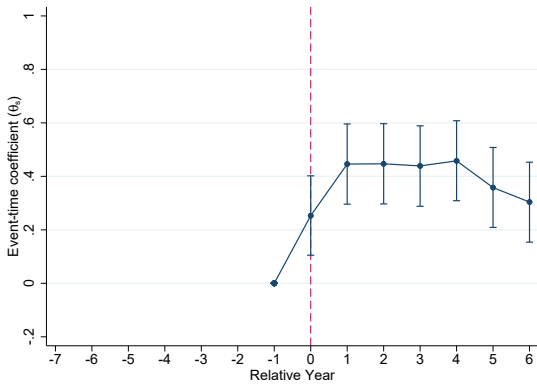
(c) Service — Relative year [-4,4]



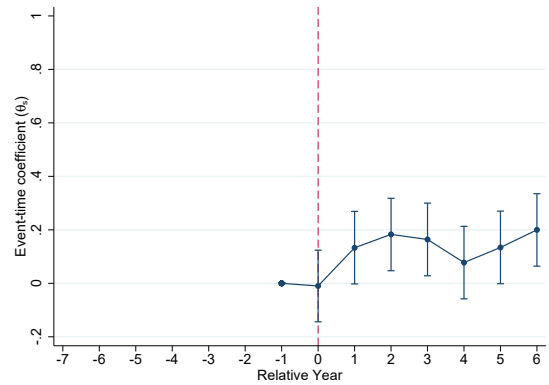
(d) Drug - Relative year [-4,4]



(e) Service — Relative year [-2,6]



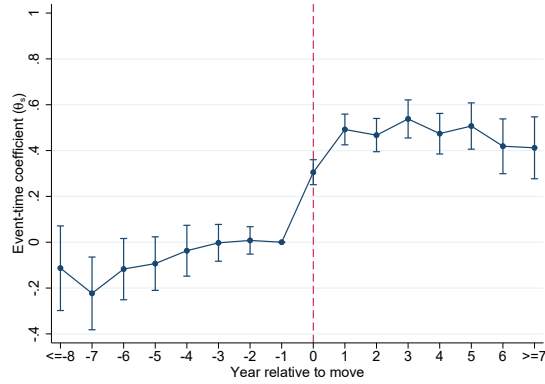
(f) Drug — Relative year [-2,6]



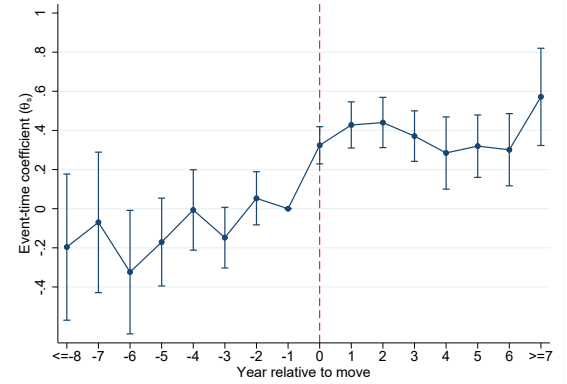
Notes: These figures replicate the event study estimation in Figure 3 using different sets of balanced samples. Panels (a) and (b) use a balanced panel in relative years [-7,1], which includes 224,491 mover-year observations (25,289 movers). Panels (c) and (d) use a balanced panel in relative years [-4,4], which includes 181,302 mover-year observations (20,351 movers). Panels (e) and (f) use a balanced panel in relative years [-1,6], which includes 213,601 mover-year observations (27,220 movers).

Figure A9: Place Effect: Intensive Margin

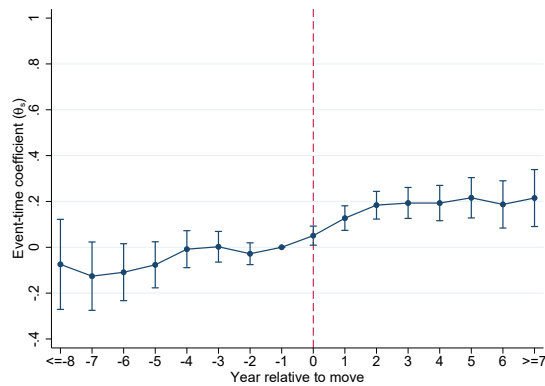
(a) Number of Service Claims



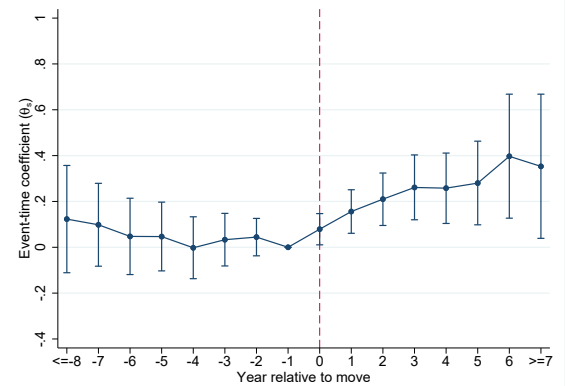
(b) Service Spending



(c) Drug Dosage

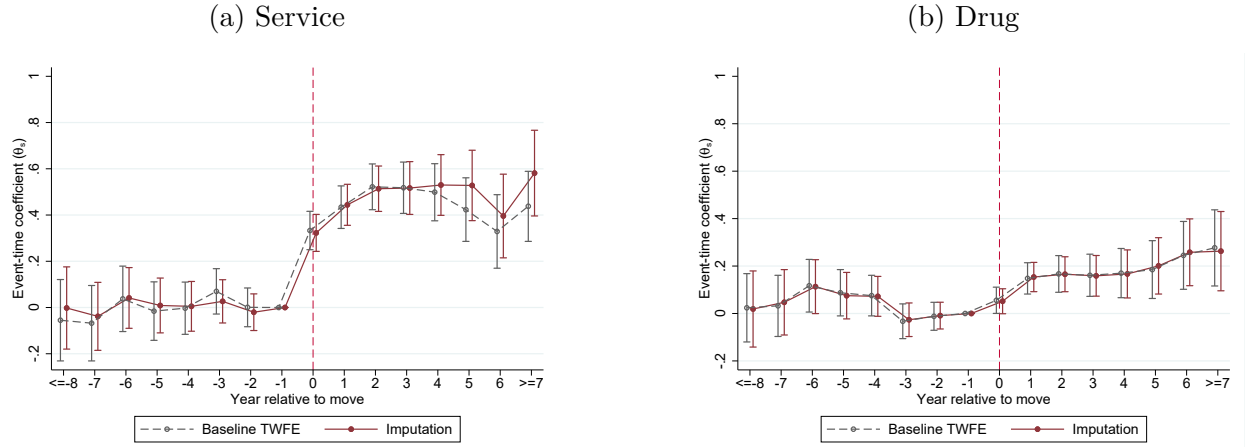


(d) Drug Spending



Notes: These figures show the event study estimation corresponding to Table 3. Panel (a) shows result for the number of mental health service claims. Panel (b) shows result for total spending on mental health service claims. Panel (c) shows result for the total dosage of mental health medications (relative to the national median). Panel (d) shows result for total spending on mental health medications. The main independent variable is the difference in the corresponding average treatment use intensity (in logs) between the destination and origin (δ_i), interacting with the indicator for years relative to moving. All regressions are estimated using Poisson pseudo-likelihood regression with multiple levels of fixed effects ('ppmlhdfc') including individual fixed effects, calendar year fixed effects, relative year fixed effects, and five-year age group fixed effects.

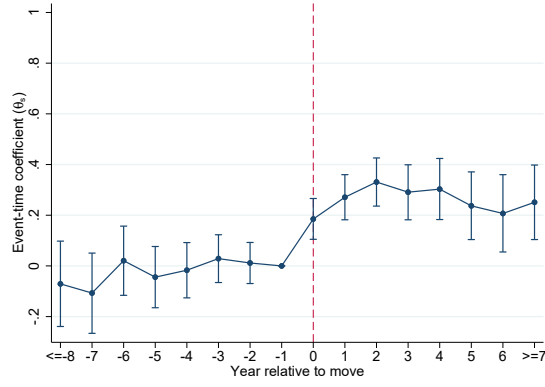
Figure A10: Event Study using the Imputation-Based Strategy



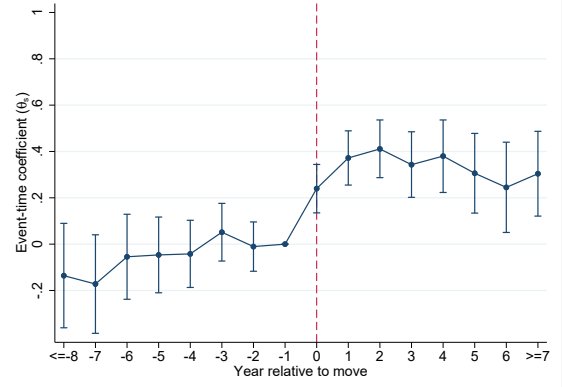
Notes: These figures show the event study results using the imputation method. The estimation is produced by first regressing mental health service or drug use on HRR-year and age-group fixed effects among the sample of all nonmovers and using these estimates to construct the residualized outcome for each mover. The residualized outcome is then used as the dependent variable in a series of event studies by the year of move. The right-hand side of each regression includes individual fixed effects, the difference in average service or drug use rates among all nonmovers between the mover's destination and origin HRR in each year, and its interaction with the year relative to move indicators. Coefficients from the interaction term are extracted and aggregated using the number of movers observed in each cell as weights. These coefficients are plotted in red, with the baseline coefficients plotted in gray. The vertical lines represent the upper and lower bounds of the 95% confidence interval, based on standard errors clustered at the individual level.

Figure A11: Place Effect: Excluding Patients in Nursing Facilities

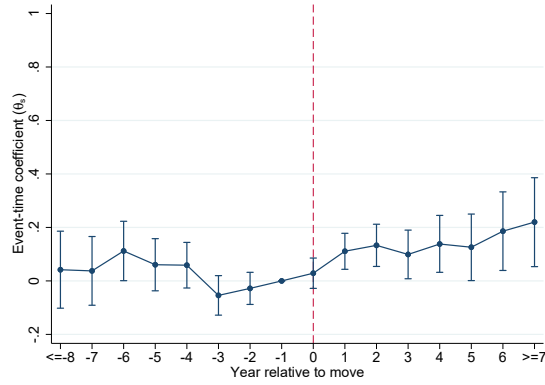
(a) Service — δ_i



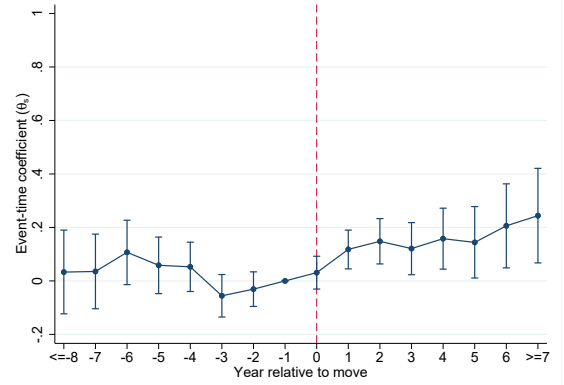
(b) Service — δ_i^{nNF}



(c) Drug — δ_i

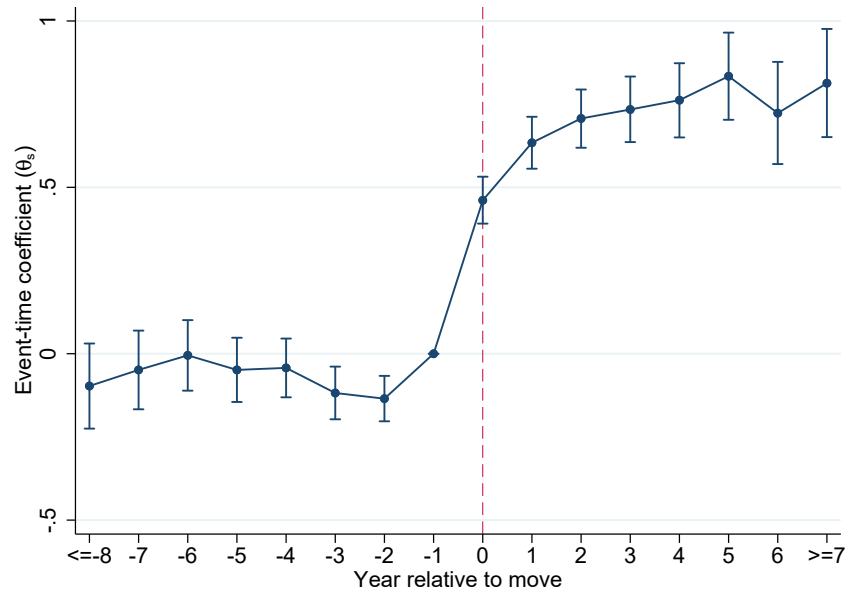


(d) Drug — δ_i^{nNF}



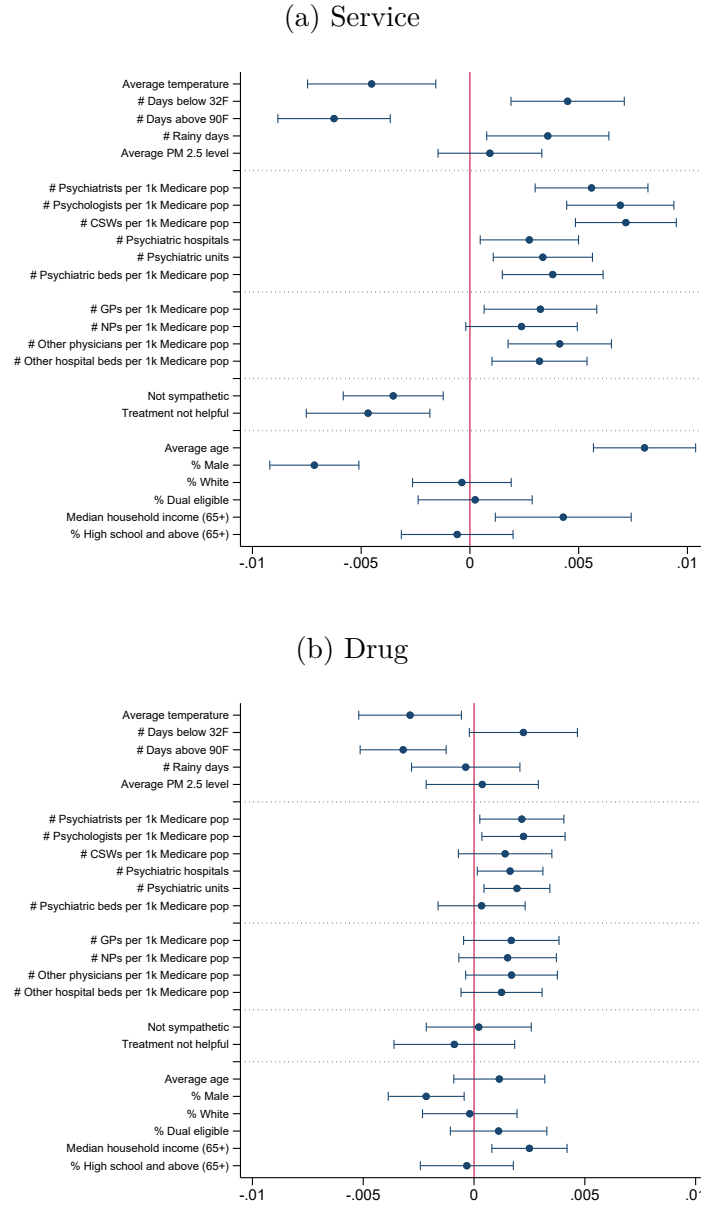
Notes: These figures replicate the event study estimation in Figure 3 using sample that excludes patients in years with any claim from nursing facilities. Panel (a) and (c) measures the difference in the service or drug utilization rate between the destination and origin measured using all non-movers (δ_i). Panel (b) and (d) measures the difference using non-movers outside nursing facilities (δ_i^{nNF}).

Figure A12: Place Effect of Nursing Home Use



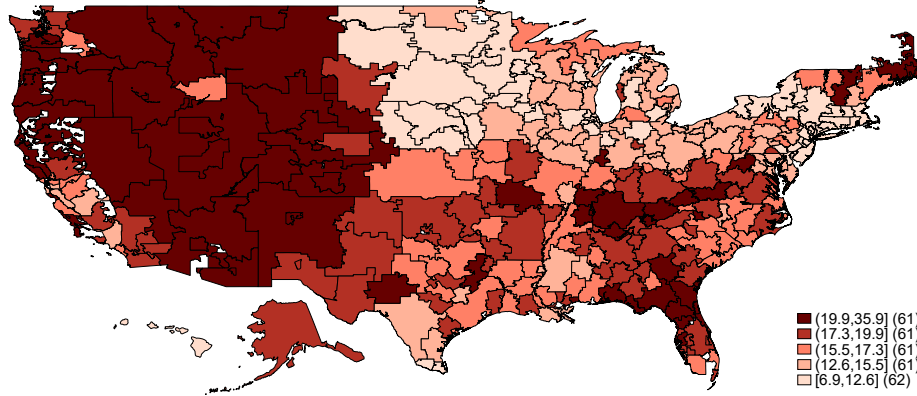
Notes: This figure show coefficients θ_s estimated from Equation (1) for nursing home use. The dependent variable is a binary indicator for whether patient i had any nursing home claim in year t . θ_s are a sequence of coefficients for the interaction terms between destination-origin differences in HRR nursing home utilization rates (δ_i) and indicators for each year relative to moving, where relative year -1 is normalized to 0. Please see the notes in Figure 3 for more details on sample and specification.

Figure A13: Correlation between the Estimated HRR-level Place Effect and HRR Characteristics — Full Set of HRRs



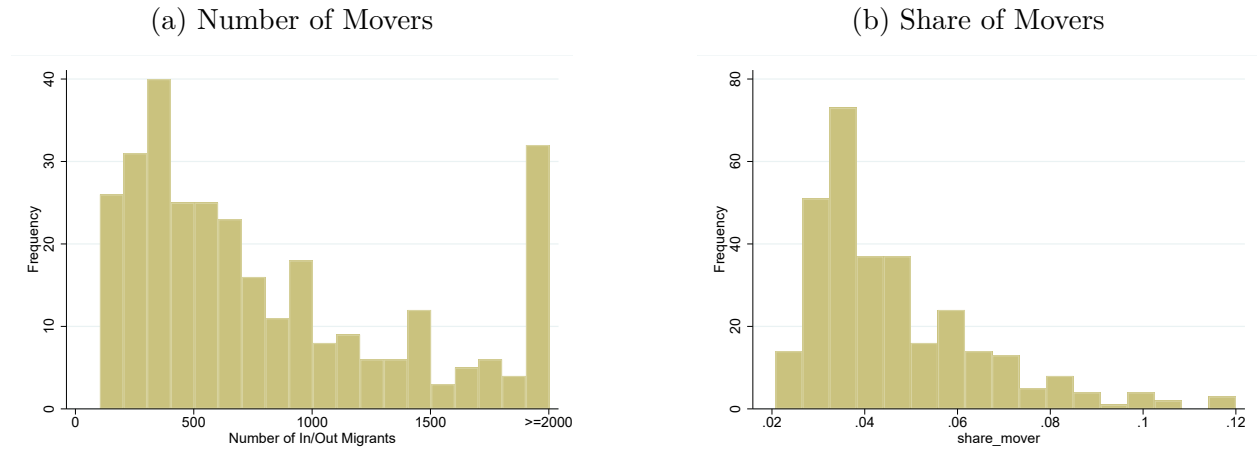
Notes: These figures replicate the correlation coefficients based on bivariate OLS regressions displayed in Figure 6 using all possible HRRs for each HRR characteristic. Specifically, correlations with environmental factors are among 286 HRRs, correlations with public attitude factors are among 240 HRRs, and all others are among the full set of 306 HRRs.

Figure A14: Suicide Rate (per 100,000) by HRR



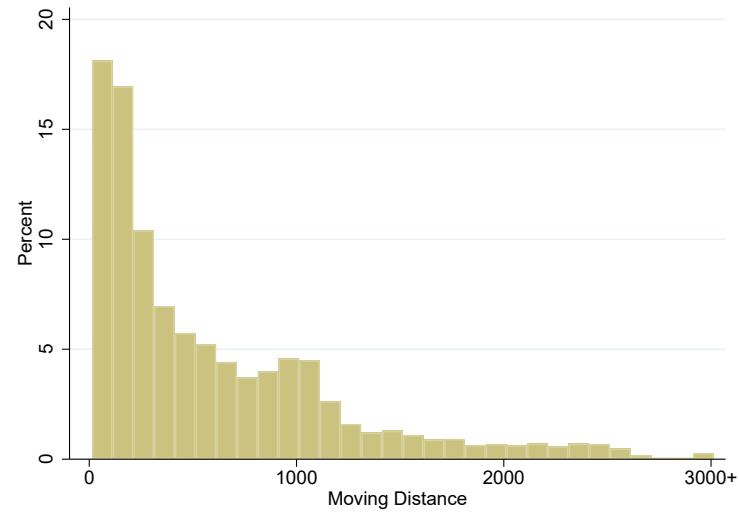
Notes: This figure presents the distribution of suicide rate for the population above age 65 by HRR. The suicide rate comes from the CDC Underlying Cause of Death database, 1999–2019. Death counts are at the county level, which are aggregated to the HRR level based on a zip code crosswalk and population share (Fisher et al., 2020; Nanda et al., 2021).

Figure A15: Histogram of the Number and Share of Movers across HRRs



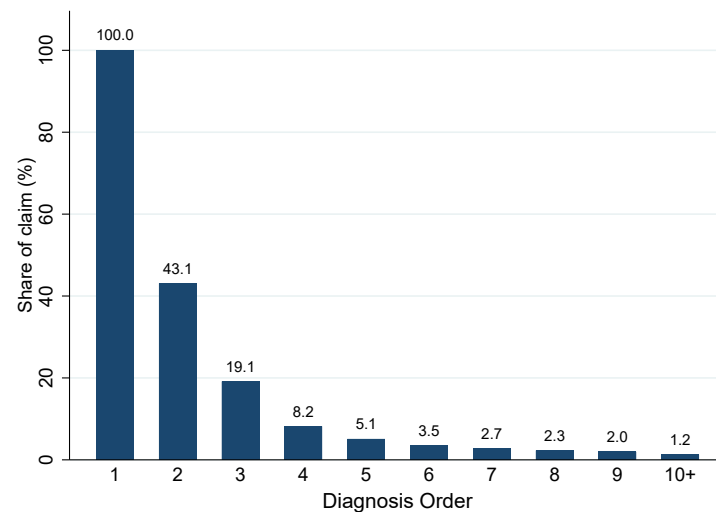
Notes: These figures plot the distribution of the number of movers (panel (a)) and the share of movers within the total population (panel (b)) in each HRR.

Figure A16: Histogram of Moving Distances (Miles)



Notes: This figure plots the distribution of moving distances in the main sample. The distance between the origin and destination HRRs is calculated as the average distance between zip codes within the two respective HRRs.

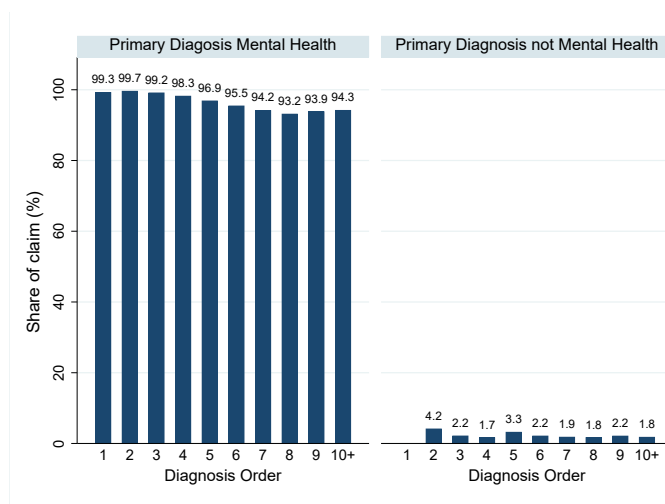
Figure A17: Share of Claims with Primary Mental Health Diagnosis Conditional on Higher Order Diagnoses



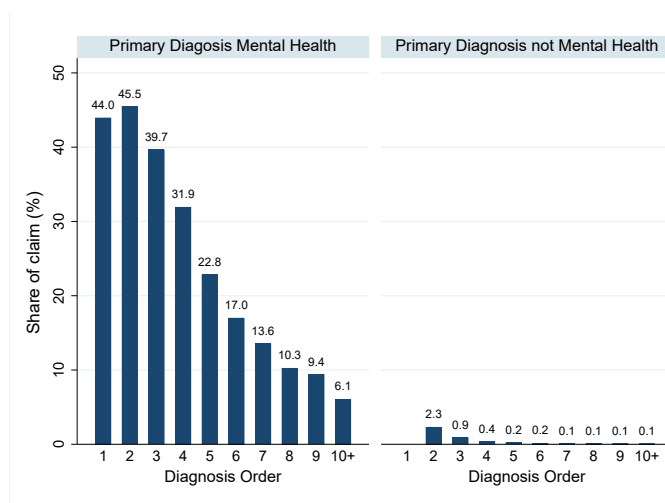
Notes: This figure presents the share of claims where mental illness is recorded as a primary diagnosis when also coded in higher orders. The claims include inpatient, outpatient, and physician service claims in Medicare 20% data from 2006–2018.

Figure A18: Share of Claims with Mental Health-Related Procedures by Diagnosis Order

(a) Mental Health-Related Procedures

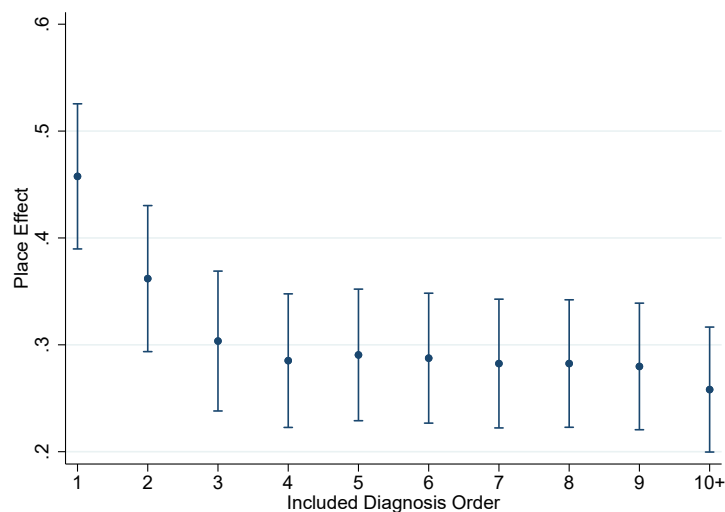


(b) Psychotherapy



Notes: These figures present the share of claims with mental health-related procedures (panel (a)) and specifically psychotherapy (panel (b)). The data include physician service claims in Medicare 20% data from 2006–2018. Mental health-related procedures are identified based on diagnosis codes supporting each procedure (i.e., line diagnosis codes), and psychotherapy is identified based on line procedure codes. In each panel, the left graph shows claims with mental illness recorded in both the primary diagnosis and in each order specified on the x-axis, while the right graph shows claims with mental illness recorded in each order but not in the primary diagnosis.

Figure A19: Place Effect — Mental Health-Related Visits Identified using Higher Order Diagnoses



Notes: This figure presents the difference-in-difference coefficients for changes in mental health-related visits when moving across regions with different average rates. Mental health-related visits are identified using diagnoses ranging from only the primary diagnosis to all diagnosis codes, as indicated on the x-axis. When using only the primary diagnosis, the estimation is the same as the main result shown in column (1) of Table 2. See the notes in Table 2 for more details on the specification. Regional diagnosis rates are calculated using the corresponding definition of mental health-related visits.

Appendix Tables

Table A1: Mental Illness Category and ICD codes

	ICD-9	ICD-10
Anxiety disorders	293.84, 300.0/10/2/3/5/89/9, 308, 309.81	F06.4, F40–F42, F43.0/1, F48.8/9
Mood disorders	293.83, 296, 300.4, 311	F06.3, F30–F39
Schizophrenia	293.81/82, 295, 297, 298	F06.0/2, F20–F29
Other mental illnesses	293.89/9, 299, 300.11–19/6/7/81/82, 301, 302, 306, 307, 309.0/1/2/3/4/82/83/89/9, 312–319	F06.1/8, F43.2/8/9, F44, F45, F48.1, F50–F99
All mental illnesses	290–319 except cognitive disorders (290, 293.0/1, 294, 310) and substance-related disorders (291–292, 303–305)	F01–F99 except cognitive disorders (F01–F05, F07, F09, F48.2) and substance-related disorders (F10–F19)

Notes: This table presents the ICD codes used for identifying (different types of) mental health claims data. ICD codes included are from “Mental Disorders” section in ICD-9 and correspondingly “Mental, Behavioral and Neurodevelopmental disorders” section in ICD-10. Classification is based on the Clinical Classifications Software (CCS) by the Agency for Healthcare Research and Quality (AHRQ). Other disorders in row 5 include adjustment disorders, attention-deficit conduct and disruptive behavior disorders, developmental disorders, impulse control disorders, personality disorders, disorders during childhood, and other miscellaneous disorders. Cognitive disorders, alcohol- and substance-related disorders are not included since related claims are not included in the main analysis. ICD codes can be expanded to two digits after decimal points, but folded in the table if they are all included in one category.

Table A2: Correlation between Regional Medicare Advantage Enrollment and Mental Health Treatment Use Rates

	(1)	(2)	(3)	(4)
	Medicare Advantage Rate			
MH Rate — Service	1.426 (0.505)	0.520 (0.336)		
MH Rate — Drug			-0.0887 (0.383)	0.356 (0.254)
Demo. Controls		Yes		Yes
Observations	306	306	306	306
Dep. Mean	0.282	0.282	0.282	0.282

Notes: This table presents the correlation between HRR’s Medicare Advantage (MA) enrollment rate and mental health service or drug use rate. MA enrollment rates are calculated using Medicare beneficiaries aged 65–99 years with full-year Medicare enrollment. Mental health service drug use rates are calculated among beneficiaries with fee-for-service Medicare Part A, B and Part D coverage. Columns (1) and (3) regress the HRR’s MA enrollment and mental health treatment rates directly. Columns (2) and (4) regress the residualized HRR rates from regressions controlling for the share of females, whites, dual-eligible, Part D enrollment, and the average age of the corresponding sample. All regressions are weighted by the number of individual-year observations in each HRR. Robust standard errors are reported in parentheses.

Table A3: Summary Statistics for Mover and Non-Mover, ACS Data

	(1) Mover	(2) Non-Mover
Male	0.430	0.436
Age	74.5	74.7
White	0.870	0.843
Black	0.067	0.087
Education		
Less than high school	0.131	0.175
High school	0.381	0.417
Some college	0.190	0.172
College and above	0.142	0.106
Household income (median)	49,900	44,160
Marital status		
Married	0.479	0.557
Divorced or separated	0.182	0.130
Widowed	0.296	0.263
Single/Never married	0.043	0.050
In labor force	0.114	0.169
Observations	70,133	6,528,275

Notes: This table presents the summary statistics for movers and non-movers aged 65 and above from the American Community Survey (ACS) data, 2006–2018. Movers are defined as individuals who moved across state lines in the past year, while non-movers are those who stayed in the same residential address.

Table A4: Correlation between Moving Decision and Life Events

	(1)	(2)	(3)
	Move		
Divorced last year	0.0290 (0.00217)		
Spouse died last year		0.00867 (0.000546)	
Retired last year			0.0131 (0.000471)
Observations	5,462,460	5,462,460	5,462,460
Dep. Mean	0.0106	0.0106	0.0106

Notes: This table presents the correlation between the indicator of moving and the life events experienced in the last year. Observations are individuals above age 65 in the ACS data from 2006 to 2018. Movers are defined as individuals who moved across state lines in the past year, while non-movers are those who stayed in the same residential address. Divorce and death of a spouse are identified based on survey questions, “did you get divorced in the past 12 months?” and “did you become a widow/widower in the past 12 months?” Retirement is identified if the interviewee reported working in the past 12 months but is not currently employed. All regressions control for gender, age, race, education level, household income, as well as interview year fixed effects, and origin state fixed effects. Robust standard errors are reported in the parenthesis. All regressions are weighted by the ACS person weight.

Table A5: Correlation between Moving Direction and Life Events

	(1)	(2)	(3)	(4)	(5)	(6)
	Destination-Origin Difference in Utilization Rate					
	Service			Drug		
Divorced last year	-0.000199 (0.00104)			0.00160 (0.00117)		
Spouse died last year		-0.000319 (0.00114)			-0.000547 (0.00100)	
Retired last year			-0.000112 (0.000460)			0.00136 (0.000677)
Observations	57,077	57,077	57,077	57,077	57,077	57,077
Mean of Dep. Var	-0.00156	-0.00156	-0.00156	0.00338	0.00338	0.00338
S.D. of Dep. Var	0.0224	0.0224	0.0224	0.0310	0.0310	0.0310

Notes: This table presents the correlation between the direction of moving and the life events experienced in the last year. Observations are individuals above age 65 who moved across states in the ACS data from 2006 to 2018. Divorce and death of a spouse are identified based on survey questions, “did you get divorced in the past 12 months?” and “did you become a widow/widower in the past 12 months?” Retirement is identified if the interviewee reported working in the past 12 months but is not currently employed. The outcome variable is the difference in the mental health service/drug utilization rate between the destination and origin states, calculated using non-movers in all years. All regressions control for gender, age, race, education level, household income, as well as interview year fixed effects, and origin state fixed effects. Robust standard errors are clustered by destination and origin states. All regressions are weighted by the ACS person weight.

Table A6: Place Effect of Mental Health Treatment Utilization, by Mental Illness

	(1)	(2)	(3)	(4)	(5)	(6)
	Any Service Use				Drug	
	Anxiety	Mood Disorder	Schizophrenia	Other	Antidepressants	Antipsychotics
$\delta_i * Post_{it}$	0.468 (0.0717)	0.508 (0.0393)	0.279 (0.0474)	0.637 (0.0671)	0.148 (0.0298)	0.224 (0.0444)
Observations	1,008,027	1,008,027	1,008,027	1,008,027	1,008,027	1,008,027
Dep. Mean	0.0358	0.0662	0.0173	0.0265	0.246	0.0435

Notes: This table presents the place effect of mental health service or drug utilization estimated using the movers sample, excluding the year of the move, for specific types of mental health conditions. The dependent variable in each column is a binary variable indicating whether patient i , in year t , had any mental health service claim with a diagnosis of anxiety, mood disorder, schizophrenia, other mental illnesses, any claims for antidepressants, or antipsychotics, respectively. The main independent variable is the difference between the destination and origin in the corresponding treatment utilization rate (δ_i), interacting with the indicator for the post-moving period. All the regressions include individual fixed effects, calendar year fixed effects, relative year fixed effects, and five-year age group fixed effects. Standard errors, clustered at the beneficiary level, are reported in parentheses.

Table A7: Place Effect of Mental Health Service Utilization by Provider

	(1)	(2)	(3)	(4)	(5)	(6)
	Hospital Inpatient	Hospital outpatient	Primary care physicians	Mental health professionals	Psychotherapy	Any service (no Part D restriction)
$\delta_i * Post_{it}$	0.685 (0.0614)	1.061 (0.0454)	0.818 (0.0593)	0.595 (0.0306)	0.663 (0.0365)	0.556 (0.0271)
Observations	1,008,027	1,008,027	1,008,027	1,008,027	1,008,027	2,547,786
Dep. Mean	0.0117	0.0212	0.0391	0.0582	0.0396	0.0995

Notes: This table presents the place effect of mental health service utilization by different providers estimated using the movers sample, excluding the year of the move. The dependent variables in Columns (1)–(4) are binary variables indicating whether patient i , in year t , had any mental health service claim provided by the hospital inpatient department, hospital outpatient department, mental health professionals (i.e., psychiatrist, psychologist, and clinical social worker), and primary care physicians, respectively. The dependent variable in Columns (5) is the indicator for any psychotherapy. The dependent variable in Column (6) is the indicator for any mental health service use (same as the baseline), but using sample not restricted by Part D coverage. The main independent variable is the difference between the destination and origin in the corresponding treatment utilization rate (δ_i), interacting with the indicator for the post-moving period. All the regressions include individual fixed effects, calendar year fixed effects, relative year fixed effects, and five-year age group fixed effects. Standard errors, clustered at the beneficiary level, are reported in parentheses.

Table A8: Robustness Checks — Heterogeneity Across Time

	(1)	(2)	(3)	(4)	(5)	(6)
	Before 2009		After 2014		HRR Average Over All Years	
	Service	Drug	Service	Drug	Service	Drug
$\delta_i * Post_{it}$	0.399 (0.147)	0.127 (0.141)	0.420 (0.0788)	0.154 (0.0519)	0.495 (0.0367)	0.172 (0.0308)
Observations	44,417	44,417	135,620	135,620	1,008,027	1,008,027
Dep. Mean	0.116	0.238	0.126	0.283	0.118	0.262

Notes: This table replicates Columns (1) and (4) from Table 2. Columns (1) and (2) restrict the sample to the years 2006–2009, with moves taking place in 2008–2009. Columns (3) and (4) restrict the sample to the years 2014–2018, with moves taking place in 2016–2018. Columns (5) and (6) use the full sample but calculate the difference in service or drug utilization rates between the destination and origin (δ_i) based on the HRR average utilization rate over the entire sample period, instead of the year before individual i moves. All regressions include individual fixed effects, calendar year fixed effects, relative year fixed effects, and five-year age group fixed effects. Standard errors, clustered at the beneficiary level, are reported in parentheses.

Table A9: Robustness Checks — Medicaid Expansion and Dual Eligibles

	(1)	(2)	(3)	(4)
	Drop dual eligibles		Drop expanded states	
	Service	Drug	Service	Drug
$\delta_i * Post_{it}$	0.524 (0.0483)	0.164 (0.0375)	0.435 (0.0409)	0.123 (0.0367)
Observations	826,118	826,118	771,583	771,583
Dep. Mean	0.103	0.244	0.112	0.252

Notes: This table replicates Columns (1) and (4) from Table 2. Columns (1) and (2) exclude beneficiary with both Medicare and Medicaid coverage from the sample. Columns (3) and (4) exclude individuals who currently live in states that have already expanded Medicaid as of the given year. The difference in service drug utilization rates between the destination and origin (δ_i) is calculated among the baseline sample of nonmovers in Columns (3) and (4), but restrict to those not having Medicaid coverage in Columns (1) and (2). All regressions include individual fixed effects, calendar year fixed effects, relative year fixed effects, and five-year age group fixed effects. Standard errors, clustered at the beneficiary level, are reported in parentheses.

Table A10: Robustness Checks — Geographic Area Level, Sample, and Additional Geographic Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Geographic Level			Between above & below median HRRs	Between top & bottom quartile HRRs	Drop moves to Florida	Census region by year FEs
	State	County	HSA				
Penal A: Any Service Use							
$\delta_i * Post_{it}$	0.513 (0.0439)	0.427 (0.0308)	0.377 (0.0301)	0.566 (0.0440)	0.596 (0.0662)	0.493 (0.0381)	0.368 (0.0374)
Observations	741,619	741,601	739,520	427,117	93,406	912,605	1,006,262
Dep. Mean	0.116	0.116	0.116	0.113	0.112	0.119	0.118
Penal B: Any Drug Use							
$\delta_i * Post_{it}$	0.0513 (0.0381)	0.144 (0.0261)	0.139 (0.0257)	0.188 (0.0350)	0.234 (0.0548)	0.164 (0.0318)	0.182 (0.0305)
Observations	741,619	741,601	739,520	386,474	66,543	912,605	1,006,262
Dep. Mean	0.259	0.259	0.259	0.260	0.252	0.266	0.262

Notes: This table replicates Columns (1) and (4) from Table 2 with mental health service use in Panel A and drug use in Panel B. Columns (1)–(3) use movers across states and treatment utilization rates measured at the state, county, and Hospital Service Area (HSA) level respectively. Columns (4) and (5) use the movers sample across HRRs with treatment utilization rates above and below the median, or in the top and bottom quartiles. Column (6) drops individuals moved into Florida from other states. Column (7) uses the same movers sample as in the baseline, but include additional census region by year fixed effects. All regressions include individual fixed effects, calendar year fixed effects, relative year fixed effects, and five-year age group fixed effects. Standard errors, clustered at the beneficiary level, are reported in parentheses.

Table A11: Adjustment for Selection on Unobservables

	(1) Baseline	(2) Controlled	(3) Adj. Coef. 1 ($R_{max} = 1.3 * R2_c$)	(4) Adj. Coef. 2 (Alt. R_{max})
Any service	0.720 (0.0355) [0.011]	0.458 (0.0346) [0.432]	0.377	0.439
Any drug	0.292 (0.0376) [0.023]	0.151 (0.293) [0.633]	0.107	0.138

Notes: This table presents adjustments for selection on unobservables following [Oster \(2019\)](#). Column (1) reports regression results of models without individual fixed effects (still includes origin HRR fixed effects, year relative to move fixed effects, calendar year fixed effects, and age-group fixed effects). Column (2) reports regression results with individual fixed effects. In both columns, standard errors are reported in parentheses, and the R-squared values are in square brackets. Column (3) reports the adjusted coefficients with R_{max} equals 1.3 times of the R-squared in column (2) and $\delta = 1$. Column (4) reports the adjusted coefficients with R_{max} from regressions with a full set of past year mental health treatment controls (i.e., whether there is any claim and total payment in log, for both service and drugs) together with controls in column (2).

Table A12: Correlation between Regional Nursing Home and Mental Health Treatment Use Rates

	(1)	(2)	(3)	(4)
	Nursing Home Use Rate			
MH Rate — Service	0.142 (0.0452)			
MH Rate — Service (non-NF)		-0.0340 (0.0568)		
MH Rate — Drug			0.127 (0.0338)	
MH Rate — Drug (non-NF)				0.0151 (0.0371)
Observations	306	306	306	306
Dep. Mean	0.0889	0.0889	0.0889	0.0889

Notes: This table presents the correlation between HRR's nursing home use rate and mental health service or drug use rate. All rates are calculated using Medicare beneficiaries with Part D coverage. Mental health treatment rates are separately calculated for the full sample and for those without nursing home claims in the given year. All regressions control for the share of female, white, dual-eligible, Part-D enrollees, and the average age of the sample. Regressions are weighted by the number of individual-year observations in each HRR. Robust standard errors are reported in parentheses.

Table A13: Place Effect by Treatment Use Rate in Origin HRR, Move-Up vs. Move-Down

	(1)	(2)	(3)	(4)	(5)
	Q1	Q2	Q3	Q4	Q5
Panel A: Any Service Use					
$Post_{it} \times \delta_i \times \mathbb{1}(\delta_i \geq 0)$	0.725 (0.125)	0.630 (0.145)	0.408 (0.174)	0.386 (0.184)	0.398 (0.172)
$Post_{it} \times \delta_i \times \mathbb{1}(\delta_i < 0)$	1.251 (0.458)	1.246 (0.303)	1.150 (0.218)	0.938 (0.171)	0.488 (0.0776)
Observations	202,146	204,624	199,633	202,791	198,833
Dep. Mean	0.104	0.115	0.116	0.121	0.137
p-value for equal coefficient test	0.308	0.107	0.0241	0.0602	0.664
Panel B: Any Drug Use					
$Post_{it} \times \delta_i \times \mathbb{1}(\delta_i \geq 0)$	0.0415 (0.0855)	0.137 (0.121)	0.261 (0.142)	0.263 (0.218)	0.0138 (0.314)
$Post_{it} \times \delta_i \times \mathbb{1}(\delta_i < 0)$	-0.0224 (0.394)	0.635 (0.251)	0.390 (0.161)	0.215 (0.154)	0.443 (0.0842)
Observations	202,693	201,679	211,274	194,633	197,748
Dep. Mean	0.224	0.253	0.261	0.279	0.296
p-value for equal coefficient test	0.881	0.122	0.611	0.881	0.221

Notes: This table presents regression results from equation (2), separately for five subsets of movers, grouped by the quintile of the treatment utilization rate in their original HRRs. The dependent variable is a dummy indicator denoting whether patient i had any mental health service (Panel (a)) or drug (Panel (b)) claim in year t . θ^{up} is the coefficient for the interaction term between the post-moving indicator ($Post_{it}$) and the destination-origin differences in the HRR mental health treatment utilization rate (δ_i) when $\delta_i > 0$, while θ^{down} is the coefficient when $\delta_i \leq 0$. The regression includes individual fixed effects, calendar year fixed effects, relative year fixed effects, and five-year age group fixed effects. Standard errors clustered at the beneficiary level are reported in parentheses.

Table A14: Geographic Variation in Provider Capacity and Perception towards Mental Illness, Distribution at HRR Level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Mean	S.D.	Min	P25	Median	P75	Max
Average annual temperature (N = 303)	56.2	8.9	34.2	49.6	55.1	63.1	77.5
# Days w/ min. temp. below 32°F annually (N = 303)	94.2	56.1	0.1	45.6	97.9	140.9	199.9
# Days w/ max. temp. above 90°F annually (N = 303)	43.9	38.5	0.1	12.5	29.9	72.9	180.7
Average monthly precipitation (N = 298)	68.5	21.3	8.8	52.2	74.7	81.8	123.4
Average daily PM2.5 level (N = 294)	6.2	2.9	0.0	4.2	6.1	8.0	16.7
# Psychiatrists per 1k MCR pop	0.85	0.50	0.18	0.50	0.70	1.03	2.97
# Psychologists per 1k MCR pop	0.76	0.50	0.04	0.38	0.66	0.96	3.17
# Clinical social workers per 1k MCR pop	0.94	0.72	0.02	0.41	0.79	1.21	5.25
# Psychiatric hospitals	1.72	1.97	0.00	0.15	1.00	2.23	10.92
# Psychiatric units	4.54	4.64	0.00	1.46	3.00	5.69	26.00
# Psychiatric beds per 1k MCR pop	3.65	2.98	0.00	1.86	2.94	4.69	25.95
# Primary care physicians per 1k MCR pop	6.6	2.5	2.7	5.0	6.0	7.4	21.2
# Nurse practitioners per 1k MCR pop	4.9	2.3	1.0	3.3	4.4	6.0	16.2
# Other specialists per 1k MCR pop	18.6	7.5	7.1	13.3	17.2	21.6	67.6
# Other hospital beds per 1k MCR pop	14.5	9.4	0.0	8.5	13.7	18.9	71.1
People are sympathetic to mental illness patients (1-Agree strongly to 5-Disagree strongly, N = 240)	2.9	0.2	2.3	2.8	2.9	3.0	4.3
Treatment can lead to normal life (1-Agree strongly to 5-Disagree strongly, N = 240)	1.7	0.2	1.2	1.5	1.6	1.8	2.9
Average age	75.7	0.6	74.0	75.3	75.7	76.2	77.2
Male	0.43	0.02	0.38	0.42	0.43	0.44	0.48
White	0.89	0.10	0.31	0.84	0.92	0.96	0.99
Medicare-Medicaid dual eligible	0.12	0.06	0.02	0.08	0.11	0.14	0.48
Medican household income (age 65+)	49,277	9,087	29,987	43,154	47,948	52,725	96,941
% w/ high school degree and above (age 65+)	78.2	6.9	42.1	74.8	79.4	83.0	91.7

Notes: This table presents the distribution of Hospital Referral Region (HRR) characteristics, including climate, provider capacity, societal attitudes towards mental illness, and demographic and economic conditions of the population. The number of physicians is calculated using the Medicare Data on Provider Practice and Specialty (MD-PPAS) from 2008–2018. The number of Medicare Fee-for-Service (FFS) recipients is estimated using the baseline sample of this analysis, multiplied by 5 to project estimates for 100% of the Medicare population. Demographic measures (i.e., age, gender, race) are based on the sample used in estimating HRR fixed effects. Data sources and methods for constructing other measurements are detailed in Appendix C. Climate information and societal attitude measures are only available for a subset of HRRs, the number of which is listed in parentheses.

Table A15: Correlation between the Estimated HRR-level Place Effects of Mental Health Treatment Use and Suicide Rates

	(1)	(2)	(3)	(4)	(5)	(6)
	Suicide Death per 100,000 Population					
	All	Male	Female	All	Male	Female
Estimated HRR-level Place Effect for Service Use	-107.7 (13.68)	-204.7 (26.18)	-34.22 (5.273)			
Estimated HRR-level Place Effect for Drug Use				-26.41 (13.22)	-46.39 (25.18)	-11.36 (5.387)
Observations	306	306	306	306	306	306
Dep. Mean	15.91	31.00	4.392	15.91	31.00	4.392
Effect of 1 s.d. place effect	-1.956	-3.717	-0.622	-0.490	-0.861	-0.211
Demographic Controls	X	X	X	X	X	X
Gun Ownership Controls	X	X	X	X	X	X

Notes: This table presents regression results of HRR suicide rates on the estimated HRR-level place effect of mental health service drug use. Observations are at the HRR level. The outcome is the suicide rate for the population aged 65 and above, obtained from the CDC Underlying Cause of Death database (1999–2019). Death counts are at the county level, which are aggregated to the HRR level based on zip code crosswalks and population share. Columns (1) and (4) use age and gender-adjusted rates for the total population, while Columns (2)–(3) and (5)–(6) use gender-specific rates adjusted by age. Place effects are estimated based on Equation (3) using a sample consisting of all movers (in all years except the year of moving) and non-movers. Demographic controls (i.e., share of white population, share of Medicaid-Medicare dual eligible patients, median household income, share of high school graduates) and gun ownership controls (i.e., state-level universal background check law, permit to purchase law, proportion of adults living in a household with a firearm, from Schell et al. (2020)) are included in all specifications. Regressions are weighted by the number of FFS Medicare population in each HRR. Robust standard errors are reported in parentheses.

Table A16: Robustness Checks — Service Use Related to Cognitive Disorders

	(1)	(2)	(3)	(4)
	Include claims w/ cognitive disorders as primary diag.	Exclude claims w/ cognitive disorders as secondary diag.	Exclude individuals w/ cognitive disorders (based on primary diag.)	Exclude individuals w/ cognitive disorders (based on all diag.)
Any Service Use				
$\delta_i * Post_{it}$	0.467 (0.0333)	0.459 (0.0348)	0.401 (0.0475)	0.389 (0.0554)
Observations	1,008,027	1,008,027	790,042	686,816
Dep. Mean	0.152	0.114	0.0881	0.0784

Notes: This table presents the place effect of mental health services, replicating Column (1) from Table 2. In Column (1), service use is defined as claims with a primary diagnosis of cognitive disorders or mental illness. In Column (2), service use is defined as claims with a primary diagnosis of mental illness and no secondary diagnosis of cognitive disorders. Columns (3) and (4) define service use as in Table 2 but exclude individuals ever diagnosed with cognitive disorders, based on either primary diagnosis alone or all diagnosis codes. In these two columns, destination-origin differences in regional utilization rates are also calculated among individuals without cognitive disorders. All regressions include individual fixed effects, calendar year fixed effects, relative year fixed effects, and five-year age group fixed effects. Standard errors, clustered at the beneficiary level, are reported in parentheses.