

Geographic Mobility of Hematology–Oncology Fellows and Its Association with Regional Cancer Care Disparities in the United States

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Abstract

Purpose

To characterize geographic mobility of hematology/oncology fellows (HOFs) across three career transitions and assess its alignment with regional socioeconomic and demographic needs.

Methods

This retrospective cohort study analyzed 703 HOFs who graduated from accredited U.S. fellowship programs (2019–2022). We tracked three transitions: medical school to residency (T1), residency to fellowship (T2), and fellowship to first attending position (T3). Regional retention and distance traveled were linked to county-level social determinants of health from the American Community Survey and Behavioral Risk Factor Surveillance System and analyzed with multivariate and quantile regression.

Results

Regional retention was highest in the West across all transitions (T1: 71.43%; T2: 83.05%; T3: 75.82%), while Northeast retention was low early (T1: 55.56%; T2: 49.55%) before recovering at T3 (75.34%). Top 50 National Institutes of Health-funded graduates were less likely than other U.S. allopathic graduates to relocate > 500 miles at T1 and T3 ($p < 0.05$). Trainees consistently moved toward higher-income counties and away from counties with higher proportions of non-Hispanic Black residents. After initially moving away from rural areas, trainees shifted toward rural placement at T3. Origin-county rurality and population were negatively associated with distance traveled during early transitions.

Conclusion

HOFs demonstrate substantial mobility favoring higher-income and less racially diverse regions. The fellowship-to-practice transition is a critical inflection point where targeted policy, community practice training, loan repayment, and infrastructure investment, may improve workforce distribution and reduce cancer care disparities.

INTRODUCTION

Cancer remains a leading cause of morbidity and mortality globally. In the United States, its burden is especially severe in rural and underserved areas, yet these are precisely the places where cancer care is most scarce. Only 7.5% of medical oncologists and 8.7% of radiation oncologists in the U.S. practice in rural areas, when nearly 20% of Americans live in non-metropolitan (rural) counties [1]. More than half of U.S. counties (54%) do not have an oncologist [2]. These disparities are compounded by a persistent unequal distribution of oncology specialists, particularly in rural and socioeconomically disadvantaged regions. Patients in these regions often experience delays in diagnosis and treatment, leading to lower survival rates [3].

In the United States, the journey from medical school to becoming an independent hematologist-oncologist involves several key stages, each shaped by competitive systems such as the National Resident Matching Program (NRMP) [4, 5]. Students frequently relocate to attend medical schools, which are disproportionately located in urban and metropolitan areas, contributing to the persistent underrepresentation of physicians in rural regions [4]. After graduation, these physicians enter a highly competitive residency match process, often requiring relocation to different parts of the country [5, 6]. Residency programs are also not evenly distributed, with a significant concentration in the Northeast and major cities [7]. This uneven distribution forces many applicants to travel long distances to secure training opportunities, especially in specialized or highly sought-after programs. Fellowship training in hematology/oncology, which follows residency, further increases this geographic mobility due to the limited number of programs and their clustering in specific regions [4, 7]. The intense competition for these positions demands geographic flexibility from applicants, contributing to the widespread movement of hematology/oncology

trainees [4, 6, 8]. These patterns highlight not only individual career goals but also systemic inequities in the availability of training programs across different regions. Collectively, these transitions impose repeated geographic disruption that may systematically shape long-term workforce distribution, particularly in underserved areas [9–11]. While the first attending position (T3) is the proximate determinant of patient access, transitions during medical school (T1) and residency (T2) are analyzed here as formative predictors that establish geographic familiarity, social networks, and institutional ties that cascade into final practice location choices. Prior research demonstrates path dependence in physician location decisions, wherein early training environments substantially shape subsequent career geography [6].

Understanding the mobility patterns of hematology/oncology fellows (HOFs) is essential for addressing workforce shortages and improving access to cancer care in underserved areas [10, 11]. We aimed to characterize geographic mobility across three critical career transitions and evaluate how these movements align with regional socioeconomic and demographic needs. We hypothesized that mobility would increase across transitions and preferentially shift physicians away from underserved communities. Subsequently, these findings may inform policymakers and training programs to foster a more equitable distribution of oncologists nationwide.

METHODS

Study Design and Data Collection

This retrospective cohort study analyzed data on HOFs who finished their fellowship between 2019 to 2022. Publicly available data were used to ensure national scope and reproducibility while avoiding reporting bias inherent in survey-based designs. We used data from the Accreditation Council for Graduate Medical Education (ACGME)-accredited HOFs programs for this study. 65 of the 165 ACGME-accredited hematology/oncology fellowship programs identified (39.4%) provided complete, publicly available graduate outcome data across all study years and were included in the analysis. The remaining 100 programs (60.6%) lacked complete data for one or more years and were excluded.

For each eligible graduate, the following variables were collected: medical degree type (MD vs. DO), medical school name, medical school geographic region and address, residency program name and region, HOFs program name and region, and the geographic area and address of the graduate's first attending position. The United States was divided into four geographic areas based on U.S. Census data: South, West, Midwest, and Northeast [Figure 1]. This regional framework aligns with prior workforce and health services research.

Outcome Measures

The primary endpoints were regional retention rates and distance traveled during three transitions: T1 (medical school to residency), T2 (residency to fellowship), and T3 (fellowship to first attending position). Distances between institutions were calculated using straight-line distance measurements to provide consistent comparisons across geographic regions. Regional retention was defined as the percentage of graduates who remained in the same geographic region during each transition.

Medical schools were categorized based on publicly available data from the National Institutes of Health (NIH) RePORT database as either top 50 NIH-funded institutions (T50NIH) or non-top 50 NIH-funded institutions (NONT50NIH). A third category, osteopathic-international medical schools (OIMS), was defined as international medical school graduates plus domestic osteopathic (DO) graduates.

Socioeconomic and Demographic Data

Descriptive statistics were used to summarize the population characteristics of the counties where HOFs originated and relocated. Data sources included the American Community Survey (2019–2022), Behavioral Risk Factor Surveillance System (2021), Bureau of Labor Statistics (2022), and Census Population Estimates (2022). Variables include, but not limited to, population-to-primary-care-physician ratio (per 1,000), high school completion rates, adult smoking and obesity prevalence,

unemployment levels, excessive alcohol consumption, diabetes and HIV prevalence, median household income (per \$1,000), proportions uninsured, under 18, and over 65, racial and gender demographics, education levels.

Data Analysis and Statistical Methods

All statistical analyses were conducted using RStudio® (version 3.0) and Microsoft Excel. A 95% confidence interval was used, and statistical significance was set at a p-value of < 0.05 .

Descriptive statistics were calculated to provide a comprehensive demographic profile of the areas from which HOFs originated and the regions to which they relocated. Delta values were computed as the mean difference between destination-county and origin-county values for each characteristic (destination minus origin), such that positive values indicate relocation to counties with higher values and negative values indicate relocation to counties with lower values. Deltas are expressed in percentage points for proportions and in native units for all other characteristics. This analysis helped identify whether graduates were moving to regions with populations that might benefit most from their services, particularly underserved or high-need areas. Mean distances traveled (in miles) were calculated for each transition (T1, T2, and T3), both for the entire cohort and for subgroups (e.g., T50NIH vs. NONT50NIH vs. OIMS). Welch's two-sample t-tests were used to compare distances between groups, as this method is robust to unequal variances and sample sizes. Chi-square tests were used to compare the proportions of graduates relocating more than 500 miles, remaining at the same institution, and remaining within the same region across cohorts (T50NIH vs. NONT50NIH vs. OIMS), and to compare regional retention across the four census regions. Because international medical schools lack U.S. county-level data, T1 distance and county-level analyses were restricted to graduates with a U.S. medical school location.

Multivariate Regression and Quantile Regression Analysis

The multivariate regression models assessed how socioeconomic and demographic factors influenced the distances traveled by graduates during each transition stage. The outcome was straight-line distance traveled (in miles), and county-level predictors described the county of origin for each transition (the medical school county for T1, the residency county for T2, and the fellowship county for T3). Models also included an indicator for graduation from a T50NIH medical school and, for T3, an indicator for fellowship graduation after the onset of the COVID-19 pandemic.

Quantile regression was employed to provide a more nuanced analysis of these factors as it examines how predictors influence different quantiles of the distance distribution (e.g., 10th, 50th, and 90th percentiles). This approach was particularly valuable for capturing variability in graduate mobility, as it allowed us to investigate whether certain factors had stronger effects on graduates who traveled shorter versus longer distances.

RESULTS

The 703 HOFs from ACGME-accredited programs were separated into their respective cohorts [Table 1]. Of these, 444 had a U.S. medical school location and were included in T1 distance and county-level analyses. Regional distribution during residency training showed the highest representation in the Northeast (31.58%), followed by the Midwest (28.45%), South (23.19%), and West (16.79%). International medical graduates ($n = 260$) were disproportionately clustered in Northeast (42.69%) and Midwest (30.00%) residency programs.

Retention Rates and Miles Traveled

Regional retention differed markedly across transitions, revealing distinct geographic patterns.

During the first transition (T1), from medical school to residency, 16.67% of these 444 fellows remained at the same institution, while 40.32% moved over 500 miles. Regional retention was highest in the West (71.43%) and lowest in the South (46.27%).

In the second transition (T2), from residency to fellowship, 23.47% of fellows stayed at the same institution, and 32.57% relocated over 500 miles. The West demonstrated the highest regional retention (83.05%), followed by the Midwest (62.50%), while the Northeast retained only 49.55% of its residency graduates.

In the third transition (T3), from fellowship to attending job placement, 9.96% of fellows remained at the same institution, and 29.16% relocated over 500 miles. Regional retention was highest in the West (75.82%) and Northeast (75.34%), with slightly lower rates in the Midwest (65.10%) and South (68.40%). The West notably showed consistently high retention rates across each transition period [Table 2].

Compared with NONT50NIH graduates, T50NIH graduates were less likely to relocate more than 500 miles at T1 (36.23% vs. 47.72%; $p = 0.025$) and T3 (19.81% vs. 29.50%; $p = 0.031$), with no significant difference at T2 (28.50% vs. 33.00%; $p = 0.38$) [Figure 2]. At T3, T50NIH graduates also traveled a shorter mean distance than NONT50NIH graduates (329 vs. 464 miles; $p = 0.039$) and OIMS graduates (527 miles; $p < 0.001$). OIMS graduates were the most likely to relocate more than 500 miles at T2 (35.14%) and T3 (35.47%). T50NIH graduates were the most likely to remain at the same institution at T1 (24.15% vs. 12.18% for NONT50NIH and 0% for OIMS; $p < 0.001$). Regional retention was similar for T50NIH and NONT50NIH graduates at T2 (68.12% and 68.00%) and higher than for OIMS graduates (54.05%; $p < 0.001$); at T3, T50NIH graduates showed the highest regional retention (78.26% vs. 72.00% for NONT50NIH and 64.19% for OIMS; $p = 0.003$). Regional retention differed significantly across census regions at T1 ($p = 0.010$) and T2 ($p < 0.001$), but not at T3 ($p = 0.076$) [Table 2].

Factors Influencing Miles Traveled

Multivariate regression analysis identified several social determinants associated with geographic mobility. These associations persisted after adjustment for training institution characteristics.

In the T1 transition, higher median household income in the medical school county was associated with longer moves (Beta = 6.6, $p = 0.023$), while greater rurality (Beta = -9.5, $p = 0.020$) and larger total county population (Beta = -7.9, $p < 0.001$) were associated with shorter moves. In the T2 transition, a higher proportion of uninsured adults in the residency county was associated with longer moves (Beta = 24, $p = 0.001$) and larger total county population with shorter moves (Beta = -6.4, $p < 0.001$); higher median household income showed a non-significant trend toward longer moves (Beta = 3.8, $p = 0.063$). In the T3 transition, graduation from a T50NIH medical school was associated with shorter moves (Beta = -143, $p = 0.018$), consistent with the lower proportion of T50NIH graduates relocating more than 500 miles [Table 3].

Relocation and Population Demographics

Relative to their origin counties, trainees consistently relocated to counties with higher median household income and lower proportions of non-Hispanic Black residents, with the latter trend intensifying over time [Table 4]. The largest shift in any proportion-based characteristic occurred at T3, when trainees moved toward more rural counties (destination counties had a rural population share 7.1 percentage points higher than origin counties), reversing the movement toward less rural counties during T1 and T2. Across all transitions, trainees also moved toward counties with lower unemployment, whereas high school completion was slightly lower in destination counties during T1 and T2 but higher at T3. Trends in uninsured rates varied across transitions.

DISCUSSION

The geographic mobility of HOFs reflects a complex interplay of professional, personal, and systemic factors that evolve throughout their training and early career stages. Contrary to our hypothesis, long-distance relocation declined rather than increased across transitions (40.32% at T1, 32.57% at T2, and 29.16% at T3), although relocation continued to favor higher-income counties and counties with lower proportions of non-Hispanic Black residents.

Regional Retention and Disparities

Our findings demonstrate pronounced regional variations in retention rates across all transitions. The West consistently exhibited the highest retention at every stage (T1: 71.43%; T2: 83.05%; T3: 75.82%), although regional differences in retention were not statistically significant at T3, and the South, rather than the West, received the largest share of fellows who changed regions at T3 (73 of 207; 35.27%). In contrast, the Northeast showed the lowest fellowship retention of any domestic region at T2 (49.55%) yet reached near-equivalent T3 retention to the West (75.34%), while the Midwest and South demonstrated persistently lower T3 retention (65.10% and 68.40%, respectively), indicating that the regions bearing the greatest burden of cancer care disparities are also those least able to retain the oncology workforce trained within them. Such regional imbalances underscore the persistent challenge of maintaining a balanced distribution of oncologists, especially in areas with lower retention rates. The concentration of HOFs and subspecialists in resource-rich areas may exacerbate existing inequities in access to specialized cancer care, clinical trials, and innovative treatments in underserved regions, particularly as rural and low-income populations already face longer travel distances and reduced proximity to cancer specialists [9, 12–15]. Notably, counties with lower oncologist density are associated with inferior survival outcomes for patients with hematologic malignancies and metastatic solid tumors [16]. Our findings extend this work by demonstrating that these disparities are reinforced by physician relocation patterns beginning during training.

The relocation patterns of HOFs are shaped by a combination of social determinants, institutional affiliations, and personal preferences. Contrary to the expectation that graduates of research-intensive institutions are the most geographically mobile, T50NIH graduates were less likely than NONT50NIH graduates to relocate more than 500 miles at T1 and T3, traveled the shortest mean distance at T3, and showed the highest regional retention at T3. This pattern may reflect retention through established research programs, mentorship networks, and internal faculty pipelines at research-intensive institutions. Conversely, OIMS graduates showed the lowest regional retention at T2 and T3 and were the most likely to relocate more than 500 miles at those stages, which may reflect the narrower set of training and practice opportunities available to international and osteopathic graduates. Regression analyses identified origin-county characteristics associated with distance traveled, including rurality, median household income, and total county population. Trainees leaving higher-income counties traveled farther at T1, whereas those leaving more rural counties (T1) and more populous counties (T1 and T2) traveled shorter distances. Shorter moves from populous counties likely reflect the density of training opportunities within large metropolitan areas, whereas shorter moves from rural counties suggest that trainees who attend medical school in rural areas tend to remain closer to those regions for residency. Survey data suggest that career mentorship, lifestyle considerations, perceived job market, and institutional factors, such as the presence of top-ranked academic centers and availability of community-based training experiences, also shape fellows' practice-location decisions [7, 8, 10]. OIMS are disproportionately represented in non-metropolitan and rural areas, serving as a vital component of the oncology workforce in underserved regions [11, 15].

The geographic mobility of HOFs has direct implications for cancer care access and quality. Studies have shown that inadequate access to high-volume providers contributes to racial and socioeconomic disparities in cancer outcomes, independent of adherence to clinical guidelines [17, 18]. Our findings suggest that the concentration of oncologists in certain regions may further limit access to specialized care for underserved populations, particularly in rural and low-income areas. Addressing these disparities requires targeted interventions to incentivize practice placements in underserved regions and expand access to telemedicine for remote communities.

Strategies for Addressing Disparities

A multifaceted approach is needed to address regional workforce imbalances. Financial incentives, including robust loan repayment programs and direct compensation, have proven effective in retaining physicians in underserved areas. Critically, the consistent movement toward higher-income counties across all three transitions likely reflects, in part, the pressure of medical debt on practice location decisions. With average educational debt exceeding \$200,000 for medical school alone, fellows face significant financial incentives to maximize early-career earnings by selecting higher-income practice markets. Targeted loan repayment programs for hematology/oncology fellows committing to underserved or rural placements could directly counteract this income-driven migration [19, 20].

The structure of hematology/oncology fellowship training itself represents a systemic barrier. Current programs emphasize basic science, translational research, and clinical trial participation, competencies that do not fully prepare graduates for the community practice environments where the majority of U.S. cancer patients receive care. Fellowship programs should intentionally incorporate community-based rotations, exposure to value-based care models, and explicit recognition of community oncology as a rewarding career pathway. As described by Roberts et al. and Iacoviello et al., developing an “academic-community hybrid” fellowship framework could bridge this gap [7, 10].

The ongoing consolidation of oncology practice into large health systems and hospital-employed models, while reducing the number of independent private practices, presents a structural opportunity. Large health systems with facilities across urban and rural sites can develop systematic rural staffing pipelines, rotating positions, and hub-and-spoke care models that distribute oncology expertise more broadly than single-practice models allow. Policymakers and fellowship training programs should engage with these systems to align organizational incentives with geographic equity goals.

Telemedicine has demonstrated potential to bridge gaps in consultation access and follow-up care in rural and underserved areas. However, its role must be understood within its realistic scope: telemedicine cannot substitute for the physical infrastructure required to deliver systemic therapies, infusions, radiation, or surgical oncology. Meaningful access improvement for patients in underserved areas ultimately requires investment in regional cancer care infrastructure, building and staffing cancer centers and oncology clinics in under-resourced communities, alongside any telehealth expansion [21, 22]. Future research should explore the long-term effects of telemedicine on oncologist distribution and patient outcomes.

Future research should incorporate qualitative data capturing personal and professional motivations behind relocation, and longitudinal tracking of post-attending career moves to characterize the full fluidity of physician geography. Program availability should be systematically measured alongside demand-side workforce preference data in future workforce analyses [23, 24].

Limitations

This study has several limitations. The ecological-level analysis draws on publicly available ACGME program data; individual-level trainee data were not available. As a result, important individual-level variables, including trainee race and ethnicity, parental socioeconomic background, and rural versus urban place of origin, could not be examined. Given extensive literature demonstrating that underrepresented minority physicians disproportionately practice in underserved areas, the absence of these variables is the most significant interpretive limitation of this study.

Practice type, whether graduates entered academic, community, or hybrid practice settings, was not captured in this dataset and likely moderates the relationship between training background and practice location. Published definitional frameworks for practice type should be incorporated in future analyses [7, 10]. This study captures only the first attending position; subsequent career relocations that further shift workforce distribution are not captured. Future longitudinal tracking of full career trajectories is needed to characterize the full fluidity of physician geography [11, 23].

The absence of longitudinal, year-matched fellowship program capacity and cancer center availability data limits our ability to fully disentangle structural program supply from individual trainee mobility preference. Program counts fluctuate year to year, and a cross-sectional enumeration cannot validly represent the opportunity landscape each graduation cohort faced. Future studies integrating matched supply-side capacity data with individual trainee mobility records would provide a more complete account of oncology workforce geography.

State-level variation in Medicaid/ACA expansion, public health infrastructure, and policy environments during 2019–2022 represents an additional source of heterogeneity not captured by regional classification. Straight-line distance calculations do not reflect actual travel distances or geographic barriers. The low adjusted R^2 values across models (0.018–0.029) indicate that measured structural factors explain only a small portion of mobility variability.

CONCLUSION

Hematology/oncology physicians demonstrate substantial geographic mobility across training and early career stages, with movements that disproportionately favor higher-income and less racially diverse regions. Fellowship-to-practice transition represents a critical inflection point where targeted policy interventions may meaningfully influence workforce distribution. Aligning training structures and incentives with population need is essential to reducing persistent disparities in cancer care access.

Declarations

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Author Contributions: All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by V.A., R.P., M.M., D.L., B.C., S.Y., A.P., W.L.. The first draft of the manuscript was written by R.S., S.S., C.N., and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript. D.Y. and A.K. provided guidance, oversight, and revisions of drafts of the final manuscript.

Data Availability: The data analyzed in this study are publicly available. Graduate outcome data were obtained from Accreditation Council for Graduate Medical Education (ACGME)-accredited hematology-oncology programs. County-level data were obtained from the U.S. Census Bureau American Community Survey, the Behavioral Risk Factor Surveillance System, the Bureau of Labor Statistics, and Census Population Estimates. The compiled analytic dataset is available from the corresponding author on reasonable request.

Ethics Approval: This study used only publicly available, aggregate data and did not involve human participants or identifiable private information. The Augusta University Institutional Review Board determined that this study did not constitute human subjects research.

Consent to Participate: Not applicable.

Consent to Publish: Not applicable.

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Tables

Table 1: Cohort totals of 2019 to 2022 Hematology/Oncology Fellows (HOFs) through each training phase.

Cohort Summary

Medical School Backgrounds	Hematology/Oncology Fellows
T50NIH	207 (29.4%)
NONT50NIH	200 (28.4%)
OIMS	296 (42.1%)
Whole Sample	703 (100%)

Table 2: Retention and movement of each transition stage is represented by a percentage of HOFs moving from the initial stage (row) to the final stage (column). The top table represents T1, middle T2, and last T3.

Regional Retention Rates

Residency Region					
		Midwest	Northeast	South	West
Medical School Region	International	30.00%	42.69%	25.00%	2.31%
	Midwest	59.56%	10.29%	9.56%	20.59%
	Northeast	7.69%	55.56%	15.38%	21.37%
	South	20.90%	18.66%	46.27%	14.18%
	West	7.14%	12.50%	8.93%	71.43%
Total Percent of HOFs		28.45%	31.58%	23.19%	16.79%
Fellowship Region					
		Midwest	Northeast	South	West
Residency Region	Midwest	62.50%	6.50%	23.00%	8.00%
	Northeast	18.02%	49.55%	22.97%	9.46%
	South	14.72%	10.43%	63.80%	11.04%
	West	2.54%	5.08%	9.32%	83.05%
Total Percent of HOFs		27.31%	20.77%	30.16%	21.76%
Job Regions					
		Midwest	Northeast	South	West
Fellowship Region	Midwest	65.10%	8.33%	17.19%	9.38%
	Northeast	6.85%	75.34%	9.59%	8.22%
	South	12.26%	7.55%	68.40%	11.79%
	West	4.58%	2.61%	16.99%	75.82%
Total Percent of HOFs		23.90%	20.77%	31.01%	24.32%

Table 3: Regression table by quantile for relevant characteristics data from medical school to residency (top), residency to fellowship (middle), and fellowship to first attending position (bottom). County-level characteristics describe the county of origin for each transition. T50NIH = graduation from a top 50 NIH-funded medical school. Beta refers to the average increase in miles per one percent increase of the characteristics. QR10, QR50, and QR90 = quantile regression at the 10th, 50th, and 90th percentiles. OLS = Ordinary Least Square of entire sample.

Factors Influencing Miles Traveled

T1 Regression Analysis												
	QR10			QR50			QR90			OLS		
Characteristics	Beta	95% CI	p-value	Beta	95% CI	p-value	Beta	95% CI	p-value	Beta	95% CI	p-value
Uninsured Adults	5.9	-12, 24	0.5	59	37, 82	<0.001	42	-3.3, 87	0.069	20	-1.6, 42	0.069
Rurality	0.43	-2.7, 3.5	0.8	-5.0	-9.1, -0.86	0.018	-17	-27, -7.2	<0.001	-9.5	-17, -1.5	0.020
T50NIH	-8.5	-81, 64	0.8	-18	-98, 62	0.7	-186	-576, 204	0.3	38	-126, 202	0.6
Individuals Who Attended Some College	-1.2	-7.4, 5.0	0.7	-1.8	-12, 8.6	0.7	-13	-52, 26	0.5	-11	-25, 3.3	0.13
Long Distance Commute	-0.88	-4.1, 2.4	0.6	-3.1	-7.4, 1.3	0.2	12	-2.5, 27	0.10	2.5	-4.7, 9.7	0.5
Median Household Income	-0.15	-2.5, 2.2	0.9	3.0	-2.5, 8.5	0.3	15	-3.1, 32	0.11	6.6	0.91, 12	0.023
T2 Regression Analysis												
	QR10			QR50			QR90			OLS		
Characteristics	Beta	95% CI	p-value	Beta	95% CI	p-value	Beta	95% CI	p-value	Beta	95% CI	p-value
Rurality	0.81	-0.92, 2.5	0.4	-1.8	-7.5, 4.0	0.5	-1.3	-6.3, 3.6	0.6	-0.44	-5.9, 5.0	0.9
T50NIH	0.00	-23, 23	>0.9	-17	-64, 30	0.5	-44	-266, 178	0.7	38	-74, 149	0.5
Uninsured Adults	0.30	-5.6, 6.2	>0.9	43	24, 62	<0.001	47	25, 69	<0.001	24	9.3, 39	0.001
Unemployment Level	7.1	-12, 26	0.5	-14	-90, 62	0.7	31	-99, 161	0.6	35	-52, 121	0.4
Individuals Who Attended Some College	-0.49	-2.4, 1.5	0.6	-2.3	-10, 5.4	0.6	-0.56	-14, 13	>0.9	-0.84	-9.7, 8.0	0.9
Long Distance Commute	0.00	-1.2, 1.2	>0.9	2.7	-2.9, 8.2	0.3	4.9	-4.7, 14	0.3	4.5	-1.5, 11	0.14
Median Household Income	0.24	-0.51, 0.99	0.5	1.1	-3.0, 5.3	0.6	4.3	-4.9, 13	0.4	3.8	-0.21, 7.9	0.063
Total County Population	-0.25	-0.79, 0.30	0.4	-4.2	-5.6, -2.8	<0.001	-9.6	-13, -6.0	<0.001	-6.4	-9.2, -3.6	<0.001
65 and Older	2.8	-3.7, 9.3	0.4	35	17, 53	<0.001	17	-18, 51	0.3	17	-6.7, 40	0.2
T3 Regression Analysis												
	QR10			QR50			QR90			OLS		
Characteristics	Beta	95% CI	p-value	Beta	95% CI	p-value	Beta	95% CI	p-value	Beta	95% CI	p-value

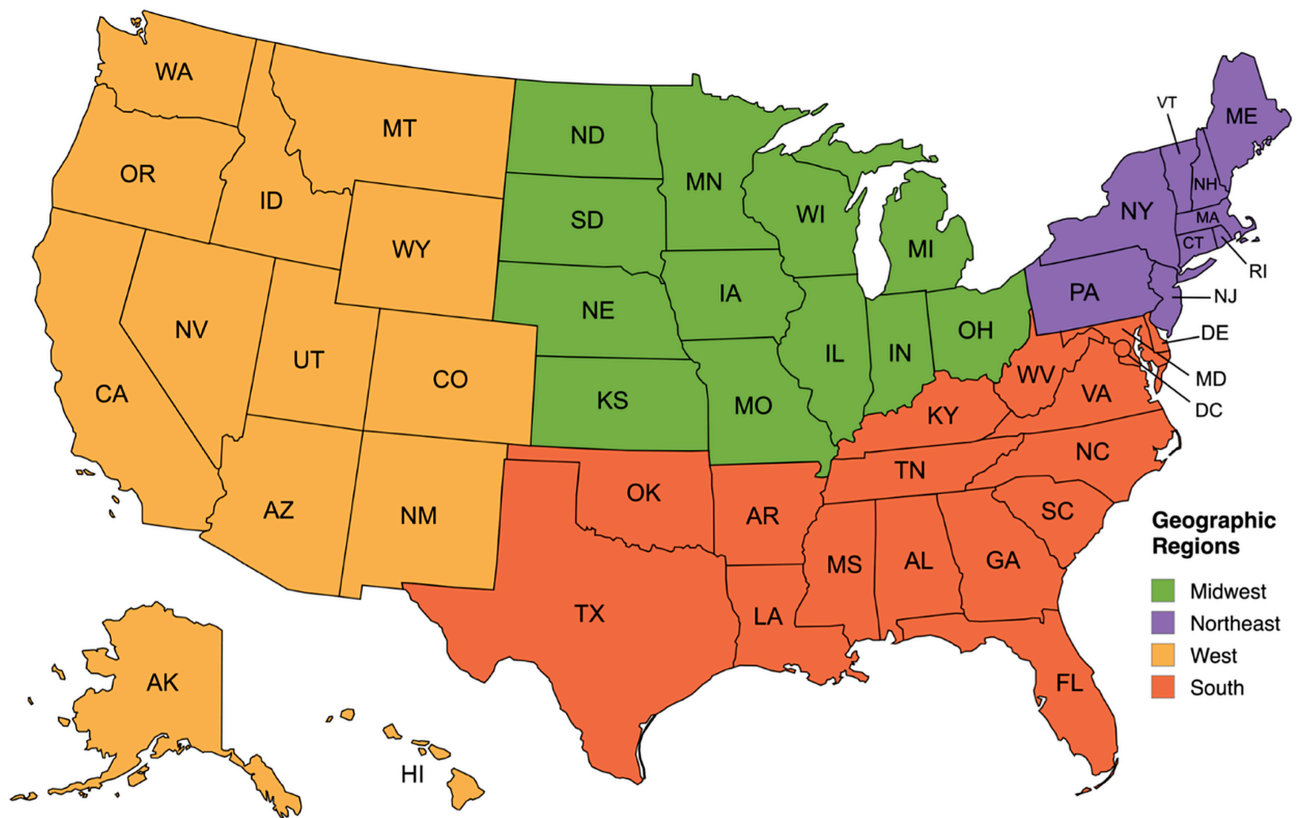
Fellowship Graduation After COVID Onset	2.2	-6.3, 11	0.6	-2.0	-57, 53	>0.9	98	-119, 316	0.4	44	-60, 149	0.4
Rurality	0.47	-0.59, 1.5	0.4	-0.93	-8.0, 6.1	0.8	3.3	-12, 18	0.7	2.0	-4.4, 8.4	0.5
T50NIH	-0.95	-9.5, 7.6	0.8	-2.1	-57, 53	>0.9	-265	-501, -29	0.028	-143	-261, -25	0.018
Uninsured Adults	-0.81	-3.3, 1.7	0.5	10	-1.2, 21	0.080	23	-6.5, 53	0.13	8.8	-5.4, 23	0.2
Unemployment Level	-1.9	-14, 10	0.8	-78	-181, 24	0.14	-147	-324, 30	0.10	-20	-136, 95	0.7
Individuals Who Attended Some College	-1.8	-3.1, -0.59	0.004	0.04	-5.2, 5.3	>0.9	2.4	-15, 20	0.8	-2.9	-12, 6.6	0.6
Long Distance Commute	-0.48	-1.5, 0.52	0.4	-4.1	-10, 2.0	0.2	-2.6	-18, 13	0.7	-8.2	-17, 0.17	0.055
Median Household Income	0.27	-0.16, 0.69	0.2	-3.3	-7.7, 1.1	0.14	-7.6	-19, 3.3	0.2	2.2	-3.4, 7.8	0.4
Total County Population	-0.05	-0.36, 0.25	0.7	0.30	-1.3, 1.9	0.7	8.1	-0.78, 17	0.074	2.7	-0.20, 5.6	0.068
65 and Older	1.6	-3.7, 7.0	0.6	15	-5.8, 35	0.2	47	-9.0, 103	0.10	8.0	-21, 37	0.6

Table 4: Adult population trends during each transition based on statistics provided by survey and census databases. Delta represents the average change in each characteristic from the origin county to the destination county (destination minus origin); negative values indicate relocation to counties with lower values. Values are in percentage points except for the ratio of population to primary care physicians (per 1,000), HIV prevalence (per 100,000), population (100,000 residents), and median household income (\$1,000s).

Demographic Trends

Characteristics	T1 Delta (n = 444)	T2 Delta (n = 703)	T3 Delta (n = 703)
Ratio of population to primary care physicians	-0.062	0.002	0.140
High school completion	-0.334	-0.302	0.595
Smoking	-1.219	-0.383	-0.306
Obesity	-1.651	0.480	0.318
Unemployment	-0.142	-0.126	-0.284
Excessive drinking	-0.066	-0.359	-0.257
Diabetes prevalence	-0.277	-0.061	-0.445
HIV prevalence	-14.67	-177.03	-224.92
Population	4.544	4.802	-2.018
Below 18 years of age	-0.564	0.801	0.675
65 and Older	-0.086	-0.252	0.617
Black	-2.492	-2.043	-5.531
American Indian or Alaska Native	-0.012	-0.051	0.154
Asian	2.664	0.375	-0.210
Native Hawaiian or Other Pacific Islander	0.0325	0.0344	0.049
Hispanic	1.771	2.249	-1.124
White	-1.981	-0.695	6.540
Female	-0.234	-0.194	-0.464
Rurality	-1.672	-0.135	7.067
Median Household Income	6.635	1.088	4.070
Uninsured	-0.568	0.770	0.519
Long Distance Commute	2.740	-0.583	-1.290
Attended Some College	1.415	-0.787	-1.204

Figures



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Figure 1

United States geographic regions: Midwest, Northeast, South, and West

Map of US Regions Analyzed

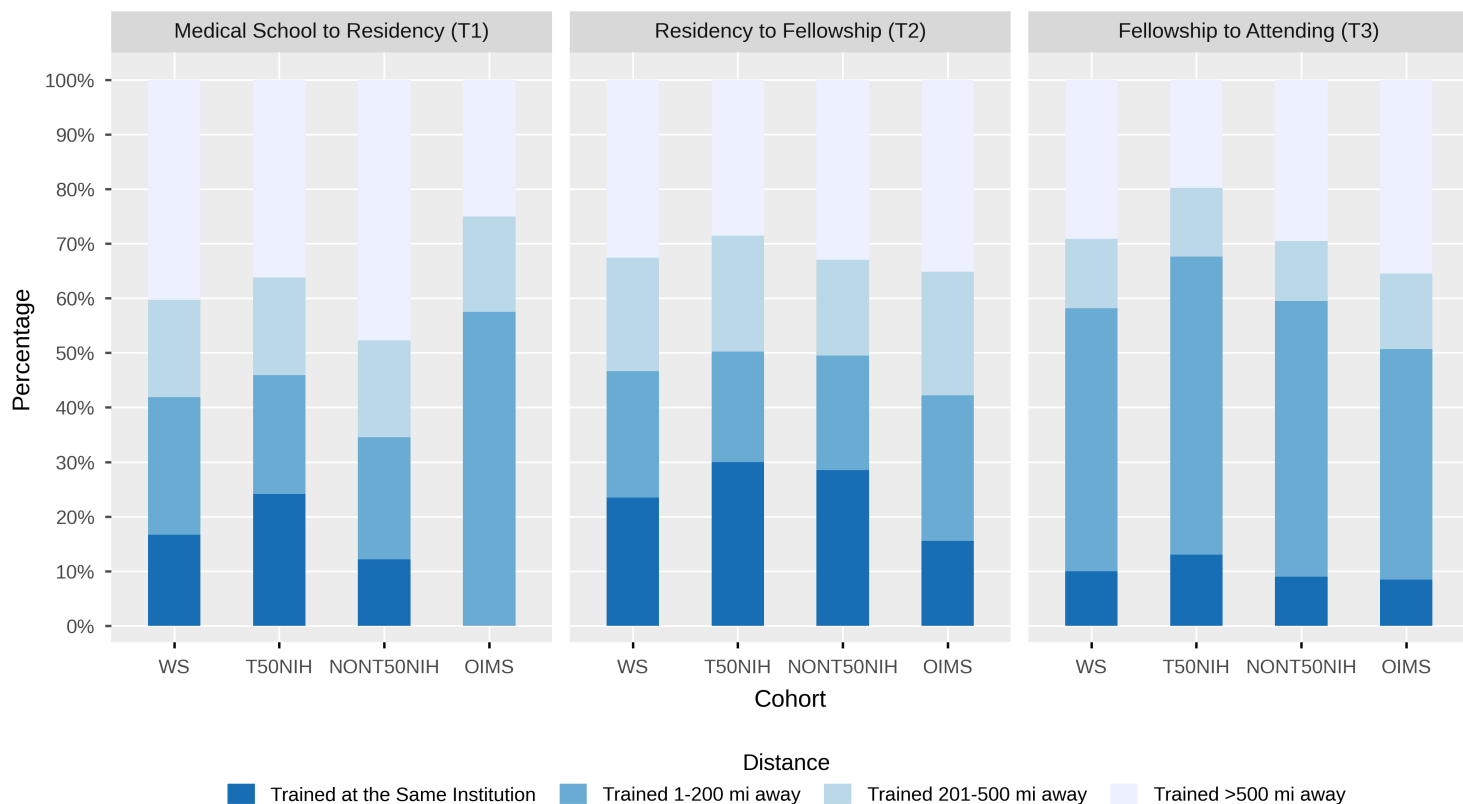


Figure 2

Distance traveled by trainees in each cohort (whole sample [WS], T50NIH, NONT50NIH, and OIMS) at each transition stage. (left) medical school to residency - T1, (middle) residency to fellowship - T2, and (right) fellowship to first attending position - T3. T1 includes only graduates with a U.S. medical school location (n = 444; OIMS at T1 includes osteopathic graduates only). Each cohort and the whole sample are divided and compared during each transition stage based on certain travel criteria: trained at the same institution, trained 1-200 miles away, trained 201 – 500 miles, and trained greater than 500 miles.

Distribution of Miles Traveled Amongst Cohorts