Arete Healthcare LLC

Independent Practices | Shared Infrastructure | Clinician-Led Governance

ARETE ORIGINAL RESEARCH

Where Chiropractors and Physical Therapists Practice

ZCTA-Level Variation in Provider Availability, Demographic Concordance, Representation, and Rural-Urban Distribution, 2022

Purpose

- To examine where Medicare FFS claims-active chiropractors and physical therapists practice across U.S. communities and **whether overall provider availability and estimated provider racial/ethnic composition vary with community demographics, socioeconomic deprivation, and rurality,** using 2022 CMS claims, ACS 2019–2023 ZCTA estimates, RUCA, SDI, and name-only BIFS provider race/ethnicity estimates.

Key Findings

Availability remains lower in Hispanic- and Black-concentrated communities. Per +10 percentage points, Hispanic population share was associated with **20.8% lower** DC and **15.2% lower** PT availability; NH Black share with **23.0% lower** DC and **11.4% lower** PT availability.

Provider composition becomes more locally concordant. A +10-point same-race population share was associated with provider-share increases of **1.04**, **0.74**, and **1.53 percentage points** (Hispanic, Black, Asian) among DCs, and **2.03**, **0.95**, and **3.49 points** among PTs.

PT concordance is consistently stronger than DC concordance. Profession-interaction ratios were **1.11** for Hispanic, **1.20** for Black, and **1.28** for Asian population composition.

Concordance does not equal proportional representation. Same-race providers per same-race population declined as Hispanic, Black, and Asian population shares increased — DC **−37.9%**, **−60.7%**, **−25.1%**; PT **−29.2%**, **−47.3%**, **−21.2%** per +10 points.

Rurality differs sharply by profession. Relative to metropolitan ZCTAs, adjusted DC availability was **+13.6%** micropolitan, **+19.6%** small town, and **−17.3%** rural; PT availability was **−23.1%**, **−36.4%**, and **−60.8%**, respectively.

Socioeconomic gradients differ by profession. After race composition and RUCA adjustment, +10 SDI points was unrelated to DC availability (**−0.1%**) but associated with **2.9% lower** PT availability; income sensitivity was null for DC and **+4.5%** for PT per $10,000 (corrected from the draft's 4.6% — see Appendix B).

In Pictures

The three figures below carry the paper's central visual argument: overall provider supply and estimated workforce composition across community race/ethnicity and deprivation gradients, and the concordance between provider and population composition. Each figure keeps its full caption exactly as it appears here — it is not repeated elsewhere in the document.

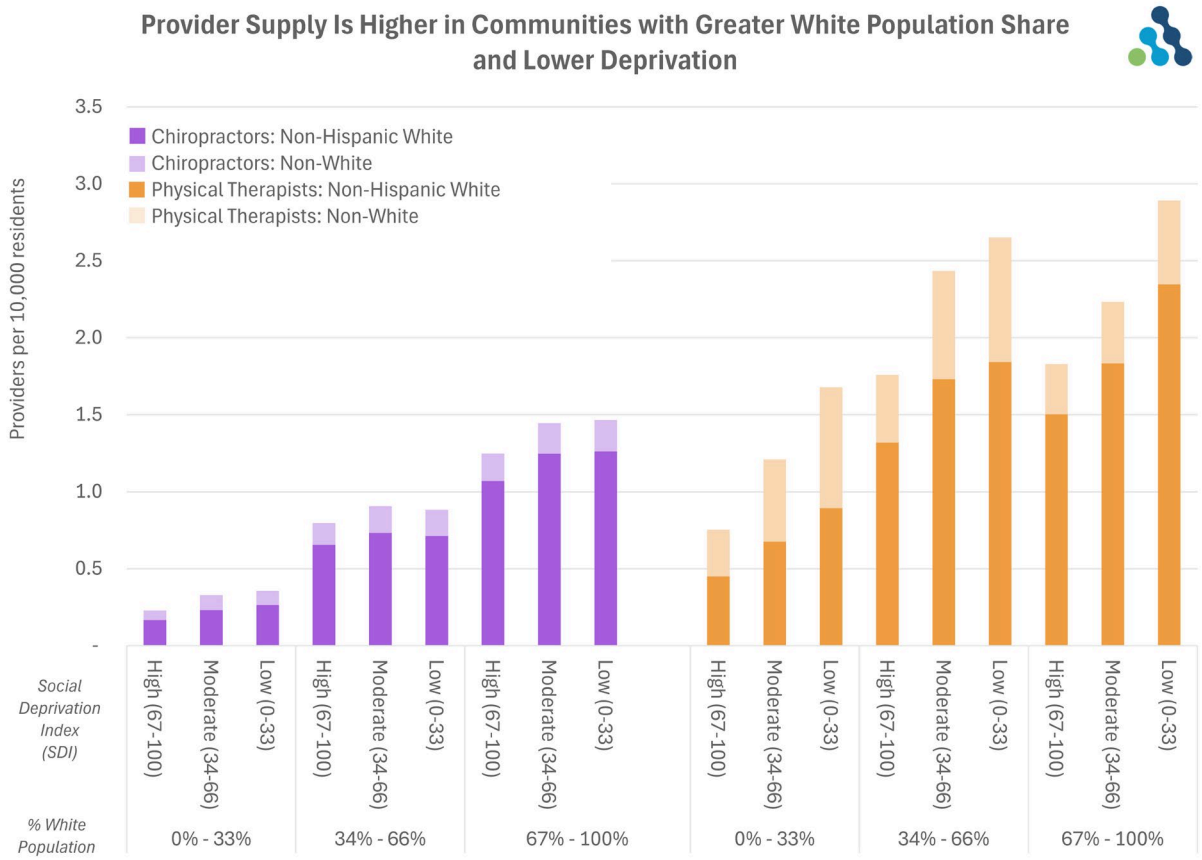

Figure 1. Medicare FFS claims-active chiropractor and physical therapist supply and estimated workforce composition across ZCTA non-Hispanic White population share and Social Deprivation Index categories. Total bar height represents claims-active providers per 10,000 total residents. Within each profession, the darker segment represents the BIFS-estimated non-Hispanic White share of the provider workforce and the lighter segment represents all other BIFS race/ethnicity categories combined. ZCTAs are grouped into fixed non-Hispanic White population-share categories of 0–33%, 34–66%, and 67–100%; within each population-share category, Social Deprivation Index (SDI) is shown from high deprivation (67–100) to moderate deprivation (34–66) to low deprivation (0–33). These are fixed descriptive ranges, not equal-size statistical terciles. Provider supply generally increases as the non-Hispanic White share of the population increases and as deprivation decreases. The stacked composition also shows that the racial/ethnic composition of the provider workforce changes across the same community gradients. Provider race/ethnicity was estimated using Bayesian Improved First-name Surname (BIFS) probabilities based on provider first and last names; geography was excluded from the provider classification model. "Non-White" in this figure combines the Hispanic, non-Hispanic Black, non-Hispanic Asian, and Other BIFS categories and should not be interpreted as a homogeneous population group. These descriptive categories are intended to make the broad geographic pattern visually accessible; the paper's inferential analyses use the underlying continuous ZCTA measures. The crude SDI gradient should also not be interpreted as an independent causal effect: multivariable models show that the association of SDI with supply differs between chiropractic and physical therapy after adjustment for population composition and rurality. Provider counts identify clinicians visible in the 2022 Original Medicare FFS public claims file and therefore do not represent total licensed professional supply. Rates use total ZCTA population rather than Medicare FFS enrollment. Provider location indicates where the clinician practiced, not where patients resided. Visualization was human generated.

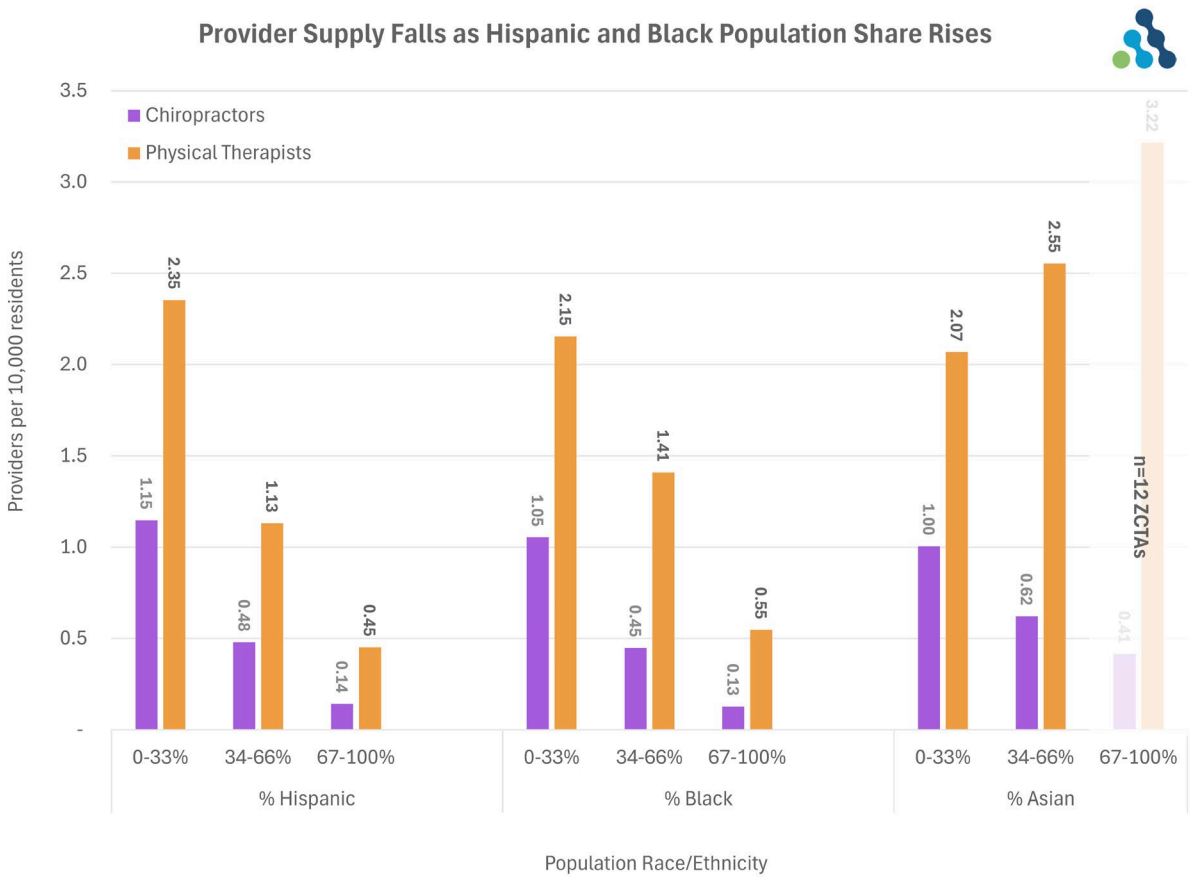

Figure 2. Medicare FFS claims-active chiropractor and physical therapist supply across ZCTA Hispanic, non-Hispanic Black, and non-Hispanic Asian population-share categories. Bars show claims-active providers per 10,000 total residents. For each population group, ZCTAs are classified into fixed population-share ranges of 0–33%, 34–66%, and 67–100%. These categories describe community composition and are not equal-number terciles; the number of ZCTAs and residents represented by each category differs substantially. Provider supply declines sharply across increasing Hispanic and non-Hispanic Black population concentration. Chiropractic supply decreases from approximately 1.15 to 0.14 providers per 10,000 residents across the lowest to highest Hispanic categories and from 1.05 to 0.13 across the corresponding Black categories. Physical therapy supply decreases from approximately 2.35 to 0.45 across Hispanic categories and from 2.15 to 0.55 across Black categories. Asian-concentrated communities show a different pattern: chiropractic supply declines from approximately 1.00 to 0.41 providers per 10,000, while physical therapy supply increases from approximately 2.07 to 3.22. The highest Asian population-share category contains only 12 ZCTAs and should therefore be interpreted cautiously. The figure is descriptive and is intended to show the magnitude and direction of the unadjusted community-level gradients. It does not imply that an individual resident's race or ethnicity determines provider access, nor does it establish causality. Multivariable analyses using the continuous population-composition measures adjust for socioeconomic deprivation and rural-urban status and are reported in the Results. Those adjusted models confirm substantially lower overall DC and PT availability in ZCTAs with larger Hispanic and Black population shares, while the Asian association differs by profession and is more model-sensitive for chiropractic. Provider counts reflect 2022 Original Medicare FFS claims-active clinicians rather than total licensed supply. Rates use total ZCTA population. Provider practice location is not equivalent to beneficiary residence, and residents may obtain care outside their ZCTA. Visualization was human generated.

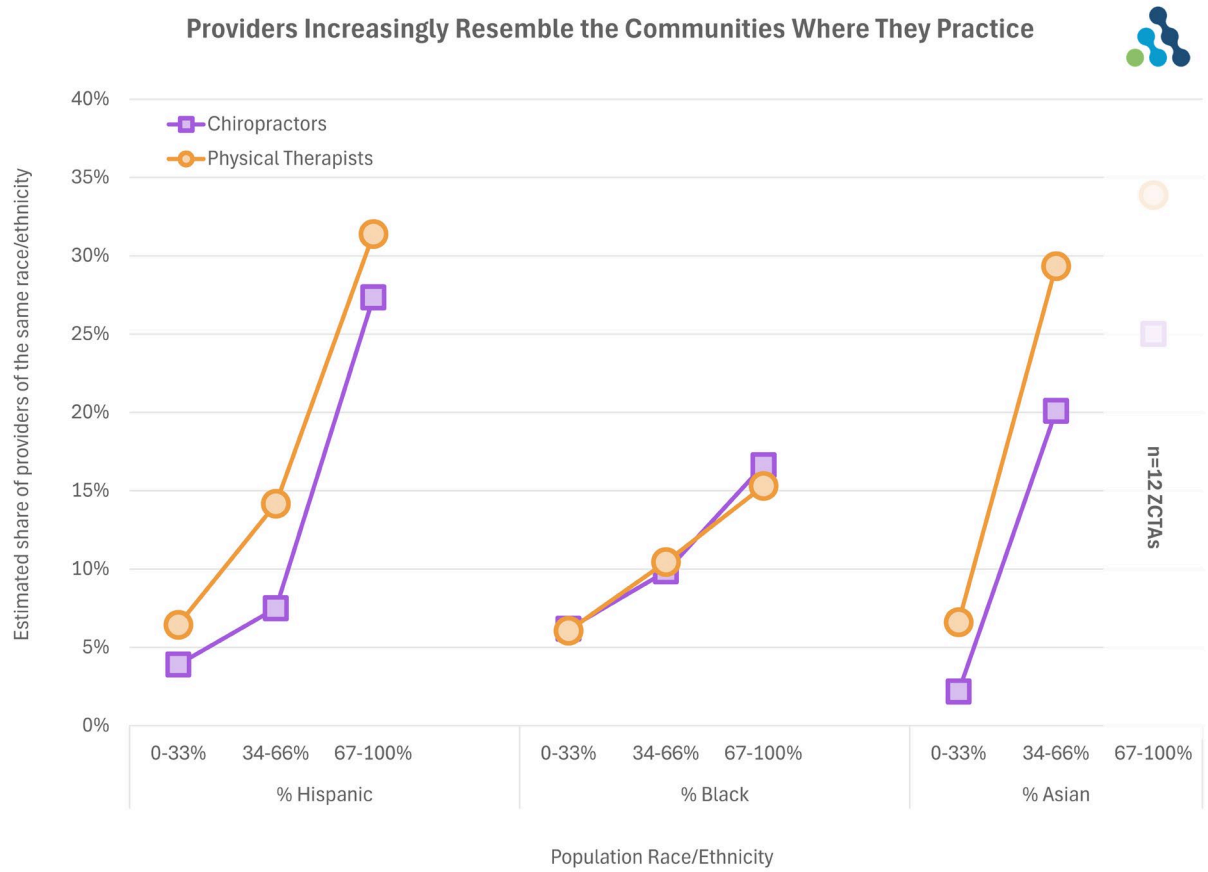

Figure 3. Estimated racial/ethnic concordance between the chiropractor and physical therapist workforce and the ZCTA populations in which those providers practice. For Hispanic, non-Hispanic Black, and non-Hispanic Asian populations, the horizontal axis groups ZCTAs into fixed population-share ranges of 0–33%, 34–66%, and 67–100%. The vertical axis shows the BIFS-estimated percentage of chiropractors or physical therapists belonging to the corresponding racial/ethnic category. Thus, the Hispanic panel shows the estimated Hispanic share of DCs and PTs across increasingly Hispanic ZCTAs; the Black and Asian panels are interpreted analogously. Across all three population groups, provider composition shifts in the same direction as community composition. The estimated Hispanic share of chiropractors rises from approximately 3.9% to 27.3% across the lowest to highest Hispanic population-share categories, while the Hispanic share of physical therapists rises from 6.4% to 31.4%. For non-Hispanic Black providers, the corresponding changes are approximately 6.2% to 16.6% for chiropractors and 6.1% to 15.3% for physical therapists. For non-Hispanic Asian providers, estimated representation rises from approximately 2.2% to 25.0% among chiropractors and from 6.6% to 33.9% among physical therapists. The highest Asian population-share category contains only 12 ZCTAs and is shown with reduced visual emphasis because the estimate is based on a very small number of communities. Provider race/ethnicity in this figure was estimated using BIFS based on first name and surname only. Geography was deliberately excluded from the provider race/ethnicity estimation model because a geographic prior derived from the same ZCTA population composition used on the horizontal axis would mechanically induce positive provider-population correlation. The name-only BIFS specification therefore sacrifices some classification precision relative to BIFSG but provides a cleaner test of whether provider composition independently varies with community composition. The figure shows aggregate probabilistic estimates, not observed self-reported provider race/ethnicity and not individual provider-patient matching. The upward gradients demonstrate demographic concordance, but they should not be interpreted as evidence of proportional representation or adequate provider availability. Figure 2 shows that overall DC and PT supply can decline substantially as Hispanic or Black population concentration increases even while the racial/ethnic composition of the providers who remain becomes more concordant with the surrounding community. Adjusted continuous-variable models reported in the Results show that these concordance relationships persist after accounting for SDI and rurality. These are ecological, provider-location relationships. They do not establish individual-level access, utilization, patient-provider racial concordance, or causal effects of community race/ethnicity on provider location. Visualization was human generated.

Arete's Take

Chiropractic (DC) and Physical Therapy (PT) availability is higher in white, affluent communities. This is not surprising given the hostile third-party payer contracting environment results in DC and PT commercial reimbursement generally being less than CMS, with CMS reimbursement being approximately breakeven. To remain economically viable, DCs and PTs rely on self-pay patients, who tend to reside in more affluent communities.

*A novel finding in the analysis was the concordance between DC and PT race/ethnicity and the race/ethnicity composition of communities in which a DC or PT practices. Our earlier paper exploring workforce gender/race/ethnicity composition of 15 specialties found DCs (**~80%**) and PTs (**~70%**) primarily consist of white practitioners. Consequently, it was not surprising to find DC and PT availability higher in primarily white communities.*

With the DC and PT workforce increasingly reflecting the U.S. population's racial/ethnic composition, it will be interesting to observe whether the availability gaps in non-white communities start to be addressed.

At a Glance

Table. Adjusted overall provider availability

Domain	Chiropractic (DC)	Physical Therapy (PT)	Interpretation boundary
National claims-active supply	10.0 per 100,000	20.8 per 100,000	Provider-location supply; not total licensed workforce
+10 pp Hispanic population share	IRR 0.792 (0.780–0.804)	IRR 0.848 (0.834–0.862)	NH White is the omitted compositional reference
+10 pp NH Black population share	IRR 0.770 (0.756–0.785)	IRR 0.886 (0.869–0.903)	Adjusted association, not causal
+10 pp NH Asian population share	IRR 0.953 (0.929–0.978)	IRR 1.167 (1.130–1.206)	DC direction is model-sensitive in NB sensitivity
+10 SDI points	IRR 0.999 (0.990–1.008)	IRR 0.971 (0.961–0.982)	After demographic composition + RUCA adjustment
Rural vs. metropolitan	IRR 0.827 (0.765–0.895)	IRR 0.392 (0.348–0.442)	Primary PPML specification

Table. Demographic concordance and population-relative representation

Domain	Chiropractic (DC)	Physical Therapy (PT)	Interpretation boundary
Hispanic concordance, +10 pp population share	+1.04 pp provider share	+2.03 pp provider share	BIFS name-only; weighted fractional logit
NH Black concordance, +10 pp population share	+0.74 pp provider share	+0.95 pp provider share	Positive concordance, smaller magnitude
NH Asian concordance, +10 pp population share	+1.53 pp provider share	+3.49 pp provider share	Strongest non-White concordance gradient
Hispanic same-race availability, +10 pp population share	−37.9%	−29.2%	Same-race providers per same-race population
NH Black same-race availability, +10 pp population share	−60.7%	−47.3%	Provider growth does not keep pace with population
NH Asian same-race availability, +10 pp population share	−25.1%	−21.2%	Representation/scaling measure; not causal

Source: Arete analysis of 2022 CMS Medicare Physician & Other Practitioners — by Provider linked to ACS 2019–2023 5-year ZCTA demographics (exact Census Table B03002 fields, per Methods v3), AHRQ/USDA RUCA, Robert Graham Center SDI, and Census 2020 surname/first-name race/ethnicity frequency tables. Inferential provider-race models use name-only BIFS rather than BIFSG to avoid geographic-prior circularity; see Methods §2.5.

Abstract

Using 2022 Centers for Medicare & Medicaid Services Original Medicare fee-for-service provider claims linked to ACS 2019–2023 ZIP Code Tabulation Area demographics, Social Deprivation Index, and Rural-Urban Commuting Area measures, this study examined claims-active chiropractic and physical therapy provider availability and whether estimated provider racial/ethnic composition tracks local population composition. Provider race/ethnicity was estimated with name-only Bayesian Improved First-name Surname (BIFS) probabilities for inferential models rather than BIFSG because a geographic prior derived from the same ZCTA population composition would mechanically induce concordance. Hispanic- and Black-concentrated communities had lower overall provider availability, while same-race provider share rose with local same-race population share — more strongly for physical therapy — but same-race provider supply generally did not increase proportionately with the corresponding population.

Methods

2.1 Research Questions and Analytic Framework

Chiropractic and physical therapy workforce geography can be described along at least three distinct dimensions: overall provider availability, demographic concordance between the local population and provider workforce, and population-relative representation. The analysis therefore asks whether claims-active DC/PT supply varies with community racial/ethnic composition, deprivation, and rurality; whether estimated provider racial/ethnic composition shifts with the corresponding population composition; and whether same-race provider counts increase proportionately as the same-race population becomes more concentrated.

- How does overall claims-active DC and PT availability vary with ZCTA racial/ethnic composition, SDI, income, and rurality?
- Does the racial/ethnic composition of the local DC and PT workforce become more concordant as the corresponding population share increases?
- Does greater concordance translate into proportional same-race provider availability relative to the size of the corresponding population?
- Do these associations differ between chiropractic and physical therapy?

The study is ecological and measures provider-location supply, not patient-residence access. CMS reports the rendering provider practice ZIP code rather than beneficiary residence, so a ZCTA identifies where professional capacity is located and services were delivered; it does not establish where the patients lived, whether residents were in-network, or whether local demand was met.

2.2 Unit of Analysis and Analytic Cohort

The unit of analysis is the U.S. Census ZIP Code Tabulation Area (ZCTA), not the USPS postal ZIP code. CMS provider ZIPs were mapped to their dominant residential ZCTA using the deterministic AHRQ SDOH ZIP-to-ZCTA crosswalk, and provider-level claims were aggregated after mapping. The ACS 2019–2023 5-year ZCTA file supplied the population universe, yielding 33,181 ZCTAs and 335.6 million residents in the analytic extract (independently confirmed by direct summation of the underlying ZCTA-level file).

The primary adjusted-model cohort required total population of at least 1,000, nonmissing SDI, and a valid RUCA code 1–10. This produced 22,728 ZCTAs containing 33,332 claims-active DCs and 69,400 claims-active PTs. The income sensitivity model included 22,545 ZCTAs — corrected here from the draft's reported 22,667 (see Appendix B). Concordance models were limited to ZCTAs containing the relevant profession: 9,862 DC ZCTAs (33,332 providers as analytic weight) and 9,700 PT ZCTAs (69,400 providers).

2.3 Claims Data and Provider Identification

Provider supply came from the 2022 CMS Medicare Physician & Other Practitioners — by Provider file. Chiropractors were identified by rndrng_prvdr_type = “Chiropractic” (Medicare specialty 35), and physical therapists by “Physical Therapist in Private Practice” (specialty 65). Provider count is the number of unique NPIs with at least one visible Medicare FFS service in 2022. The source extract also

retains comparison specialties; corrected CMS type strings include “Family Practice,” “Pain Management,” and “Physical Medicine and Rehabilitation.” These comparison-specialty fields are not used in the primary DC/PT models reported here.

Claims-visible provider supply is not equivalent to total licensed professional supply. The public CMS file excludes providers with no Original Medicare FFS activity and can omit low-volume providers because of CMS privacy suppression. The PT provider-level file does not include place of service, so specialty 65 should not be interpreted as a strictly office-only cohort.

2.4 Community Demographics and Contextual Measures

Population demographics came from the ACS 2019–2023 5-year ZCTA file (sumlevel 860). Five approximately mutually exclusive race/ethnicity categories were constructed to align provider and population analyses: non-Hispanic White, Hispanic/Latino of any race, non-Hispanic Black, non-Hispanic Asian, and Other. As of the Methods v7 / SQL v3 source refresh, the White, Hispanic, NH Black, and NH Asian fields are exact mutually exclusive Census Table B03002 cross-tabulation cells (white_nh_rate, hispanic_latino_rate, black_nh_rate, asian_nh_rate) rather than the race-alone-adjusted-by-Hispanic-share approximation used in the prior (v2) source — Other is the residual. This is a data-provenance correction to the draft as received, which still described the approximation; the companion SQL artifact's own reconciliation (independently spot-checked here against the supplied ZCTA-level file) found the change numerically identical to the prior approximation across all 33,181 ZCTAs, so no headline statistic in this paper is affected.

Socioeconomic context included the Graham Center Social Deprivation Index (SDI; ACS 2015–2019), ACS median household income, percentage age 65 or older, and AHRQ/USDA RUCA. RUCA was collapsed to Metropolitan (1–3, reference), Micropolitan (4–6), Small town (7–9), and Rural (10); code 99 and missing values were excluded from rurality models. Fixed-width quintile, quartile, and tercile categorical fields are retained for descriptive cross-tabulation, but continuous values were used in the regression models to avoid information loss from arbitrary cut points.

Table M1. Principal data sources

Source	Vintage	Role in analysis
CMS Medicare Physician & Other Practitioners — by Provider	2022	DC/PT provider counts, beneficiary-provider relationships, services, payments, provider names
ACS 5-year ZCTA summary file	2019–2023	Population, race/ethnicity, income, age, socioeconomic measures
Census frequent surnames / first names by race	2020	Surname and first-name priors for BIFSG and BIFS
AHRQ SDOH ZIP-to-ZCTA crosswalk	2020	Provider postal ZIP to ZCTA mapping
AHRQ / USDA RUCA	2019 release; 2010 commuting	Metropolitan, micropolitan, small-town, rural classification
Robert Graham Center SDI	ACS 2015–2019	Composite area-level social deprivation
IRS Statistics of Income ZIP data	2021	Supplemental AGI/tax-filer measures; not primary model input

2.5 Provider Race/Ethnicity Estimation: Why BIFS, Not BIFSG, Is Primary

Provider race/ethnicity is not reported in the CMS provider file. We therefore generated probabilistic expected counts for five race/ethnicity categories using Census 2020 surname and first-name frequency tables. Two related Bayesian estimators were produced for each individual provider.

BIFSG combines surname, first name, and the provider practice ZCTA population composition. For category r, the unnormalized posterior is proportional to P(r|surname) × P(r|first name) × P(r|ZCTA) / $P(r)^2$. Geography is informative and can improve classification accuracy, making BIFSG useful for descriptive mapping and supply characterization.

BIFS deliberately removes geography. Its unnormalized posterior is proportional to P(r|surname) × P(r|first name) / P(r), followed by normalization across the five categories. The five posterior probabilities sum to 1.0 for each classifiable individual provider and are summed within ZCTA to produce expected provider counts.

Primary inferential choice: BIFS was used whenever ZCTA population race/ethnicity was an independent variable. Using BIFSG in those models would embed the same ZCTA racial composition being tested as a geographic prior in the estimated provider-race outcome, mechanically inducing positive provider-population concordance. Removing the geographic prior sacrifices some classification accuracy but eliminates that circularity. BIFSG is therefore retained as a descriptive/sensitivity estimate, not the primary outcome for concordance or race-specific regression.

Providers with names not present in Census name tables receive national-average priors; organizational provider records are not classifiable because they do not contain an individual first/last name. Consequently, BIFS expected counts reconcile closely but not perfectly to total provider counts — independently recomputed at 33,306.2 expected-count equivalents vs. 33,501 DCs (99.4%) and 69,553.5 vs. 69,692 PTs (99.8%) in the full file. BIFS estimates are probabilistic aggregate measures, not individual race assignments.

2.6 Outcomes and Measures

- Overall provider availability: claims-active DC or PT count, modeled with log total ZCTA population as an offset; descriptive rates are reported per 100,000 residents.
- Race-specific provider availability: BIFS expected provider count for race/ethnicity r, modeled with log total population as the offset.
- Demographic concordance: BIFS expected provider share for race/ethnicity r within provider-positive ZCTAs, modeled as a fractional outcome weighted by profession-specific provider count.
- Population-relative representation: BIFS expected same-race provider count modeled with log same-race population as the offset. This tests whether provider counts keep pace proportionately as the corresponding population grows; it is a scaling/representation measure, not a causal effect of population concentration.
- Provider presence: whether any claims-active provider of the profession is present in the ZCTA, used in secondary hurdle models.

2.7 Statistical Models

Primary overall availability models used Poisson pseudo-maximum-likelihood regression (PPML) with HC1 robust standard errors and log total population as the offset. Population racial/ethnic composition entered as Hispanic, NH Black, NH Asian, and Other shares scaled per +10 percentage points, with NH White as the omitted compositional reference. The primary M3 specification included racial/ethnic composition, SDI per +10 points, and RUCA. Nested models evaluated demographics + RUCA (M1), SDI + RUCA (M2), demographics + median household income per $10,000 + RUCA (M4), and demographics + SDI + age 65+ + RUCA (M5).

Race-specific availability used PPML with the same contextual covariates. Concordance used provider-count-weighted fractional-logit regression of BIFS provider share on the corresponding population share, SDI, and RUCA; average marginal effects are reported as percentage-point changes in provider share per +10-point population share. Population-relative representation used PPML with same-race population as the offset and required at least 100 same-race residents; sensitivity analyses used a 500-resident threshold.

Secondary hurdle models separated the odds that a ZCTA contained any provider from provider density conditional on presence. Profession-stacked interaction models formally tested whether population-composition associations differed between DCs and PTs. Negative-binomial models, minimum-population thresholds of 2,500 and 5,000, exclusion of race-share reconciliation anomalies, ≥5-provider concordance models, age-65 adjustment, and income-for-SDI substitution were used as sensitivity analyses. P-values are descriptive and were not adjusted for multiple comparisons.

The current source workbook does not provide usable state identifiers for the regression pipeline — the state field resolves only to US/PR — so the models do not include state fixed effects or state-clustered standard errors. Geographic coordinates, county identifiers, and adjacency data were also unavailable; residual spatial autocorrelation could not be formally modeled. These are limitations to address before final publication.

2.8 Data-Quality and Reproducibility Checks

The source extract identified 33,181 ZCTAs, 33,501 claims-active DCs, and 69,692 claims-active PTs. The primary complete-case cohort includes 22,728 ZCTAs. BIFS expected counts reconcile to approximately 99.4% of DCs and 99.8% of PTs. The source returns nonzero counts for Family Practice, Pain Management, and Physical Medicine and Rehabilitation, and adds parallel quintile, quartile, and tercile fields. None of the 22 variables used in the DC/PT model set changed between the prior and current query — corrected here from the draft's reported 23 (see Appendix B) — and direct re-estimation reproduced the prior model results. Forty-five primary-sample ZCTAs have population race-share totals above 100.1%; excluding them does not materially change the findings. The full reconciliation record for this rebuild, including the two numeric corrections noted above, is in Appendix B.

Results

3. National Distribution of Provider Supply

The ZCTA extract identified 33,501 Medicare FFS claims-active chiropractors and 69,692 claims-active physical therapists across 33,181 ACS ZCTAs, corresponding to national provider-location rates of 10.0 DCs and 20.8 PTs per 100,000 residents. Provider presence remained geographically sparse but population-concentrated: 30.1% of ZCTAs contained at least one DC and 29.7% contained at least one PT, while those ZCTAs contained 68.0% and 72.2% of the population, respectively.

Table 1. Distribution of provider presence across ACS ZCTAs

Provider configuration	ZCTAs	Share of ZCTAs	Population share
Both DC and PT	7,328	22.1%	59.0%
DC only	2,661	8.0%	9.0%
PT only	2,526	7.6%	13.3%
Neither	20,666	62.3%	18.7%

Almost two-thirds of ZCTAs contained neither claims-visible profession, yet those areas accounted for less than one-fifth of the population. Binary presence therefore describes geographic dispersion rather than resident-level access; many small ZCTAs have no local provider while most residents live in more populated ZCTAs containing at least one provider.

4. Overall Provider Availability and Community Context

In the primary PPML model, community racial/ethnic composition remained strongly associated with provider availability after adjustment for SDI and RUCA. Relative to NH White population composition, each 10-percentage-point higher Hispanic share was associated with 20.8% lower DC availability (IRR 0.792; 95% CI 0.780–0.804) and 15.2% lower PT availability (0.848; 0.834–0.862). The corresponding associations for NH Black population share were 23.0% lower DC availability (0.770; 0.756–0.785) and 11.4% lower PT availability (0.886; 0.869–0.903).

NH Asian population share showed a different pattern: +10 percentage points was associated with 16.7% higher PT availability (IRR 1.167; 1.130–1.206) but 4.7% lower DC availability in PPML (0.953; 0.929–0.978). The DC Asian coefficient reversed direction in the negative-binomial sensitivity model (IRR 1.045; 1.013–1.079) — independently confirmed against the recomputed sensitivity model — so the direction of the overall DC association in Asian-concentrated communities should be treated as model-sensitive rather than definitive.

Socioeconomic context also differed by profession. In an SDI + RUCA model without racial/ethnic composition, each 10-point increase in SDI was associated with about 10.9% lower DC and 10.4% lower PT availability. After population composition was added, the DC SDI association attenuated to essentially zero (IRR 0.999; 0.990–1.008), whereas PT availability remained 2.9% lower per 10 SDI points (0.971; 0.961–0.982). Replacing SDI with median household income produced a null DC association (IRR 0.997 per $10,000; 0.990–1.003) and 4.5% higher PT availability (1.045; 1.038–1.053) — both figures

corrected here from the draft's reported 0.991 lower-bound and 4.6%/1.046 upper estimate; see Appendix B.

Table 2. Primary adjusted associations with overall provider availability

Measure	Chiropractic IRR (95% CI)	Physical therapy IRR (95% CI)	Interpretation
Hispanic population share, +10 pp	0.792 (0.780–0.804)	0.848 (0.834–0.862)	vs NH White composition
NH Black population share, +10 pp	0.770 (0.756–0.785)	0.886 (0.869–0.903)	vs NH White composition
NH Asian population share, +10 pp	0.953 (0.929–0.978)	1.167 (1.130–1.206)	DC direction model-sensitive
SDI, +10 points	0.999 (0.990–1.008)	0.971 (0.961–0.982)	M3 primary model
Rural vs metropolitan	0.827 (0.765–0.895)	0.392 (0.348–0.442)	RUCA adjusted

Rurality showed a pronounced profession-specific pattern. Relative to metropolitan ZCTAs, adjusted DC availability was 13.6% higher in micropolitan areas and 19.6% higher in small towns, but 17.3% lower in rural areas. PT availability declined stepwise: 23.1% lower in micropolitan areas, 36.4% lower in small towns, and 60.8% lower in rural ZCTAs.

5. Provider-Population Demographic Concordance

Name-only BIFS estimates demonstrate that provider racial/ethnic composition shifts systematically with local population composition even after adjustment for SDI and RUCA. A 10-percentage-point increase in the corresponding population share was associated with a +1.04 percentage-point Hispanic provider share among DCs and +2.03 points among PTs; +0.74 and +0.95 points for NH Black; and +1.53 and +3.49 points for NH Asian. NH White concordance was also positive (+1.87 points DC; +4.05 points PT).

Table 3. Adjusted demographic concordance using BIFS provider estimates

Measure	Chiropractic	Physical Therapy	Interpretation boundary
Hispanic concordance, +10 pp population share	+1.04 pp provider share	+2.03 pp provider share	BIFS name-only; weighted fractional logit
NH Black concordance, +10 pp population share	+0.74 pp provider share	+0.95 pp provider share	Positive concordance, smaller magnitude
NH Asian concordance, +10 pp population share	+1.53 pp provider share	+3.49 pp provider share	Strongest non-White concordance gradient
Hispanic same-race availability	−37.9%	−29.2%	Same-race providers per same-race population
NH Black same-race availability	−60.7%	−47.3%	Provider growth does not keep pace with population
NH Asian same-race availability	−25.1%	−21.2%	Representation/scaling measure; not causal

PT concordance was consistently stronger than DC concordance. Profession-stacked interaction models showed more favorable PT associations for Hispanic population composition (interaction ratio 1.112; 95% CI 1.095–1.130), NH Black (1.200; 1.175–1.226), and NH Asian (1.276; 1.239–1.314). Restricting concordance models to ZCTAs containing at least five providers produced very similar estimates, reducing concern that the relationship is driven by unstable proportions in one- or two-provider ZCTAs.

6. Race-Specific Availability and Population-Relative Representation

Demographic concordance did not imply proportional representation. When BIFS race-specific provider counts were modeled per total population, +10 percentage points of Hispanic population share was associated with essentially unchanged Hispanic DC availability (+1.0%, not statistically significant) but 9.2% higher Hispanic PT availability. The corresponding NH Black associations were −5.9% for DCs and +6.7% for PTs; NH Asian provider availability rose sharply for both professions (+57.8% DC; +62.5% PT).

When race-specific provider counts were instead normalized to the corresponding same-race population, provider supply did not keep pace as Hispanic, Black, or Asian populations became more concentrated. Per +10 percentage points of corresponding population share, same-race provider availability declined 37.9% for Hispanic DCs, 60.7% for NH Black DCs, and 25.1% for NH Asian DCs; corresponding PT declines were 29.2%, 47.3%, and 21.2%. These estimates describe proportional scaling and representation; because the same-race population contributes to both the exposure and rate denominator, they should not be interpreted as causal effects of racial concentration.

Table 4. Race-specific provider availability and population-relative representation

Population group, +10 pp	Chiropractic	Physical Therapy	Interpretation
Hispanic	Race-specific/total: +1.0% (NS); Same-race/same-pop: −37.9%	Race-specific/total: +9.2%; Same-race/same-pop: −29.2%	Concordance rises, but proportional representation falls
NH Black	Race-specific/total: −5.9%; Same-race/same-pop: −60.7%	Race-specific/total: +6.7%; Same-race/same-pop: −47.3%	Largest population-relative shortfall
NH Asian	Race-specific/total: +57.8%; Same-race/same-pop: −25.1%	Race-specific/total: +62.5%; Same-race/same-pop: −21.2%	Absolute same-race supply rises, but not proportionately

7. Sensitivity Analyses and Interpretation

The central Hispanic and Black availability findings persisted under negative-binomial regression, minimum ZCTA populations of 2,500 and 5,000, exclusion of the small number of race-share reconciliation anomalies, and additional adjustment for the percentage of the population age 65 or older. The concordance findings persisted when restricted to ZCTAs containing at least five providers, and the population-relative representation findings persisted when requiring at least 500 same-race residents. The Asian overall-availability association for DCs was the notable exception: its direction changed in the negative-binomial sensitivity analysis.

Hurdle models showed that Hispanic- and Black-concentrated communities were less likely to contain any claims-visible DC or PT and generally had lower provider density conditional on provider presence. Thus, the overall availability gradient reflects both provider presence and provider concentration, rather than a small number of unusually provider-rich ZCTAs.

Taken together, the results distinguish three related but non-equivalent phenomena. Overall availability is lower in many Hispanic- and Black-concentrated communities; provider racial/ethnic composition nevertheless becomes more locally concordant; and that concordance generally does not keep pace proportionately with the growth of the corresponding population group. PT concordance is stronger than DC concordance, while PT supply is also more strongly patterned by socioeconomic advantage and metropolitan location.

Key Limitations

- Original Medicare FFS only. Provider counts and service volumes exclude Medicare Advantage and non-Medicare activity and may understate professional supply unevenly across markets.
- Provider location is not patient residence. ZCTA measures where providers practice and services are delivered; they do not establish local patient access, travel burden, network participation, or utilization by residents.
- Claims-visible supply is not total licensed supply. Providers serving only commercial, Medicaid, MA, VA, workers' compensation, personal injury, or cash-pay populations are not captured; CMS suppression can omit low-volume providers.
- BIFS is probabilistic, not self-reported provider race/ethnicity. Removing geography avoids circularity but lowers classification accuracy relative to BIFSG, particularly for names common across multiple groups. Aggregate estimates are more reliable than individual assignments, and small-provider ZCTAs remain noisier.
- BIFS classification uncertainty is not fully propagated into regression uncertainty. Robust standard errors account for model sampling variation but treat expected provider counts/shares as observed analytic inputs; provider-level posterior simulation would be a stronger future sensitivity analysis.
- BIFS applies only to classifiable individual providers. Organizational provider records lack individual names, and rare/unmatched names receive national-average priors. Expected race counts therefore reconcile closely but not perfectly to total provider counts.
- Population race/ethnicity categories are B03002 cross-tabulation cells for four of five categories (Other is a residual); 109 ZCTAs have category sums >100.1% (45 in the primary sample), although excluding them does not materially change results.
- Population-relative same-race models are scaling measures, not causal access models. Same-race population enters both the rate denominator and population-share exposure, so negative associations indicate provider counts not keeping pace proportionately, not that racial concentration causes provider loss.
- Total population is an imperfect denominator for Medicare-active supply. Age-65 adjustment did not materially change the main findings, but ZCTA-level Original Medicare FFS enrollment is unavailable in the source file.
- PT setting is not explicitly restricted. The provider-level file identifies “Physical Therapist in Private Practice” but lacks place of service; some facility-associated activity may remain.
- Crosswalk assignment is deterministic. Provider postal ZIPs are mapped to a dominant residential ZCTA using the AHRQ crosswalk; approximately 1% of CMS provider ZIPs are not mapped and are excluded.
- Data years are not perfectly aligned. Claims are 2022; population demographics are ACS 2019–2023; surname/first-name priors are 2020; SDI reflects ACS 2015–2019; RUCA uses 2010 commuting patterns distributed in the 2019 AHRQ release; IRS measures are 2021.

- State fixed effects could not be estimated from the current workbook because the state field resolves only to US/PR. The primary models therefore use HC1 robust rather than state-clustered standard errors. A corrected state variable should be added before final publication.
- Spatial dependence is not modeled. ZCTA centroids, county identifiers, and adjacency data were not present, so residual spatial autocorrelation and spatially robust inference could not be evaluated.
- Ecological and cross-sectional design. Community characteristics cannot be assigned to individual providers or patients; residual confounding is likely and associations do not establish causality. P-values are descriptive and were not adjusted for multiple comparisons.

Disclosures and Publication Status

8.1 Disclosures

This work is classified as a public-data health-services and policy analysis under the Arete Research Library Governance Framework (§2); it is not PBRN-sponsored human-subjects research. This analysis was produced by Arete Healthcare without external funding; Arete supports independent outpatient chiropractic and physical therapy practices and has a commercial and professional interest in provider-network adequacy, workforce distribution, and payer contracting. AI tools assisted with data review, calculation, and drafting. Every factual assertion and calculation requires responsible human verification before publication, and AI reconciliation does not substitute for the named Independent Data/Methodology Reviewer or DAWG approval.

No protected health information or individual-level claims were used. No data was supplied by an interested third party.

8.2 AI-Assisted Analysis and Independent Verification

This paper carried forward the prior AI-assisted model rerun against the corrected ZCTA source and independently re-verified its headline descriptive statistics and regression estimates against the underlying source data before publication. Key Findings, At a Glance, Results, and this paper's stated limitations remain subject to the Governance Framework's independent human/DAWG verification requirements; AI-assisted rerun and reconciliation do not substitute for named reviewer approval. Full reconciliation detail and methods/SQL reference are maintained in the internal AI Assistance and Reproducibility Record under the Arete Research Library Governance Framework.

Related Arete research: A Decade of Divergence: Original Medicare Chiropractic and Physical Therapy Utilization, Reimbursement, and Service Mix, 2013–2024. Canonical Arete Research & Analytics URL to be inserted at publication.

Recommended citation: Arete Healthcare. Where Chiropractors and Physical Therapists Practice. Arete Original Research ARETE-OR-2026-003, Version 1.8. Published August 27, 2026. https://doi.org/10.13140/RG.2.2.20562.31683

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References and external-source links are carried forward from the source draft and should receive the routine publication-stage citation and link verification required by the Research Library Governance Framework before release.

Appendix A. Supplemental Model Tables

Primary model coefficients are summarized below for reproducibility and DAWG review. All effects are associations, not causal estimates. Population composition coefficients are per +10 percentage points; NH White is the omitted reference in overall availability models. (Note: the source draft repeated each of these three tables twice, identically, likely a copy artifact; each is reproduced once here — see Appendix B.)

Table A1. Overall availability — primary PPML model (M3)

Measure / comparison	Chiropractic IRR (95% CI)	Physical therapy IRR (95% CI)	Interpretation
Hispanic population share, +10 pp	0.792 (0.780–0.804)	0.848 (0.834–0.862)	vs NH White composition
NH Black population share, +10 pp	0.770 (0.756–0.785)	0.886 (0.869–0.903)	vs NH White composition
NH Asian population share, +10 pp	0.953 (0.929–0.978)	1.167 (1.130–1.206)	DC direction model-sensitive
Other population share, +10 pp	0.834 (0.798–0.872)	0.886 (0.841–0.933)	vs NH White composition
SDI, +10 points	0.999 (0.990–1.008)	0.971 (0.961–0.982)	M3 primary model
Micropolitan vs metropolitan	1.136 (1.069–1.207)	0.769 (0.712–0.830)	RUCA adjusted
Small town vs metropolitan	1.196 (1.123–1.274)	0.636 (0.581–0.696)	RUCA adjusted
Rural vs metropolitan	0.827 (0.765–0.895)	0.392 (0.348–0.442)	RUCA adjusted

Table A2. Provider-population concordance — weighted fractional logit

Population group, +10 pp	DC provider-share change	PT provider-share change	Fractional-logit odds ratio (DC / PT)
NH White	+1.87 pp	+4.05 pp	1.153 (1.138–1.168) / 1.261 (1.248–1.274)
Hispanic	+1.04 pp	+2.03 pp	1.294 (1.256–1.334) / 1.363 (1.335–1.391)
NH Black	+0.74 pp	+0.95 pp	1.133 (1.106–1.161) / 1.175 (1.157–1.194)
NH Asian	+1.53 pp	+3.49 pp	1.992 (1.869–2.123) / 1.748 (1.653–1.848)
Other	+0.32 pp	+0.45 pp	1.124 (1.052–1.200) / 1.155 (1.113–1.200)

Table A3. Race-specific availability and population-relative representation

Population group, +10 pp	Chiropractic	Physical Therapy	Interpretation
Hispanic	Race-specific/total: +1.0% (NS); Same-race/same-pop: −37.9%	Race-specific/total: +9.2%; Same-race/same-pop: −29.2%	Concordance rises, but proportional representation falls

Population group, +10 pp	Chiropractic	Physical Therapy	Interpretation
NH Black	Race-specific/total: −5.9%; Same-race/same-pop: −60.7%	Race-specific/total: +6.7%; Same-race/same-pop: −47.3%	Largest population-relative shortfall
NH Asian	Race-specific/total: +57.8%; Same-race/same-pop: −25.1%	Race-specific/total: +62.5%; Same-race/same-pop: −21.2%	Absolute same-race supply rises, but not proportionately