

SIMILARITYINDEX™ **MARKETS**

June 2022

An Introduction to the Trilliant Health SimilarityIndex™

As a society, we have been primed to determine what is “best” using third-party rankings and abstract measures. What are the top five restaurants in New York? What are the best colleges in the country? Healthcare is no exception. What are the best hospitals in America? Who are the best orthopedic surgeons in Tampa? In healthcare, these lists often factor in self-reported, survey-based data that are misaligned with patient outcomes.

The trend: these lists are used to identify which organizations or individuals are the “top,” and therefore become the benchmark for everyone else. *U.S. News and World Report* ranks Mayo Clinic as the best health system in the United States, but IBM Watson Health includes Allina Health, Avera Health, and Sentara Healthcare among the top performing health systems. According to *Forbes*, Aetna, Blue Cross BlueShield, and Cigna are the best health insurance companies even as UPMC, Capital District Physicians, and Kaiser Foundation Health Plan of the Mid-Atlantic States are rated highest on NCQA’s Health Plan Report Card.

The consequence: the entire health economy pursues aspirational and arbitrary benchmarks to guide critical decisions from M&A to value-based network development.

A benchmark is “something that serves as a standard by which others may be measured or judged.” In business, to benchmark is “to study (something, such as a competitor’s product or business practices) in order to improve the performance of one’s own company.”¹ Yet for decades, the healthcare industry has used benchmarks grounded in anecdotes and *perceived similarity*.

Using mathematical principles to create comparison groups, also known as benchmarks, has always been possible. However, until 2015, creating those cohorts at scale was not possible because of the limitations of raw computing power. Today, other industries now routinely apply this mathematical rigor in everyday life, from Netflix and Spotify recommending similar content based on features of previous activity to Amazon and food delivery platforms suggesting similar items.

With similarity analysis so ingrained in modern decision making, why does the health economy still benchmark against the “best” rather than relevant peers? Why strive to achieve unattainable metrics when you can identify the top performer in your industry that is *most similar* to you?

In the increasingly complex health economy, the need for evidence-based strategies among every stakeholder - from policymakers and health plans to providers and life sciences - has never been more critical.

The foundation of an evidence-based strategy is an accurate benchmark. In an effort to improve decision making, I am pleased to introduce the **SimilarityIndex™** : benchmarks generated from the health economy’s first machine-learning-based **SimilarityEngine™**. Since healthcare is local, the first application of the SimilarityEngine™ is focused on **MARKETS**. Future applications of the SimilarityEngine™ will include **FACILITIES**, **PHYSICIANS**, and **PATIENTS**.

I hope this report will fundamentally change how you think about the market(s) you serve, whether it be from the lens of its patient population, competitive dynamics, or something else; and going forward, you will consider leveraging the web-based [SimilarityIndex™ tool](#) to identify the *correct* benchmarks.



Sanjula

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Using Machine Learning to Identify Similar Markets

Most healthcare veterans know that **healthcare is local** and, therefore, “know” that **demand for healthcare services varies between markets**. While national or even state-level incidence rates help reflect the health status of a population, incidence rates within a locality (e.g., ZIP Code, county, CBSA) more precisely reflect healthcare demand in an individual market. Said another way, if we rely on a national benchmark, we end up applying that rate to every other CBSA in America (e.g., applying national primary care supply numbers (71 per 100K) to a market like Salt Lake City where the provider rate is nearly *double* (140 per 100K) that of the national average). As a result, **evidence-based** strategic initiatives (e.g., physician staffing, therapeutic distribution) must consider inter-market differences to effectively meet the care needs and preferences of individual healthcare consumers.

While markets can be characteristically similar, they can have vastly different healthcare demand and supply. Despite being geographically dispersed, many HCA markets are similar in population size, demographics, and consumer psychographics. Even so, there is **dissimilarity** in supply (e.g., rate of primary care providers) and demand (e.g., projected surgical demand growth) across these HCA markets. Not every health system can be like HCA or Cleveland Clinic; in fact, almost none can be. However, every health system (or health plan, life sciences company, etc.) can more effectively meet the needs of patients they serve by applying successful strategies in similar patient populations.

SIMILARITIES AND DIFFERENCES IN DEMOGRAPHICS AND HEALTHCARE SUPPLY AND DEMAND FOR SELECT HCA MARKETS

	CBSA	POPULATION SIZE	DOMINANT PSYCHOGRAPHIC PROFILE	WHITE TO NON-WHITE POPULATION RATIO	MEDIAN HOUSEHOLD INCOME	PROJECTED SURGICAL DEMAND CAGR (2021-2030)	PRIMARY CARE PROVIDERS PER 100K
NATIONAL	United States of America	331,893,745	Willful Endurer (26.7%)	3.2 to 1	\$65K	4.9%	71
SMALL MARKETS	Bowling Green, KY	186K	Willful Endurer (30.4%)	4.6 to 1	\$47.7K	5.6%	77
	Idaho Falls, ID	160K	Willful Endurer (34.4%)	4.2 to 1	\$54K	5.6%	91
MEDIUM MARKETS	Chattanooga, TN-GA	575K	Willful Endurer (27.2%)	3.5 to 1	\$51.1K	5.4%	93
	Anchorage, AK	413K	Willful Endurer (40.0%)	2.1 to 1	\$74.8K	5.2%	89
LARGE MARKETS	Jacksonville, FL	1.6M	Willful Endurer (37.4%)	1.7 to 1	\$60.1K	5.8%	106
	Salt Lake City, UT	1.3M	Willful Endurer (38.7%)	2.2 to 1	\$69.5K	4.8%	140

Note: HCA was selected due to its status as the largest health system in the U.S. by revenue and number of beds. Population size reflected for 2021. See Appendix B for more information about psychographics. Source: Trilliant Health national all-payer claims and consumer database; proprietary demand forecast model; U.S. Census Bureau.

Market Similarity Informs *Inter-Organizational* Benchmarking

Benchmarking yourself against **actual peers** based on meaningful metrics empowers more realistic and successful decisions. The three largest non-profit health systems, by revenue and number of hospitals, are CommonSpirit Health, Ascension, and Trinity Health. While all three health systems generate revenue >\$20B, are headquartered in the Midwest, and have hospitals in >20 states, the individual markets in which they operate are *dissimilar* in other characteristics. To illustrate this, we identified a “benchmark” for each health system based on the market in which they have the highest inpatient surgical volume: Phoenix (CommonSpirit Health), Detroit (Ascension), and Columbus (Trinity Health).

Herfindahl-Hirschman Index (HHI) is the standard measure of market concentration. Traditionally, the HHI has focused on hospitals, looking *exclusively* at inpatient volumes. Because much of healthcare takes place outside of the hospital setting, we calculated the CBSA-level HHI for inpatient medical, inpatient surgical, and outpatient surgical. With each of those HHI values weighted evenly and input into the SimilarityEngine™, we identified **the five most competitively similar markets to the benchmark.**



\$30.2B REVENUE

PHOENIX-MESA-SCOTTSDALE, AZ



\$21.9B REVENUE

DETROIT-WARREN-DEARBORN, MI



\$20.2B REVENUE

COLUMBUS, OH

	SIMILAR METROPLITAN MARKETS	SIMILARITY SCORE
1	BUFFALO-CHEEKTOWAGA-NIAGARA FALLS, NY	0.994
2	AUGUSTA-RICHMOND COUNTY, GA-SC	0.984
3	ST. LOUIS, MO-IL	0.979
4	WORCESTER, MA-CT	0.977
5	JACKSON, MS	0.976

	SIMILAR METROPLITAN MARKETS	SIMILARITY SCORE
1	HOUSTON-THE WOODLANDS-SUGAR LAND, TX	0.992
2	CINCINNATI, OH-KY-IN	0.985
3	KANSAS CITY, MO-KS	0.985
4	MINNEAPOLIS-ST. PAUL-BLOOMINGTON, MN-WI	0.983
5	SAN FRANCISCO-OAKLAND-HAYWARD, CA	0.977

	SIMILAR METROPLITAN MARKETS	SIMILARITY SCORE
1	BATON ROUGE, LA	0.984
2	SALISBURY, MD-DE	0.980
3	INDIANAPOLIS-CARMEL-ANDERSON, IN	0.979
4	TUCSON, AZ	0.978
5	ST. LOUIS, MO-IL	0.974

Note: For ease of comparison, Ascension’s geography is noted as 20 states but is officially classified as 19 states and the District of Columbia. See p.9 for an explanation of Similarity Score. See Methodology for HHI calculation and interpretation as inputs into the SimilarityEngine™ to create a Competitive SimilarityIndex™.

Source: Trilliant Health national all-payer claims database; analysis of publicly available financial statements.

...and Effective *Intra-Organizational* Benchmarking

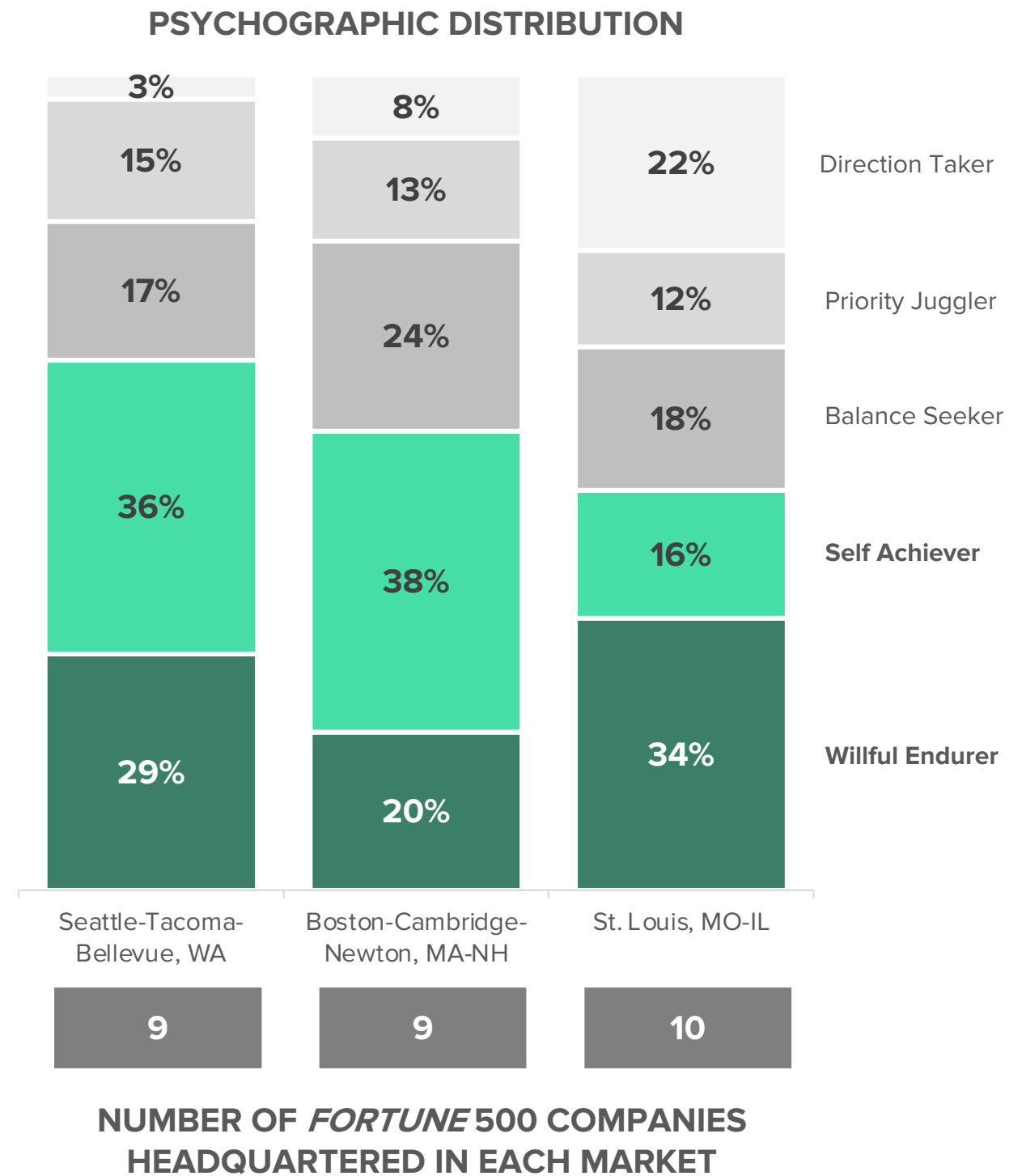
Measuring market similarity across entities (e.g., competitors) plays an important role in site selection and partnerships, among other decisions. However, it is equally as important to assess variation between markets **within a given entity**. This allows organizations to **benchmark the effectiveness of their own strategy**.

For example, Amazon Care has planned expansions for its in-person and tele-enabled healthcare services in over 20 markets by the end of 2023. While Amazon’s pilot was focused on a direct-to-consumer model, the company has since stated a focus on employer partnerships.

While Amazon **selected markets that are similar in employer composition (i.e., number of Fortune 500 companies), its success hinges upon use of services by employees within each employer**. Ultimately, employees are consumers, and their behaviors vary by market.

Psychographics play a considerable role in understanding which consumers will be more inclined to use Amazon Care services. Given the virtual nature of Amazon Care, it will likely be received best among both Self Achievers and Willful Endurers, who are more likely to use telehealth. Willful Endurers live in the “here and now,” and are more likely to obtain care in urgent care settings. Self Achievers are most proactive about wellness and stay on top of health issues with regular medical checkups, health screenings, and research.

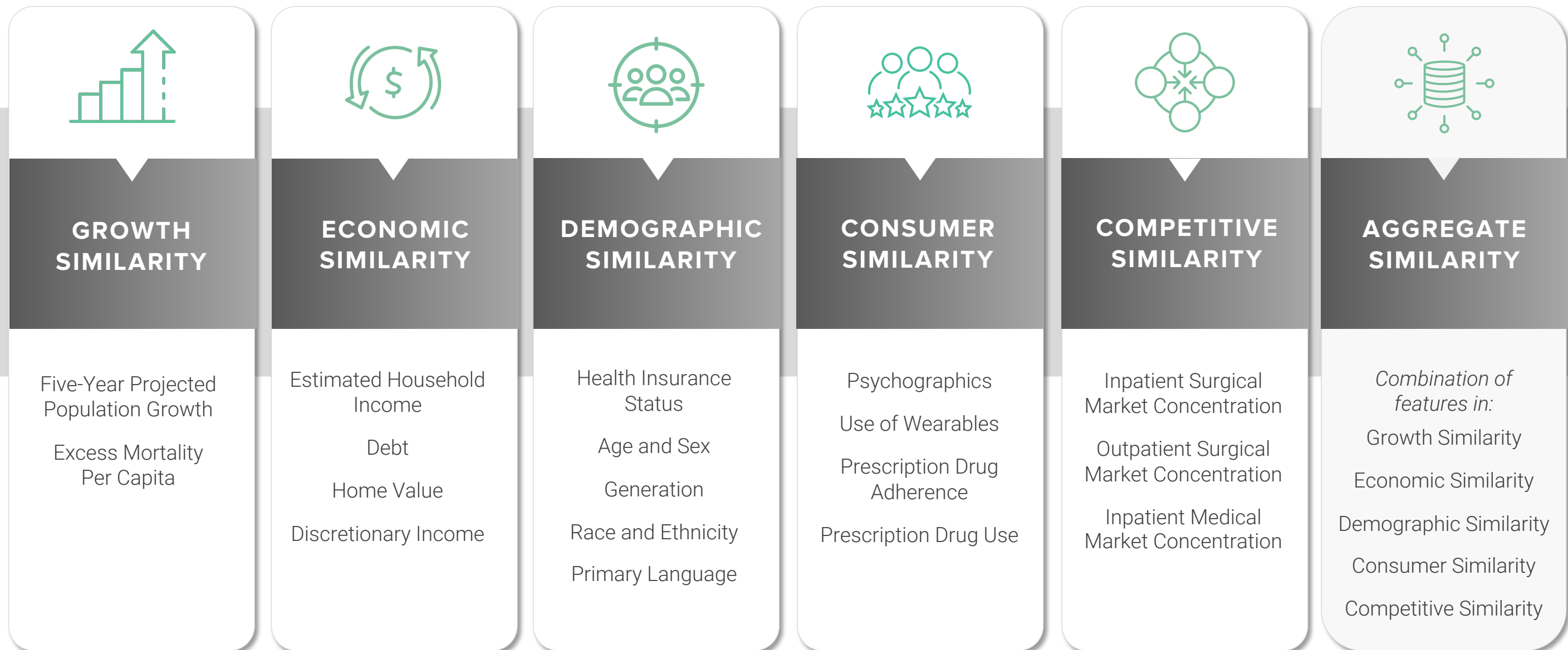
Seattle and Boston have a similar psychographic distribution, with the combination of Willful Endurers and Self Achievers accounting for the highest proportion, whereas St. Louis is primarily concentrated with Willful Endurers and Direction Takers. **Given these differences, Amazon’s performance (and therefore its engagement strategies) will likely vary within each of its expansion markets.**



Note: Each healthcare consumer is classified into one of five psychographic profiles; see Appendix B for more information. Source: Trilliant Health national consumer database; 2022 Fortune 500 List.

Methods | SimilarityEngine™ → SimilarityIndex™

The SimilarityEngine™ leverages multiple similarity models to create a SimilarityIndex™ based on user-selected features. To create the SimilarityIndex™ | Markets, we selected the following categories based upon the selected features.



Note: See Methodology for explanation of the SimilarityEngine™.

Methods | Creating SimilarityIndex™ | Markets

The SimilarityEngine™ was utilized to determine the most similar metropolitan CBSAs by SimilarityIndex™ category. Select markets were further analyzed using healthcare supply and demand metrics.

1 MARKET SELECTION

We selected illustrative benchmark metropolitan CBSAs using secondary sources (e.g., Census Bureau) for each SimilarityIndex™ category: Growth, Economic, Demographic, Consumer, and Competitive.

The primary benchmarks selected often show the highest or “best-case scenario” for each category, as well as a median value to represent a national “average.”

2 SIMILARITY ANALYSIS BY CATEGORY

We input the selected benchmark metropolitan CBSAs into the SimilarityEngine™ and weighted the relevant similarity features for each SimilarityIndex™ category. For example, the SimilarityEngine™ identified the ten metropolitan markets most similar to Austin, TX based on the Growth features (i.e., five-year projected population growth and excess mortality).

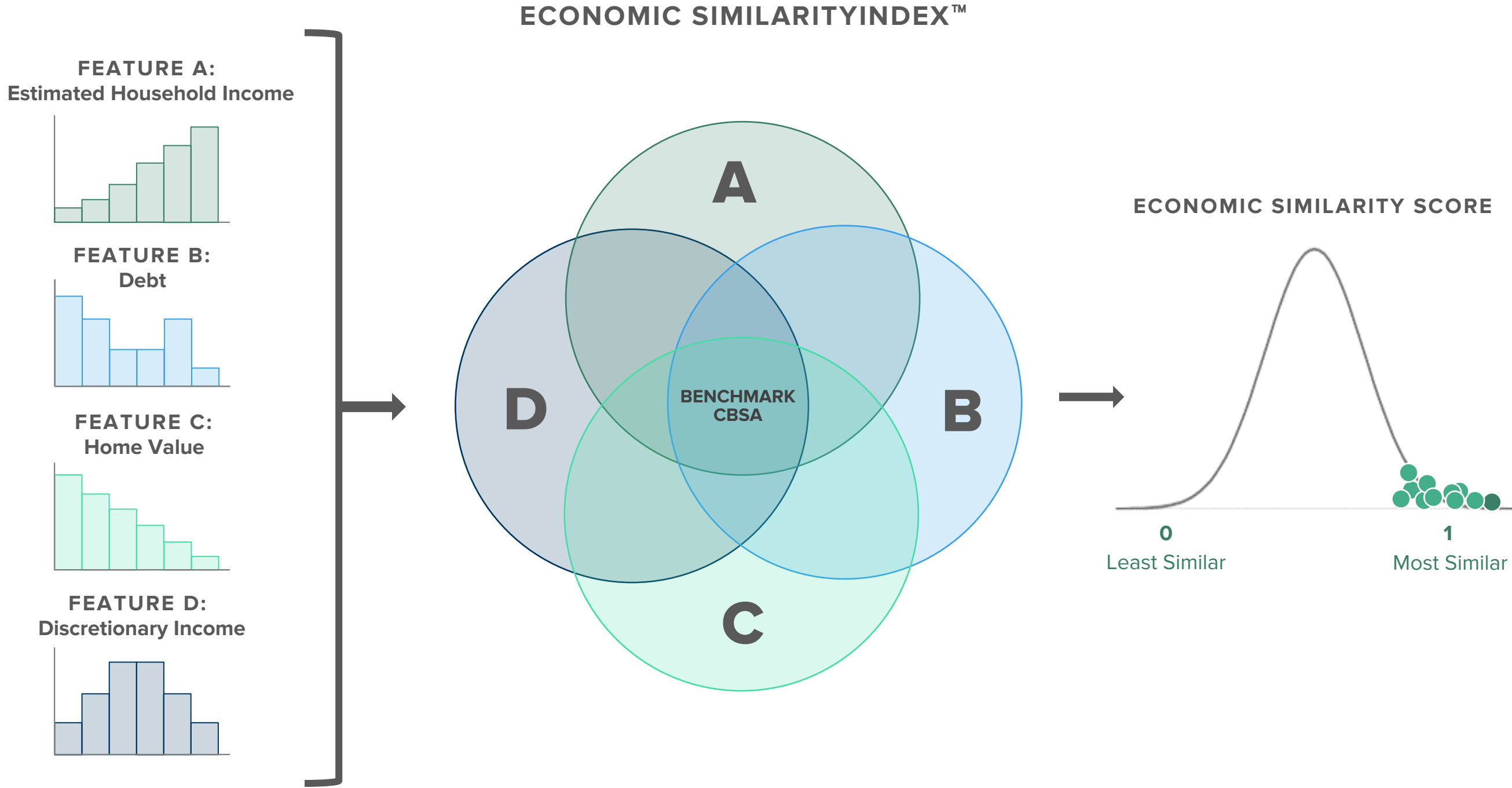
3 HEALTHCARE METRIC COMPARISON

To compare the “similar” metropolitan markets identified using the SimilarityEngine™, we leveraged our national all-payer claims and database, provider directory, and proprietary demand forecast model to analyze various healthcare supply and demand metrics within each market.

Note: This Report provides comparisons for benchmark markets chosen by Trilliant Health as illustrative examples. To see how the comparable markets vary for a different benchmark, input your selection directly via the web-based [SimilarityIndex™ tool](#).

Methods | Interpreting a Similarity Score

To generate each SimilarityIndex™, the features were normalized and equally weighted. Ultimately, similarity to the benchmark CBSA is measured in *Euclidean space*. CBSAs with a Similarity Score closest to 1 are *most similar* to the benchmark. The more features that are included in the SimilarityEngine™, the more challenging it becomes to identify similar markets, as the mathematical distance from the benchmark is likely to widen.

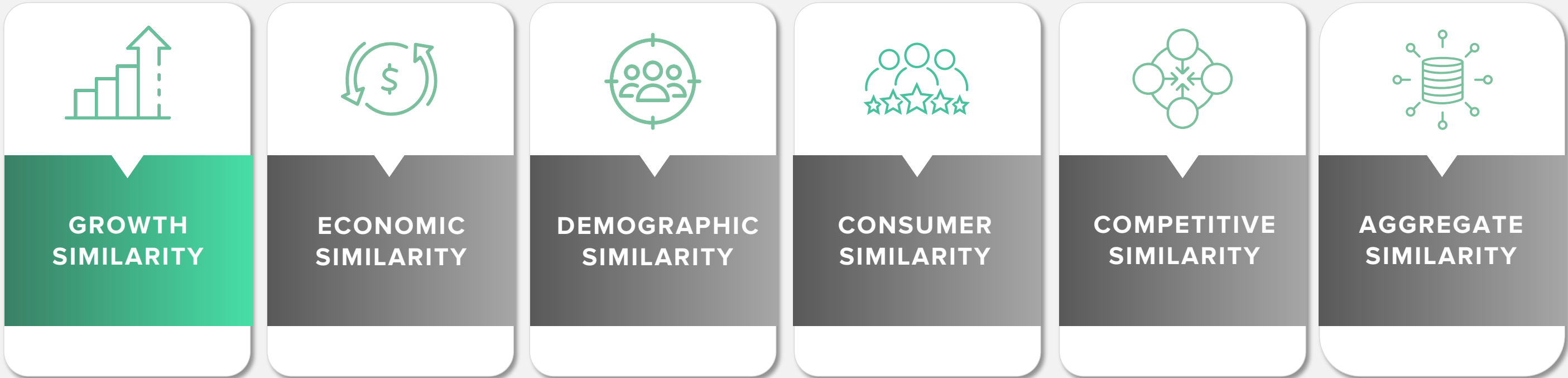


Growth Similarity

Benchmarking markets by compound annual growth rate in population from 2010 to 2020:

■ Highest (2.9%): Austin-Round Rock-Georgetown, TX

■ Median (0.5%): Tallahassee, FL



Growth Similarity | Primary Benchmark

Raleigh, NC is **most similar** to Austin, TX based on the Growth SimilarityIndex™.

TEN MOST SIMILAR METROPOLITAN MARKETS, BY GROWTH SIMILARITYINDEX™

	METROPOLITAN MARKET	2021 POPULATION	% OVER AGE 65	SIMILARITY SCORE
	AUSTIN-ROUND ROCK-GEORGETOWN, TX	2,370,127	9.4%	1
1	RALEIGH-CARY, NC	1,408,061	10.8%	0.903
2	COEUR D'ALENE, ID	172,116	17.4%	0.897
3	ST. GEORGE, UT	193,006	23.8%	0.896
4	PROVO-OREM, UT	695,066	6.2%	0.895
5	BOISE CITY, ID	797,853	14.6%	0.873
6	BEND, OR	197,087	16.8%	0.866
7	FARGO, ND-MN	261,964	12.8%	0.862
8	FAYETTEVILLE-SPRINGDALE-ROGERS, AR	536,157	8.7%	0.859
9	ORLANDO-KISSIMMEE-SANFORD, FL	2,683,344	10.1%	0.853
10	SIOUX FALLS, SD	281,850	12.9%	0.848



GROWTH SIMILARITYINDEX™ FEATURES

Five-Year Projected Population Growth | Excess Mortality Per Capita

Note: The Growth SimilarityIndex™ factors in five-year projected population growth between 2019 and 2024 at the CBSA level, sourced from Trilliant Health's access to geographic data from Esri, and excess mortality per capita in 2020 and 2021, sourced from National Vital Statistics System. The first market selected to index against, Austin-Round Rock-Georgetown, TX, was chosen because, of all metropolitan CBSAs, its population grew the fastest between 2010 and 2020 according to the U.S. Census Bureau. The SimilarityEngine™ compared CBSAs with the selected Growth SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (Austin-Round Rock-Georgetown, TX and Tallahassee, FL) were identified and compared. Source: U.S. Census Bureau; National Vital Statistics System; Trilliant Health national all-payer claims database.

Growth Similarity | Median Benchmark

Tuscaloosa, AL is **most similar** to Tallahassee, FL based on the Growth SimilarityIndex™.

TEN MOST SIMILAR METROPOLITAN MARKETS, BY GROWTH SIMILARITYINDEX™

METROPOLITAN MARKET	2021 POPULATION	% OVER AGE 65	SIMILARITY SCORE
TALLAHASSEE, FL	399,154	10.4%	1
1 TUSCALOOSA, AL	242,990	13.8%	0.988
2 TULSA, OK	1,011,718	14.8%	0.981
3 HANFORD-CORCORAN, CA	157,465	12.3%	0.981
4 VALDOSTA, GA	149,532	12.7%	0.979
5 GRANTS PASS, OR	91,710	20.0%	0.975
6 VISALIA, CA	472,433	13.2%	0.973
7 BAKERSFIELD, CA	913,498	10.0%	0.973
8 LAS CRUCES, NM	241,375	16.1%	0.972
9 FAYETTEVILLE, NC	506,438	12.0%	0.971
10 FRESNO, CA	1,022,589	12.6%	0.969



GROWTH SIMILARITYINDEX™ FEATURES

Five-Year Projected Population Growth | Excess Mortality Per Capita

Note: The Growth SimilarityIndex™ factors in five-year projected population growth between 2019 and 2024 at the CBSA level, sourced from Trilliant Health's access to geographic data from Esri, and excess mortality per capita in 2020 and 2021, sourced from National Vital Statistics System. The second market selected to index against, Tallahassee, FL, was chosen, because of all metropolitan CBSAs, it saw median population compound annual growth between 2010 and 2020 according to the U.S. Census Bureau. The SimilarityEngine™ compared CBSAs with the selected Growth SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (Austin-Round Rock-Georgetown, TX and Tallahassee, FL) were identified and compared. Source: U.S. Census Bureau; National Vital Statistics System; Trilliant Health national all-payer claims database.

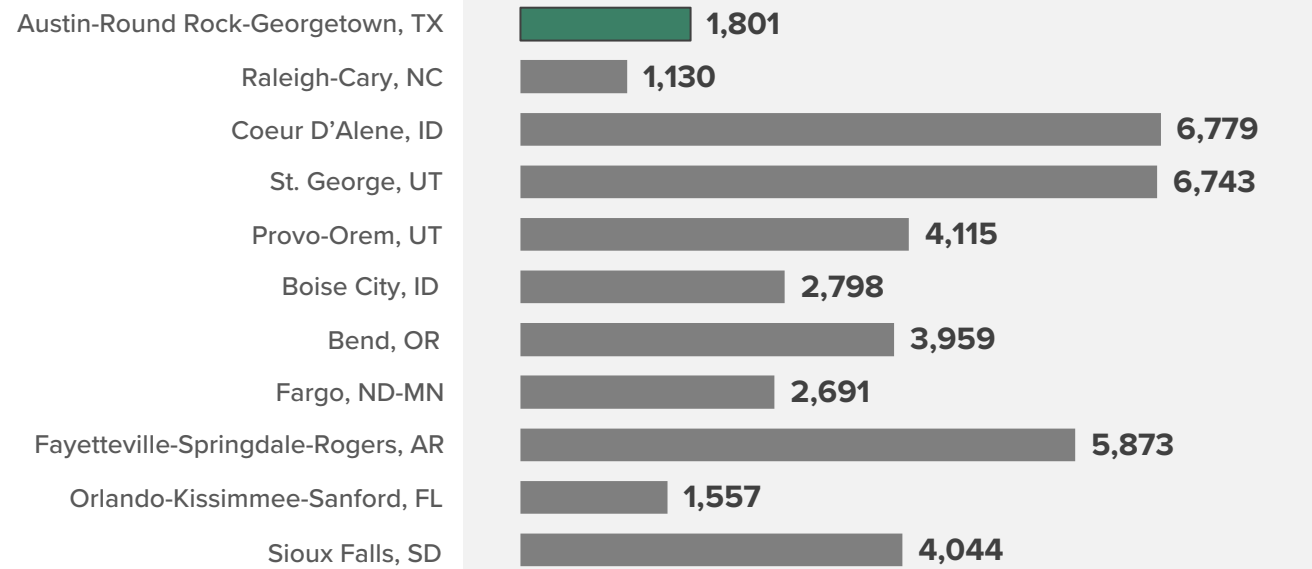
Growth Similarity | Surgery

While Austin, TX and Provo, UT are similar in population growth, surgical demand CAGR is one percentage point less in Provo. This difference is meaningful over time with a projected 32% increase in Austin versus 25% in Provo between now and 2030.

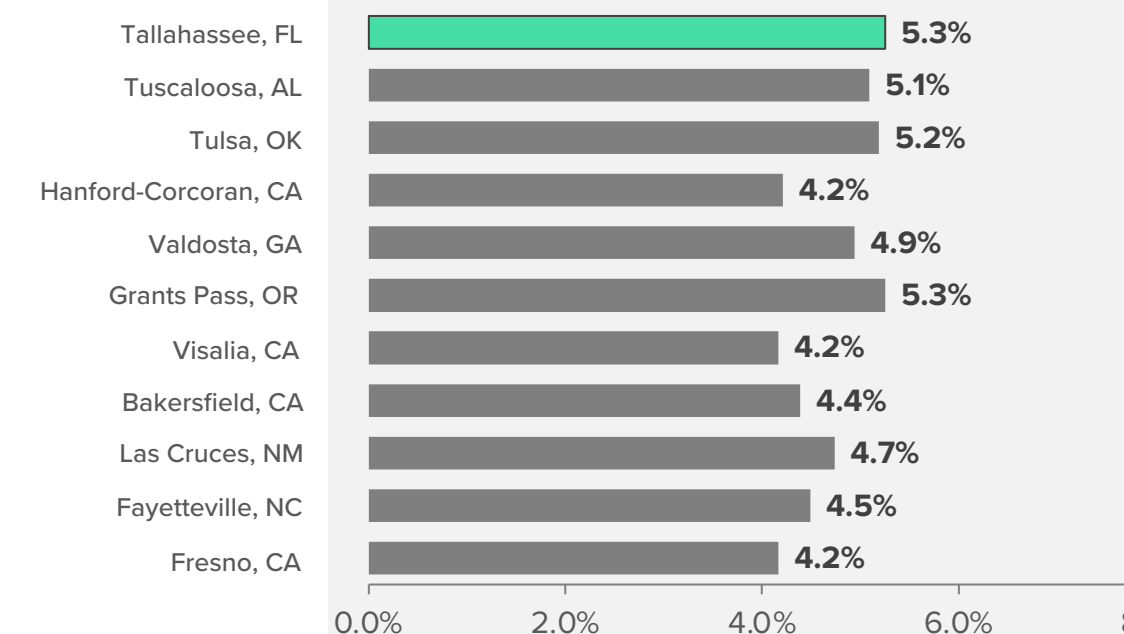
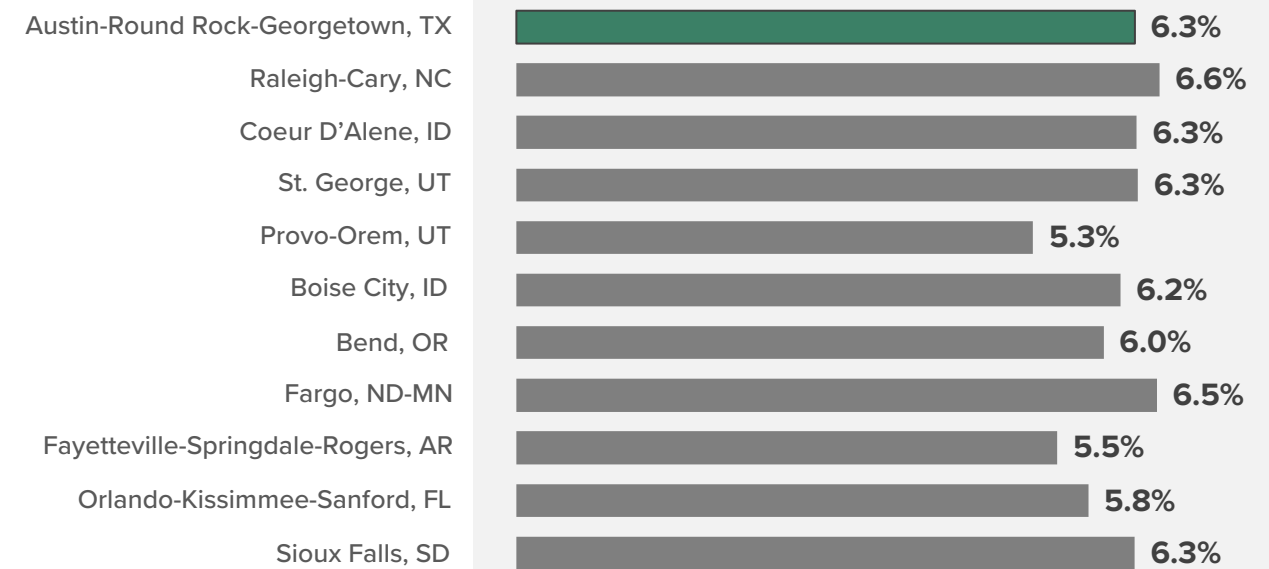
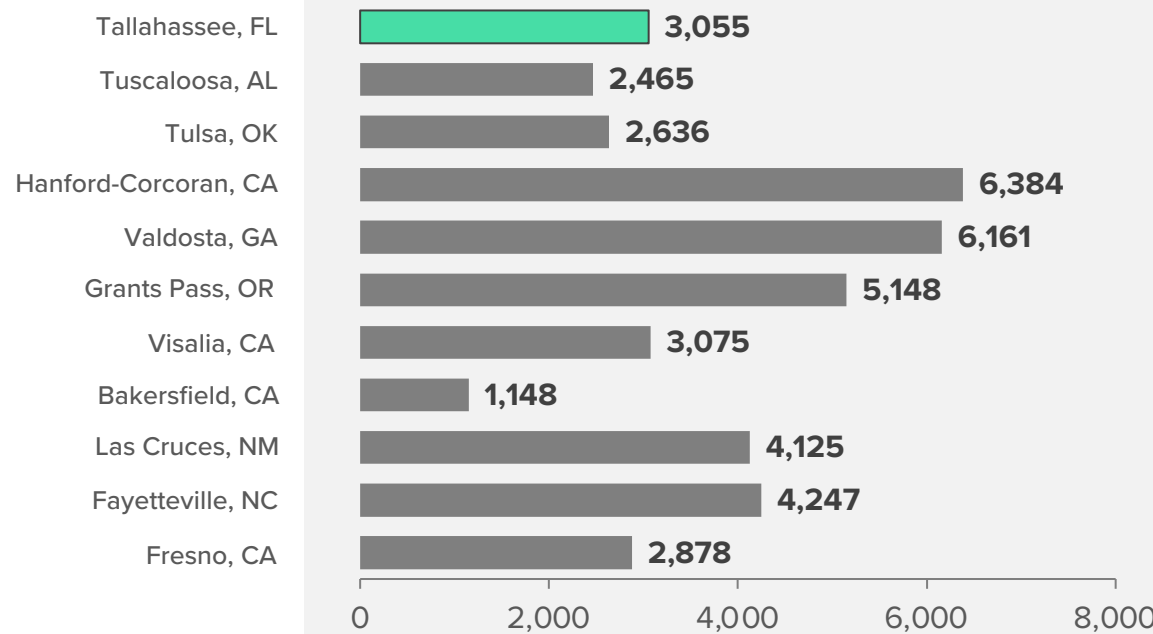
+ SURGICAL CONCENTRATION SURGICAL CONCENTRATION MIDPOINT: 3,677

2021-2030 SURGICAL DEMAND (CAGR) SURGICAL DEMAND CAGR MIDPOINT: 4.9%

PRIMARY BENCHMARK



MEDIAN BENCHMARK



Note: A surgical concentration value below 1,500 indicates a competitive market; between 1,500 and 2,500 a indicates moderately concentrated market, whereas a value greater than 2,500 indicates a highly concentrated market. CAGR indicates compound annual growth rate.

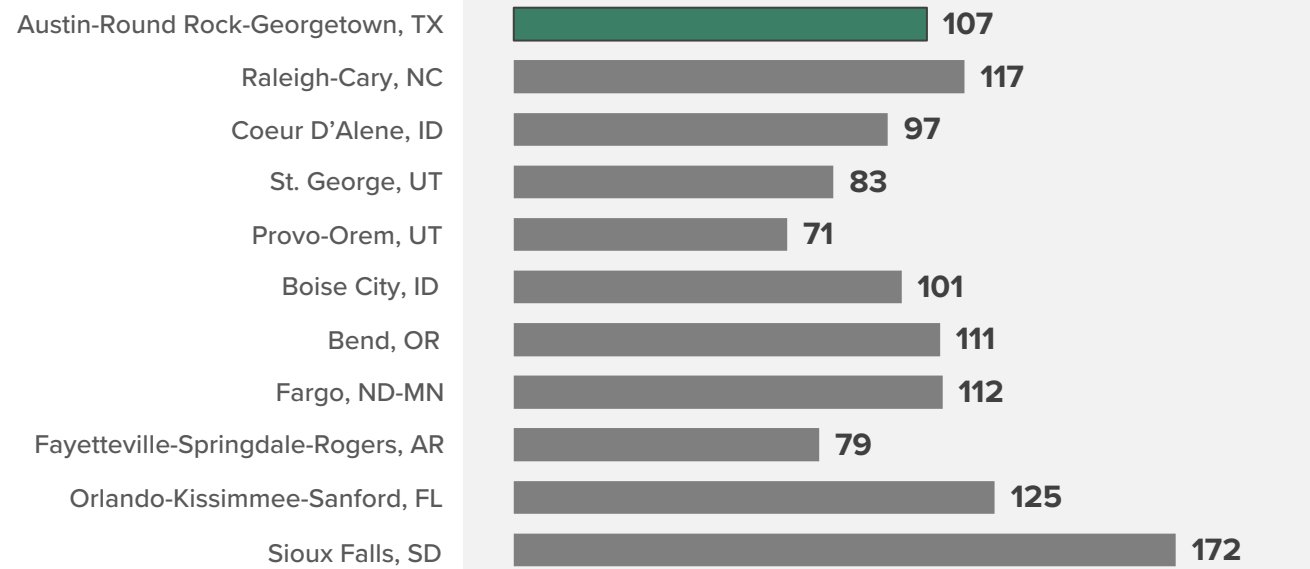
Source: Trilliant Health national all-payer claims database and proprietary demand forecast model.

Growth Similarity | Primary Care

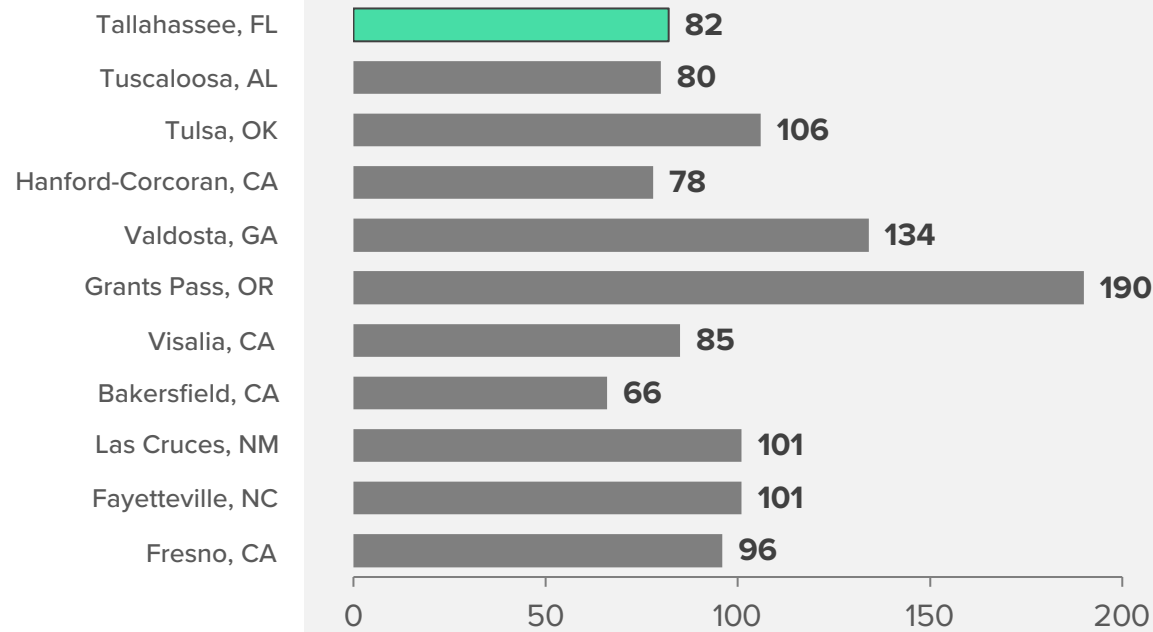
Despite being highly similar in population growth, the supply of primary care providers per 100K population in Tallahassee, FL is almost 60% lower than in Grants Pass, Oregon.

+ PRIMARY CARE PROVIDERS PER 100K PCP MIDPOINT: 110

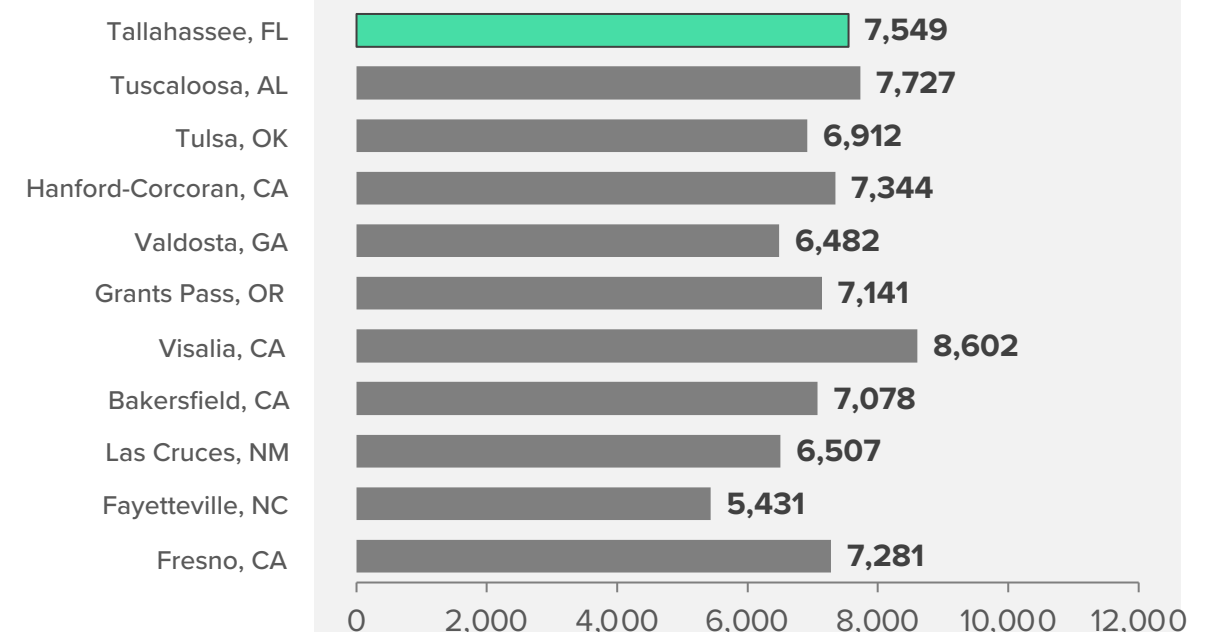
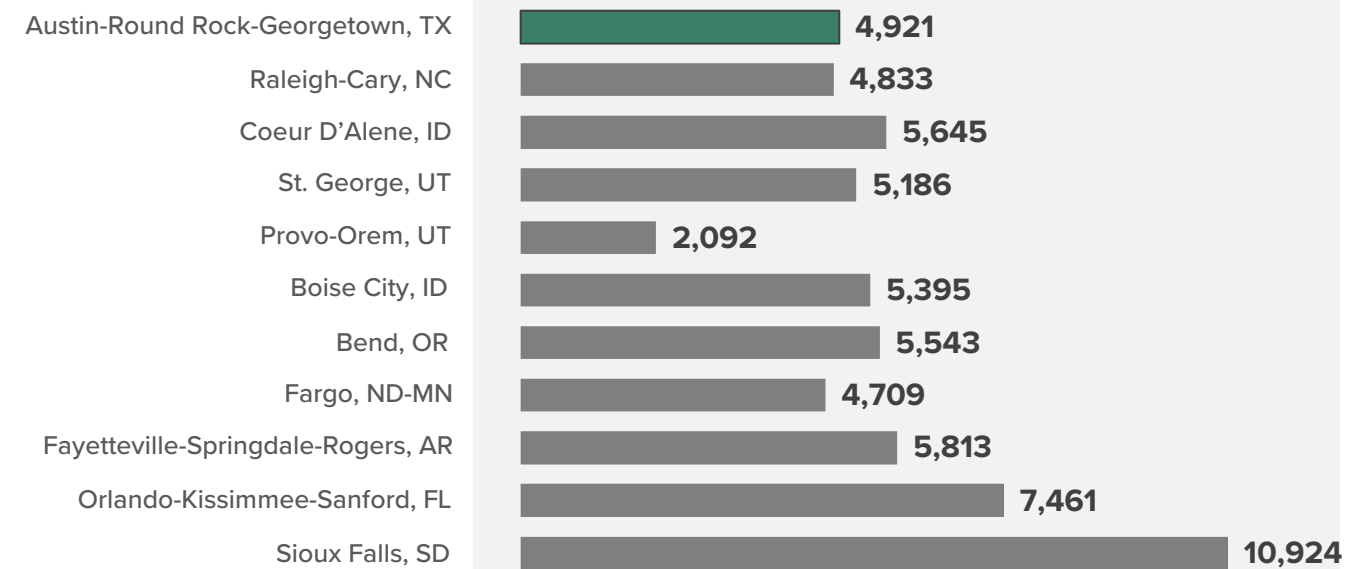
PRIMARY BENCHMARK



MEDIAN BENCHMARK



DIABETES PER 100K DIABETES MIDPOINT: 7,087



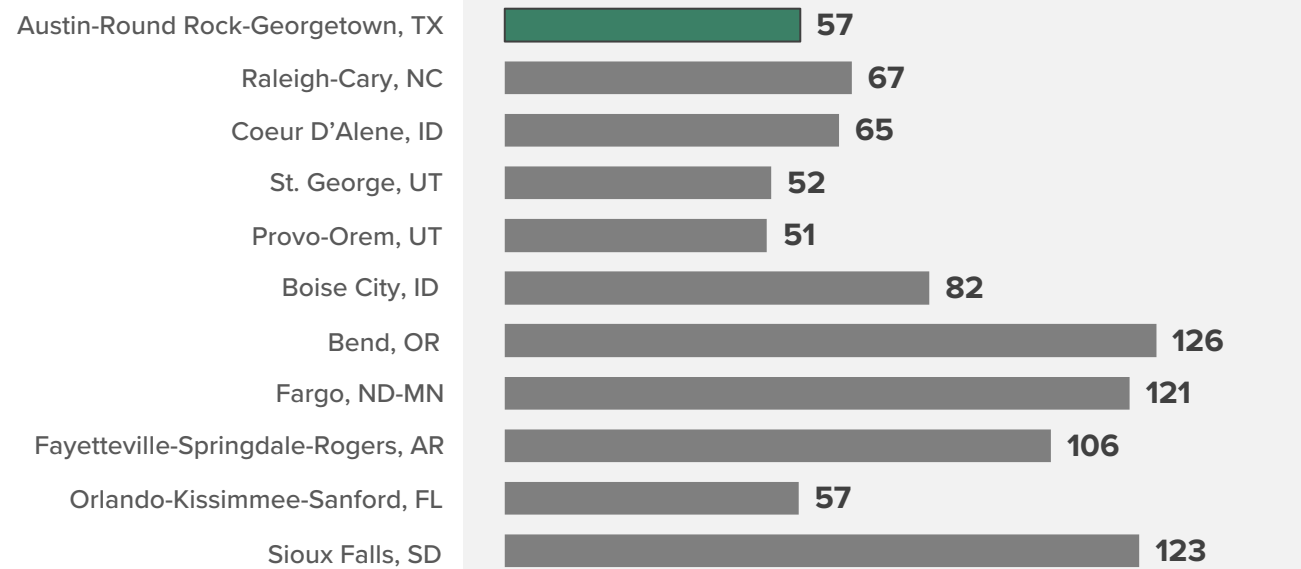
Source: Trilliant Health national all-payer claims database and provider directory.

Growth Similarity | Behavioral Health

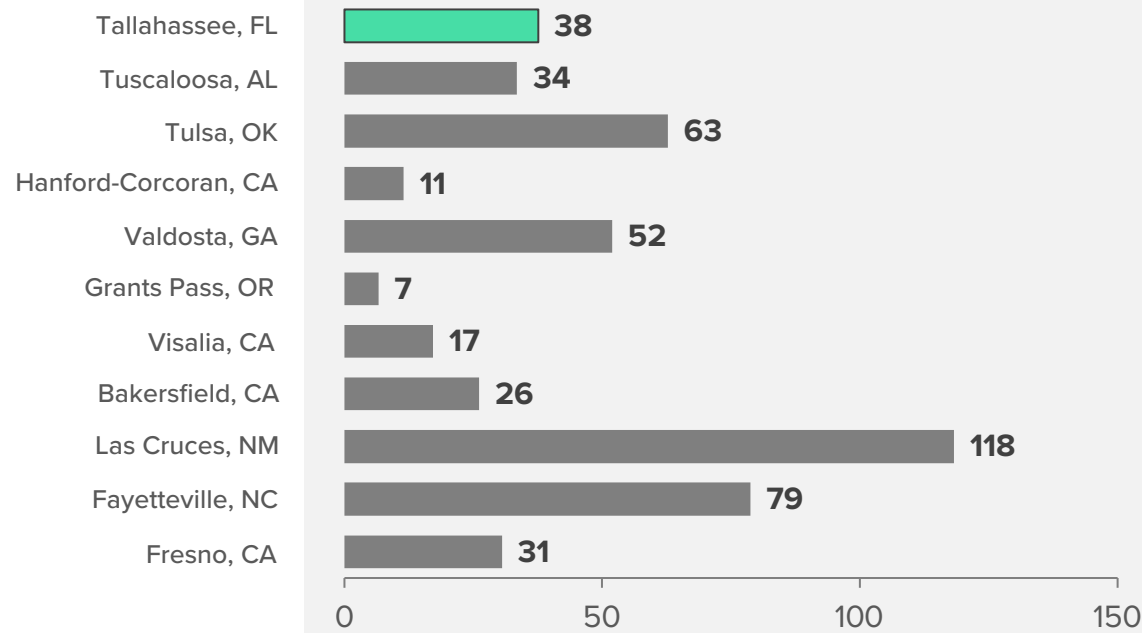
Although Austin, TX and Sioux Falls, SD are highly similar in population growth, the rate of anxiety and depression is 100% higher in Sioux Falls than in Austin.

+ BEHAVIORAL HEALTH PROVIDERS PER 100K BHP MIDPOINT: 61

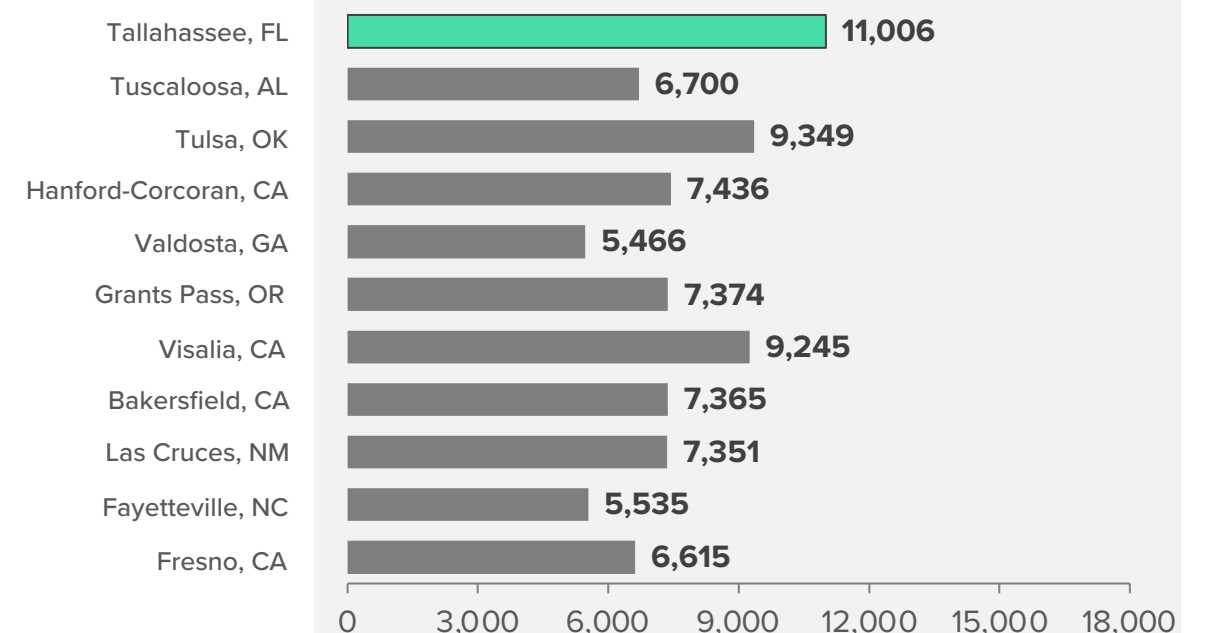
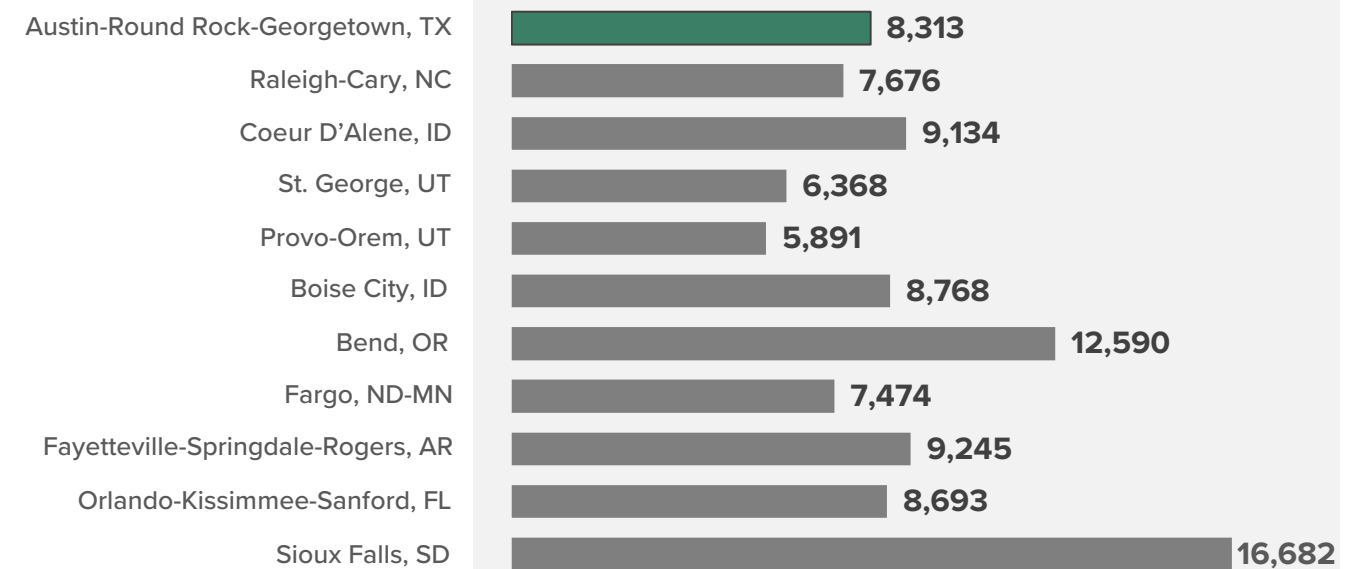
PRIMARY BENCHMARK



MEDIAN BENCHMARK



↘ ANXIETY AND DEPRESSION PER 100K ANXIETY AND DEPRESSION MIDPOINT: 8,232



Source: Trilliant Health national all-payer claims database and provider directory.

Economic Similarity

Benchmarking markets by compound annual growth rate in per capita income from 2010 and 2020:

■ Highest (7.3%): San Jose-Sunnyvale-Santa Clara, CA

■ Median (0.5%): Auburn-Opelika, AL



GROWTH
SIMILARITY



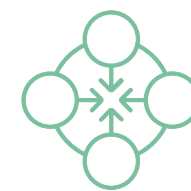
ECONOMIC
SIMILARITY



DEMOGRAPHIC
SIMILARITY



CONSUMER
SIMILARITY



COMPETITIVE
SIMILARITY



AGGREGATE
SIMILARITY

Economic Similarity | Primary Benchmark

San Francisco, CA is **most similar** to San Jose, CA based on the Economic SimilarityIndex™. Even so, the similarity distance reflects that San Jose is quite different from its most similar CBSAs.

TEN MOST SIMILAR METROPOLITAN MARKETS, BY ECONOMIC SIMILARITYINDEX™

	METROPOLITAN MARKET	% IN POVERTY	PER CAPITA INCOME	SIMILARITY SCORE
	SAN JOSE-SUNNYVALE-SANTA CLARA, CA	8.3%	\$49,207	1
1	SAN FRANCISCO-OAKLAND-BERKELEY, CA	10.0%	\$72,041	0.797
2	SANTA CRUZ-WATSONVILLE, CA	10.7%	\$44,278	0.681
3	URBAN HONOLULU, HI	8.0%	\$38,288	0.662
4	SANTA MARIA-SANTA BARBARA, CA	12.7%	\$21,945	0.637
5	NAPA, CA	7.9%	\$46,912	0.626
6	NAPLES-MARCO ISLAND, FL	7.6%	\$114,338	0.575
7	BOULDER, CO	9.5%	\$48,776	0.572
8	SAN LUIS OBISPO-PASO ROBLES, CA	10.6%	\$38,686	0.558
9	SANTA ROSA-PETALUMA, CA	10.0%	\$38,773	0.556
10	LOS ANGELES-LONG BEACH-ANAHEIM, CA	13.2%	\$35,685	0.553



ECONOMIC SIMILARITYINDEX™ FEATURES

Estimated Household Income | Debt | Home Value | Discretionary Income

Note: The Economic SimilarityIndex™ factors in estimated household income, debt amounts, average home value, and discretionary income amount at the CBSA level, sourced from Trilliant Health's national consumer database. The first market selected to index against, San Jose-Sunnyvale-Santa Clara, CA, was chosen because, of all metropolitan CBSAs, the CAGR of per capita personal income was highest between 2010 and 2020 according to the U.S. Bureau of Economic Analysis. The SimilarityEngine™ compared CBSAs with the selected Economic SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (San Jose-Sunnyvale-Santa Clara, CA and Auburn-Opelika, AL) were identified and compared. Source: U.S. Census Bureau; Trilliant Health national consumer database.

Economic Similarity | Median Benchmark

Augusta, GA is **most similar** to Auburn, AL based on the Economic SimilarityIndex™.

TEN MOST SIMILAR METROPOLITAN MARKETS, BY ECONOMIC SIMILARITYINDEX™

	METROPOLITAN MARKET	% IN POVERTY	PER CAPITA INCOME	SIMILARITY SCORE
	AUBURN-OPELIKA, AL	26.3%	\$30,246	1
1	AUGUSTA-RICHMOND COUNTY, GA-SC	23.2%	\$23,861	0.924
2	GREENSBORO-HIGH POINT, NC	18.4%	\$30,455	0.922
3	WINSTON-SALEM, NC	19.2%	\$29,130	0.917
4	JACKSONVILLE, FL	15.0%	\$30,906	0.911
5	TYLER, TX	18.9%	\$21,632	0.911
6	SAVANNAH, GA	20.4%	\$26,102	0.911
7	GREENVILLE-ANDERSON, SC	12.1%	\$34,430	0.910
8	PENSACOLA-FERRY PASS-BRENT, FL	15.9%	\$35,873	0.907
9	TAMPA-ST. PETERSBURG-CLEARWATER, FL	17.5%	\$37,834	0.904
10	HOUMA-THIBODAU, LA	21.0%	\$30,306	0.903



ECONOMIC SIMILARITYINDEX™ FEATURES

Estimated Household Income | Debt | Home Value | Discretionary Income

Note: The Economic SimilarityIndex™ factors in estimated household income, debt amounts, average home value, and discretionary income amount at the CBSA level, sourced from Trilliant Health's national consumer database. The second market selected to index against, Auburn-Opelika, AL, was chosen because, of all metropolitan CBSAs, it saw median CAGR of per capita personal income between 2010 and 2020 according to the U.S. Bureau of Economic Analysis. The SimilarityEngine™ compared CBSAs with the selected Economic SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (San Jose-Sunnyvale-Santa Clara, CA and Auburn-Opelika, AL) were identified and compared. Source: U.S. Census Bureau; Trilliant Health national consumer database.

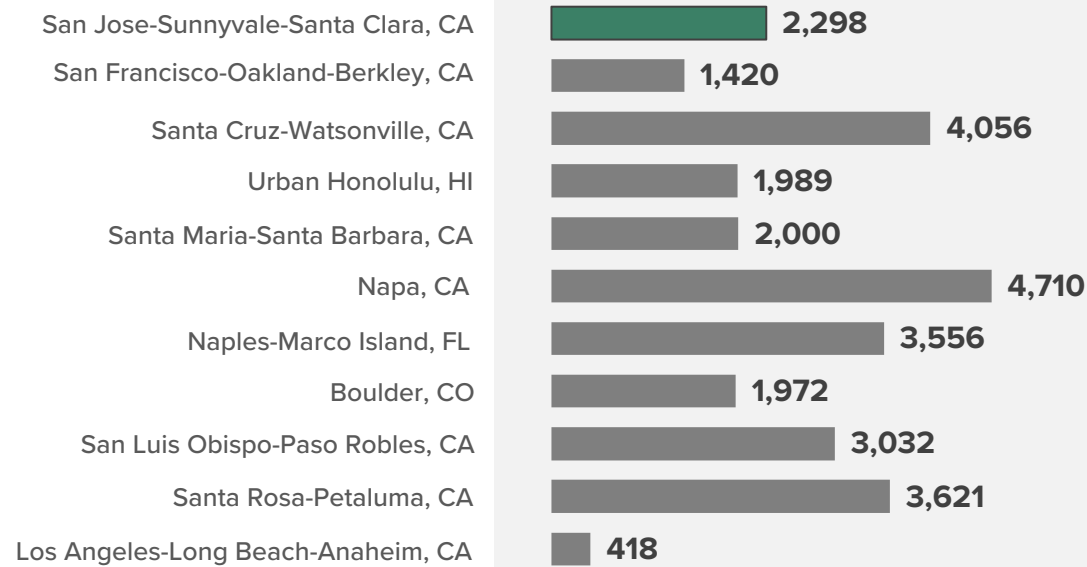
Economic Similarity | Surgery

While San Jose, CA and San Francisco, CA are economically similar, the surgical market in San Francisco is much more competitive than San Jose.

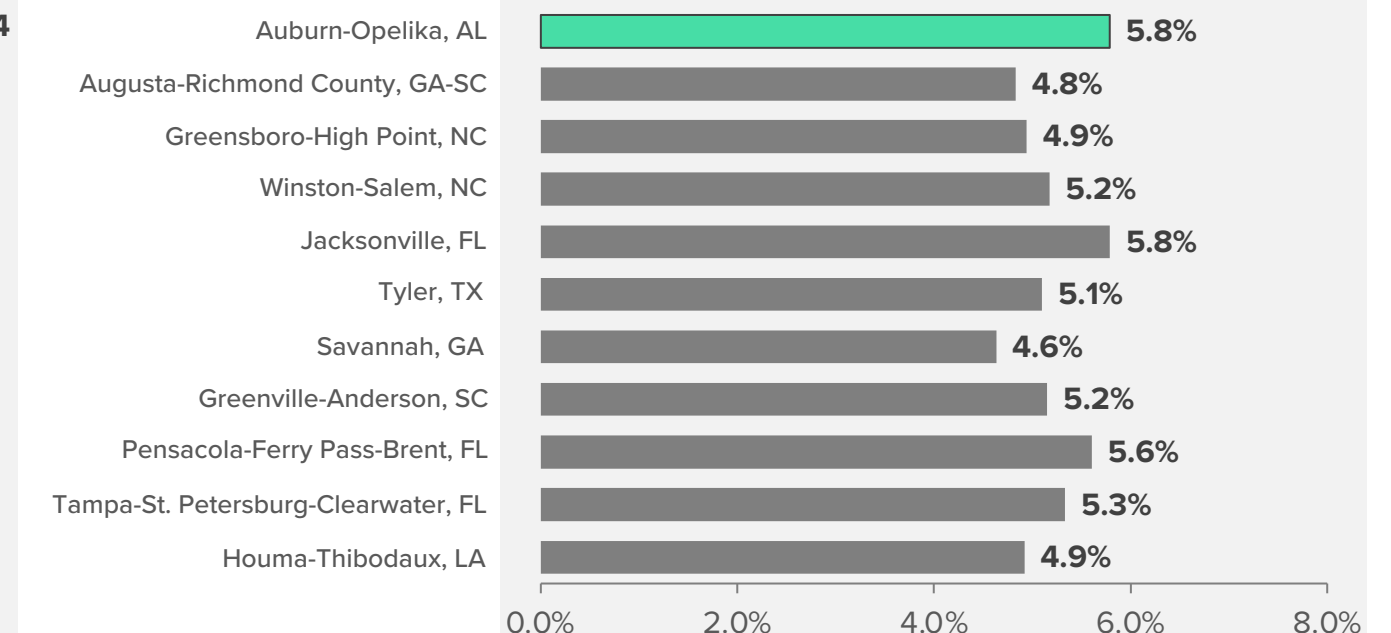
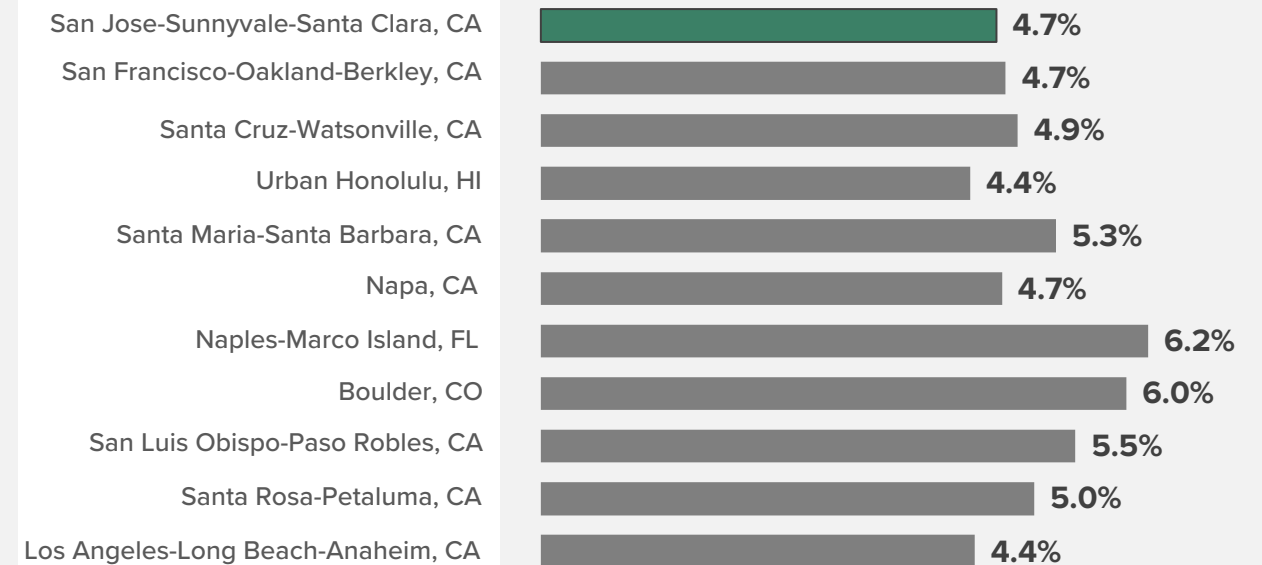
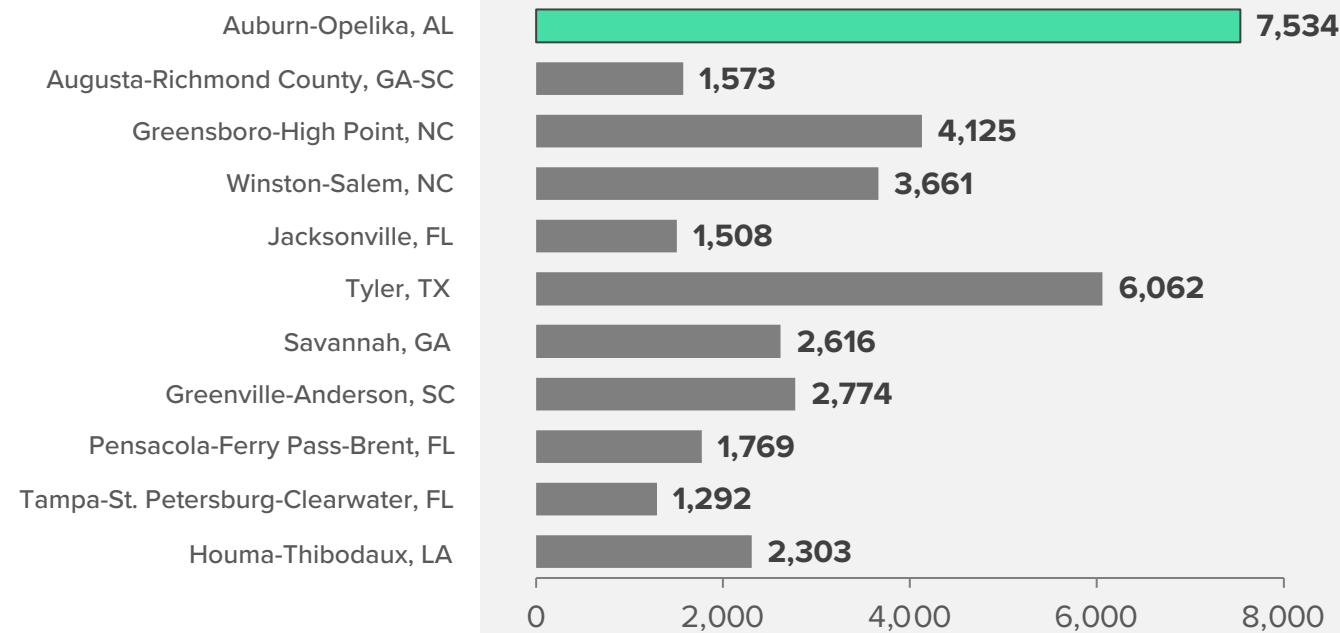
+ SURGICAL CONCENTRATION SURGICAL CONCENTRATION MIDPOINT: 3,677

2021-2030 SURGICAL DEMAND (CAGR) SURGICAL DEMAND CAGR MIDPOINT: 4.9%

PRIMARY BENCHMARK



MEDIAN BENCHMARK



Note: A surgical concentration value below 1,500 indicates a competitive market; between 1,500 and 2,500 a indicates moderately concentrated market, whereas a value greater than 2,500 indicates a highly concentrated market. CAGR indicates compound annual growth rate.

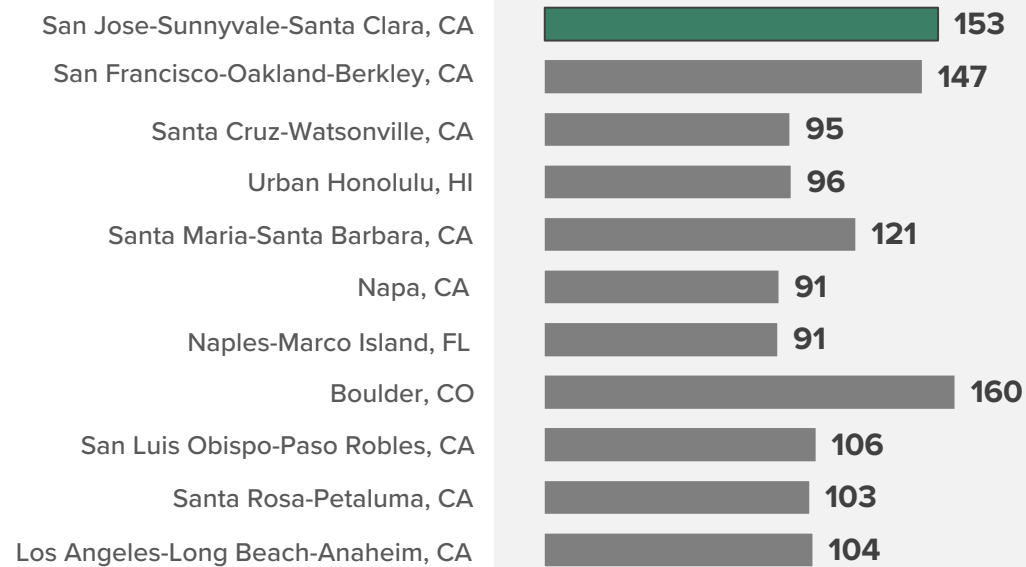
Source: Trilliant Health national all-payer claims database and proprietary demand forecast model.

Economic Similarity | Primary Care

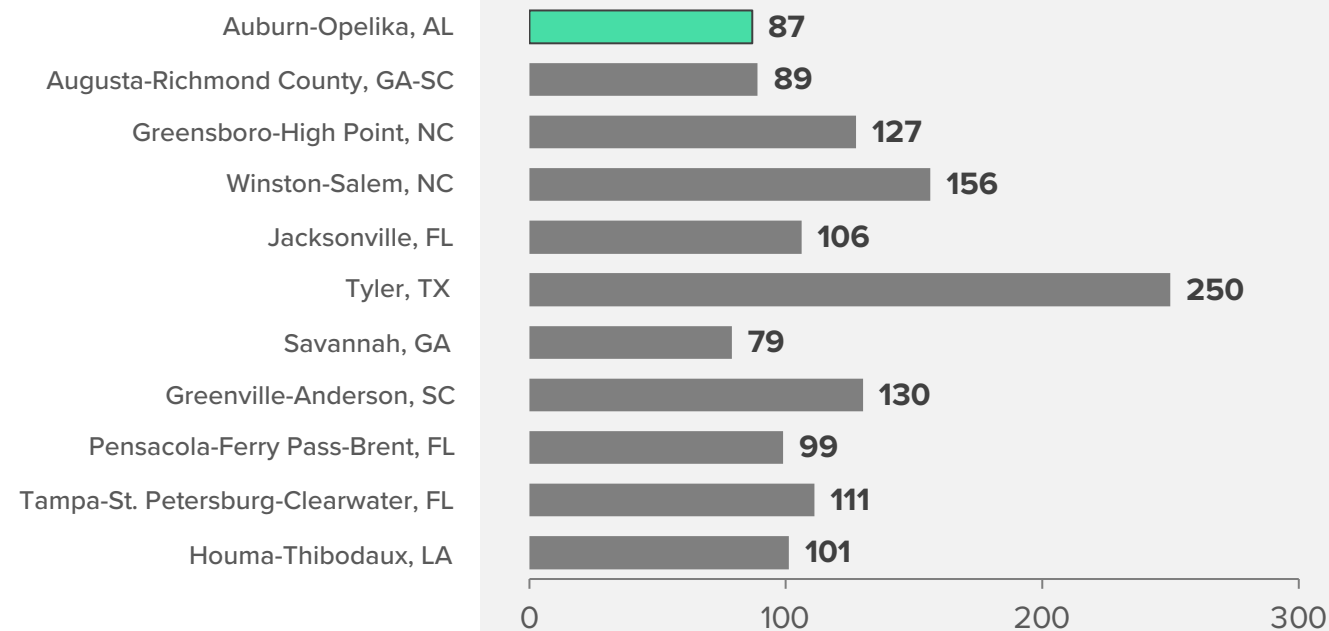
Although Auburn, AL and Tyler, TX are economically similar, the rate of diabetes per 100K population is almost 3X higher in Tyler than in Auburn.

+ PRIMARY CARE PROVIDERS PER 100K PCP MIDPOINT: 110

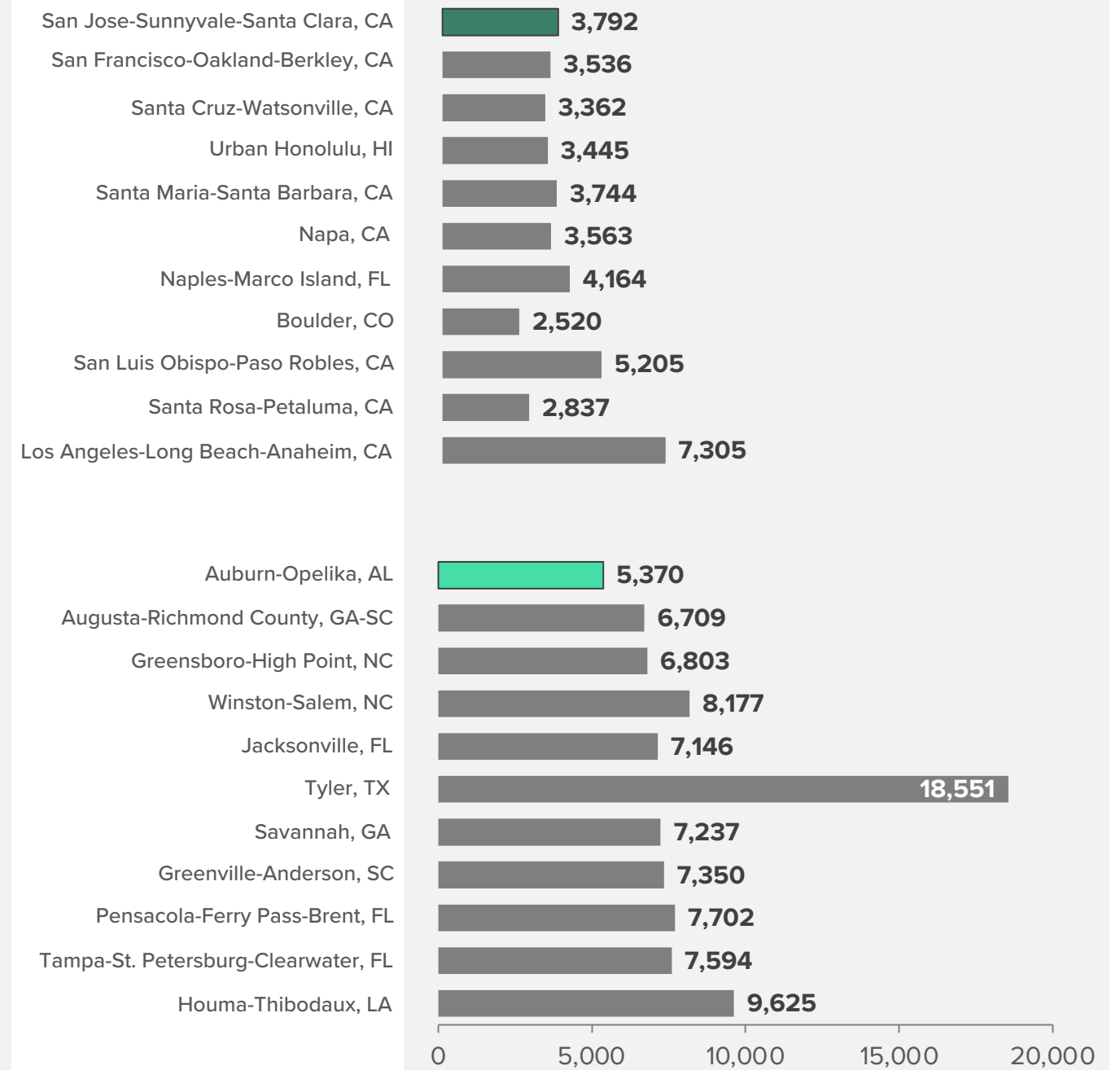
PRIMARY BENCHMARK



MEDIAN BENCHMARK



DIABETES PER 100K DIABETES MIDPOINT: 7,087



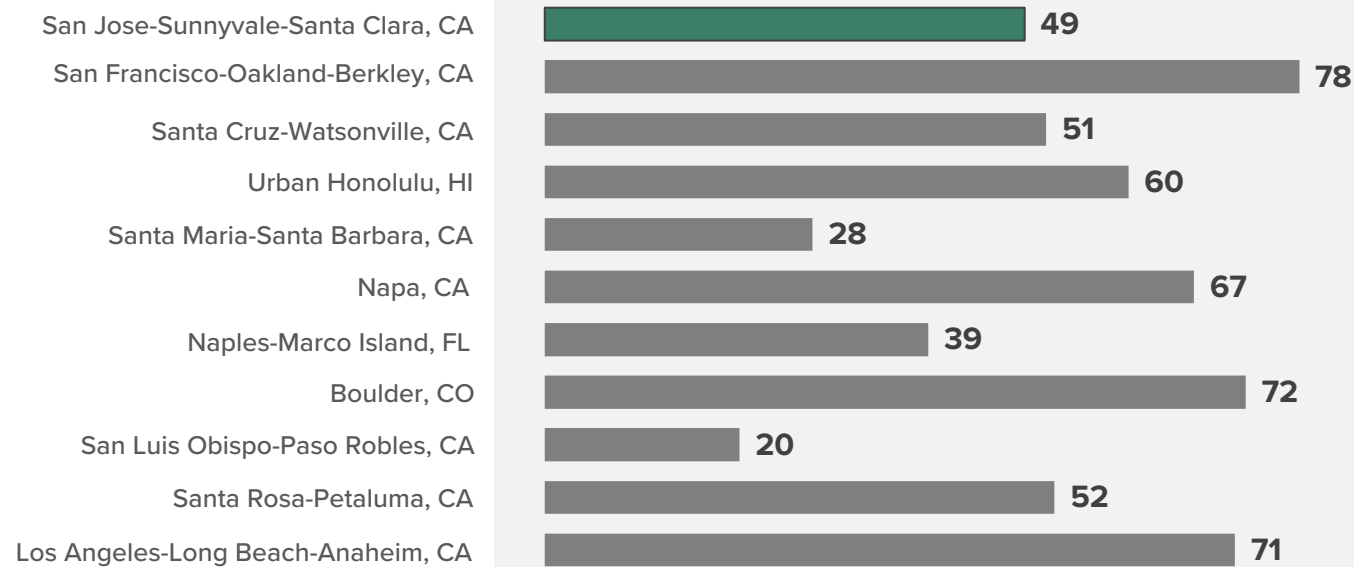
Source: Trilliant Health national all-payer claims database and provider directory.

Economic Similarity | Behavioral Health

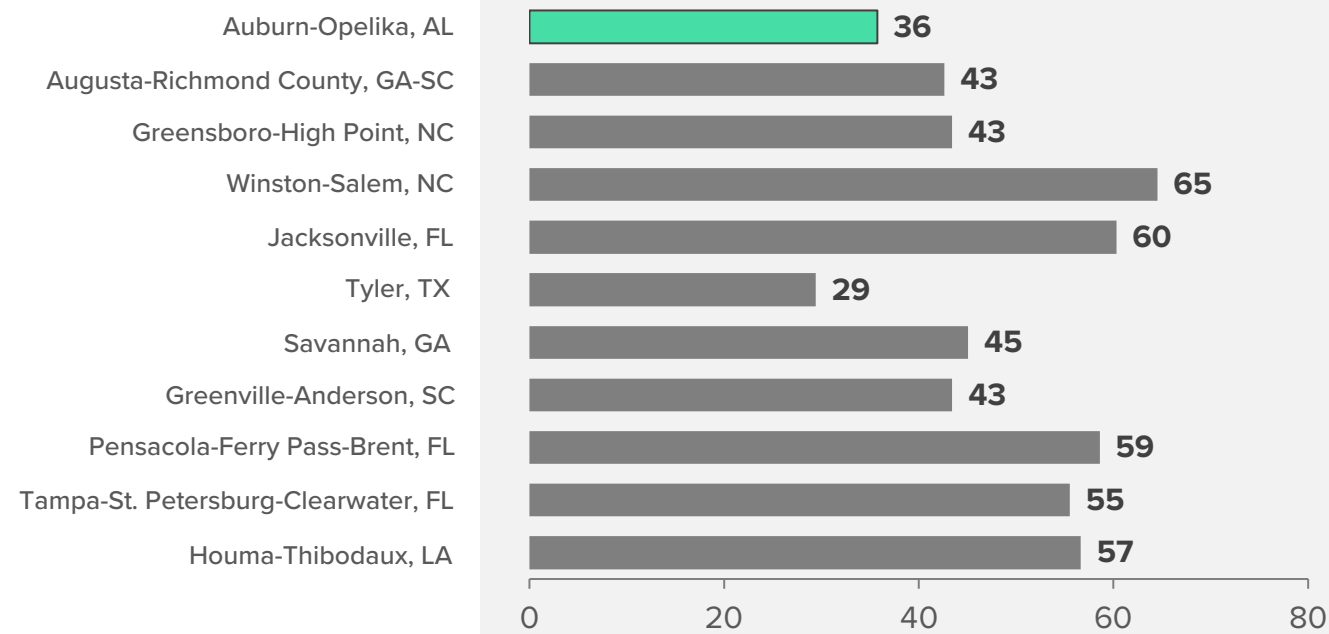
Despite being economically similar, San Jose, CA has more than twice as many behavioral health providers per 100K population than San Luis Obispo, CA.

+ BEHAVIORAL HEALTH PROVIDERS PER 100K BHP MIDPOINT: 61

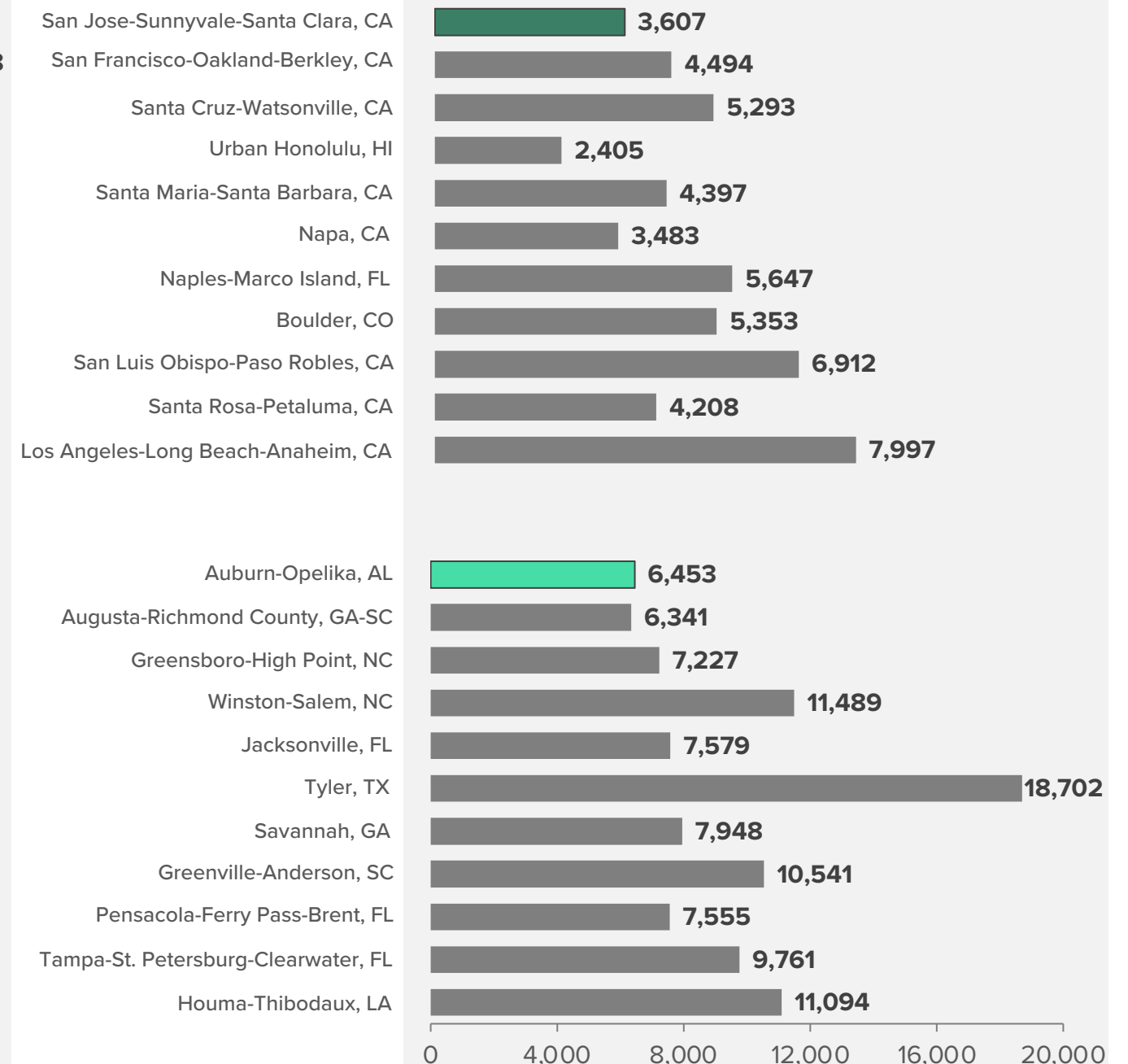
PRIMARY BENCHMARK



MEDIAN BENCHMARK



↘ ANXIETY AND DEPRESSION PER 100K ANXIETY AND DEPRESSION MIDPOINT: 8,232



Source: Trilliant Health national all-payer claims database and provider directory.

Demographic Similarity

Benchmarking racially diverse markets with minimums of 15% and 30% minority populations (Black, Latino or Hispanic, and Asian American):

■ Washington-Arlington-Alexandria, DC-MD-VA (52.1%)

- Black (24.1%); Asian American (10.9%); Latino or Hispanic (17.1%)

■ Minneapolis-St. Paul-Bloomington, MN-WI (22.8%)

- Black (9.0%); Asian American (7.2%); Latino or Hispanic (6.6%)



GROWTH
SIMILARITY



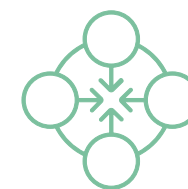
ECONOMIC
SIMILARITY



DEMOGRAPHIC
SIMILARITY



CONSUMER
SIMILARITY



COMPETITIVE
SIMILARITY



AGGREGATE
SIMILARITY

Demographic Similarity | Primary Benchmark

Chicago, IL is **most similar** to Washington, DC based on the Demographic SimilarityIndex™.

TEN MOST SIMILAR METROPOLITAN MARKETS, BY DEMOGRAPHIC SIMILARITYINDEX™

	METROPOLITAN MARKET	BACHELOR'S DEGREE	UNINSURED UNDER 65	SIMILARITY SCORE
	WASHINGTON-ARLINGTON-ALEXANDRIA, DC-MD-VA	59.8%	4.1%	1
1	CHICAGO-NAPERVILLE-ELGIN, IL-IN-WI	41.1%	10.7%	0.835
2	SEATTLE-TACOMA-BELLEVUE, WA	65.0%	4.9%	0.827
3	SAN DIEGO-CHULA VISTA-CARLSBAD, CA	39.5%	8.9%	0.817
4	COLUMBUS, OH	36.8%	10.1%	0.809
5	TRENTON-PRINCETON, NJ	14.2%	16.8%	0.807
6	DALLAS-FORT WORTH-ARLINGTON, TX	32.5%	25.1%	0.804
7	OMAHA-COUNCIL BLUFFS, NE-IA	38.3%	12.0%	0.801
8	AUSTIN-ROUND ROCK-GEORGETOWN, TX	23.0%	21.6%	0.797
9	WORCESTER, MA-CT	37.1%	3.5%	0.795
10	ATLANTA-SANDY SPRINGS-ALPHARETTA, GA	53.4%	11.9%	0.795



DEMOGRAPHIC SIMILARITYINDEX™ FEATURES

Health Insurance Status | Age and Sex | Generation | Race and Ethnicity | Primary Language

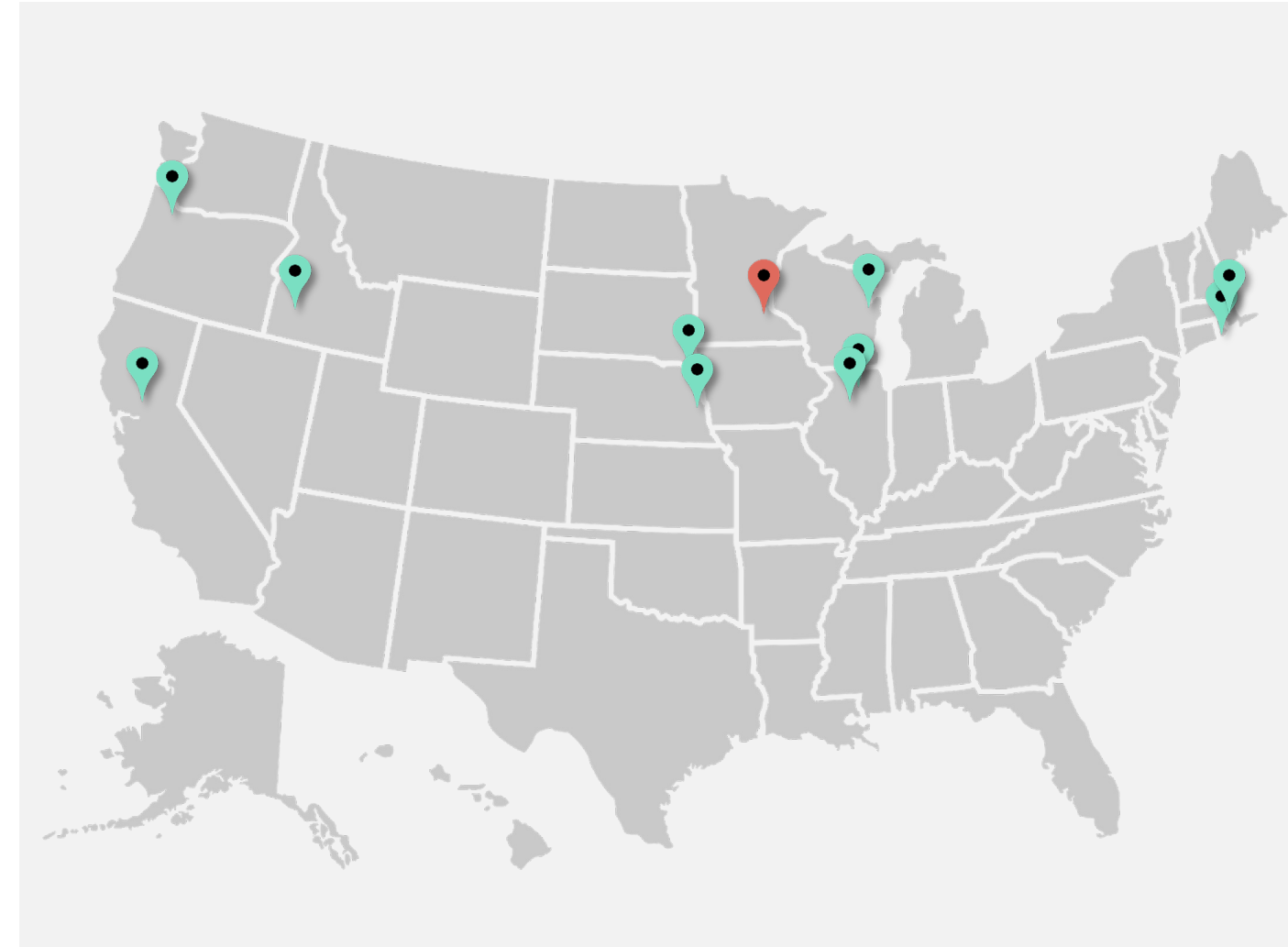
Note: The Demographic SimilarityIndex™ factors in 2021 health insurance (commercial, Medicare, Medicaid) distribution, age and sex, generation (e.g., Millennials), uninsured estimates, race and ethnicity, and English speakers at the CBSA level, sourced from Trilliant Health's national consumer and all-payer claims databases. The first market selected to index against, Washington-Alexandria-Arlington, DC-VA-MD, was chosen because, of all metropolitan CBSAs, its 2020 population was comprised of at least 30% minority groups, according to the U.S. Census Bureau. The SimilarityEngine™ compared CBSAs with the selected Demographic SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (Washington-Alexandria-Arlington, DC-VA-MD and Minneapolis-St. Paul-Bloomington MN-WI) were identified and compared. Source: U.S. Census Bureau; Trilliant Health national all-payer claims database.

Demographic Similarity | Median Benchmark

Portland, OR is **most similar** to Minneapolis, MN based on the Demographic SimilarityIndex™.

TEN MOST SIMILAR METROPOLITAN MARKETS, BY DEMOGRAPHIC SIMILARITYINDEX™

METROPOLITAN MARKET	BACHELOR'S DEGREE	UNINSURED UNDER 65	SIMILARITY SCORE
MINNEAPOLIS-ST. PAUL-BLOOMINGTON, MN-WI	51.8%	6.8%	1
1 PORTLAND-VANCOUVER-HILLSBORO, OR-WA	51.0%	7.0%	0.863
2 SIOUX CITY, IA-NE-SD	22.4%	7.3%	0.859
3 BOSTON-CAMBRIDGE-NEWTON, MA-NH	51.3%	3.9%	0.851
4 ROCKFORD, IL	22.3%	8.3%	0.836
5 PROVIDENCE-WARWICK, RI-MA	30.3%	5.8%	0.835
6 SACRAMENTO-ROSEVILLE-FOLSOM, CA	31.4%	6.8%	0.831
7 OMAHA-COUNCIL BLUFFS, NE-IA	38.3%	12.0%	0.820
8 BOISE CITY, ID	28.4%	12.1%	0.819
9 GREEN BAY, WI	24.4%	8.9%	0.818
10 PEORIA, IL	31.1%	7.3%	0.811



DEMOGRAPHIC SIMILARITYINDEX™ FEATURES

Health Insurance Status | Age and Sex | Generation | Race and Ethnicity | Primary Language

Note: The Demographic SimilarityIndex™ factors in 2021 health insurance (commercial, Medicare, Medicaid) distribution, age and sex, generation (e.g., Millennials), uninsured estimates, race and ethnicity, and English speakers at the CBSA level, sourced from Trilliant Health's national consumer and all-payer claims databases. The second market selected to index against, Minneapolis-St. Paul-Bloomington MN-WI, was chosen because, of all metropolitan CBSAs, its 2020 population was comprised of at least 15% minority groups, according to the U.S. Census Bureau. The SimilarityEngine™ compared CBSAs with the selected Demographic SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (Washington-Alexandria-Arlington, DC-VA-MD and Minneapolis-St. Paul-Bloomington MN-WI) were identified and compared. Source: U.S. Census Bureau; Trilliant Health national all-payer claims database.

Demographic Similarity | Surgery

While Washington, D.C. and Austin, TX are demographically similar, surgical demand CAGR is 1.4 percentage points less in D.C. This difference is meaningful over time with a projected 32% increase in Austin versus 17% in D.C. between 2021 and 2030.



SURGICAL CONCENTRATION

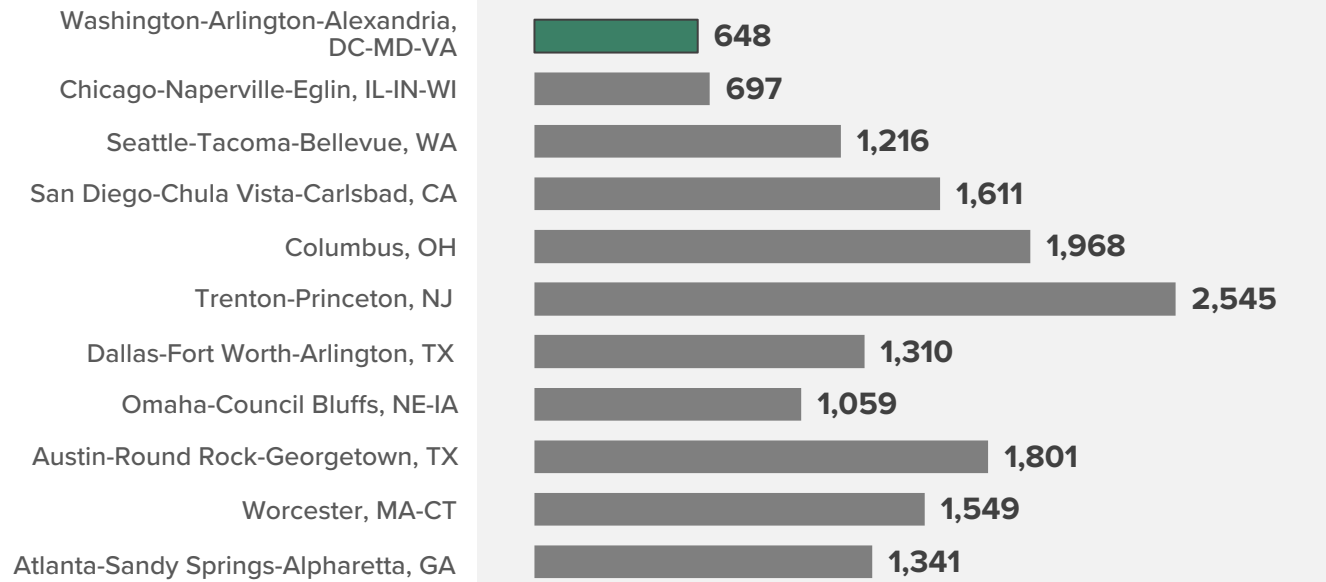
SURGICAL CONCENTRATION MIDPOINT: 3,677



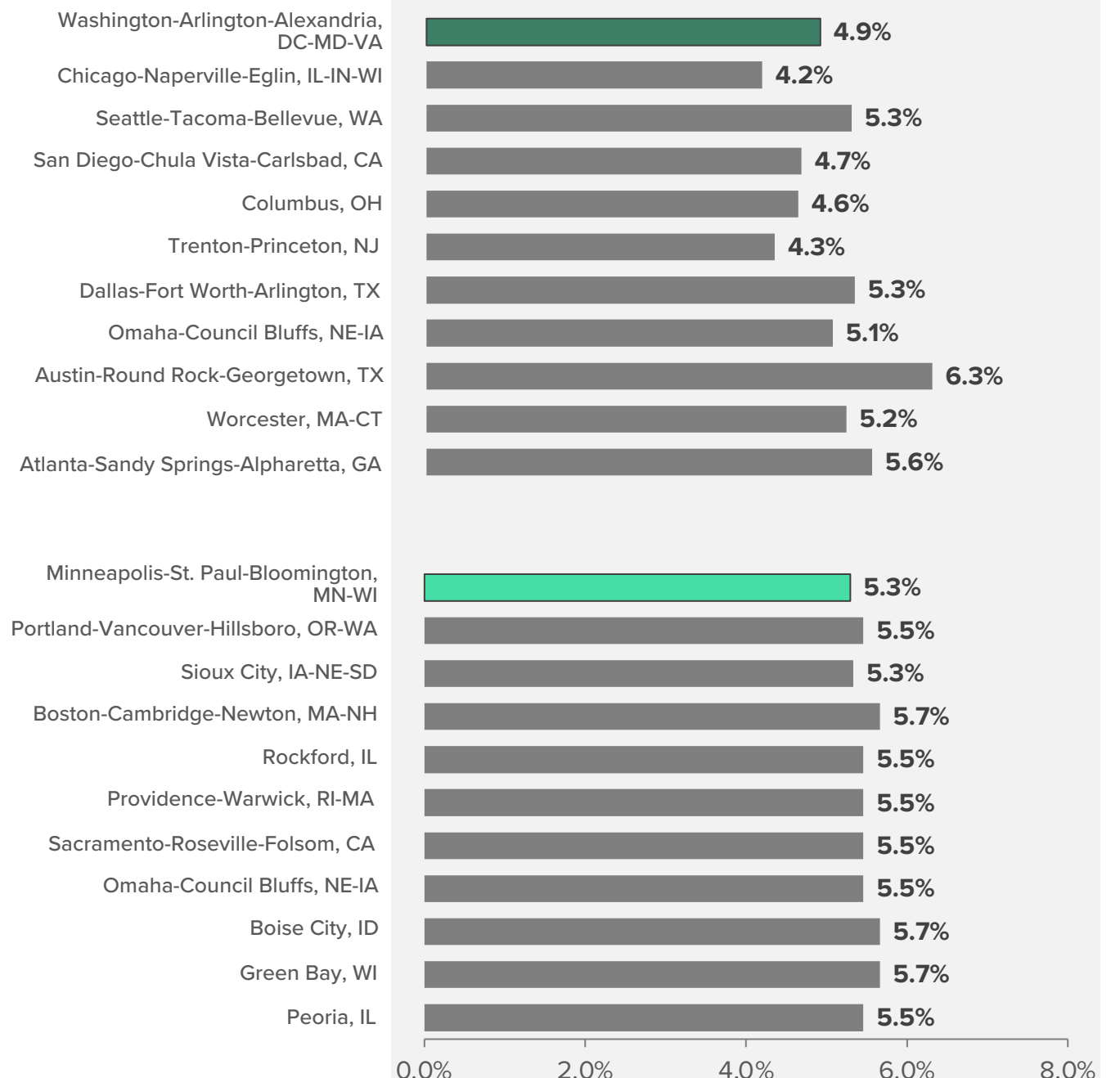
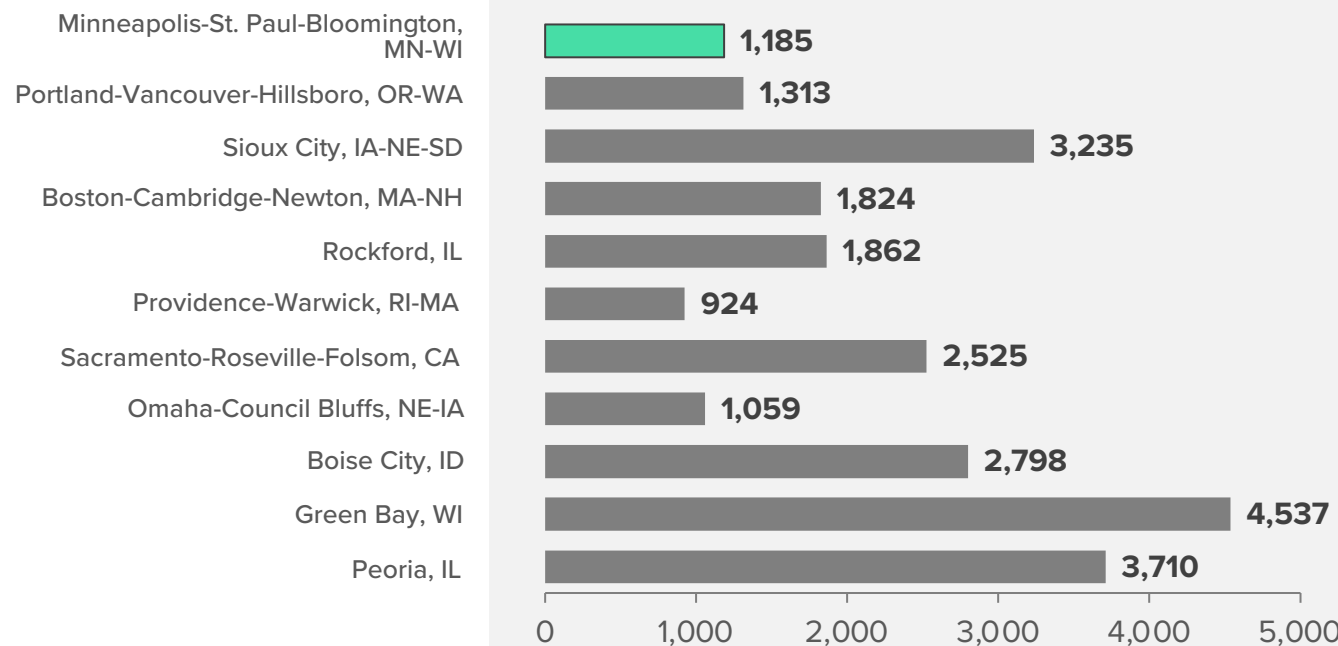
2021-2030 SURGICAL DEMAND (CAGR)

SURGICAL DEMAND CAGR MIDPOINT: 4.9%

PRIMARY BENCHMARK



MEDIAN BENCHMARK



Note: A surgical concentration value below 1,500 indicates a competitive market; between 1,500 and 2,500 indicates a moderately concentrated market, whereas a value greater than 2,500 indicates a highly concentrated market. CAGR indicates compound annual growth rate.

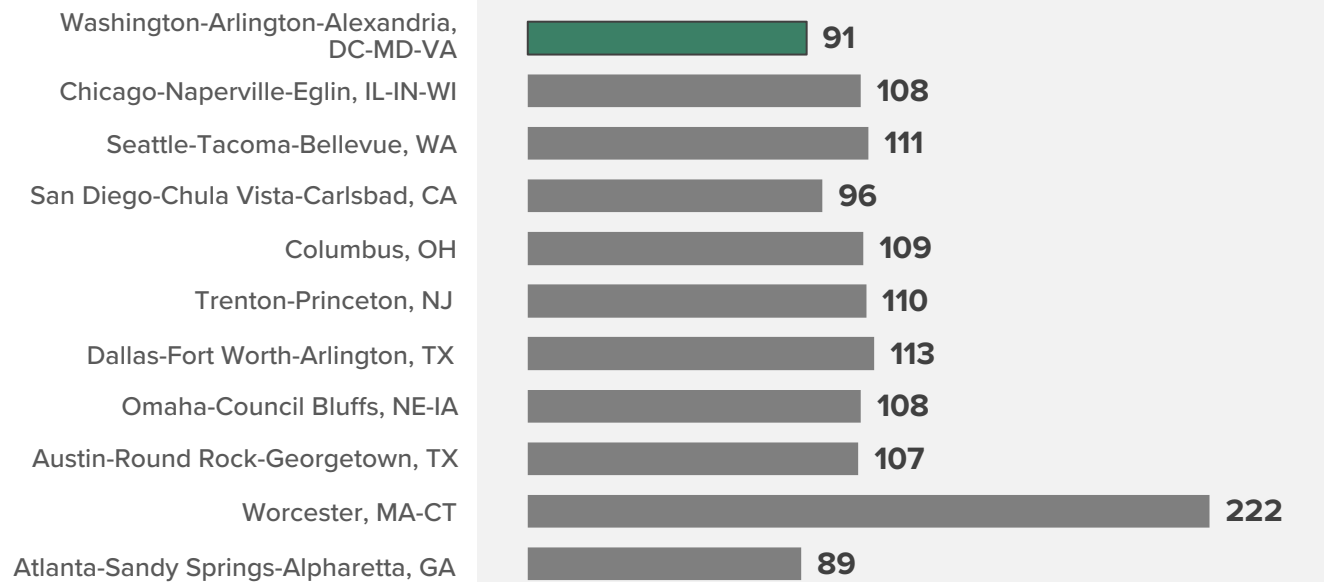
Source: Trilliant Health national all-payer claims database and proprietary demand forecast model.

Demographic Similarity | Primary Care

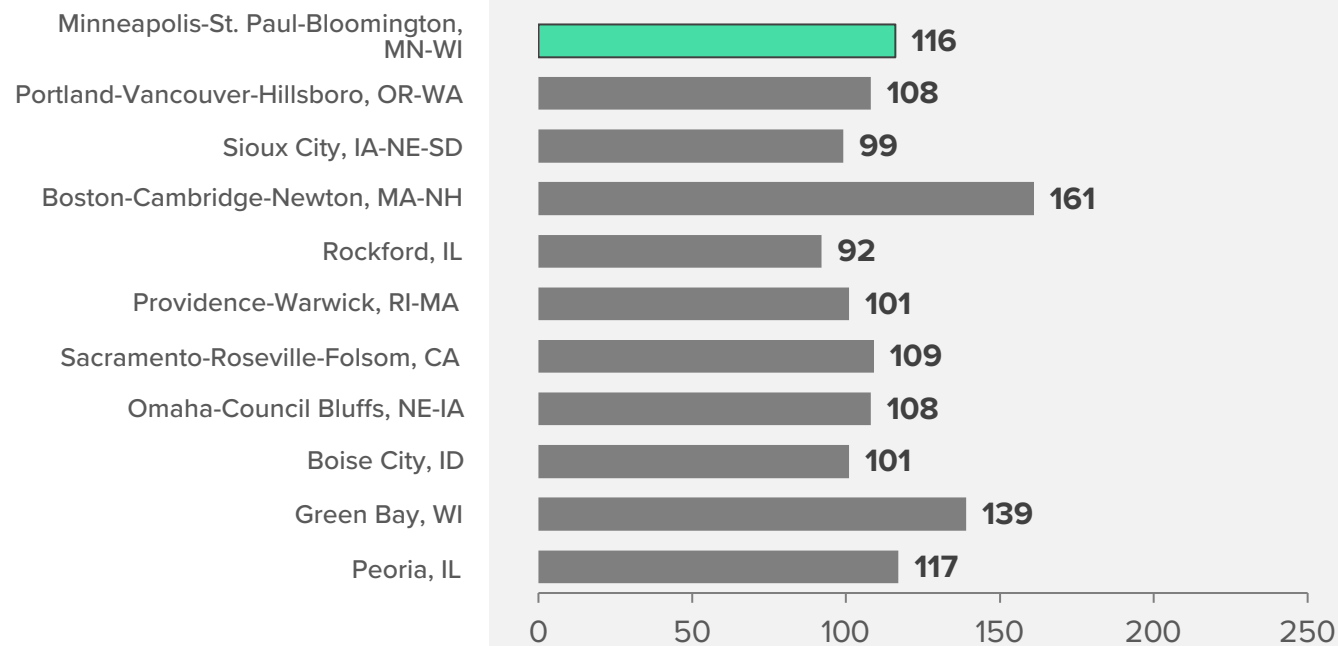
Despite being demographically similar, Washington, D.C. has less than half of the supply of primary care providers per 100K population than Worcester, MA.

+ PRIMARY CARE PROVIDERS PER 100K PCP MIDPOINT: 110

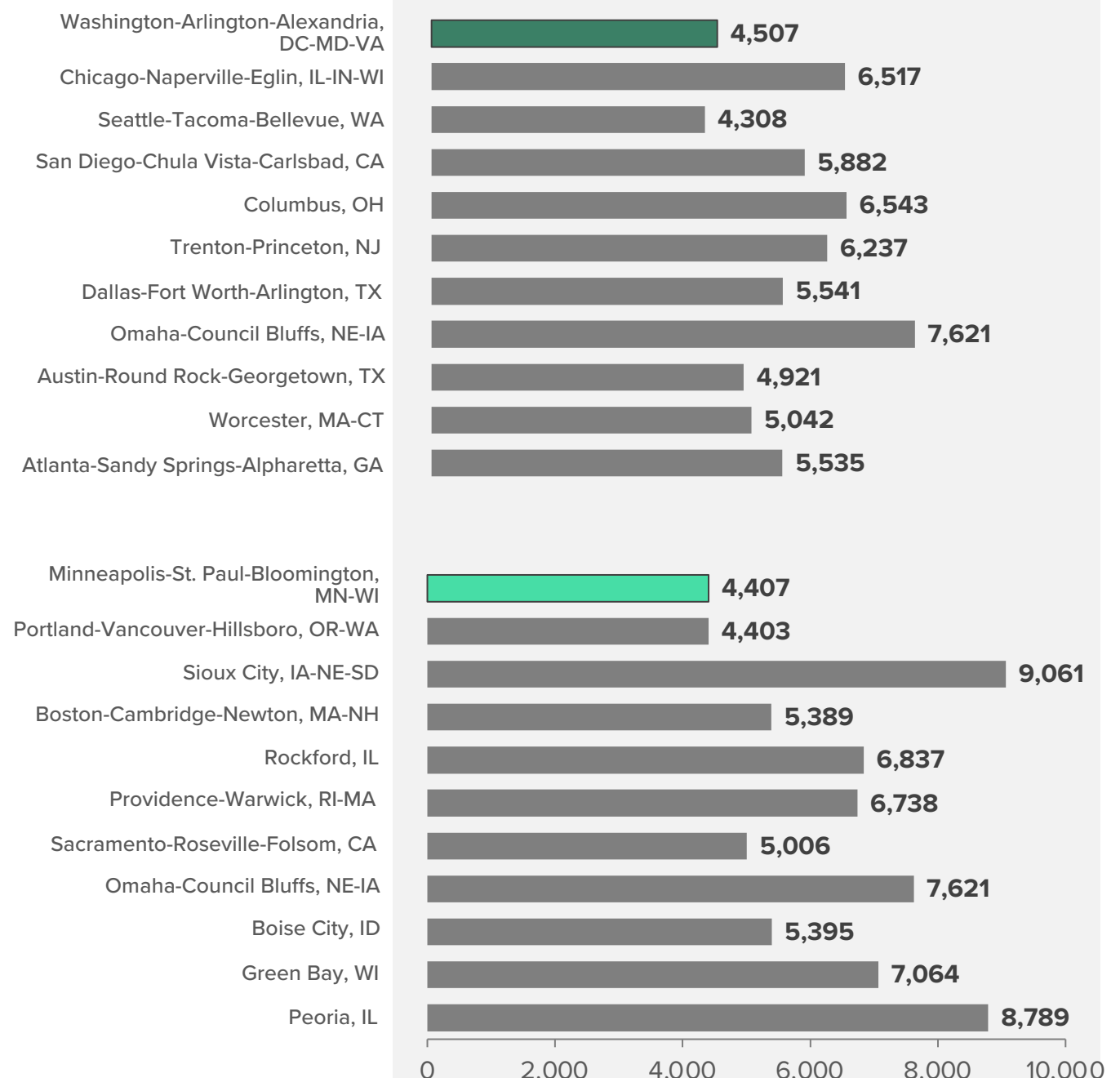
PRIMARY BENCHMARK



MEDIAN BENCHMARK



DIABETES PER 100K DIABETES MIDPOINT: 7,087



Source: Trilliant Health national all-payer claims database and provider directory.

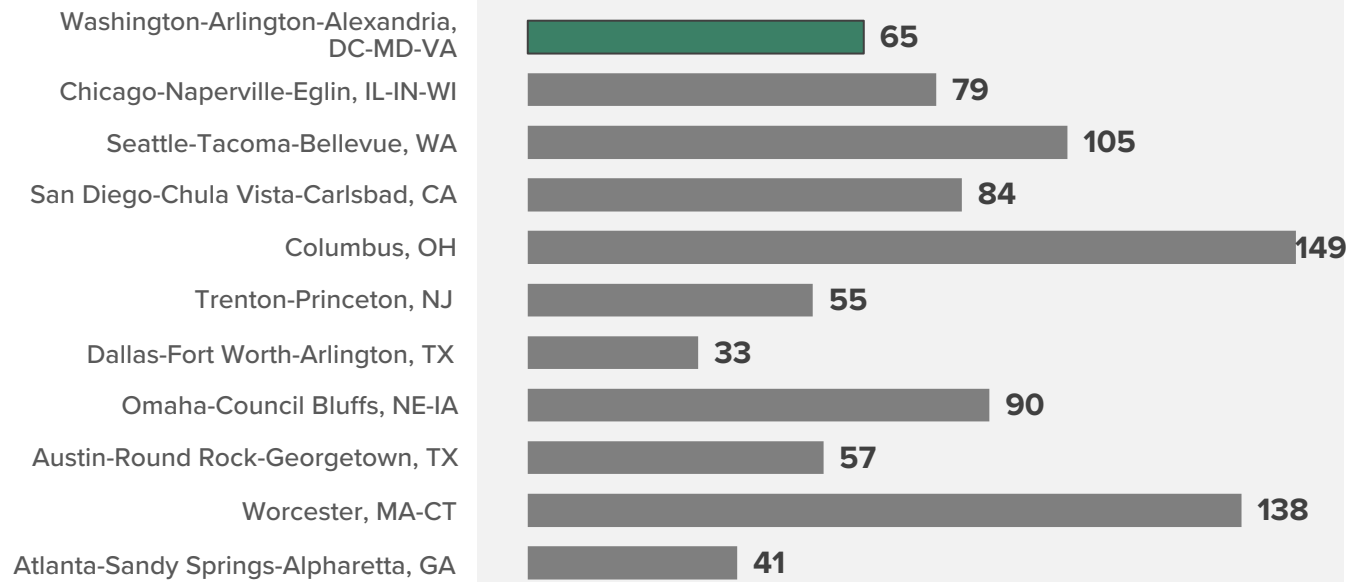
Demographic Similarity | Behavioral Health

Although Minneapolis, MN and Sioux City, IA are demographically similar, the rate of anxiety and depression per 100K population in Sioux Falls is 98% higher than in Minneapolis.

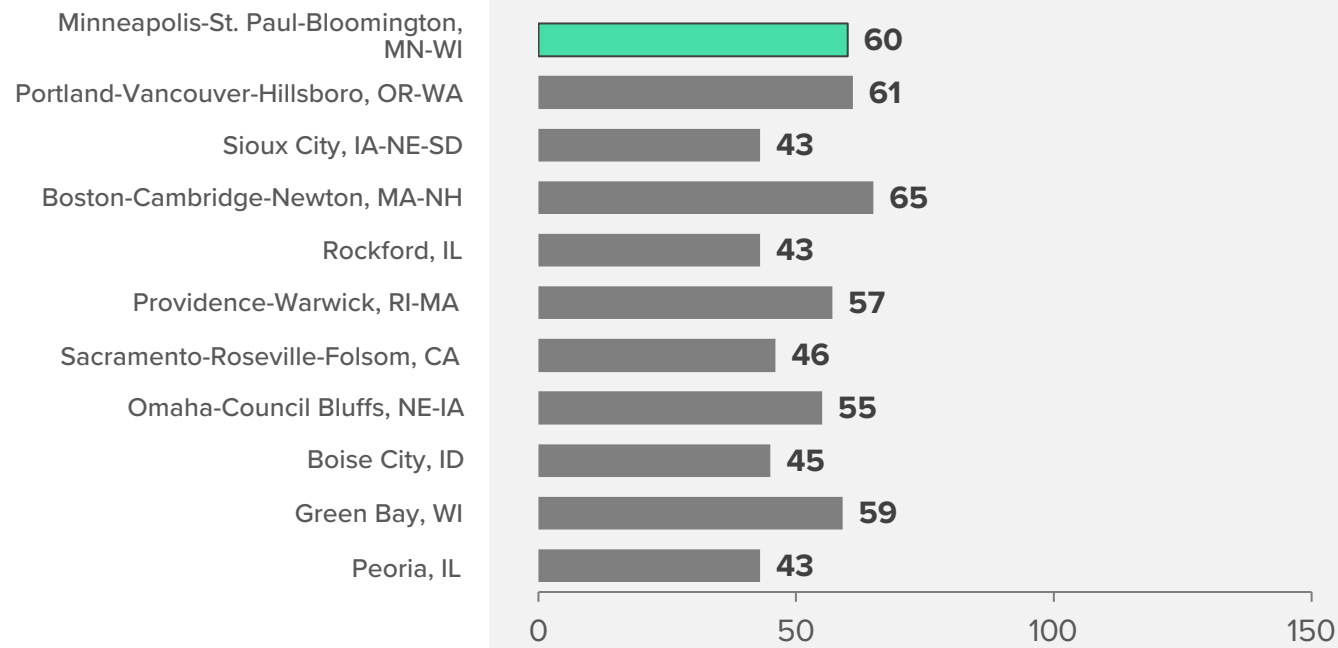


BEHAVIORAL HEALTH PROVIDERS PER 100K BHP MIDPOINT: 61

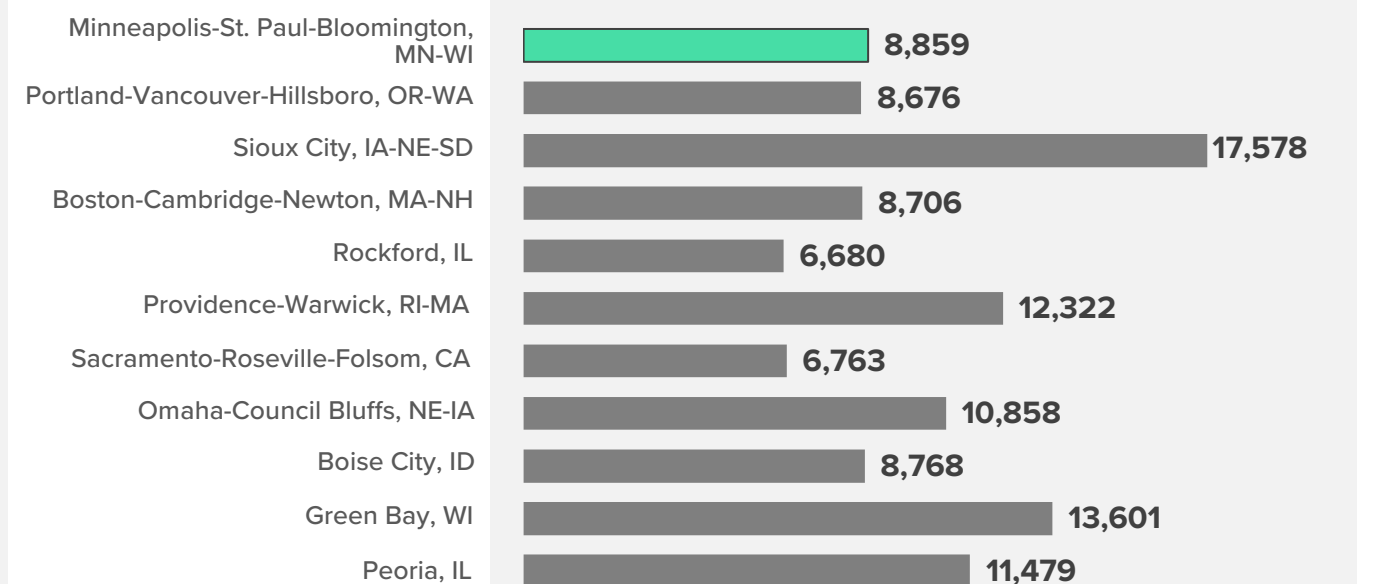
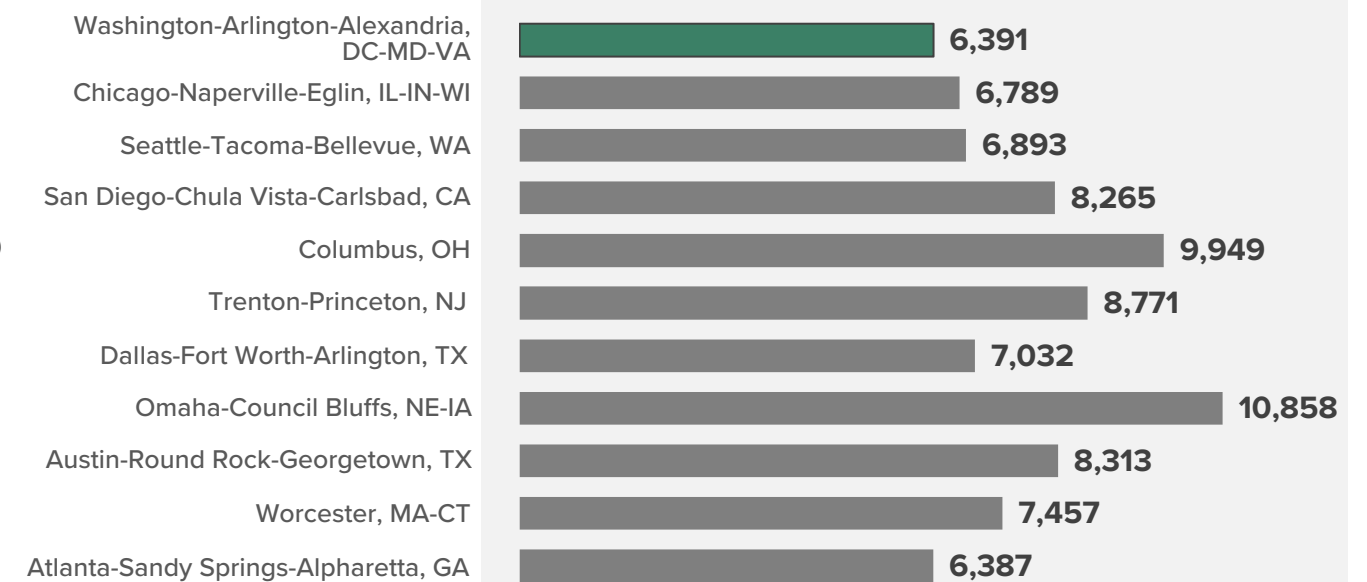
PRIMARY BENCHMARK



MEDIAN BENCHMARK



ANXIETY AND DEPRESSION PER 100K ANXIETY AND DEPRESSION MIDPOINT: 8,232

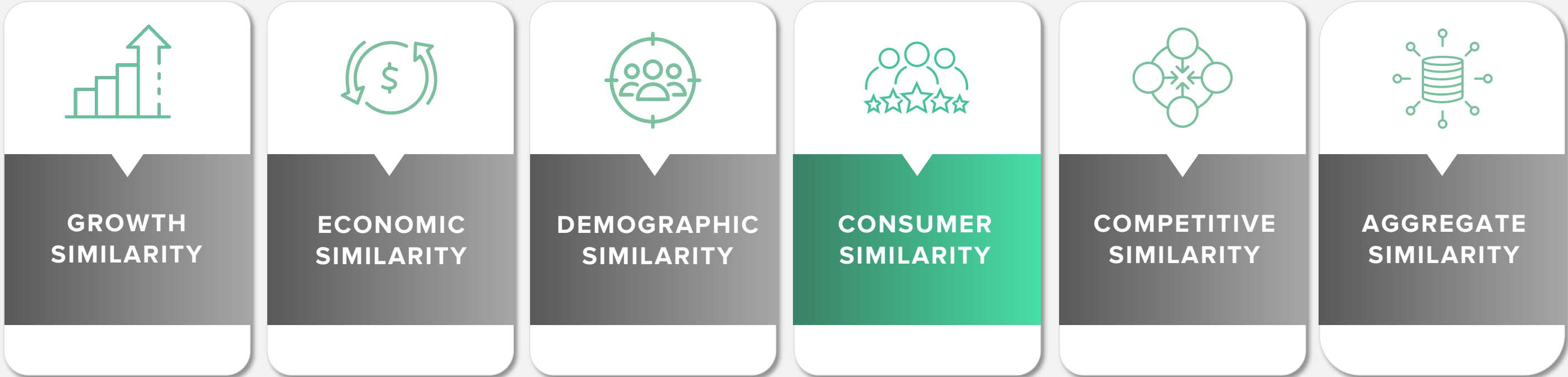


Source: Trilliant Health national all-payer claims database and provider directory.

Consumer Similarity

Benchmarking markets by average loyalty to healthcare providers:

- **Lowest (44%): Las Vegas-Henderson-Paradise, NV**
- **Median (65%): Portland-South Portland, ME**



Consumer Similarity | Primary Benchmark

Orlando, FL is **most similar** to Las Vegas, NV based on the Consumer SimilarityIndex™.

TEN MOST SIMILAR METROPOLITAN MARKETS, BY CONSUMER SIMILARITYINDEX™

	METROPOLITAN MARKET	HOUSEHOLDS WITH BROADBAND	AVERAGE DISCRETIONARY INCOME	SIMILARITY SCORE
	LAS VEGAS-HENDERSON-PARADISE, NV	82.6%	18.0%	1
1	ORLANDO-KISSIMMEE-SANFORD, FL	88.6%	17.5%	0.895
2	AUBURN-OPELIKA, AL	88.2%	17.3%	0.851
3	HOUSTON-THE WOODLANDS-SUGAR LAND, TX	67.3%	18.5%	0.837
4	IOWA CITY, IA	88.5%	18.1%	0.836
5	RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	89.3%	18.2%	0.834
6	COLUMBIA, MO	85.3%	19.4%	0.832
7	ITHACA, NY	80.9%	33.2%	0.832
8	WILMINGTON, NC	83.9%	23.5%	0.829
9	GREENVILLE, NC	85.0%	17.0%	0.829
10	DALLAS-FORT WORTH-ARLINGTON, TX	84.9%	17.7%	0.828



CONSUMER SIMILARITYINDEX™ FEATURES

Psychographics | Use of Wearables | Prescription Drug Adherence | Prescription Drug Use

Note: The Consumer SimilarityIndex™ factors in psychographics (see Appendix B), the likelihood to use a wearable (see Appendix C), prescription drug adherence (See Appendix C), and the average number of prescription drugs per individual at the CBSA level, sourced from Trilliant Health's national consumer database. The first market selected to index against, Las Vegas-Henderson-Paradise NV, was chosen because, of all metropolitan CBSAs, it had the lowest healthcare provider loyalty value (44%), as calculated with Trilliant Health's national all-payer claims database. Provider loyalty in a market is calculated for patients with at least four medical encounters and measures the proportion of visits with each individual provider from which they have received care. Patients with more than 70% of care attributed to a particular provider entity are considered loyal; those with 30%-70% attributed to one provider entity are considered splitters; and those with less than 30% of care attributed to a provider entity are considered not loyal. The SimilarityEngine™ compared CBSAs with the selected Consumer SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (Las Vegas-Henderson-Paradise NV and Portland-South Portland, ME) were identified and compared.

Source: U.S. Census Bureau; Trilliant Health national consumer database.

Consumer Similarity | Median Benchmark

Kingston, NY is **most similar** to Portland, ME based on the Consumer SimilarityIndex™.

TEN MOST SIMILAR METROPOLITAN MARKETS, BY CONSUMER SIMILARITYINDEX™

METROPOLITAN MARKET	HOUSEHOLDS WITH BROADBAND	AVERAGE DISCRETIONARY INCOME	SIMILARITY SCORE
PORTLAND-SOUTH PORTLAND, ME	87.4%	22.0%	1
1 KINGSTON, NY	87.1%	17.4%	0.869
2 MANCHESTER-NASHUA, NH	87.4%	18.4%	0.867
3 GETTYSBURG, PA	77.0%	18.1%	0.863
4 CHAMBERSBURG-WAYNESBORO, PA	80.2%	13.5%	0.863
5 ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	90.0%	15.2%	0.857
6 LANCASTER, PA	80.6%	20.2%	0.847
7 SHEBOYGAN, WI	86.8%	18.6%	0.846
8 WINCHESTER, VA-WV	79.3%	15.3%	0.833
9 BILLINGS, MT	86.7%	15.6%	0.828
10 JEFFERSON CITY, MO	73.1%	18.1%	0.827



CONSUMER SIMILARITYINDEX™ FEATURES

Psychographics | Use of Wearables | Prescription Drug Adherence | Prescription Drug Use

Note: The Consumer SimilarityIndex™ factors in psychographics (see Appendix B), the likelihood to use a wearable (see Appendix C), prescription drug adherence (See Appendix C), and the average number of prescription drugs per individual at the CBSA level, sourced from Trilliant Health's national consumer database. The second market selected to index against, Portland-South Portland, ME, was chosen because it has a median provider loyalty value (65%), as calculated with Trilliant Health's national all-payer claims database. Provider loyalty in a market is calculated for patients with at least four medical encounters and measures the proportion of visits with each individual provider from which they have received care. Patients with more than 70% of care attributed to a particular provider entity are considered loyal; those with 30%-70% attributed to one provider entity are considered splitters; and those with less than 30% of care attributed to a provider entity are considered not loyal. The SimilarityEngine™ compared CBSAs with the selected Consumer SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (Las Vegas-Henderson-Paradise NV and Portland-South Portland, ME) were identified and compared.

Source: U.S. Census Bureau; Trilliant Health national consumer database.

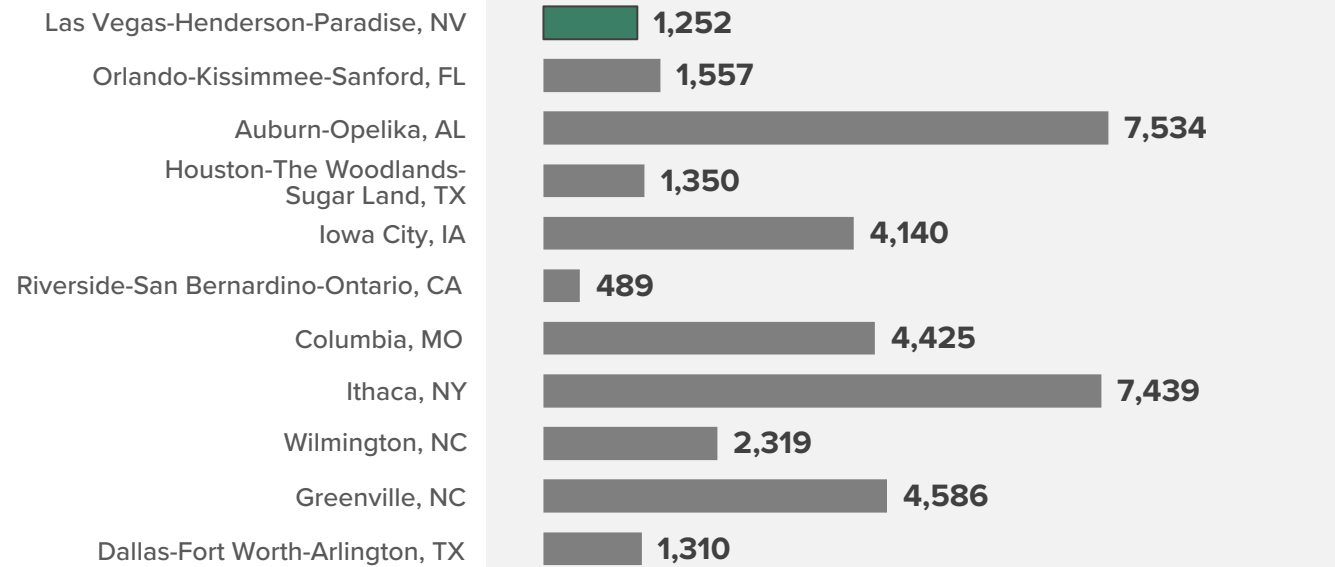
Consumer Similarity | Surgery

While healthcare consumers in Portland, ME and Manchester, NH are highly similar, Manchester is a much more competitive market than Portland.

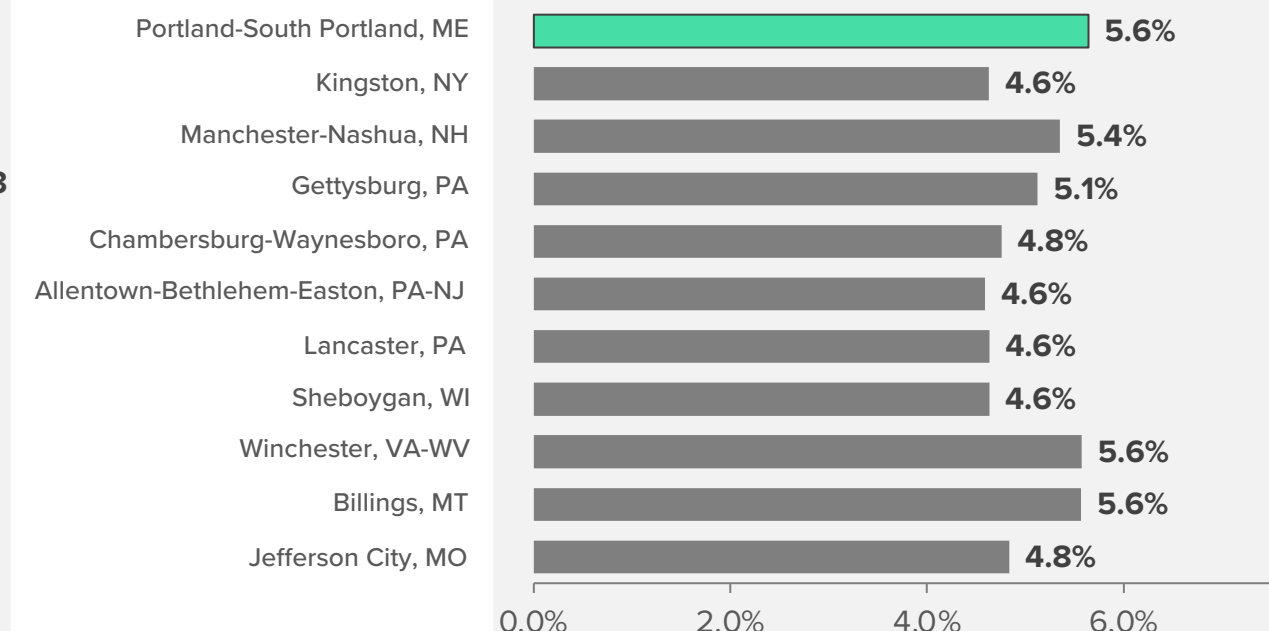
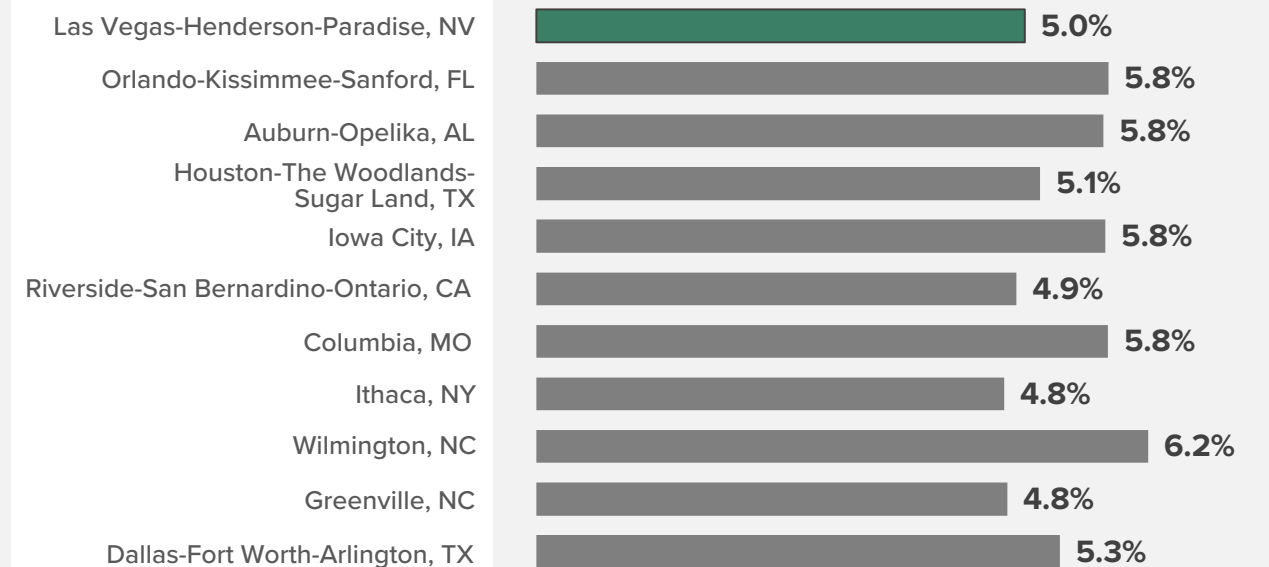
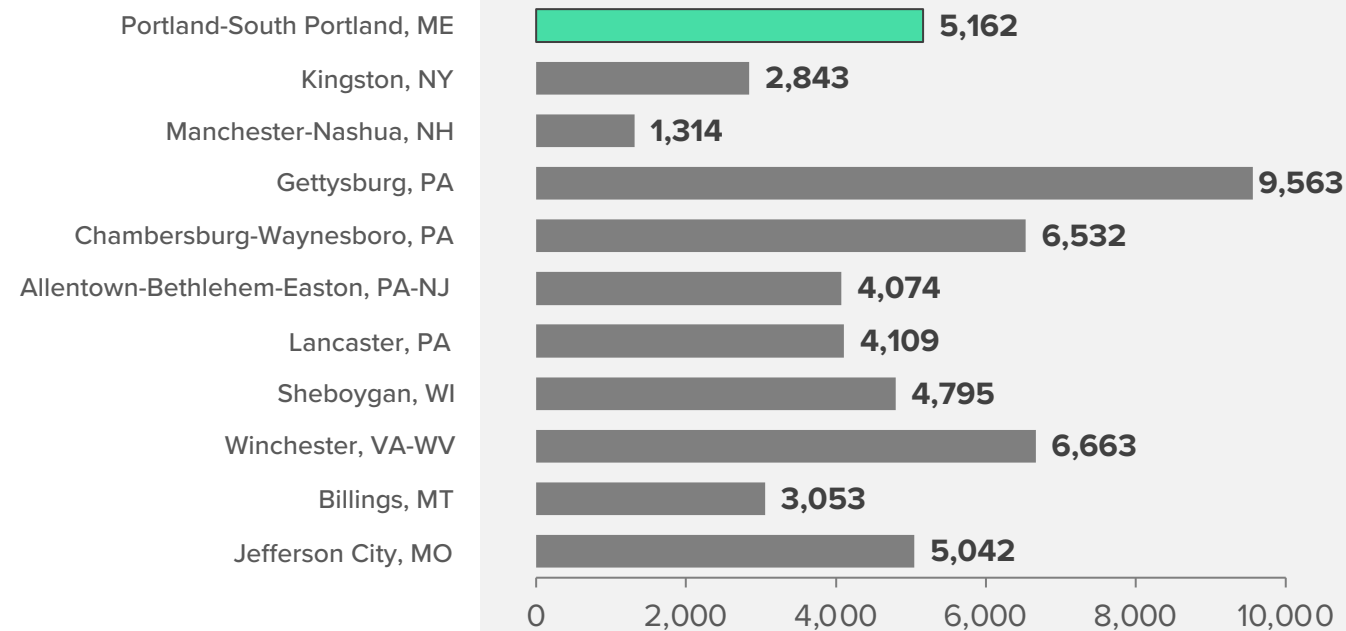
+ SURGICAL CONCENTRATION SURGICAL CONCENTRATION MIDPOINT: 3,677

2021-2030 SURGICAL DEMAND (CAGR) SURGICAL DEMAND CAGR MIDPOINT: 4.9%

PRIMARY BENCHMARK



MEDIAN BENCHMARK



Note: A surgical concentration value below 1,500 indicates a competitive market; between 1,500 and 2,500 indicates a moderately concentrated market, whereas a value greater than 2,500 indicates a highly concentrated market. CAGR indicates compound annual growth rate.

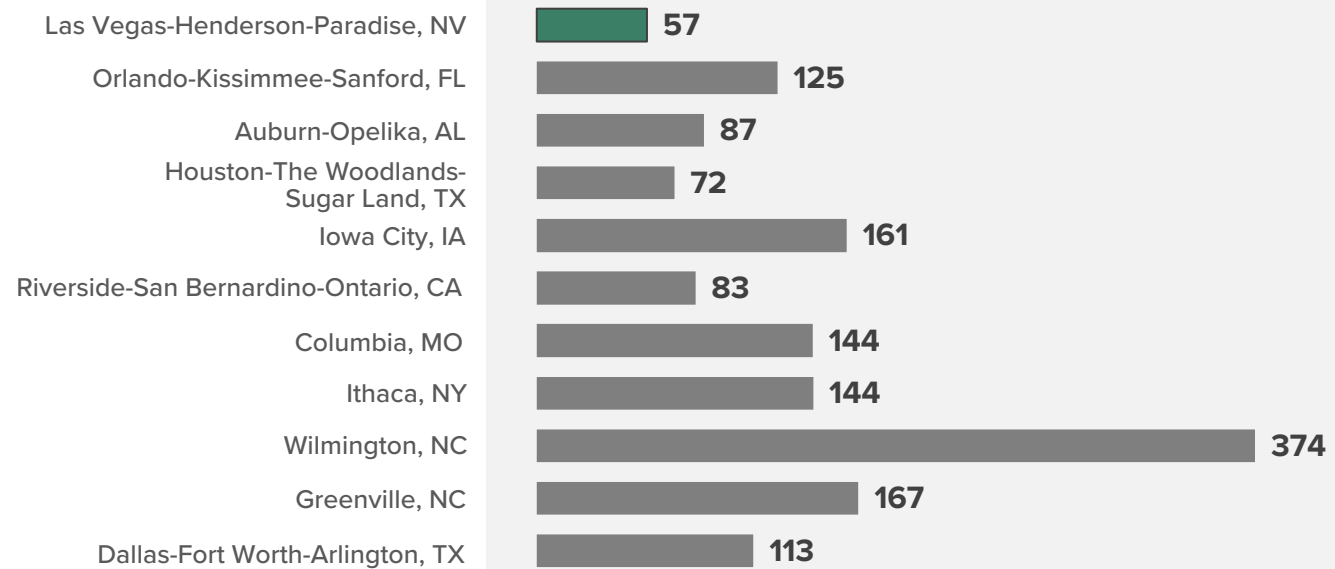
Source: Trilliant Health national all-payer claims database and proprietary demand forecast model.

Consumer Similarity | Primary Care

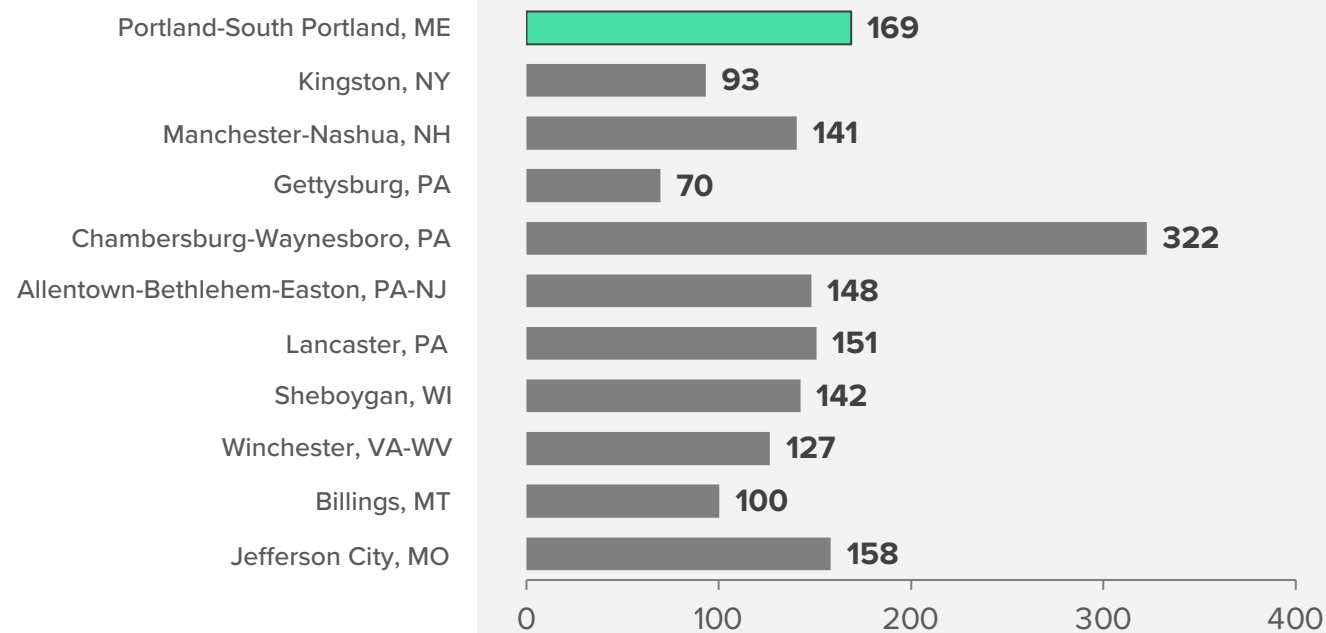
Although healthcare consumers in Las Vegas, NV and Wilmington, NC are highly similar, Wilmington has 7X as many primary care providers per 100K population as Las Vegas.

+ PRIMARY CARE PROVIDERS PER 100K PCP MIDPOINT: 110

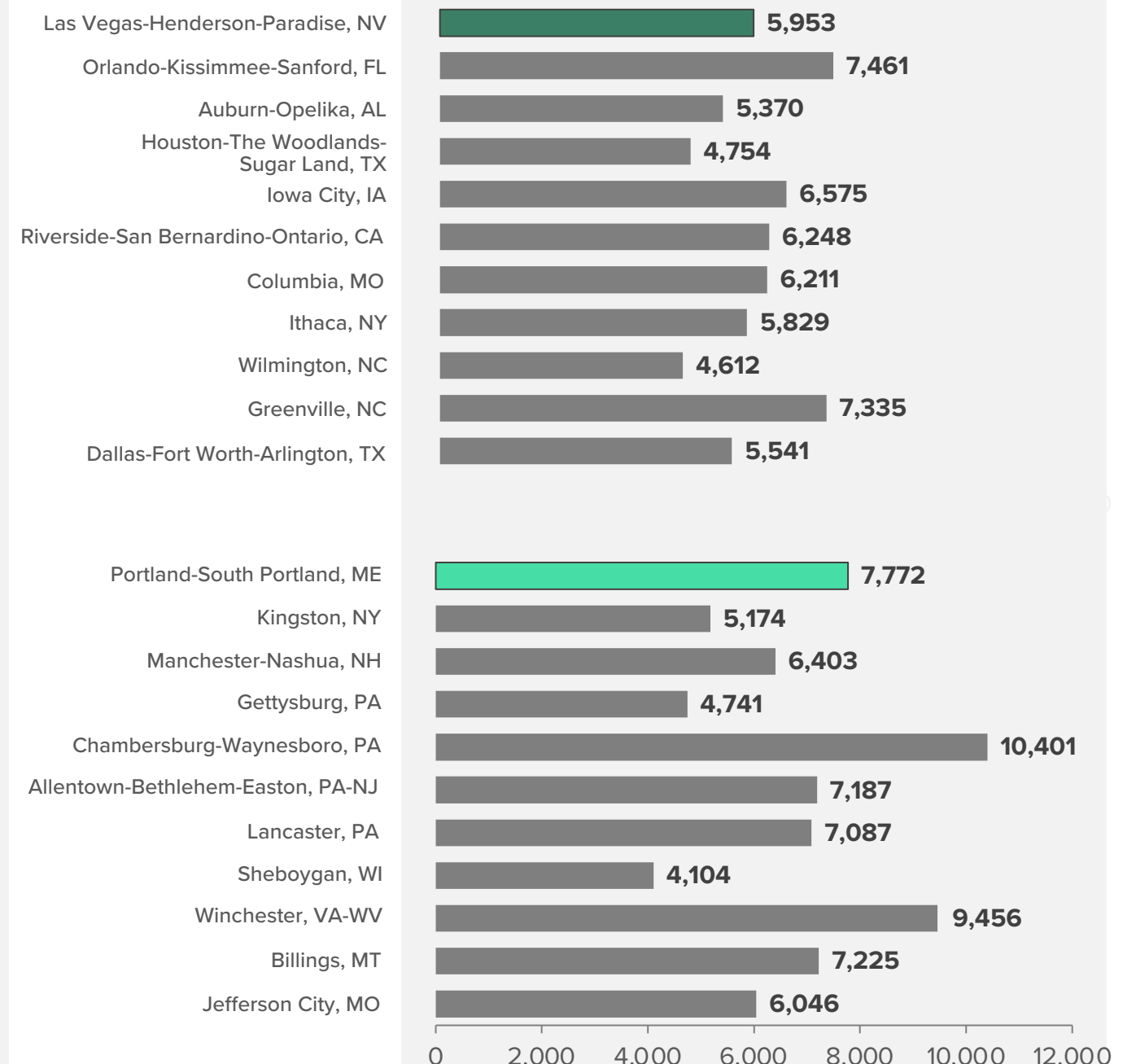
PRIMARY BENCHMARK



MEDIAN BENCHMARK



DIABETES PER 100K DIABETES MIDPOINT: 7,087



Source: Trilliant Health national all-payer claims database and provider directory.

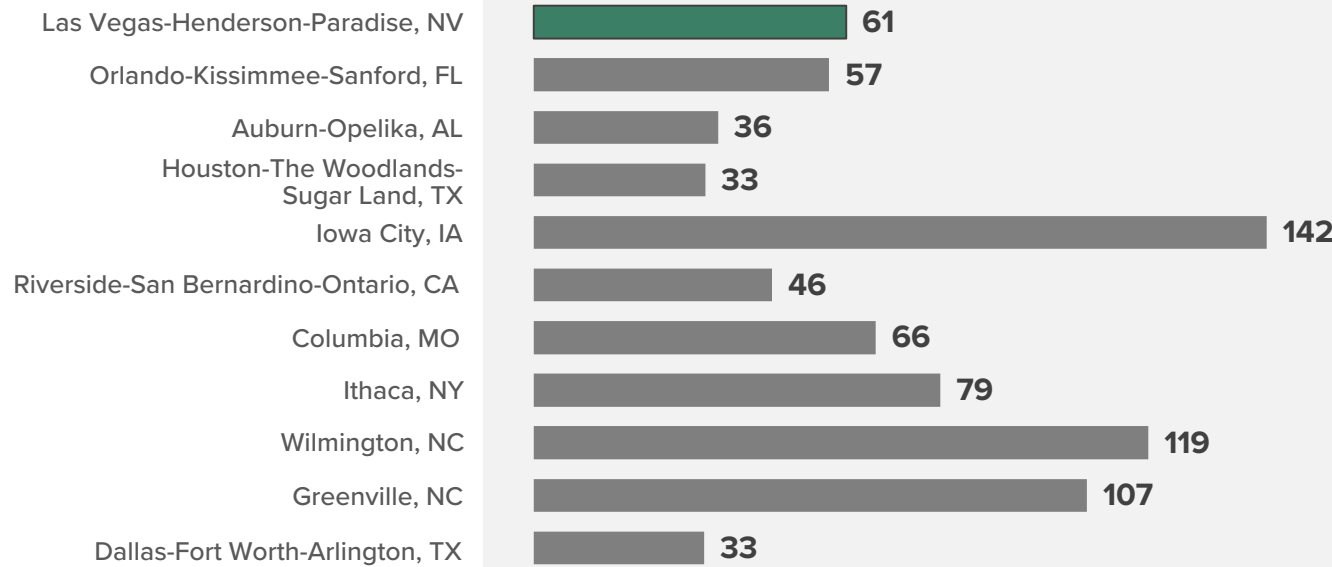
Consumer Similarity | Behavioral Health

Although healthcare consumers in Portland, ME and Gettysburg, PA are similar, the rate of anxiety and depression per 100K population in Portland is more than 5X higher than in Gettysburg.

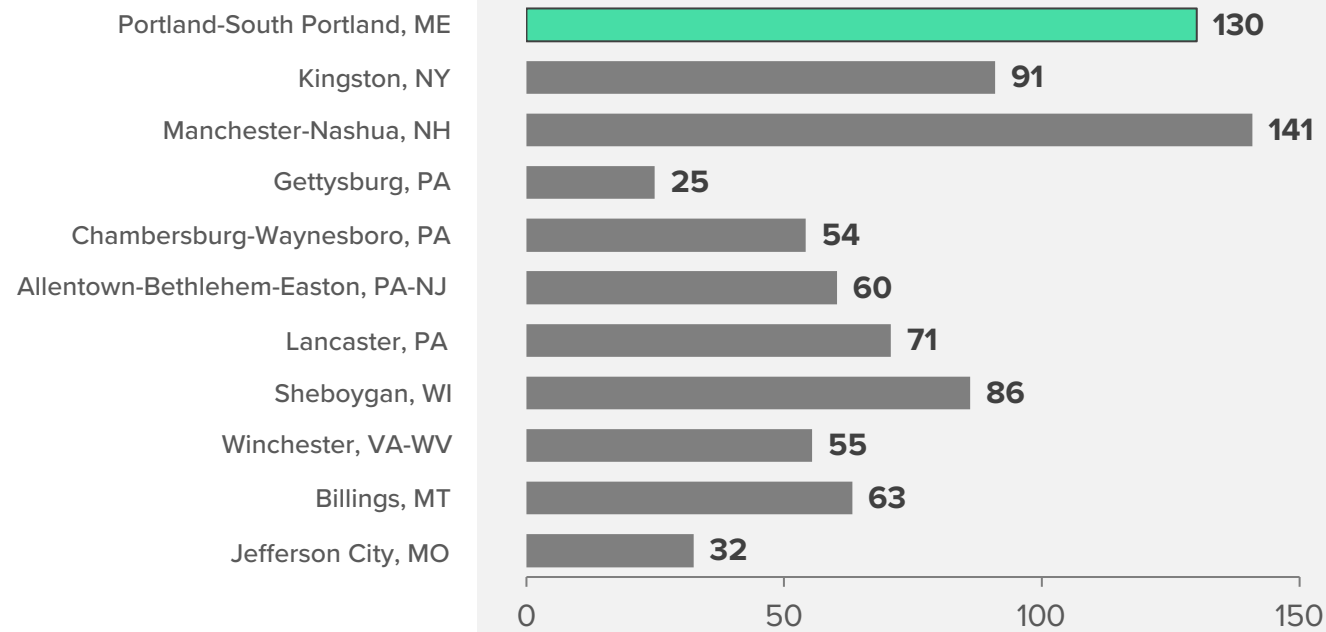


BEHAVIORAL HEALTH PROVIDERS PER 100K BHP MIDPOINT: 61

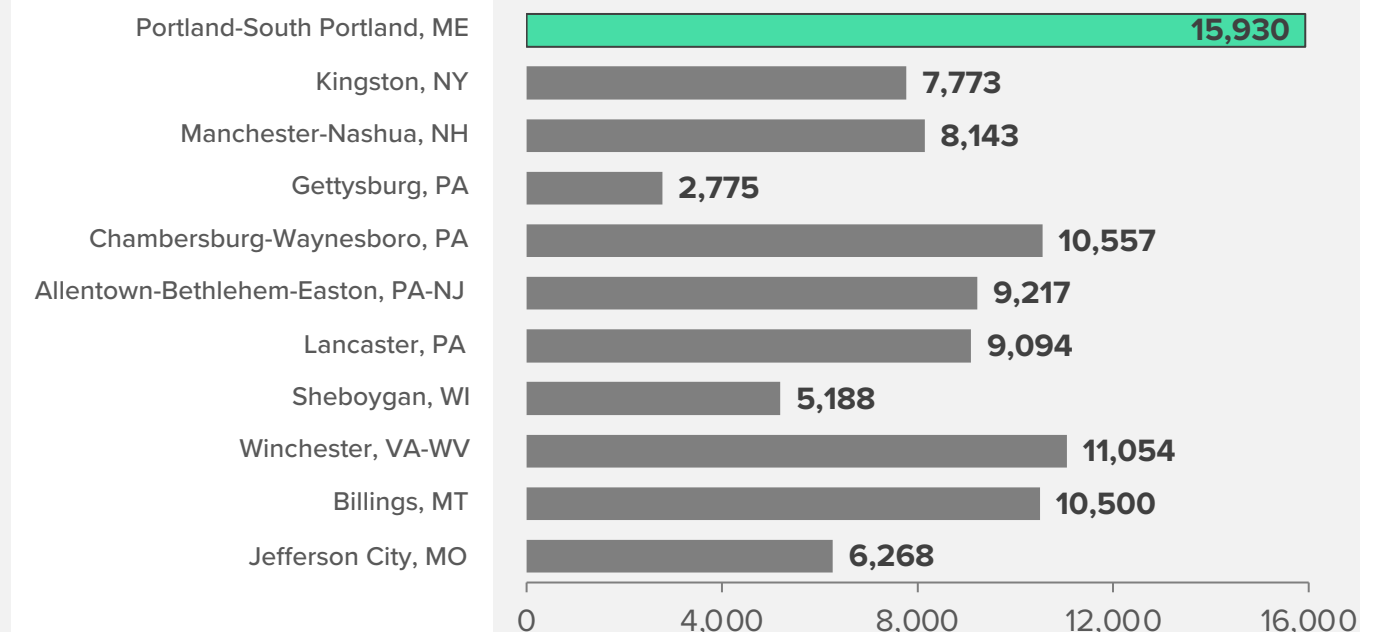
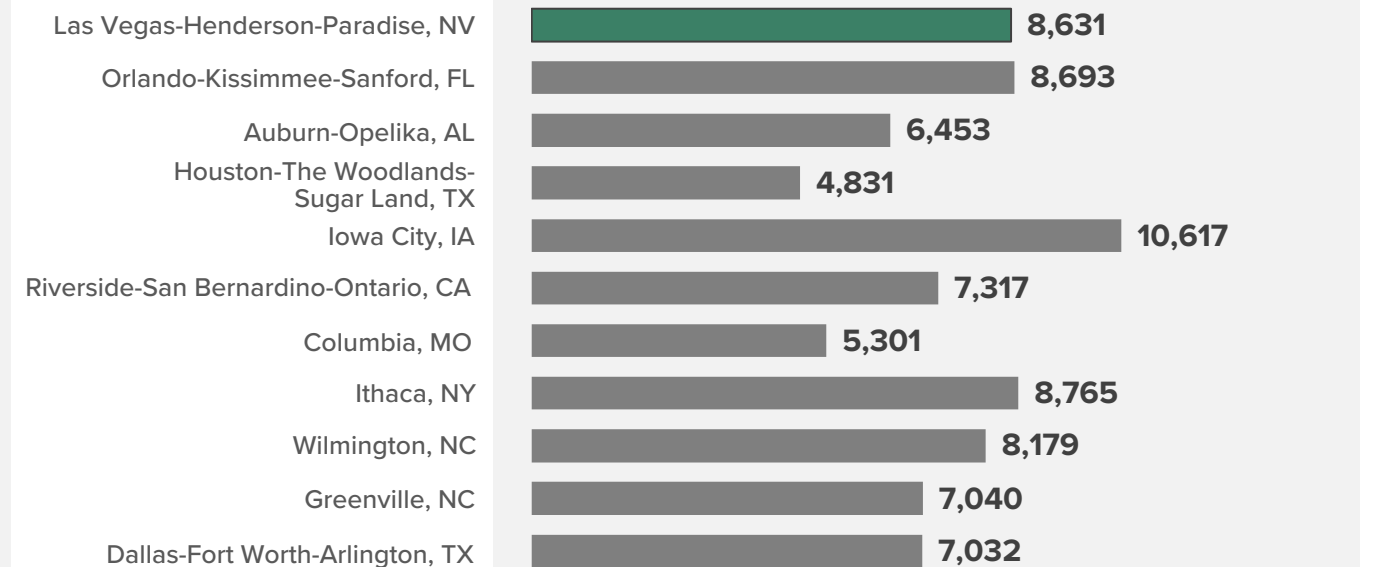
PRIMARY BENCHMARK



MEDIAN BENCHMARK



ANXIETY AND DEPRESSION PER 100K ANXIETY AND DEPRESSION MIDPOINT: 8,232



Source: Trilliant Health national all-payer claims database and provider directory.

Competitive Similarity

The DOJ and FTC generally consider markets in which the HHI is between 1,500 and 2,500 points to be moderately concentrated and consider markets in which the HHI is in excess of 2,500 points to be highly concentrated.

Benchmarking markets by level of concentration using inpatient surgical, outpatient surgical, and inpatient medical HHI.

■ **Most Competitive (349): New York-Newark-Jersey City, NY-NJ-PA**

■ **Highly Concentrated (3,670): Greeley, CO**



GROWTH
SIMILARITY



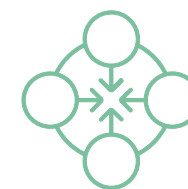
ECONOMIC
SIMILARITY



DEMOGRAPHIC
SIMILARITY



CONSUMER
SIMILARITY



COMPETITIVE
SIMILARITY



AGGREGATE
SIMILARITY

Competitive Similarity | Primary Benchmark

Los Angeles, CA is **most similar** to New York City based on the Competitive SimilarityIndex™.

TEN MOST SIMILAR METROPOLITAN MARKETS, BY COMPETITIVE SIMILARITYINDEX™

METROPOLITAN MARKET	RELATIVE PAYMENT FOR KNEE/HIP REPLACEMENT	RELATIVE PAYMENT FOR COLONOSCOPY	SIMILARITY SCORE
NEW YORK-NEWARK-JERSEY CITY, NY-NJ-PA	+11.3%	-22.8%	1
1 LOS ANGELES-LONG BEACH-ANAHEIM, CA	+19.8%	-7.1%	0.992
2 WASHINGTON-ARLINGTON-ALEXANDRIA, DC-VA-MD-WV	+7.8%	+52.1%	0.973
3 CHICAGO-NAPERVILLE-ELGIN, IL-IN-WI	-14.6%	-6.1%	0.973
4 RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	-22.0%	+49.6%	0.970
5 PHILADELPHIA-CAMDEN-WILMINGTON, PA-NJ-DE-MD	+3.4%	+59.0%	0.967
6 MIAMI-FORT LAUDERDALE-POMPANO BEACH, FL	+19.0%	+56.2%	0.947
7 PITTSBURGH, PA	-42.6%	-54.1%	0.919
8 PROVIDENCE-WARWICK, RI-MA	-38.8%	-9.6%	0.905
9 SEATTLE-TACOMA-BELLEVUE, WA	+0.1%	+11.4%	0.897
10 BALTIMORE-COLUMBIA-TOWSON, MD	Not available	Not available	0.889



COMPETITIVE SIMILARITYINDEX™ FEATURES

Inpatient Surgical Market Concentration | Outpatient Surgical Market Concentration | Inpatient Medical Market Concentration

Note: Commercial rates represent blended average rates of Inpatient procedures represented as a percent difference from the median blended commercial rate. The Competitive SimilarityIndex™ factors in Herfindahl–Hirschman Index (HHI), calculated individually for inpatient medical, inpatient surgical, and outpatient surgical (excluding integumentary, ocular, dermatology, pain management, and podiatry service lines). Data was sourced from Trilliant Health’s national all-payer claims database. HHI is a commonly accepted measure of market concentration calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. It approaches zero when a market is occupied by many firms of relatively equal size and reaches its maximum of 10,000 points when a market is controlled by a single firm. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. The first market selected to index against, New York-Newark-Jersey City, NY-NJ-PA, was chosen because of all metropolitan CBSAs, it had the lowest HHI value reflecting low market concentration and high market competition. The SimilarityEngine™ compared CBSAs with the selected Competitive SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (New York-Newark-Jersey City, NY-NJ-PA and Greeley, CO) were identified and compared.

Source: Trilliant Health national all-payer claims database; analysis of publicly reported hospital rate data.

Competitive Similarity | Median Benchmark

Gadsden, AL is **most similar** to Greeley, CO based on the Competitive SimilarityIndex™.

TEN MOST SIMILAR METROPOLITAN MARKETS, BY COMPETITIVE SIMILARITYINDEX™

METROPOLITAN MARKET	RELATIVE PAYMENT FOR KNEE/HIP REPLACEMENT	RELATIVE PAYMENT FOR COLONOSCOPY	SIMILARITY SCORE
GREELEY, CO	+126.9%	-40.5%	1
1 GADSDEN, AL	+13.2%	+44.5%	0.994
2 GRAND RAPIDS-KENTWOOD, MI	-11.3%	-16.2%	0.977
3 KENNEWICK-RICHLAND, WA	+54.2%	-6.7%	0.976
4 EAST STROUDSBURG, PA*	-36.9%	-30.1%	0.976
5 SHREVEPORT-BOSSIER CITY, LA	-12.5%	-12.8%	0.975
6 COLUMBUS, GA-AL	-48.5%	-34.4%	0.973
7 PUNTA GORDA, FL	-41.9%	+231.4%	0.973
8 SIOUX CITY, IA-NE-SD	-39.8%	-22.9%	0.972
9 ATLANTIC CITY-HAMMONTON, NJ	-31.4%	+18.0%	0.972
10 SPOKANE-SPOKANE VALLEY, WA	-9.0%	-36.6%	0.971



COMPETITIVE SIMILARITYINDEX™ FEATURES

Inpatient Surgical Market Concentration | Outpatient Surgical Market Concentration | Inpatient Medical Market Concentration

Note: Commercial rates represent blended average rates of Inpatient procedures represented as a percent difference from the median blended commercial rate. The Competitive SimilarityIndex™ factors in Herfindahl-Hirschman Index (HHI), calculated individually for inpatient medical, inpatient surgical, and outpatient surgical (excluding integumentary, ocular, dermatology, pain management, and podiatry service lines). Data was sourced from Trilliant Health's national all-payer claims database. HHI is a commonly accepted measure of market concentration calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. It approaches zero when a market is occupied by many firms of relatively equal size and reaches its maximum of 10,000 points when a market is controlled by a single firm. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. The second market selected to index against, Greeley, CO, was chosen because of all metropolitan CBSAs, it had the median HHI value. The SimilarityEngine™ compared CBSAs with the selected Competitive SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (New York-Newark-Jersey City, NY-NJ-PA and Greeley, CO) were identified and compared. *East Stroudsburg rates include Allentown-Bethlehem-Easton, PA-NJ to comply with the Sherman Antitrust Act.

Source: Trilliant Health national all-payer claims database; analysis of publicly reported hospital rate data.

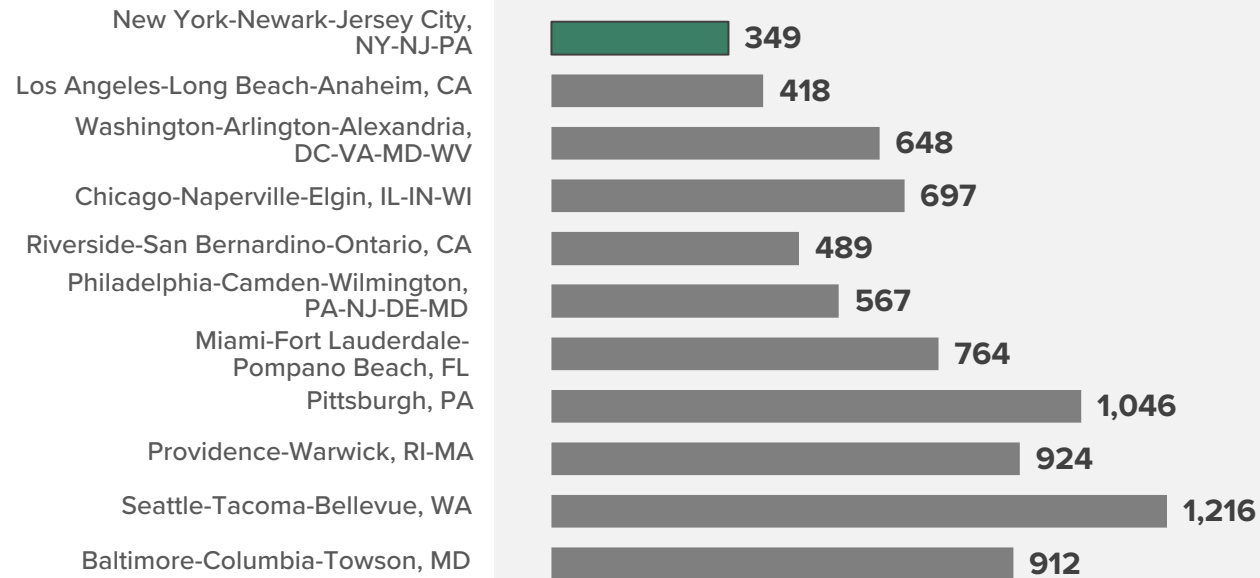
Competitive Similarity | Surgery

While New York City and Seattle, WA are competitively similar, surgical demand CAGR is 1.2 percentage points less in NYC. This difference is meaningful over time with a projected 21% increase in Seattle versus 9% in NYC between 2021 and 2030.

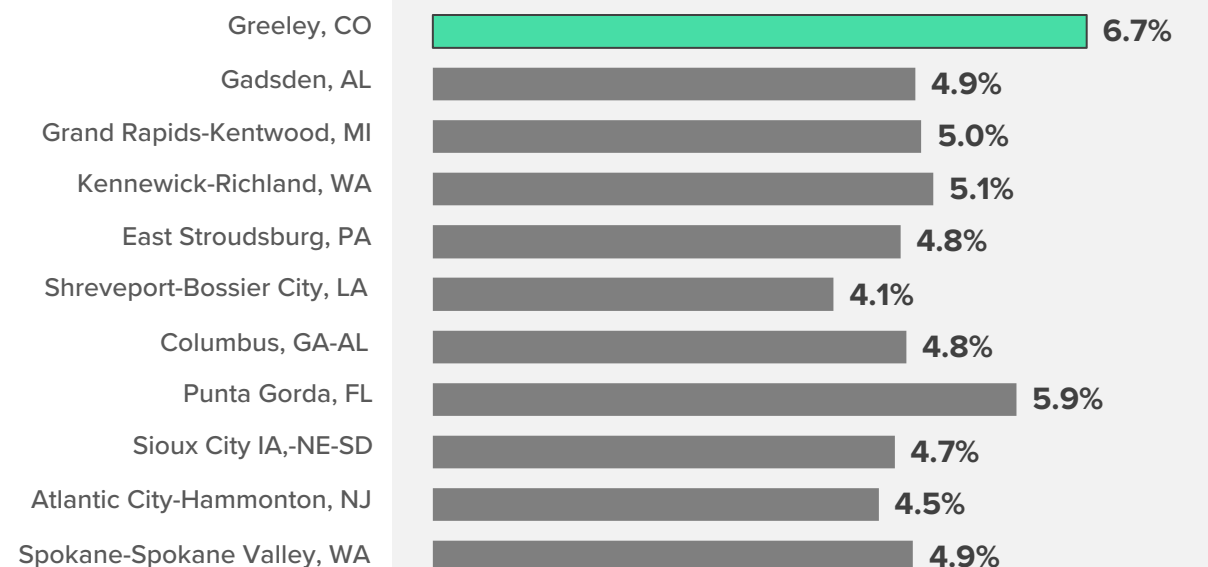
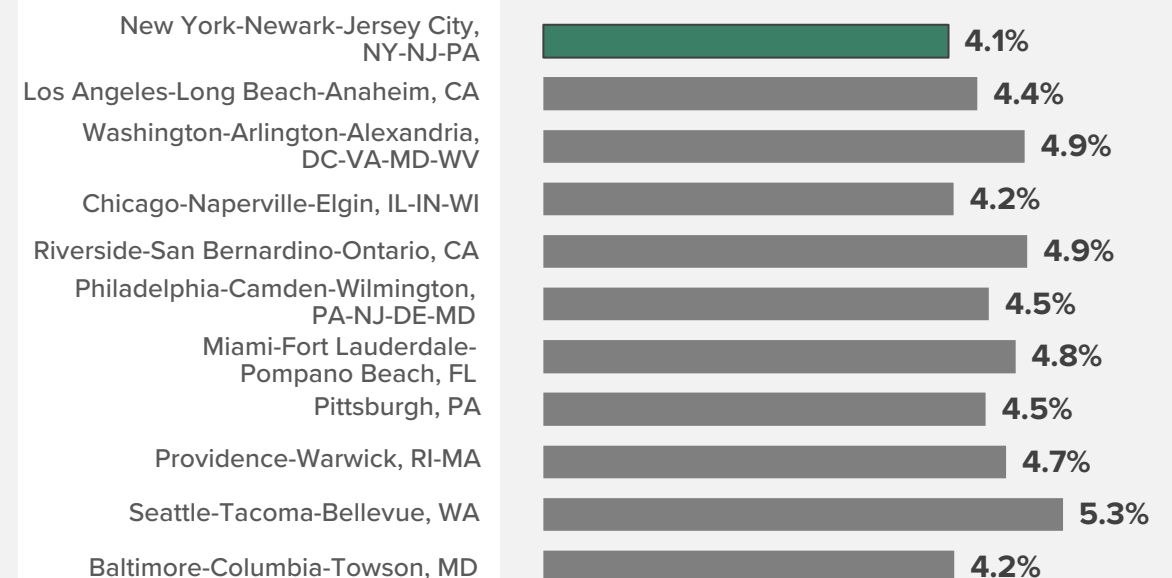
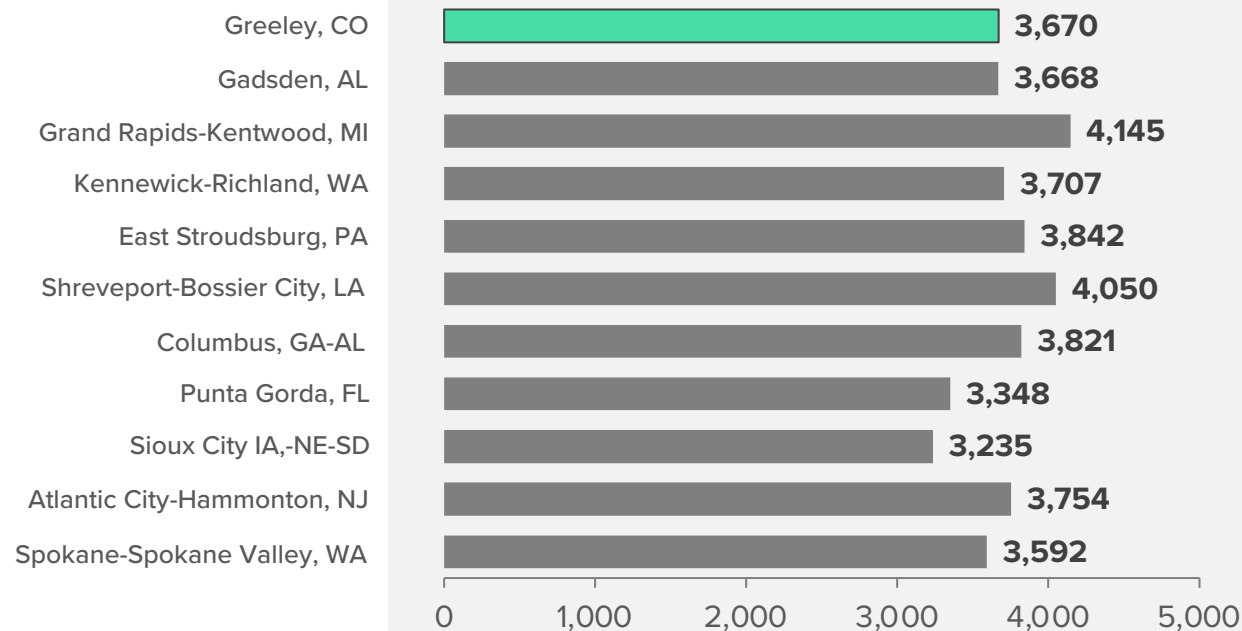
+ **SURGICAL CONCENTRATION (HHI)**
SURGICAL CONCENTRATION MIDPOINT: 3,677

↘ **2021-2030 SURGICAL DEMAND (CAGR)**
SURGICAL DEMAND CAGR MIDPOINT: 4.9%

PRIMARY BENCHMARK



MEDIAN BENCHMARK



Note: A surgical concentration value below 1,500 indicates a competitive market; between 1,500 and 2,500 indicates a moderately concentrated market, whereas a value greater than 2,500 indicates a highly concentrated market. CAGR indicates compound annual growth rate.

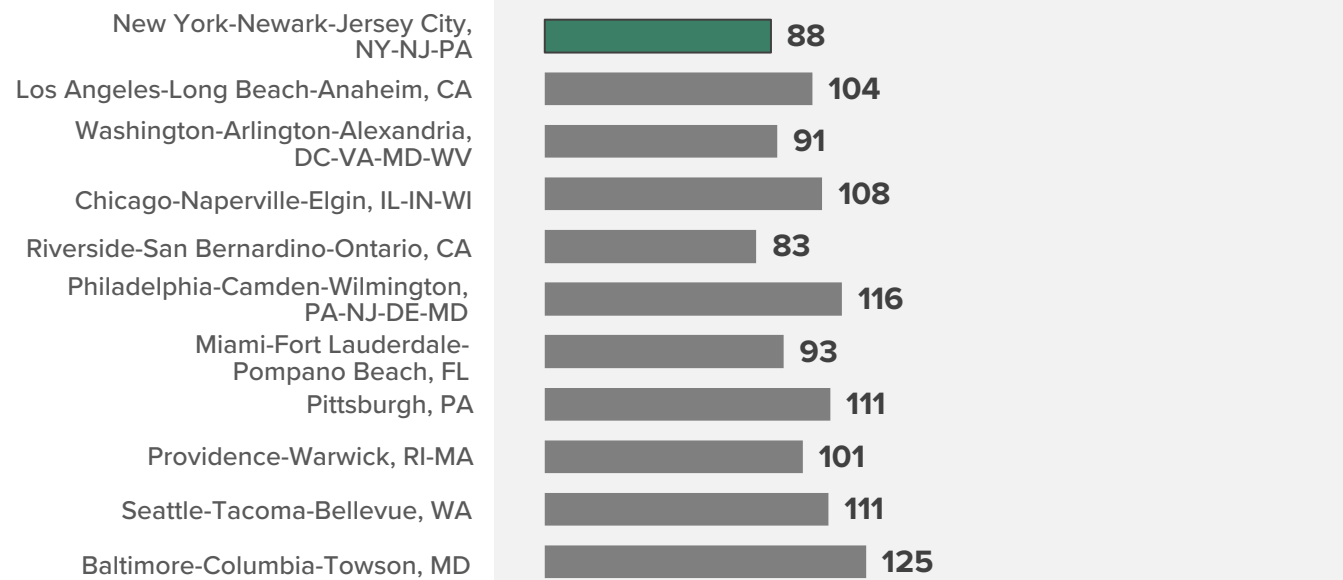
Source: Trilliant Health national all-payer claims database and proprietary demand forecast model.

Competitive Similarity | Primary Care

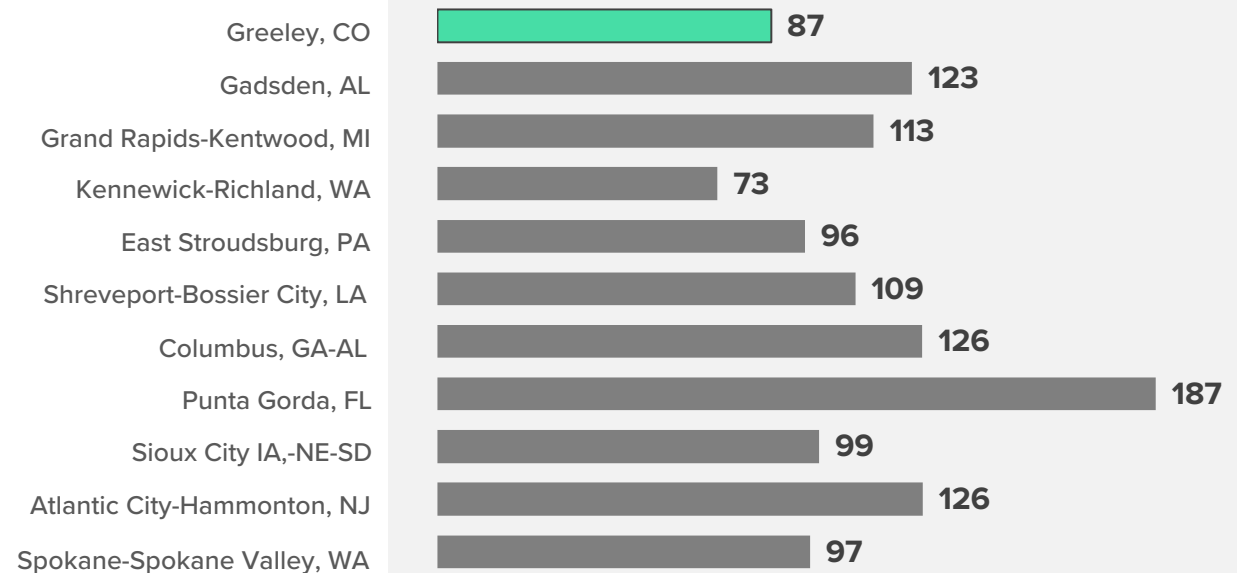
While Shreveport, LA and Greeley, CO are competitively similar, the rate of diabetes per 100K population in Shreveport is 3.5X higher than in Greeley.

+ PRIMARY CARE PROVIDERS PER 100K PCP MIDPOINT: 110

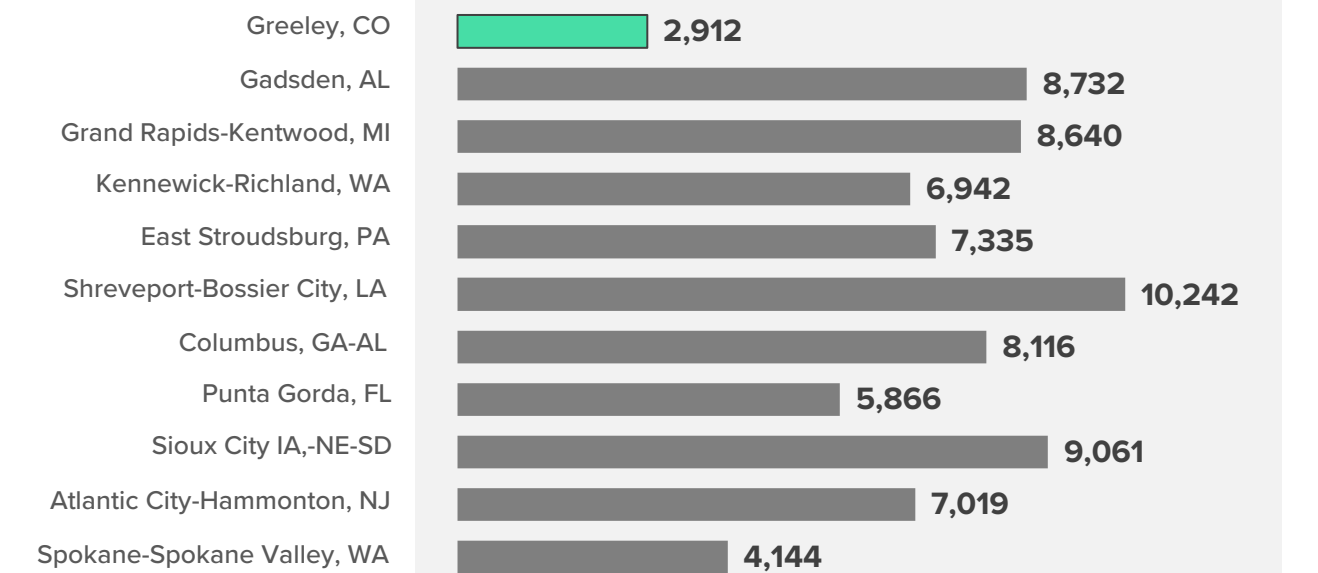
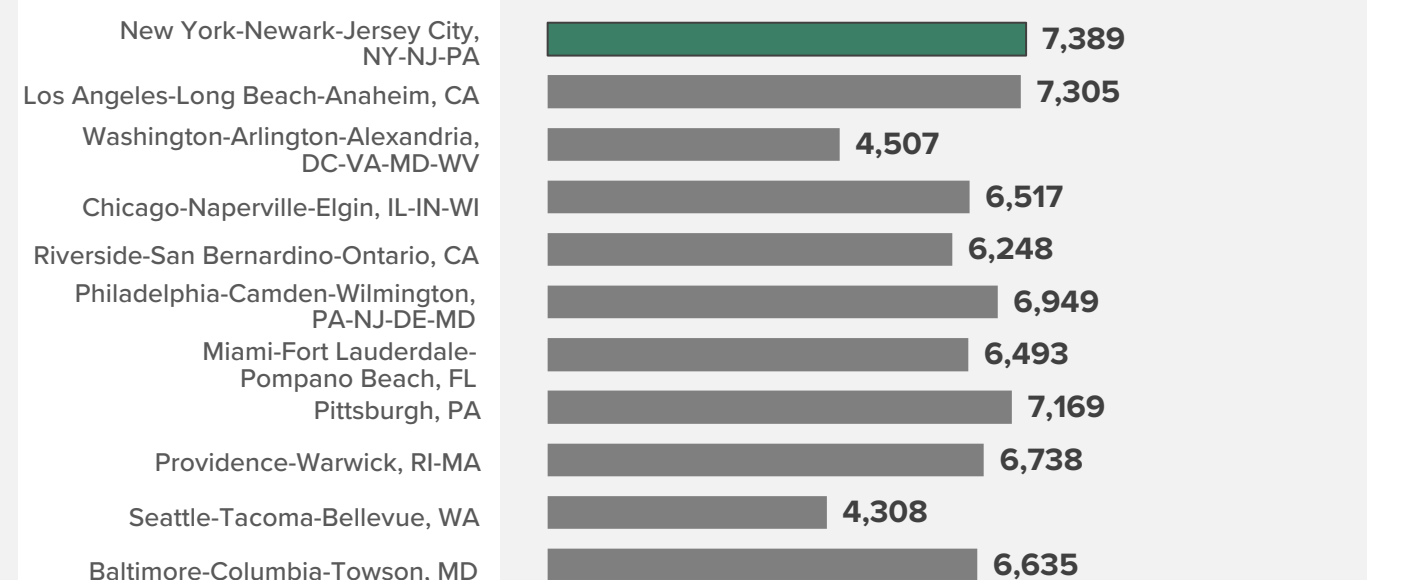
PRIMARY BENCHMARK



MEDIAN BENCHMARK



DIABETES PER 100K DIABETES MIDPOINT: 7,087



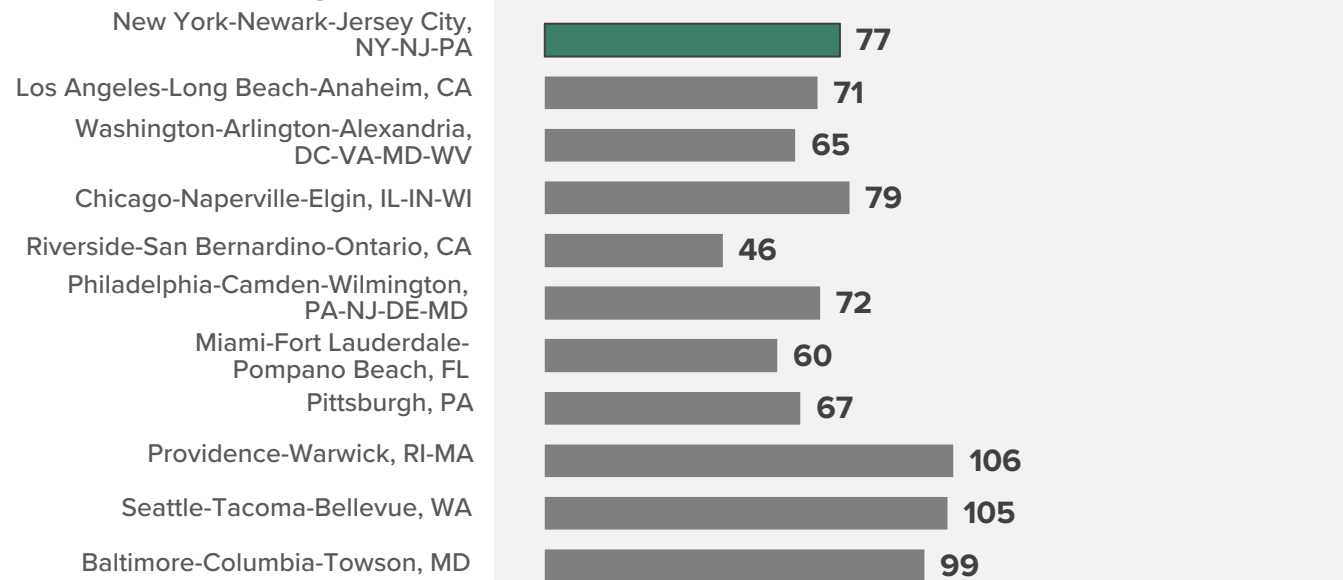
Source: Trilliant Health national all-payer claims database and provider directory.

Competitive Similarity | Behavioral Health

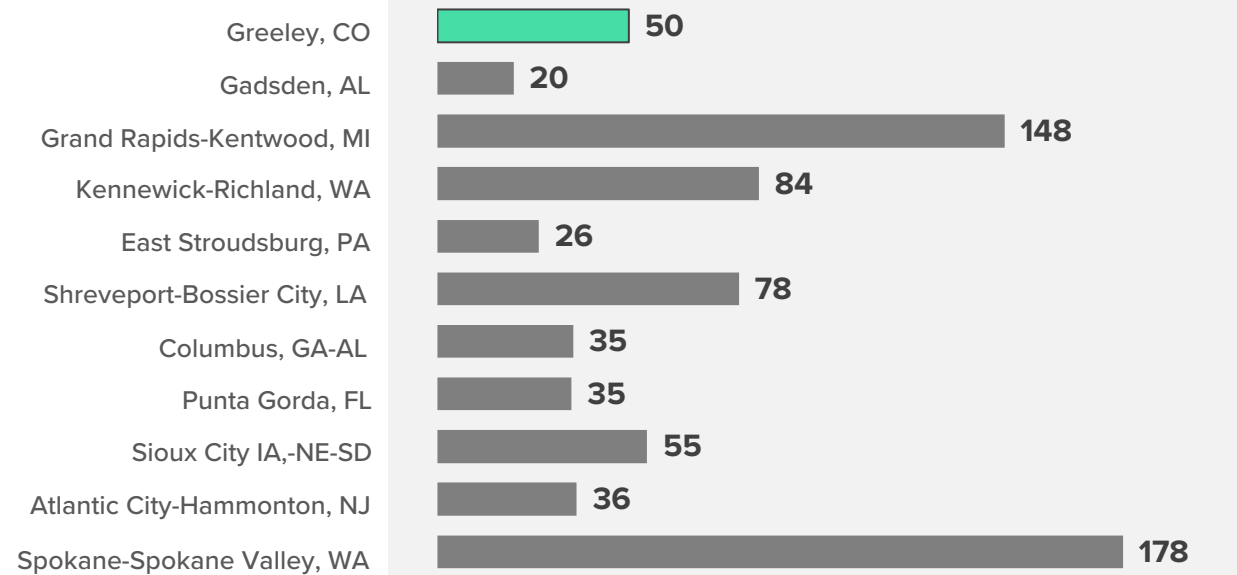
Although New York City and Riverside, CA are competitively similar, the supply of behavioral health providers per 100K population is more than 40% lower in Riverside than in NYC.

+ BEHAVIORAL HEALTH PROVIDERS PER 100K BHP MIDPOINT: 61

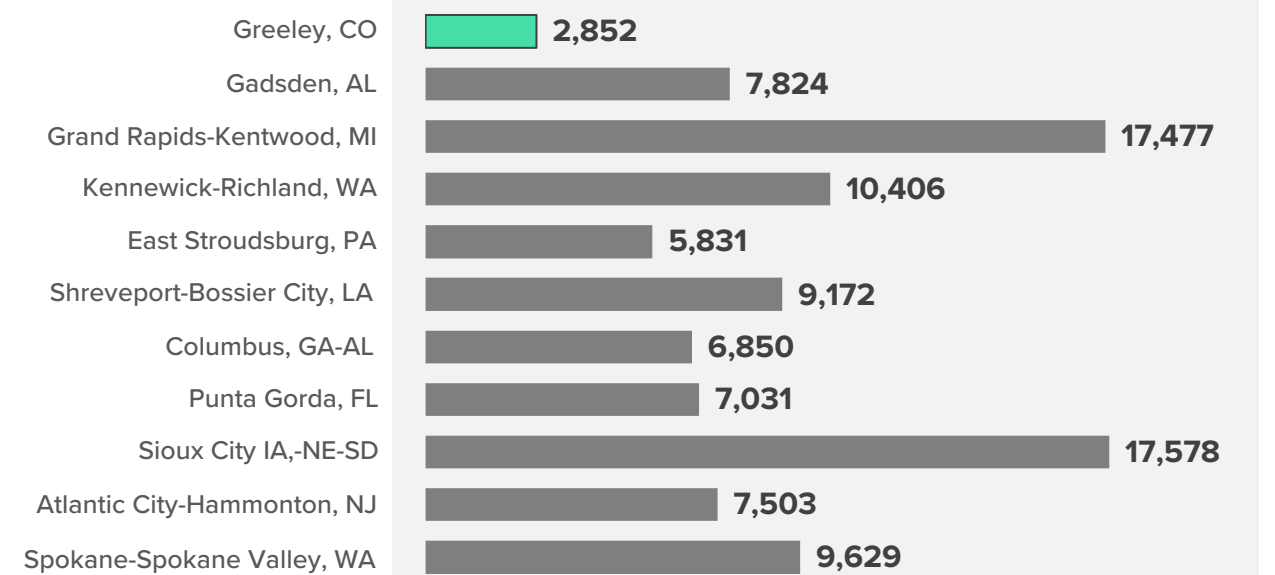
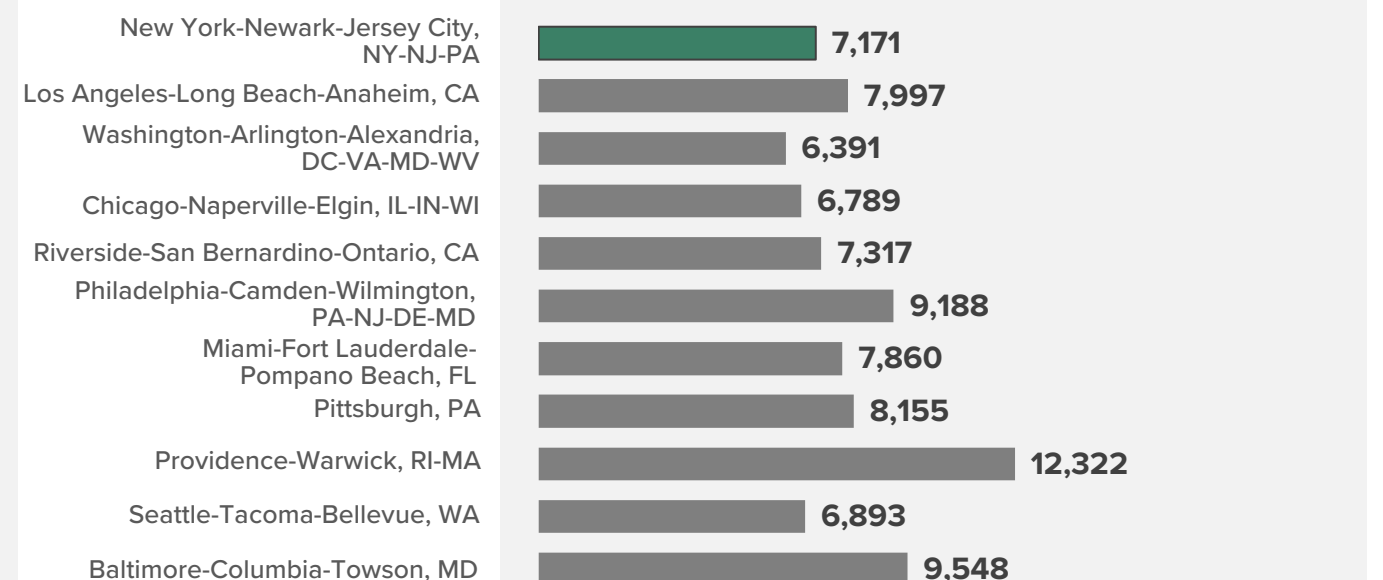
PRIMARY BENCHMARK



MEDIAN BENCHMARK



↘ ANXIETY AND DEPRESSION PER 100K ANXIETY AND DEPRESSION MIDPOINT: 8,232



Source: Trilliant Health national all-payer claims database and provider directory.

Aggregate Similarity

Benchmarking the previously identified primary markets in aggregate:

- **Growth:** Austin-Round Rock-Georgetown, TX
- **Economic:** San Jose-Sunnyvale-Santa Clara, CA
- **Demographic:** Washington-Alexandria-Arlington, DC-MD-VA
- **Consumer:** Las Vegas-Henderson-Paradise, NV
- **Competitive:** New York-Newark-Jersey City, NY-NJ-PA



GROWTH
SIMILARITY



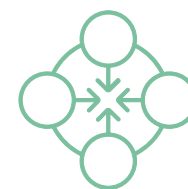
ECONOMIC
SIMILARITY



DEMOGRAPHIC
SIMILARITY



CONSUMER
SIMILARITY



COMPETITIVE
SIMILARITY



AGGREGATE
SIMILARITY

Aggregate Similarity | Growth Benchmark

Raleigh-Cary, NC and Fayetteville, AR are the only markets that are similar to Austin based on the Growth SimilarityIndex™ and the Aggregate SimilarityIndex™.

BENCHMARK MARKET: AUSTIN-ROUND ROCK-GEORGETOWN, TX

TEN MOST SIMILAR METROPOLITAN MARKETS,
BY **GROWTH** SIMILARITYINDEX™

1	RALEIGH-CARY, NC
2	COEUR D'ALENE, ID
3	ST. GEORGE, UT
4	PROVO-OREM, UT
5	BOISE CITY, ID
6	BEND, OR
7	FARGO, ND-MN
8	FAYETTEVILLE-SPRINGDALE-ROGERS, AR
9	ORLANDO-KISSIMMEE-SANFORD, FL
10	SIOUX FALLS, SD

TEN MOST SIMILAR METROPOLITAN MARKETS,
BY **AGGREGATE** SIMILARITYINDEX™

1	DALLAS-FORT WORTH-ARLINGTON, TX
2	RALEIGH-CARY, NC
3	HOUSTON-THE WOODLANDS-SUGAR LAND, TX
4	DENVER-AURORA-LAKEWOOD, CO
5	DES MOINES-WEST DES MOINES, IA
6	FAYETTEVILLE-SPRINGDALE-ROGERS, AR
7	SEATTLE-TACOMA-BELLEVUE, WA
8	NASHVILLE-DAVIDSON-MURFREESBORO-FRANKLIN, TN
9	SALT LAKE CITY, UT
10	ANCHORAGE, AK

Source: Trilliant Health's national consumer and all-payer claims databases; U.S Census Bureau; National Vital Statistics System.

Aggregate Similarity | Economic Benchmark

Five markets, four of which are in California, are similar to San Jose based on the Economic Similarity Index™ and the Aggregate Similarity Index™.

BENCHMARK MARKET: SAN JOSE-SUNNYVALE-SANTA CLARA, CA

TEN MOST SIMILAR METROPOLITAN MARKETS,
BY **ECONOMIC** SIMILARITY INDEX™

1	SAN FRANCISCO-OAKLAND-BERKELEY, CA
2	SANTA CRUZ-WATSONVILLE, CA
3	URBAN HONOLULU, HI
4	SANTA MARIA-SANTA BARBARA, CA
5	NAPA, CA
6	NAPLES-MARCO ISLAND, FL
7	BOULDER, CO
8	SAN LUIS OBISPO-PASO ROBLES, CA
9	SANTA ROSA-PETALUMA, CA
10	LOS ANGELES-LONG BEACH-ANAHEIM, CA

TEN MOST SIMILAR METROPOLITAN MARKETS,
BY **AGGREGATE** SIMILARITY INDEX™

1	SAN FRANCISCO-OAKLAND-HAYWARD, CA
2	SAN DIEGO-CARLSBAD, CA
3	WASHINGTON-ARLINGTON-ALEXANDRIA, DC-VA-MD-WV
4	SEATTLE-TACOMA-BELLEVUE, WA
5	NEW YORK-NEWARK-JERSEY CITY, NY-NJ-PA
6	OXNARD-THOUSAND OAKS-VENTURA, CA
7	SANTA CRUZ-WATSONVILLE, CA
8	LOS ANGELES-LONG BEACH-ANAHEIM, CA
9	NAPA, CA
10	BOULDER, CO

Aggregate Similarity | Demographic Benchmark

Five markets are similar to Washington, D.C. based on the Demographic SimilarityIndex™ and the Aggregate SimilarityIndex™.

BENCHMARK MARKET: WASHINGTON-ARLINGTON-ALEXANDRIA, DC-MD-VA

TEN MOST SIMILAR METROPOLITAN MARKETS,
BY **DEMOGRAPHIC** SIMILARITYINDEX™

1	CHICAGO-NAPERVILLE-ELGIN, IL-IN-WI
2	SEATTLE-TACOMA-BELLEVUE, WA
3	SAN DIEGO-CHULA VISTA-CARLSBAD, CA
4	COLUMBUS, OH
5	TRENTON-PRINCETON, NJ
6	DALLAS-FORT WORTH-ARLINGTON, TX
7	OMAHA-COUNCIL BLUFFS, NE-IA
8	AUSTIN-ROUND ROCK-GEORGETOWN, TX
9	WORCESTER, MA-CT
10	ATLANTA-SANDY SPRINGS-ALPHARETTA, GA

TEN MOST SIMILAR METROPOLITAN MARKETS,
BY **AGGREGATE** SIMILARITYINDEX™

1	SEATTLE-TACOMA-BELLEVUE, WA
2	BALTIMORE-COLUMBIA-TOWSON, MD
3	NEW YORK-NEWARK-JERSEY CITY, NY-NJ-PA
4	SAN DIEGO-CHULA VISTA-CARLSBAD, CA
5	OXNARD-THOUSAND OAKS-VENTURA, CA
6	AUSTIN-ROUND ROCK-GEORGETOWN, TX
7	DENVER-AURORA-LAKEWOOD, CO
8	PHILADELPHIA-CAMDEN-WILMINGTON, PA-NJ-DE-MD
9	ATLANTA-SANDY SPRINGS-ALPHARETTA, GA
10	DALLAS-FORT WORTH-ARLINGTON, TX

Aggregate Similarity | Consumer Benchmark

Only Orlando, Riverside and Houston are similar to Las Vegas based on the Consumer SimilarityIndex™ and the Aggregate SimilarityIndex™.

BENCHMARK MARKET: LAS VEGAS-HENDERSON-PARADISE, NV

TEN MOST SIMILAR METROPOLITAN MARKETS,
BY **CONSUMER** SIMILARITYINDEX™

1	ORLANDO-KISSIMMEE-SANFORD, FL
2	AUBURN-OPELIKA, AL
3	HOUSTON-THE WOODLANDS-SUGAR LAND, TX
4	IOWA CITY, IA
5	RIVERSIDE-SAN BERNARDINO-ONTARIO, CA
6	COLUMBIA, MO
7	ITHACA, NY
8	WILMINGTON, NC
9	GREENVILLE, NC
10	DALLAS-FORT WORTH-ARLINGTON, TX

TEN MOST SIMILAR METROPOLITAN MARKETS,
BY **AGGREGATE** SIMILARITYINDEX™

1	ORLANDO-KISSIMMEE-SANFORD, FL
2	RIVERSIDE-SAN BERNARDINO-ONTARIO, CA
3	PHOENIX-MESA-SCOTTSDALE, AZ
4	COLORADO SPRINGS, CO
5	HOUSTON-THE WOODLANDS-SUGAR LAND, TX
6	RENO, NV
7	OKLAHOMA CITY, OK
8	SAN ANTONIO-NEW BRAUNFELS, TX
9	DURHAM-CHAPEL HILL, NC
10	MIAMI-FORT LAUDERDALE-WEST PALM BEACH, FL

Aggregate Similarity | Competitive Benchmark

The three largest CBSAs in the country (NYC, Los Angeles, Chicago) are similar based on the Competitive SimilarityIndex™ and the Aggregate SimilarityIndex™.

BENCHMARK MARKET: NEW YORK-NEWARK-JERSEY CITY, NY-NJ-PA

TEN MOST SIMILAR METROPOLITAN MARKETS, BY **COMPETITIVE** SIMILARITYINDEX™

1	LOS ANGELES-LONG BEACH-ANAHEIM, CA
2	WASHINGTON-ARLINGTON-ALEXANDRIA, DC-VA-MD-WV
3	CHICAGO-NAPERVILLE-ELGIN, IL-IN-WI
4	RIVERSIDE-SAN BERNARDINO-ONTARIO, CA
5	PHILADELPHIA-CAMDEN-WILMINGTON, PA-NJ-DE-MD
6	MIAMI-FORT LAUDERDALE-POMPANO BEACH, FL
7	PITTSBURGH, PA
8	PROVIDENCE-WARWICK, RI-MA
9	SEATTLE-TACOMA-BELLEVUE, WA
10	BALTIMORE-COLUMBIA-TOWSON, MD

TEN MOST SIMILAR METROPOLITAN MARKETS, BY **AGGREGATE** SIMILARITYINDEX™

1	SAN DIEGO-CARLSBAD, CA
2	CHICAGO-NAPERVILLE-ELGIN, IL-IN-WI
3	TRENTON, NJ
4	OXNARD-THOUSAND OAKS-VENTURA, CA
5	LOS ANGELES-LONG BEACH-ANAHEIM, CA
6	SEATTLE-TACOMA-BELLEVUE, WA
7	PHILADELPHIA-CAMDEN-WILMINGTON, PA-NJ-DE-MD
8	SAN FRANCISCO-OAKLAND-HAYWARD, CA
9	WASHINGTON-ARLINGTON-ALEXANDRIA, DC-VA-MD-WV
10	MINNEAPOLIS-ST. PAUL-BLOOMINGTON, MN-WI

Conclusion

Conclusion | Aggregate Similarity ≠ Categorical Similarity

Depending on the SimilarityIndex™, Nashville is similar to Kansas City, and *not* similar to Austin, TX, as is commonly cited.

BENCHMARK MARKET: NASHVILLE-DAVIDSON-MURFREESBORO-FRANKLIN, TN

TEN MOST SIMILAR METROPOLITAN MARKETS TO NASHVILLE BY:

GROWTH SIMILARITY	ECONOMIC SIMILARITY	DEMOGRAPHIC SIMILARITY	CONSUMER SIMILARITY	COMPETITIVE SIMILARITY	AGGREGATE SIMILARITY
KENNEWICK-RICHLAND, WA	DALLAS-FORT WORTH-ARLINGTON, TX	INDIANAPOLIS-CARMEL-ANDERSON, IN	KANSAS CITY, MO-KS	NORTH PORT-SARASOTA-BRADENTON, FL	KANSAS CITY, MO-KS
MIDLAND, TX	HOUSTON-THE WOODLANDS-SUGAR LAND, TX	KANSAS CITY, MO-KS	BATON ROUGE, LA	ORLANDO-KISSIMMEE-SANFORD, FL	OMAHA-COUNCIL BLUFFS, NE-IA
CHARLOTTE-CONCORD-GASTONIA, NC-SC	MIDLAND, TX	BALTIMORE-COLUMBIA-TOWSON, MD	PORTLAND-VANCOUVER-HILLSBORO, OR-WA	PORTLAND-VANCOUVER-HILLSBORO, OR-WA	CHARLESTON-NORTH CHARLESTON, SC
DENVER-AURORA-LAKEWOOD, CO	CINCINNATI, OH-KY-IN	ST. LOUIS, MO-IL	TULSA, OK	EL PASO, TX	INDIANAPOLIS-CARMEL-ANDERSON, IN
COLLEGE STATION-BRYAN, TX	CHARLOTTE-CONCORD-GASTONIA, NC-SC	RICHMOND, VA	CHARLESTON-NORTH CHARLESTON, SC	MEMPHIS, TN-MS-AR	OKLAHOMA CITY, OK
DALLAS-FORT WORTH-ARLINGTON, TX	PROVIDENCE-WARWICK, RI-MA	UNITED STATES OF AMERICA	CINCINNATI, OH-KY-IN	MONROE, LA	ATLANTA-SANDY SPRINGS-ROSWELL, GA
DES MOINES-WEST DES MOINES, IA	KANSAS CITY, MO-KS	HAGERSTOWN-MARTINSBURG, MD-WV	JACKSONVILLE, FL	WICHITA, KS	CINCINNATI, OH-KY-IN
CHARLESTON-NORTH CHARLESTON, SC	LEXINGTON-FAYETTE, KY	ATLANTA-SANDY SPRINGS-ROSWELL, GA	ATLANTA-SANDY SPRINGS-ROSWELL, GA	HICKORY-LENOIR-MORGANTON, NC	SIoux FALLS, SD
FAYETTEVILLE-SPRINGDALE-ROGERS, AR-MO	NEW ORLEANS-METAIRIE, LA	CHATTANOOGA, TN-GA	SAVANNAH, GA	DENVER-AURORA-LAKEWOOD, CO	BOISE CITY, ID
RENO, NV	RALEIGH-CARY, NC	KNOXVILLE, TN	IOWA CITY, IA	LAS VEGAS-HENDERSON-PARADISE, NV	RICHMOND, VA

Note: Nashville was selected as a benchmark as an illustrative example given: (1) it is a market that was not featured in earlier sections; and (2) of interest to the authors of this Report as the location of Trilliant Health's headquarters. Source: Trilliant Health's national consumer and all-payer claims databases; U.S Census Bureau; National Vital Statistics System.

Conclusion | SimilarityIndex™ → Informed Decision Making

While there is value in learning from perceived peers like Mayo Clinic or Intermountain, **benchmarking for the purposes of effective decision making requires a more algorithmic approach.**

Healthcare is inherently local, and therefore a *complete* understanding of a market across a multitude of factors, including provider supply, population demographics, consumer attributes, competitive dynamics, and incidence of disease, is essential for meeting the care needs and preferences of individual patient populations.

While resources such as the Dartmouth Atlas of Health Care have attempted to highlight local variation through specific data points, the health economy has struggled to meaningfully incorporate these data into their strategies (let alone evaluate their effectiveness).

Most health economy stakeholders, from large health systems to pharmaceutical manufacturers, operate in several markets, often in disparate geographic areas. Therefore, distinguishing between similarity and dissimilarity on any number of factors is necessary, if challenging, and requires a new mindset and a modern analytic approach.

Machine learning and similarity modeling enable healthcare stakeholders to identify similar markets and *true peers* accurately, thus guiding informed decision making. How will your strategy change knowing that the current market you are benchmarking against is more dissimilar to your own than originally thought? Will this help your organization identify why certain markets in your portfolio are performing better than others? Identify partnership opportunities? How to address health disparities? Where to prioritize public health resources? How to design value-based networks?

While this Report discusses how the SimilarityEngine™ can influence decisions at the MARKET level, it also has implications for how we compare and characterize facilities, physicians, and patients (applications we will explore in future research).

Improving U.S. healthcare outcomes and affordability requires an exponentially better approach to decision making. Now is the time to modernize benchmarking, the foundation for developing evidence-based strategies.

Methodology

Methodology | SimilarityIndex™ Categories

Sources and methods used to index selected markets.

The **Growth SimilarityIndex™** factors in five-year projected population growth between 2019 and 2024 at the CBSA level, sourced from Trilliant Health's access to geographic data from Esri, and excess mortality per capita in 2020 and 2021, sourced from National Vital Statistics System. The first market selected to index against, Austin-Round Rock-Georgetown, TX, was chosen because, of all metropolitan CBSAs, its population grew the fastest between 2010 and 2020 according to the U.S. Census Bureau. The second market selected to index against, Tallahassee, FL, was chosen, because of all metropolitan CBSAs, it saw median population compound annual growth between 2010 and 2020 according to the U.S. Census Bureau. The SimilarityEngine™ compared CBSAs with the selected Growth SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (Austin-Round Rock-Georgetown, TX and Tallahassee, FL) were identified and compared.

The **Economic SimilarityIndex™** factors in estimated household income, debt amounts, average home value, and discretionary income amount at the CBSA level, sourced from Trilliant Health's national consumer database. The first market selected to index against, San Jose-Sunnyvale-Santa Clara, CA, was chosen because, of all metropolitan CBSAs, the CAGR of per capita personal income was highest between 2010 and 2020 according to the U.S. Bureau of Economic Analysis. The second market selected to index against, Auburn-Opelika, AL, was chosen because, of all metropolitan CBSAs, it saw median CAGR of per capita personal income between 2010 and 2020 according to the U.S. Bureau of Economic Analysis. The SimilarityEngine™ compared CBSAs with the selected Economic SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (San Jose-Sunnyvale-Santa Clara, CA and Auburn-Opelika, AL) were identified and compared.

The **Demographic SimilarityIndex™** factors in 2021 health insurance (commercial, Medicare, Medicaid) distribution, age and sex, generation (e.g., Millennials), uninsured estimates, race and ethnicity, and English speakers at the CBSA level, sourced from Trilliant Health's national consumer and all-payer claims databases. The first market selected to index against, Washington-Alexandria-Arlington, DC-VA-MD, was chosen because, of all metropolitan CBSAs, its 2020 population was comprised of at least 30% minority groups according to the U.S. Census Bureau. The second market selected to index against, Minneapolis-St. Paul-Bloomington MN-WI, was chosen because, of all metropolitan CBSAs, its 2020 population was comprised of at least 15% minority groups according to the U.S. Census Bureau. The SimilarityEngine™ compared CBSAs with the selected Demographic SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (Washington-Alexandria-Arlington, DC-VA-MD and Minneapolis-St. Paul-Bloomington MN-WI) were identified and compared.

Note: The Villages, FL was omitted from the analysis due to the unique nature of its population growth and composition, specifically a 98% non-Hispanic White and 84.2% 65+ population. While its population grew faster than Austin-Round Rock-Georgetown, TX during the same time period, it was omitted.

Methodology | SimilarityIndex™ Categories, cont.

Sources and methods used to index selected markets.

The **Consumer SimilarityIndex™** factors in psychographics (see Appendix B), the likelihood to use a wearable (see Appendix C), prescription drug adherence (See Appendix C), and the average number of prescription drugs per individual at the CBSA level, sourced from Trilliant Health’s national consumer database. The first market selected to index against, Las Vegas-Henderson-Paradise NV, was chosen because, of all metropolitan CBSAs, it had the lowest healthcare provider loyalty value (44%), as calculated with Trilliant Health’s national all-payer claims database. The second market selected to index against, Portland-South Portland, ME, was chosen because it has a median provider loyalty value (65%), as calculated with Trilliant Health’s national all-payer claims database. Provider loyalty in a market is determined by the proportion of patients considered to be loyal to a provider entity. This is calculated for patients with at least four medical encounters and measures the proportion of visits with each individual provider from which they have received care. Patients with more than 70% of care attributed to a particular provider entity are considered loyal; those with 30%-70% attributed to one provider entity are considered splitters; and those with less than 30% of care attributed to a provider entity are considered not loyal. The SimilarityEngine™ compared CBSAs with the selected Consumer SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (Las Vegas-Henderson-Paradise NV and Portland-South Portland, ME) were identified and compared.

The **Competitive SimilarityIndex™** factors in Herfindahl–Hirschman Index (HHI), calculated individually for inpatient medical, inpatient surgical, and outpatient surgical (excluding integumentary, ocular, dermatology, pain management, and podiatry service lines). Data was sourced from Trilliant Health’s national all-payer claims database. HHI is a commonly accepted measure of market concentration calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. It approaches zero when a market is occupied by many firms of relatively equal size and reaches its maximum of 10,000 points when a market is controlled by a single firm. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. The first market selected to index against, New York-Newark-Jersey City, NY-NJ-PA, was chosen because of all metropolitan CBSAs, it had the lowest HHI value reflecting low market concentration and high market competition. The second market selected to index against, Greeley, CO, was chosen because of all metropolitan CBSAs, it had the median HHI value. The SimilarityEngine™ compared CBSAs with the selected Competitive SimilarityIndex™ features, and the ten metropolitan CBSAs with the closest Similarity Scores to the benchmarks (New York-Newark-Jersey City, NY-NJ-PA and Greeley, CO) were identified and compared.



Methodology | Healthcare Metrics

Sources and methods for the six healthcare supply and demand metrics.

Surgical concentration applies the construct and calculation for HHI (See SimilarityIndex™ Categories Methodology) to both inpatient and outpatient surgical market share, excluding those in integumentary, ocular, dermatology, pain management, and podiatry service lines. Using Trilliant Health's national all-payer claims database, HHI was calculated to determine inpatient and outpatient surgical and inpatient medical market share, inclusive of all pay types (Medicare, Medicaid, commercial).

The **10-year surgical demand projections** were calculated using Trilliant Health's proprietary demand forecast model, inclusive of all pay types (Medicare, Medicaid, commercial). As a proxy for demand, we limited our modeling analysis to the most common surgical service lines (Digestive System, Endocrine System, Eye/Ocular, Heart/Vascular, Hemic/Lymphatic, Neuro/Spine, Orthopedic, Respiratory, Urinary, OB/GYN) given the contributory impact, in terms of volume and revenues, for providers. Forecast outputs represent the 50th (median) percentiles to provide a conservative baseline. Forecast projections account for the impact of COVID-19.

Rates of anxiety/depression and diabetes per 100K were calculated using Trilliant Health's national all-payer claims database, inclusive of all pay types (Traditional Medicare, Medicare Advantage, Medicaid, commercial). Anxiety and depression were limited to ICD-10 codes F41 (Other anxiety disorders), F32 (Depressive episode), and F33 (Recurrent depressive disorder), excluding ICD-10 codes indicating depression in remission. Diabetes was limited to ICD-10 codes E10 (Type 1 diabetes mellitus) and E11 (Type 2 diabetes mellitus). Patients with an E11 or E12 were required to have at least two medical claims in the inpatient or outpatient setting with either diagnosis code, excluding medical claims solely for lab testing. Additionally, patients with at least one medical or pharmacy claim indicating insulin use or prescription were included in the analysis. Patients receiving those diagnoses between 2019 and 2021 were included in the analysis and duplicate patients were removed. 2020 Census population was used to calculate a per 100K rate.

Primary care providers (PCPs) per 100K were calculated using Trilliant Health's provider directory. We limited our definition of PCPs, solely including board-certified physicians, though acknowledge the role physician assistants and nurse practitioners serve in delivering primary care services. 2020 Census population was used to calculate a per 100K rate.

Behavioral health providers (BHPs) per 100K were calculated using Trilliant Health's provider directory. Our definition of BHPs includes board-certified psychiatrists, psychologists, behavioral therapists, social workers, psychiatric nurse practitioners, etc. 2020 Census population was used to calculate a per 100K rate.

Methodology | Additional Notes

DATA SOURCES & STUDY PARAMETERS

- While market and CBSA are often used interchangeably throughout the report, all references reflect the 927 core-based statistical areas defined by the U.S. Office of Management and Budget. A core-based statistical area is a U.S. geographic area that consists of one or more counties anchored by an urban center of at least 10K people plus adjacent counties that are socioeconomically tied to the urban center by commuting.
- The CBSAs indexed against were limited to *metropolitan* CBSAs. As of March 2020, there are 384 metropolitan areas and 543 micropolitan areas in the United States. Each metropolitan CBSA must have at least one urbanized area of 50,000 or more inhabitants. Each micropolitan CBSA must have at least one urban cluster of at least 10,000 but less than 50,000 population.
- A variety of data sources were leveraged as part of this research, with most insights gleaned from proprietary Trilliant Health datasets: all-payer claims, consumer, provider directory, and demand forecast. Trilliant Health's all-payer claims database combines commercial, Medicare Advantage, traditional Medicare, and Medicaid claims representing more than 320M Americans. The analytics were calculated using a variety of methods, and the projections were created using machine learning. Additional data was gleaned from sources such as the U.S. Census Bureau and the National Vital Statistics Program.

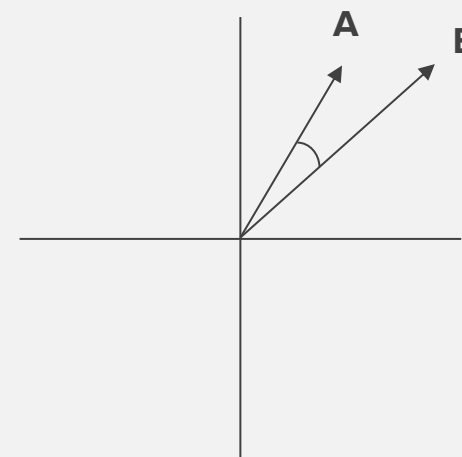
SIMILARITYENGINE™

- The SimilarityEngine™ was developed using a machine-learning-based model that applies the mathematical concepts of “cosine similarity.” Cosine similarity measures the cosine of the angle between two vectors projected in a multi-dimensional space. If the angle between the two vectors is 90 degrees, the cosine similarity will have a value of 0, meaning that the two vectors are perpendicular to each other denoting no correlation between them. The closer the cosine value is to 1, the more similar the vectors.

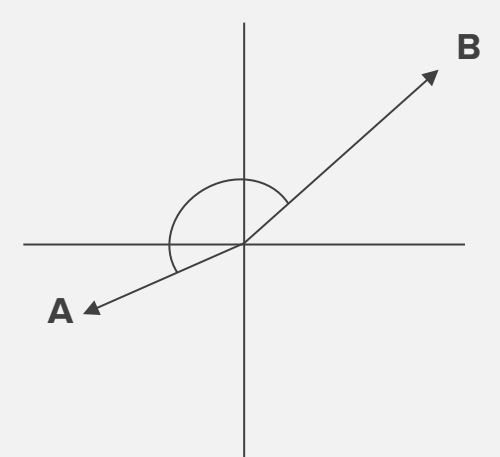
COMMONLY USED ACRONYMS

- **BHP:** Behavioral Health Provider
- **CAGR:** Compound Annual Growth Rate
- **CBSA:** Core-Based Statistical Area
- **HHI:** Herfindahl-Hirschman Index
- **ICD-10:** International Statistical Classification of Diseases and Related Health Problems
- **PCP:** Primary Care Provider
- **Rx:** Prescription

SIMILAR



DISSIMILAR



Methodology | Acknowledgements

From whiteboarding the initial concepts and programming the similarity model to selecting the features relevant to studying markets, the development of the SimilarityEngine™ and SimilarityIndex™ | Markets Report is the product of significant interdisciplinary collaboration and efforts of many of our colleagues behind the scenes.

Grant Anderson, Matt Fili and Matt Eby were instrumental in supporting the development of the SimilarityEngine™.

Many thanks to Jim Browne and David Taylor for their data support and detailed data review. We are grateful to Jason Nardella, Allison Oakes, Megan Davis, Hannah Pike, Kelsey Thomas and Anna Jordan for their thoughtful edits.

Above all, the health economy's first machine-learning-based SimilarityIndex™ would not have been possible without the vision from Hal Andrews, who has championed this concept since learning it from Hud Connery, Charlie Martin, and Mal Wall decades ago.

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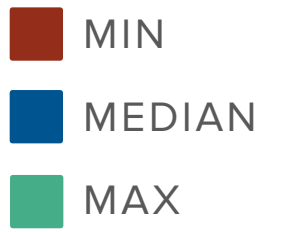
Appendices

Appendix A1 | Healthcare Metrics: All Metropolitan CBSAs

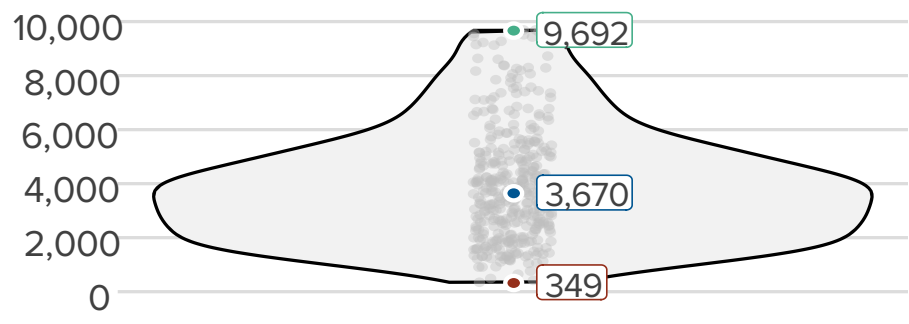
While the Report only highlighted a handful of CBSAs, the following plots represent the distribution of each featured healthcare supply and demand metric across all 384 U.S. metropolitan CBSAs.

+ DEMAND

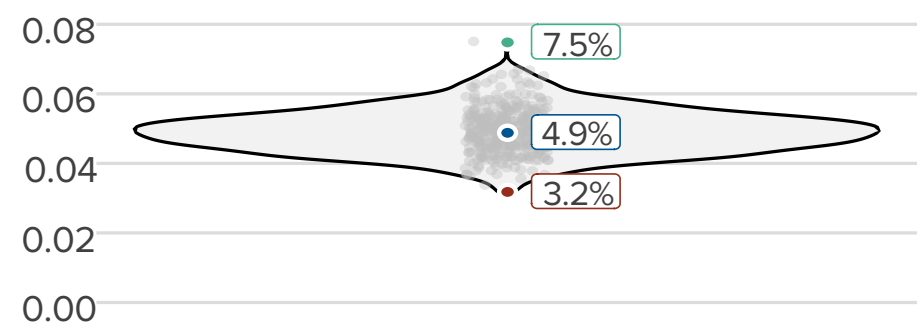
↓ SUPPLY



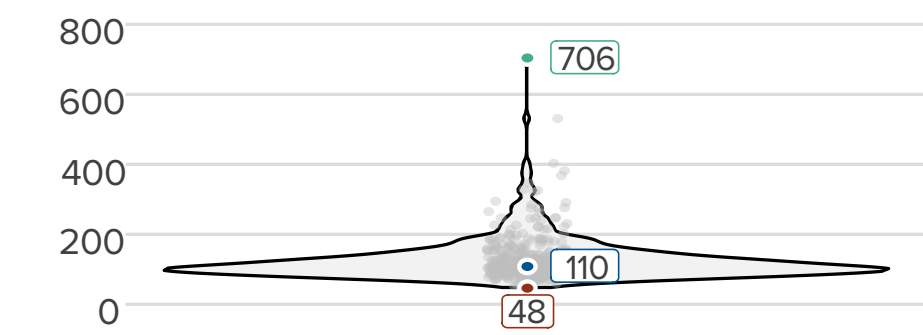
SURGICAL CONCENTRATION (HHI)



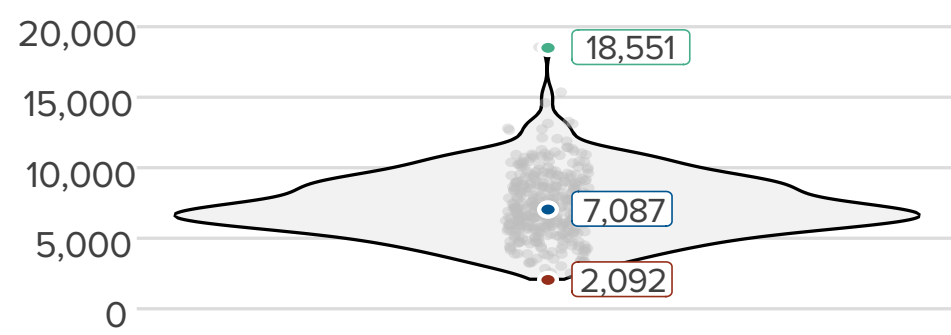
2021-2030 SURGICAL DEMAND FORECAST (CAGR)



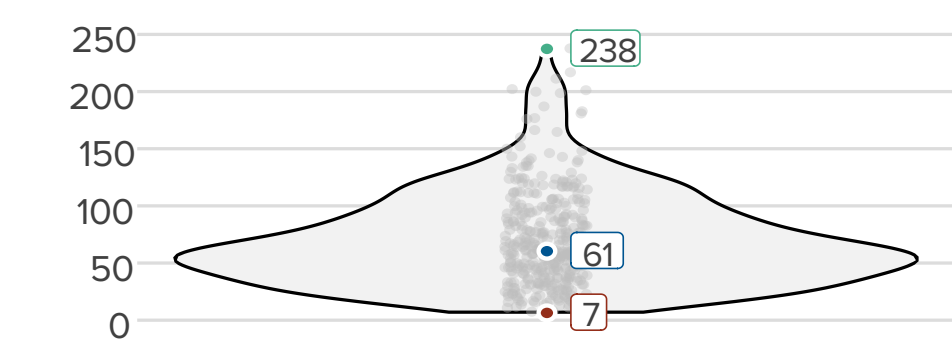
PRIMARY CARE PROVIDERS PER 100K



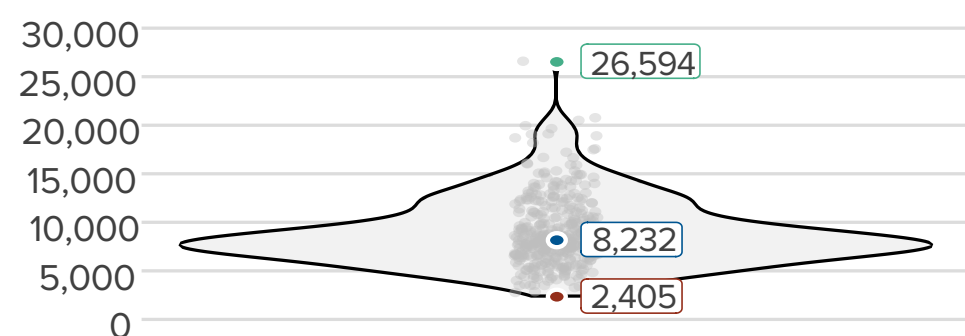
DIABETES PER 100K



BEHAVIORAL HEALTH PROVIDERS PER 100K



ANXIETY AND DEPRESSION PER 100K



Appendix A2 | Healthcare Metrics: Reference Metropolitan CBSAs

While the Report featured the Median values as a reference point comparing supply and demand measures in specific benchmark markets, the following tables summarize the ranges (attributed to CBSAs) for each metric.

	MIN	MEDIAN	MAX
HHI	349 New York-Newark- Jersey City, NY-NJ-PA	3,670 Greeley, CO	9,692 Elizabethtown-Fort Knox, KY
2021-2030 SURGICAL DEMAND (CAGR)	3.2% Danville, IL	4.9% See Table 1	7.5% The Villages, FL
PRIMARY CARE PROVIDERS PER 100K	48 Jacksonville, NC	110 See Table 2	706 Bloomsburg-Berwick, PA
DIABETES PER 100K	2,092 Provo-Orem, UT	7,087 Lancaster, PA	18,551 Tyler, TX
BEHAVIORAL HEALTH PROVIDERS PER 100K	7 Grants Pass, OR	61 See Table 3	238 Lima, OH
ANXIETY AND DEPRESSION PER 100K	2,405 Urban Honolulu, HI	8,232 Rapid City, SD	26,594 Ames, IA

TABLE 1

CBSA
Greensboro-High Point, NC
Riverside-San Bernardino-Ontario, CA
Farmington NM
Valdosta, GA
Columbia, SC
Cape Girardeau, MO-IL
Houma-Thibodaux, LA
Pueblo, CO
Washington-Arlington-Alexandria, DC-VA-MD-WV
Gadsden, AL
Lebanon, PA
Great Falls, MT
Harrisburg-Carlisle, PA
Lynchburg, VA
Spokane-Spokane Valley WA
Longview, TX
Hickory-Lenoir-Morganton, NC
Wenatchee, WA
Muskegon, MI
Salem, OR

TABLE 2

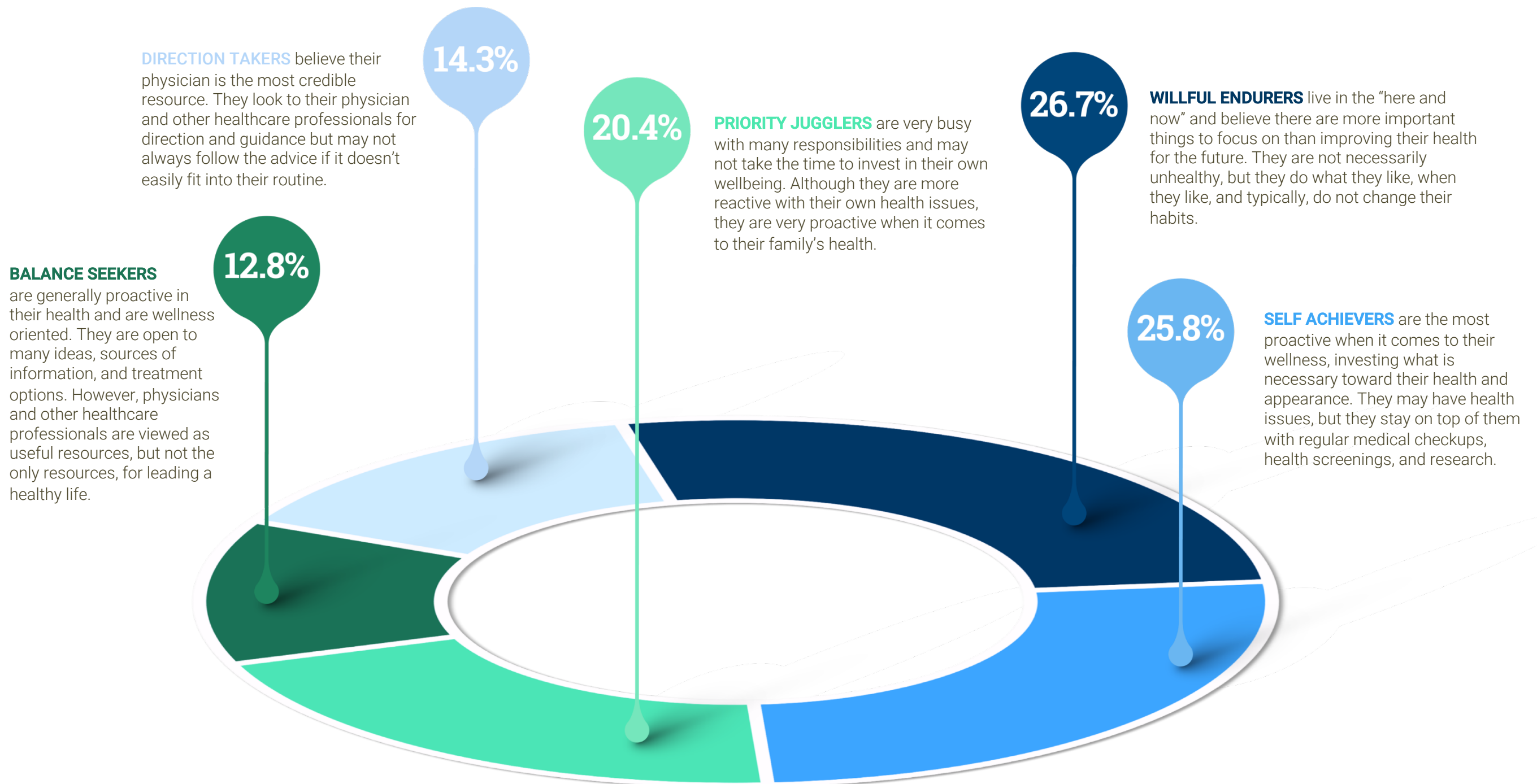
CBSA
Trenton-Princeton, NJ
Bellingham, WA
Chico, CA
Yuba City, CA
Poughkeepsie-Newburgh-Middletown, NY
Seattle-Tacoma-Bellevue, WA
Ogden-Clearfield, UT
Bend, OR
Burlington, NC

TABLE 3

CBSA
Pine Bluff, AR
Syracuse, NY
Baton Rouge, LA
Charlotte-Concord-Gastonia, NC-SC
North Port-Sarasota-Bradenton, FL
Kansas City, MO-KS

Appendix B | National Psychographic Distribution

Demographics describe facts about a person in a moment and vary over time (e.g., age). Psychographics describe why a person makes the decisions they do and persist over time; which is why they are more predictive of healthcare behaviors.



Source: Trilliant Health consumer database inclusive of psychographic data for all 50 states and Washington, D.C.; 2020.

Appendix C | Consumer SimilarityEngine™ Features

The Consumer SimilarityIndex™ Category is a function of the following three data inputs, or features.

Rx Adherence Maintenance: A demographic-based analytical model which predicts if an individual is taking maintenance drugs as directed and on time.

Rx Number of Drugs: A demographic-based analytical model which predicts the number of medications an individual takes on a regular basis.

Use Wearable Device to Manage Health: Health index that predicts an individual likely uses a wearable device (i.e., Fitbit, Jawbone, Fuelband, Apple Watch) to measure and manage their health.

Examine your market using the SimilarityIndex™ tool:

datalab.trillianthealth.com/similarity-index/markets/2022

