Regional Forecasts of the Registered Nurse Workforce in California

by Joanne Spetz, PhD

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UCSF Philip R. Lee Institute for Health Policy Studies

Abstract

Regional projections of the supply and demand for registered nurses (RNs) indicate wide variation in current and projected RN supply, with the lowest supply in the Central Valley and Sierra and the Central Coast regions. In addition, the Central Valley and Sierra, Central Coast, and San Francisco Bay Area are projected to have supply that will be notably lower than national benchmarks for demand.

Acknowledgements

These projections are based on surveys of registered nurses and nursing education programs collected for the Board of Registered Nursing, managed by Lisel Blash, MPA, Lela Chu, BS, and Amy Quan, MPH, at the Philip R. Lee Institute for Health Policy Studies and Healthforce Center at UCSF. Additional data were provided from BRN licensing records by Steven Wong, MBA, California Board of Registered Nursing.

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Key Findings

- The current supply of RNs varies widely by region, and the ratio of full-time equivalent (FTE) RNs per 100,000 population is below the national median ratio in all regions.
- By 2035, the Inland Empire, Sacramento, San Diego and Imperial, Northern Counties, and Los Angeles Core regions are projected to have RN FTE supply exceeding the current national median ratio, while the Central Valley and Sierra, San Francisco Bay Area, and Central Coast will remain below the national median ratio.
- In the Northern Counties, San Francisco Bay Area, Central Valley and Sierra, Central Coast, and Los Angeles Core regions, current demand for RNs is notably lower than the national median benchmark. The largest gaps are in the Central Valley and Sierra and the Central Coast, suggesting that demand for RNs – and the health care infrastructure as a whole – may be falling short of population need.
- By 2035, the projections indicate that no regions will have a shortfall of supply relative to demand. However, the San Francisco Bay Area, Central Valley and Sierra, and Central Coast regions are projected to continue to have a shortfall relative to the national median benchmark.

Background

Reports of nursing shortages in California go back nearly a decade, particularly in rural communities and for registered nurses (RNs) with experience in specialized clinical fields such as perioperative care, labor and delivery, intensive care, and emergency care. Nationwide, it has been reported that the supply of RNs decreased by more than 100,000 between 2020 and 2021 (Auerbach et al., 2022) and, in 2023, the U.S. Health Services and Resources Administration (HRSA) estimated that there is a shortage of 320,000 RNs, leaving nearly 10% of the current demand unfilled (HRSA, 2023). However, it also has been reported that the national RN workforce grew 5.3% between 2019 and 2023 (HRSA, 2024a), and the total number of full-time equivalent (FTE) RNs was 6% higher in 2023 than in 2019 (Auerbach et al., 2024). Together, these data suggest that the COVID-19 pandemic's effect on RN employment and graduations was temporary. The size of the RN workforce has been projected to increase by nearly 1.2 million FTEs by 2035, reaching 4.56 million FTEs, which is close to pre-pandemic forecasts and more than 1 million greater than the HRSA projection of 3.39 million FTEs (Auerbach et al., 2024).

Different projections of California's future RN supply have been published, with HRSA projecting growth of only 4.2% (HRSA, 2023) and the California Department of Health Care Access and Information (HCAI) projecting an increase of 45.2% between 2023 and 2028 (HCAI, 2024a). The different results of these models demonstrate the variation that can result from different data sources and assumptions about factors that affect RN supply and demand. HCAI more recently presented estimates that there was a statewide shortage of approximately 2% in 2022 (~6,000 RNs) and that the shortage is projected to increase to 16% by 2033 (~60,000 RNs). However, the HCAI projection models rely on data collected by that agency and, as presented, do not appear to use up-to-date estimates of nursing enrollments and new licenses issued to RNs from other states and countries, leading to an underestimate of future supply.

This report provides forecasts of RN supply and demand for each of eight regions of California, based on a statewide projection model developed for the California Board of Registered Nursing (BRN). The projections are inclusive of all RNs, including those with advanced practice licensure (i.e., nurse practitioners, nurse anesthetists, and nurse midwives). The data used to construct the model were derived from the 2022 BRN Survey of Registered Nurses (Chu & Spetz, 2024), the 2022-2023 BRN Annual Schools Report (Blash & Spetz, 2024), and BRN license records. The supply forecast is compared with several benchmarks of demand, including national ratios of RNs per capita, estimates that adjust for population aging and current vacancies, and projections published by the California Employment Development Department (EDD, 2022).

Definition of the Regions

The eight regions of California are composed of counties that have interconnected economies and labor markets. These regional definitions have been used for BRN surveys since the mid-2000s and were derived from regions defined by the California Economic Strategy Panel in 1998 (California Economic Strategy Panel, 2006).

- Northern Counties: Butte, Colusa, Del Norte, Glenn, Humboldt, Lake, Lassen, Mendocino, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Tehama, Trinity
- Sacramento: El Dorado, Placer, Sacramento, Sutter, Yolo, Yuba
- San Francisco Bay Area: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma
- Central Valley & Sierra: Alpine, Amador, Calaveras, Fresno, Inyo, Kern, Kings, Madera, Mariposa, Merced, Mono, San Joaquin, Stanislaus, Tulare, Tuolumne
- Central Coast: Monterey, San Benito, Santa Barbara, San Luis Obispo
- Los Angeles Core: Los Angeles, Orange, Ventura
- Southern Border: Imperial, San Diego

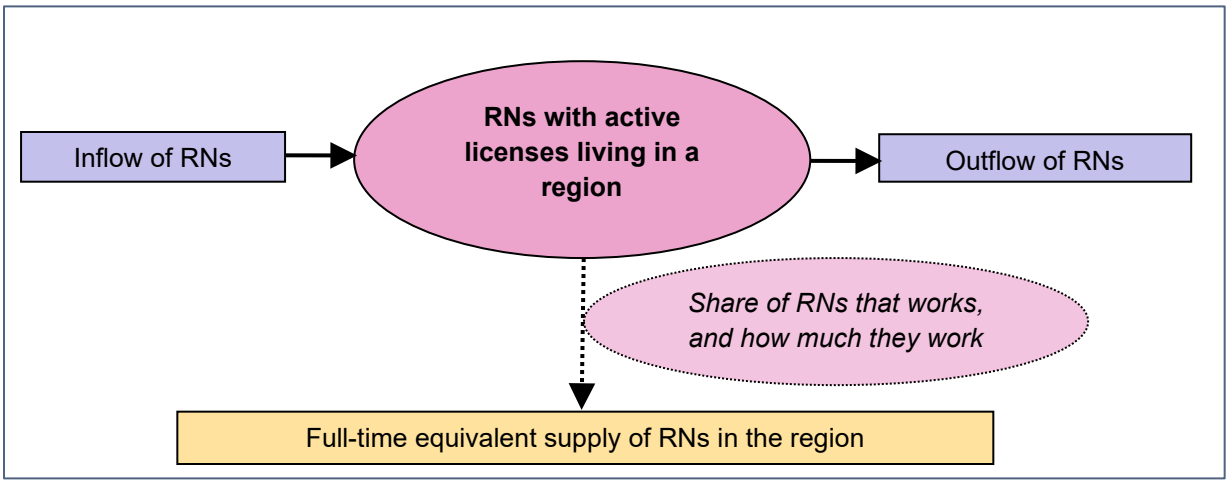
Modeling the Supply of RNs

The RN workforce constantly changes with the entrance of newly graduated nurses; migration of nurses from other regions, states, and countries; retirements; temporary departures from nursing work; and fluctuations in the number of hours that nurses choose to work. These factors can be grouped into three categories:

1) Inflows of nurses: Additions to the number of RNs in the region
    a) Graduates from regional nursing programs
    b) Graduates of nursing programs in other states and regions who obtain their first RN license in California and move to the region
    c) Internationally educated nurses who immigrate to the region and obtain their RN license
    d) Inter-regional and interstate migration of RNs
    e) Changes from inactive or lapsed to active license status
2) Outflows of nurses: The loss of RNs from the region
    a) Migration out of region (to another region, state, or country)
    b) Movements from active to inactive or lapsed license status
3) Labor force participation factors: Decisions to work, and how much to work
    a) Percentage of RNs with active licenses that work in a nursing job
    b) Average number of hours worked per week by RNs working in nursing

The inflows are added to the number of RNs living in the region with active licenses, which is called the "stock" of nurses available to work, and the outflows are subtracted from the stock. Estimates of the labor supply of RNs are derived from the stock of RNs potentially available to work and how much they choose to work in nursing. This number is expressed as full-time equivalent (FTE) employment in order to account for differences in the work commitments of those employed full-time and part-time. Figure 1 illustrates this model of the supply of RNs, commonly called a "stock-and-flow model."

Figure 1. A model of the supply of RNs



Method of calculating RN supply

The total supply of employed RNs is determined by the age distribution of the stock of RNs, as well as of each inflow and outflow component. In the supply model, the number of RNs with active licenses who reside in the region is divided into 13 age categories: under 25, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, and 80 and older. The model assumes that nurses are evenly distributed within each 5-year age group. Therefore, in each year, 20% of the RNs in each age group – or 1 in 5 RNs – moves into the next (older) age group, until they reach the oldest age group.

For each year of the model, the inflow estimates are added to each age group and the outflow estimates are subtracted from each age group, resulting in an estimate of the new stock of RNs for the subsequent year. For each age category, the basic formula is:

Forecasted Supply of RNs next year

= Current supply of RNs in current year + Estimated total inflows – Estimated total outflows.

Employment rates and hours worked per week in nursing are then applied to the estimated stock of RNs in each age group, resulting in an estimated FTE supply. This calculation is iterated through 2035 to obtain yearly forecasts of the region's RN supply.

Inflows of nurses

Graduates from California nursing programs

According to the BRN Annual School Report, there were 13,989 new graduates from California RN programs in the 2022-2023 academic year. Table 1 presents the numbers of new enrollments and graduates from the past 10 Annual Schools Reports. We used the enrollment data to project future numbers of RN graduates. Some California RN programs have satellite campuses in other regions than the home campus. Enrollments for these satellite campuses were reallocated to their region. We assumed that new student enrollments in each year are associated with graduations two years later.

Table 1. Statewide RN Program Enrollments and Graduations, 2016-2017 to 2022-2023

Survey year	Number of new student enrollments	Growth in new student enrollments	Number of graduates	Growth in graduates
2013-2014	13,237	0.4%	11,291	-0.01%
2014-2015	13,318	0.7%	11,119	-1.5%
2015-2016	13,190	-1.0%	11,191	0.7%
2016-2017	13,599	3.1%	11,302	1.0%
2017-2018	14,139	4.0%	11,831	5.2%
2018-2019	15,150	7.2%	11,857	-0.3%
2019-2020	15,002	-1.0%	12,714	7.2%
2020-2021	14,004	-6.7%	12,304	-3.2%
2021-2022	16,612	18.6%	13,372	8.7%
2022-2023	17,653	6.3%	13,989	4.6%

Note: The large increase in enrollments between 2020-21 and 2021-22 is in part due to one program not reporting data in 2019-20 and 2020-21; that school's enrollment was estimated at its 2018-19 level for those years but their 2021-22 data suggest that they were expanding in the intervening years.
Source: Blash, L, Spetz, J. 2022-2023 Annual School Report: Data Summary and Historical Trend Analysis, A Presentation for Pre-Licensure Nursing Programs in California. Sacramento, CA: California Board of Registered Nursing.

From the 2016-2017 through 2022-2023 school years (but excluding the year during which one program did not report their new enrollments) graduates averaged 87.2% of the number of student enrollments two years prior.

This rate, which applies to the past 5 years of graduations, was used to estimate the number of future graduates. As actual enrollments after 2023-2024 were not yet known, we used estimates from the BRN Annual School Survey, for which schools are asked to estimate future enrollment for the next two academic years (through 2024-2025). These estimates were multiplied by 87.2% to obtain the forecasted number of graduates for 2025-2026 and 2026-2027. Graduations after that are assumed to remain stable to provide a conservative estimate of long-term graduation growth. Actual and projected numbers of graduates from 2021-2022 through 2026-2027 are presented in Table 2.

Table 2. Actual and Projected RN Program Graduations, 2021-2022 to 2026-2027

Survey year	Northern Counties	Sacramento	San Francisco Bay Area	Central Valley & Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
2021-22	376	533	2,574	1,384	219	6,390	938	958
2022-23	389	599	2,811	1,282	226	6,615	1,030	1,037
2023-24*	368	837	2,344	1,453	238	5,752	2,221	1,184
2024-25*	356	757	2,322	1,429	248	7,793	1,094	1,118
2025-26*	356	822	2,392	1,600	267	8,361	1,243	1,185
2026-27*	458	949	2,824	1,912	327	6,868	2,605	1,312

Source: Calculated from Blash, L, Spetz, J. 2022-2023 Annual School Report: Data Summary and Historical Trend Analysis, A Presentation for Pre-Licensure Nursing Programs in California. Sacramento, CA: California Board of Registered Nursing.

The age distribution of new RN graduates is published in the BRN Annual Schools Report using different groupings than the 5-year age groups of the stock-and-flow model. The BRN data were redistributed to 5-year age groups for each region.

International nursing graduates

BRN records report that 2,037 internationally-educated nurses passed the National Council Licensure Examination for RNs (NCLEX-RN) in 2023 and received initial licensure as RNs in California. Of these, 1,606 had a California residence; the remainder lived in other states or countries. In the supply model, the number of 2023 international graduates was used to identify the number of immigrant RNs that moved to each region (Table 3). Because there were few internationally educated nurses newly licensed in some regions, the statewide age distribution was applied to all regions (Table 4).

Table 3. Internationally Educated RNs, 2023

Year	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
2023	14	127	444	233	24	517	137	111

Source: California Board of Registered Nursing licensing records, 2023.

Table 4. Age Distribution of Internationally Educated RNs, 2023

Age group	Percentage	Age group	Percentage
Under 25 years	2.8%	50-54 years	5.4%
25-29 years	12.3%	55-59 years	2.2%
30-34 years	24.2%	60-64 years	0.7%
35-39 years	30.9%	65-69 years	0.1%
40-44 years	12.5%	70-74 years	0.1%
45-49 years	8.6%	75+ years	0.0%

Source: California Board of Registered Nursing licensing records, 2023.

Interstate migration of RNs

Nurses can migrate to California before or after they have received a California license. Rates of migration into California were calculated for each of these two components. First, licensing files from 2022 and 2024 were used to identify nurses who had California licenses in both years, but who lived outside California in 2022 and lived in California in 2024. Over the two-year period, the difference was 8,293. This figure was divided by two to get an estimate of one-year change for each region and age group. These numbers were then divided by the total number of licensed RNs in each region and age group to obtain a rate of in-migration of already-licensed RNs. Table 5 presents the rates for each region and age group.

Table 5. Rate of Already-Licensed RNs Moving to California from Other States

Age Group	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Under 25	0.7%	1.5%	1.8%	0.9%	0.6%	1.9%	0.8%	3.8%
25-29	0.9%	1.8%	2.3%	0.8%	1.8%	1.5%	0.9%	5.4%
30-34	1.6%	1.8%	2.3%	0.8%	1.5%	1.1%	0.8%	2.6%
35-39	0.7%	1.6%	1.4%	0.8%	0.8%	0.6%	0.8%	1.4%
40-44	0.6%	0.9%	0.8%	0.6%	1.1%	0.5%	0.5%	0.9%
45-49	0.7%	1.0%	0.8%	0.5%	0.9%	0.5%	0.5%	1.0%
50-54	0.8%	0.6%	0.7%	0.6%	0.7%	0.5%	0.7%	0.9%
55-59	1.2%	1.0%	1.3%	0.7%	1.3%	0.8%	0.8%	1.6%
60-64	1.2%	1.3%	1.4%	0.8%	1.3%	1.0%	0.9%	1.7%
65-69	0.9%	0.9%	1.0%	0.6%	1.0%	0.7%	0.7%	1.1%
70-74	0.5%	0.4%	0.6%	0.8%	0.6%	0.5%	0.9%	1.0%
75-79	0.2%	1.0%	0.4%	0.5%	0.7%	0.3%	0.7%	0.8%
80+	0.7%	0.4%	0.1%	0.0%	0.0%	0.2%	0.3%	0.4%

Source: California Board of Registered Nursing licensing files, 2022 and 2024.

Second, California Board of Registered Nursing records were used to count the number of RNs in 2023 who had requested endorsement of their out-of-state license to California and had a California address, by age group. These data were divided by the total number of RNs in each region and age group to obtain a rate of in-migration of newly-licensed RNs. Table 6 presents the rates for each region and age group.

Table 6. Rate of RNs Endorsing Licenses to California from Other States

Age Group	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Under 25	6.0%	6.8%	4.5%	5.9%	14.3%	3.5%	3.2%	10.2%
25-29	2.8%	2.5%	3.1%	2.6%	2.6%	1.7%	1.4%	4.1%
30-34	1.1%	1.8%	2.0%	2.3%	1.4%	1.1%	0.9%	2.0%
35-39	0.5%	1.4%	1.2%	1.5%	1.7%	0.8%	0.8%	1.2%
40-44	0.4%	0.7%	0.8%	0.7%	0.7%	0.5%	0.7%	0.5%
45-49	0.7%	0.7%	0.5%	0.8%	0.8%	0.5%	0.5%	0.4%
50-54	0.7%	0.3%	0.3%	0.2%	0.7%	0.3%	0.3%	0.5%
55-59	0.5%	0.1%	0.3%	0.3%	0.1%	0.3%	0.2%	0.3%
60-64	0.7%	0.0%	0.2%	0.1%	0.1%	0.1%	0.1%	0.2%
65-69	0.2%	0.2%	0.1%	0.0%	0.0%	0.1%	0.1%	0.2%
70-74	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
75-79	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
80+	0.7%	0.9%	0.9%	1.0%	0.9%	0.7%	0.6%	1.1%

Source: California Board of Registered Nursing licensing records, 2023.

Changes from inactive or lapsed to active license status

Data were obtained from the BRN on the number of RNs with California addresses, by age category, changing from lapsed or inactive status to active license status in 2023. The number that transitioned from inactive to active status and had a California county in their address record was 498, and the number that reactivated a delinquent license and had a California county on record was 3,580. Table 7 presents the rates.

Table 7. Rate of RNs Reactivating Their Licenses from Inactive or Delinquent Status

Age Group	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Under 25	0.0%	0.0%	0.1%	0.2%	0.0%	0.0%	0.2%	0.2%
25-29	0.5%	0.5%	0.3%	0.5%	0.3%	0.3%	0.3%	0.6%
30-34	0.4%	0.4%	0.4%	0.5%	0.5%	0.5%	0.7%	0.5%
35-39	0.7%	0.8%	0.7%	0.6%	1.0%	0.5%	0.7%	0.6%
40-44	1.0%	0.7%	0.7%	0.6%	0.5%	0.7%	0.7%	0.9%
45-49	1.3%	0.7%	0.6%	1.0%	0.6%	0.8%	0.7%	0.6%
50-54	1.2%	0.7%	0.7%	1.1%	0.9%	0.9%	0.6%	0.8%
55-59	2.1%	0.9%	1.0%	0.9%	1.3%	1.2%	1.0%	1.3%
60-64	1.1%	1.5%	1.7%	1.0%	1.7%	1.4%	1.6%	1.5%
65-69	2.8%	2.3%	2.0%	1.7%	1.8%	2.1%	2.2%	2.0%
70-74	3.1%	3.7%	3.3%	4.1%	2.3%	2.4%	3.7%	3.1%
75-79	4.5%	4.1%	3.5%	3.7%	2.6%	4.0%	4.1%	3.1%
80+	2.8%	6.6%	4.6%	5.4%	3.4%	4.1%	4.0%	6.3%

Source: California Board of Registered Nursing licensing records, 2023.

Inter-regional movements of RNs

The movement of RNs from region to region within California was determined by counting the number of RNs who were licensed in both 2022 and 2024 and changed their county of residence. These numbers were tabulated by region and age group, and then divided by the total number of nurses to obtain rates for each region and age group. The rates of RNs remaining in their region are presented in Table 8.

Table 8. Rate of RNs Staying in Their Region of Residence

Age Group	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Under 25	88.6%	95.0%	94.4%	92.4%	87.8%	95.6%	94.6%	95.4%
25-29	92.4%	94.8%	94.3%	94.1%	91.9%	95.5%	94.0%	94.5%
30-34	94.9%	96.1%	95.6%	95.0%	93.8%	96.0%	94.7%	96.1%
35-39	94.5%	97.8%	96.4%	96.1%	94.5%	96.7%	96.1%	96.9%
40-44	95.7%	97.3%	97.0%	96.5%	95.4%	97.3%	96.9%	97.4%
45-49	96.1%	97.8%	97.0%	96.6%	95.9%	97.4%	96.9%	97.2%
50-54	95.0%	96.7%	96.0%	96.4%	94.8%	96.1%	95.5%	96.8%
55-59	92.8%	95.2%	94.1%	94.2%	93.2%	93.3%	94.2%	95.0%
60-64	95.2%	95.2%	92.9%	93.1%	90.3%	91.7%	92.5%	95.1%
65-69	92.2%	93.1%	92.1%	93.0%	92.7%	91.5%	93.0%	94.6%
70-74	93.4%	94.5%	92.6%	92.8%	92.3%	90.8%	92.9%	94.4%
75-79	89.1%	93.0%	90.6%	91.2%	89.8%	92.3%	96.6%	93.8%
80+	100.0%	97.9%	90.6%	93.2%	88.0%	94.9%	87.7%	100.0%

Source: California Board of Registered Nursing licensing files, 2022 and 2024.

In addition, some new graduates move to regions other than where they were educated. To estimate this rate, multiple data points were examined. First, the number of new licensees between 2022 and 2024 was calculated for each region and age group and divided by two to obtain annual counts, as described above. Then, the numbers of new graduates, new internationally educated licensees, endorsements from other states, and reactivations were subtracted. The remaining numbers capture the numbers moving from their graduation location to a different region, changing from one age group to another (i.e., graduating at age 24 and obtaining a license at age 25), and differences that might exist between each year in licensing rates (i.e., measurement error). Because most new graduates are under 30 years old, the region-to-region differences were used to estimate rates at which new, younger graduates move to a new region when they obtain their license. Table 9 presents the rates for each region, which were applied to graduates under 30 years of age. Positive values indicate that new graduates are moving to the region, and negative values indicate that new graduates are leaving the region.

Table 9. Rate of New Graduates Under 30 Years of Age Moving to a New Location

Age Group	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Under 30	-25.3%	49.6%	1.4%	17.1%	33.2%	-16.4%	61.0%	18.9%

Source: Calculated from California Board of Registered Nursing licensing files, 2022 and 2024; California Board of Registered Nursing licensing records, 2023; Blash, L, Spetz, J. 2022-2023 Annual School Report: Data Summary and Historical Trend Analysis, A Presentation for Pre-Licensure Nursing Programs in California. Sacramento, CA: California Board of Registered Nursing.

Outflows of nurses

Migration out of region (to another region, state, or country)

Estimates of migration out of California were developed by comparing BRN licensing records from 2022 and 2024. Nurses who had California licenses in both years but who lived in California in 2022 and resided outside California in 2024 were counted by region and age group and divided by two to get an estimate of one-year out-migration. The number of RNs moving to other states was divided by the total number of RNs in each region and age group to obtain estimates of out-migration as a percentage of the current workforce. Table 10 presents the rates.

Table 10. Rate of RNs Moving to Other States

Age Group	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Under 25	2.1%	1.1%	0.9%	0.9%	0.6%	0.8%	0.7%	2.0%
25-29	1.3%	0.9%	1.0%	0.7%	1.9%	0.9%	0.9%	2.0%
30-34	1.1%	0.9%	1.2%	0.8%	1.3%	0.9%	0.9%	1.9%
35-39	1.3%	0.8%	0.9%	0.7%	1.5%	0.8%	0.8%	1.7%
40-44	1.0%	0.7%	1.0%	0.7%	0.7%	0.7%	0.7%	1.1%
45-49	1.0%	0.8%	0.8%	0.7%	1.0%	0.8%	0.9%	1.2%
50-54	1.2%	0.7%	0.9%	0.9%	0.8%	0.8%	0.9%	1.2%
55-59	1.8%	1.2%	1.2%	1.2%	1.3%	1.3%	1.3%	1.4%
60-64	1.4%	1.9%	1.5%	1.5%	1.3%	1.5%	1.6%	1.5%
65-69	1.7%	1.3%	1.3%	1.2%	1.4%	1.4%	1.4%	1.1%
70-74	1.0%	0.7%	1.1%	1.1%	0.8%	1.1%	1.0%	1.2%
75-79	1.1%	0.4%	0.9%	0.6%	0.7%	1.0%	1.2%	1.0%
80+	0.7%	0.4%	0.6%	0.7%	0.0%	0.5%	0.6%	0.4%

Source: California Board of Registered Nursing licensing files, 2022 and 2024.

Movements from active to inactive or lapsed license status

Estimates of the rate at which actively licensed RNs allow their licenses to lapse are very important to the model because they measure the loss of nurses due to relocation, change in employment plans, retirement, and death. The model does not distinguish among these reasons for allowing a license to lapse. BRN licensing records from 2022 were compared with those from 2024. Nurses who had California licenses and residences in 2022 but were not in the license file in 2024 were counted as an estimate of the number of lapsed licenses over a two-year period for each region and age group. These numbers were divided by 2 to estimate annual counts and divided by the total RN population to obtain rates. Table 11 presents these estimated rates.

Table 11. Rate of RNs Allowing Their Licenses to Lapse

Age Group	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Under 25	3.5%	1.1%	1.2%	1.2%	0.6%	1.2%	1.4%	2.3%
25-29	0.8%	1.0%	1.1%	0.8%	0.9%	1.1%	1.3%	2.2%
30-34	1.9%	1.1%	1.1%	0.8%	1.7%	1.0%	1.0%	2.2%
35-39	1.2%	0.8%	0.9%	0.7%	1.3%	0.9%	1.1%	1.3%
40-44	1.0%	0.5%	0.7%	0.7%	0.9%	0.7%	0.8%	1.2%
45-49	1.1%	0.8%	0.8%	0.6%	1.0%	0.8%	0.8%	0.9%
50-54	1.4%	1.0%	0.8%	0.9%	1.6%	0.8%	1.0%	1.2%
55-59	3.2%	1.7%	2.0%	2.1%	2.9%	1.7%	1.9%	2.6%
60-64	5.5%	5.7%	5.7%	5.2%	5.5%	5.1%	4.7%	5.9%
65-69	10.3%	10.6%	11.0%	9.5%	10.4%	9.7%	9.1%	10.9%
70-74	10.3%	8.7%	10.5%	10.0%	9.4%	10.2%	8.7%	9.8%
75-79	10.6%	12.0%	11.5%	13.4%	7.4%	11.6%	11.2%	12.4%
80+	11.1%	12.3%	16.2%	10.4%	11.9%	16.0%	11.4%	18.1%

Source: California Board of Registered Nursing licensing files, 2022 and 2024.

Calculating FTEs

In the 2022 survey data, estimated employment rates range from a high of 94.7% for RNs 25-29 years to a low of 30.9% for RNs aged 75-79 years. Employment rates were calculated for each region and age group. For some region-age cells, the number of observations was very small and, thus, the estimate differed notably from the average for the age group. For these cells, the average of other regions was used. Table 12 presents the employment rates, with asterisks indicating the estimates that are averages rather than the computed values.

Data from the 2022 Survey of Registered Nurses were used to estimate the average usual hours worked per week by RNs who resided in California and were employed in nursing for each age category. Estimated hours per week were divided by 40 to obtain the average FTE for each age category. The data used for this calculation are presented in Table 13. As in Table 12, asterisks indicate estimates that are averages rather than the computed values.

Table 12. RN Employment Rates

Age Group	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Under 25	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%*	100.0%
25-29	99.7%	100.0%	95.5%	95.5%	100.0%	98.6%	99.4%	99.8%
30-34	90.4%	90.2%	94.5%	62.9%	97.6%	95.9%	97.9%	96.9%
35-39	87.1%	97.6%	77.9%	47.5%	85.4%	94.8%	93.9%	83.2%
40-44	99.0%	98.8%	95.3%	95.8%	93.8%	80.0%	79.8%	97.3%
45-49	84.8%	83.5%	84.0%	76.1%	83.3%	83.3%	82.0%	93.2%
50-54	91.1%	22.0%	93.6%	92.5%	92.8%	92.3%	97.9%	84.3%
55-59	71.4%*	79.1%	75.2%	50.9%	74.5%	79.7%	71.6%	68.9%
60-64	83.3%	79.1%	68.4%	83.3%	72.0%	66.0%	91.8%	79.6%
65-69	50.6%	18.0%	37.5%	52.9%	36.1%*	61.4%	16.9%	15.4%
70-74	39.7%	24.6%	27.2%	32.6%	31.7%	67.1%	68.8%	37.2%
75-79	28.0%	12.3%	35.1%	57.5%	36.0%	32.6%	18.8%	14.1%
80+	53.3%*	53.3%*	53.3%*	53.3%*	53.3%*	53.3%*	53.3%*	53.3%*

* Average of the age group rather than computed value.

Source: Chu, Lela & Joanne Spetz. 2024. California Board of Registered Nursing 2022 Survey of Registered Nurses. Sacramento, CA: California Board of Registered Nursing. https://rn.ca.gov/pdfs/forms/survey2022.pdf.

Table 13. Average Hours Worked per Week by RNs

Age Group	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Under 25	40.0	33.9	32.0	36.5	40.0	48.0	38.1*	36.0
25-29	43.9	36.4	40.6	35.9	35.1	38.3	37.8	36.6
30-34	36.5	34.8	36.2	45.2	40.1	37.4	42.8	35.1
35-39	37.7	36.0	36.6	36.9*	34.9	41.9	37.4	34.7
40-44	36.2	38.4	30.2	30.5	38.6	41.5	39.8	36.0
45-49	36.5	35.2	34.4	38.6	36.2	38.0	37.6	35.5
50-54	37.6	38.3	33.2	37.5	26.6	39.5	45.8	35.7
55-59	31.7	36.8	35.2	40.3	32.9	37.6*	43.7	42.5
60-64	41.9	29.5	32.2	34.4	33.6	36.3	40.9	39.8
65-69	32.8*	31.1	32.8	37.5	27.3	32.2	35.9	32.6
70-74	38.8	25.8*	23.8	24.2	20.0	19.4	24.9	29.4
75-79	21.2	5.0	32.6	28.0	16.0	15.5	16.0	30.0
80+	25.8*	25.8*	25.8*	25.8*	25.8*	25.8*	25.8*	25.8*

* Average of the age group rather than computed value.

Source: Chu, Lela & Joanne Spetz. 2024. California Board of Registered Nursing 2022 Survey of Registered Nurses. Sacramento, CA: California Board of Registered Nursing. https://rn.ca.gov/pdfs/forms/survey2022.pdf.

Supply Projection Results

Figure 2 and Table 14 present the projected FTE supply of RNs in California from 2024 through 2035. Both indicate that the RN workforce is expected to grow in all regions of California, ranging from a 19% increase in the San Francisco Bay Area to an 80% in the Sacramento region.

Figure 3 presents projected FTE RNs per 100,000 population by region, based on population projections from the California Department of Finance. In 2024, FTEs per 100,000 population ranged from a low of 609 in the Central Coast to a high of 896 in the Inland Empire. All of these ratios are lower than the national median of 947 FTE RNs per 100,000. By 2035, the ratios are projected to range from 866 RN FTEs per 100,000 population in the Central Coast region to 1,527 RN FTEs per 100,000 population in the Inland Empire region. The relative rankings of each region are projected to remain stable, except for the San Francisco Bay Area, where the RN FTE to 100,000 population ratio will increase much less than in other regions.

Figure 2. Projected FTE RN Supply, 2024-2035

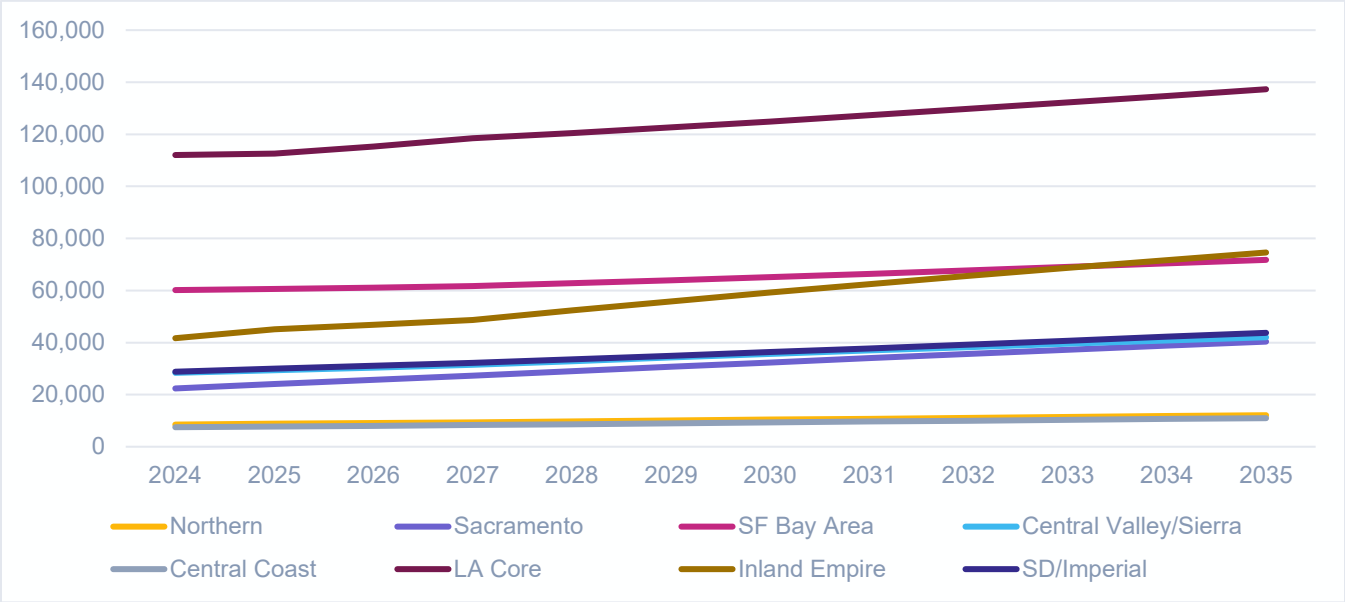
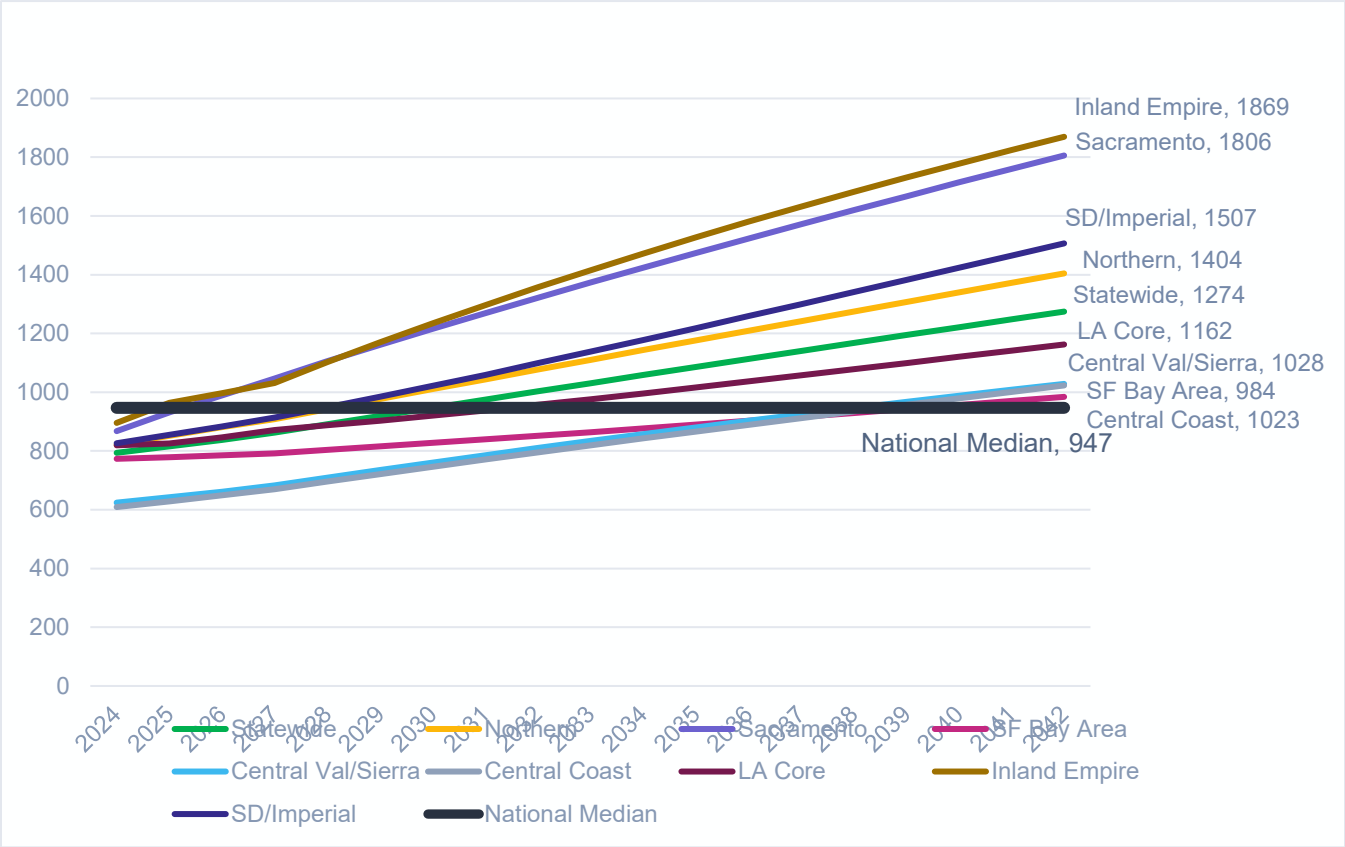


Table 14. Projected FTE RN Supply, 2024-2035

Year	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
2024	8,504	22,385	60,165	28,380	7,496	112,038	41,684	28,815
2025	8,808	24,111	60,552	29,351	7,763	112,602	45,063	29,945
2026	9,092	25,698	61,041	30,330	8,035	115,248	46,818	31,047
2027	9,369	27,308	61,687	31,464	8,322	118,506	48,711	32,235
2028	9,723	29,018	62,779	32,860	8,665	120,495	52,328	33,568
2029	10,072	30,701	63,939	34,242	9,006	122,642	55,822	34,940
2030	10,418	32,361	65,154	35,606	9,343	124,916	59,203	36,347
2031	10,760	34,000	66,415	36,945	9,676	127,287	62,476	37,784
2032	11,100	35,619	67,713	38,259	10,004	129,731	65,648	39,247
2033	11,437	37,220	69,042	39,546	10,329	132,227	68,723	40,730
2034	11,771	38,805	70,395	40,806	10,648	134,755	71,705	42,230
2035	12,102	40,374	71,768	42,039	10,964	137,300	74,598	43,742
Growth	42.3%	80.4%	19.3%	48.1%	46.3%	22.5%	79.0%	51.8%

Figure 3. Projected FTE RNs per 100,000 Population, 2024-2035



The Demand for RNs

The demand for RNs can be measured and forecasted in many ways, reflecting disparate notions of what demand is or should be. Many policymakers and health planners consider population needs as the primary factor in determining demand for health care workers. For example, the World Health Organization has established a benchmark that countries need a minimum of 2.3 health care professionals per 1,000 population in order to achieve the goal of 80% of newborn deliveries being attended by a skilled birth attendant (WHO, 2016). Similarly, demand for RNs could be defined as a specific number of nurses per capita.

It is important to recognize, however, that demand based on population needs is not the same thing as demand based on economic factors. Nurses and other health professionals are not free, and the cost of employing them must be weighed against cost of other necessary resources. A nurse employer might want to hire more nurses but may not have sufficient income from its patient care services to afford more nurses. An employer might have resources that could be used to hire more nurses but decide that investment in a new electronic health record will produce more value for patients. In this context, demand for nurses is derived from economic forces, which may not be aligned with population needs (Scheffler, et al., 2012).

For this report, different measures of demand (or need) were considered. The approaches used were:

- Fixed benchmarks based on U.S. RN-to-population ratios;
- Benchmarks based on current RN-to-population ratios in each region, adjusted for current hospital vacancy rates and for future population growth and aging;
- Regional demand projections for 2030 published by the California Employment Development Department (EDD, 2022).

Forecasts based on RNs per capita

The number of employed RNs per 100,000 population is a frequently-used benchmark to measure demand for RNs. For decades, California has had one of the lowest ratios of employed RNs per capita in the U.S., usually ranking in the bottom 10 nationwide. This low RN-per-capita ratio does not necessarily mean that the supply of RNs is inadequate or that quality is lower; for example, California's population may be healthier than average or its health system might rely less on hospital care (where most RNs are employed). California is the only state that has had minimum RN staffing ratios in hospitals over the past 20 years, which makes it unlikely that the low ratio of RNs per capita reflects low hospital staffing ratios.

Data from the 2022 National Sample Survey of Registered Nurses was used to estimate the number of full-time-equivalent RNs per 100,000 population in each state (HRSA, 2024b). The national median was 947 FTEs per 100,000 population and the national 25th percentile was 825 FTEs per 100,000 population. The same report estimated that California has 766 FTEs per 100,000 population, ranking 42nd nationally.

Data on the current and forecasted population of each region (California Department of Finance, 2024) were used to calculate the number of RNs that would be needed to maintain current RN-to-population ratios, reach the 25th percentile ratio, and reach the national median ratio.

The main shortcoming of targeting a fixed number of RNs per population, such as a national median, is that the target may not reflect the unique population and health care system of the state or region. An additional shortcoming is that fixed nurse-to-population ratios do not account for increased demand for health care services resulting from an increase in the number of persons with insurance coverage or an aging population.

Forecasts based on vacancy-adjusted and age-adjusted RNs per capita

A second approach to forecasting demand for RNs involves using current employment patterns as a baseline measure of economically driven demand and projecting future demand based on this standard. However, current employment might be lower than desired if there is a shortage of nurses. The vacancy rate can be used as a measure of unmet demand; the number of people currently employed plus the number of vacancies is a thus reasonable estimate of current demand for RNs.

Projections of future demand can be based on population projections. However, population numbers do not reflect changes in demand that might arise due to changes in population needs. One of the most important drivers of growth in health care utilization is age; people generally demand more health care services as they grow older. This second approach to demand projection uses data on hospital utilization by age group was used as a proxy for overall differences in health care use by age.

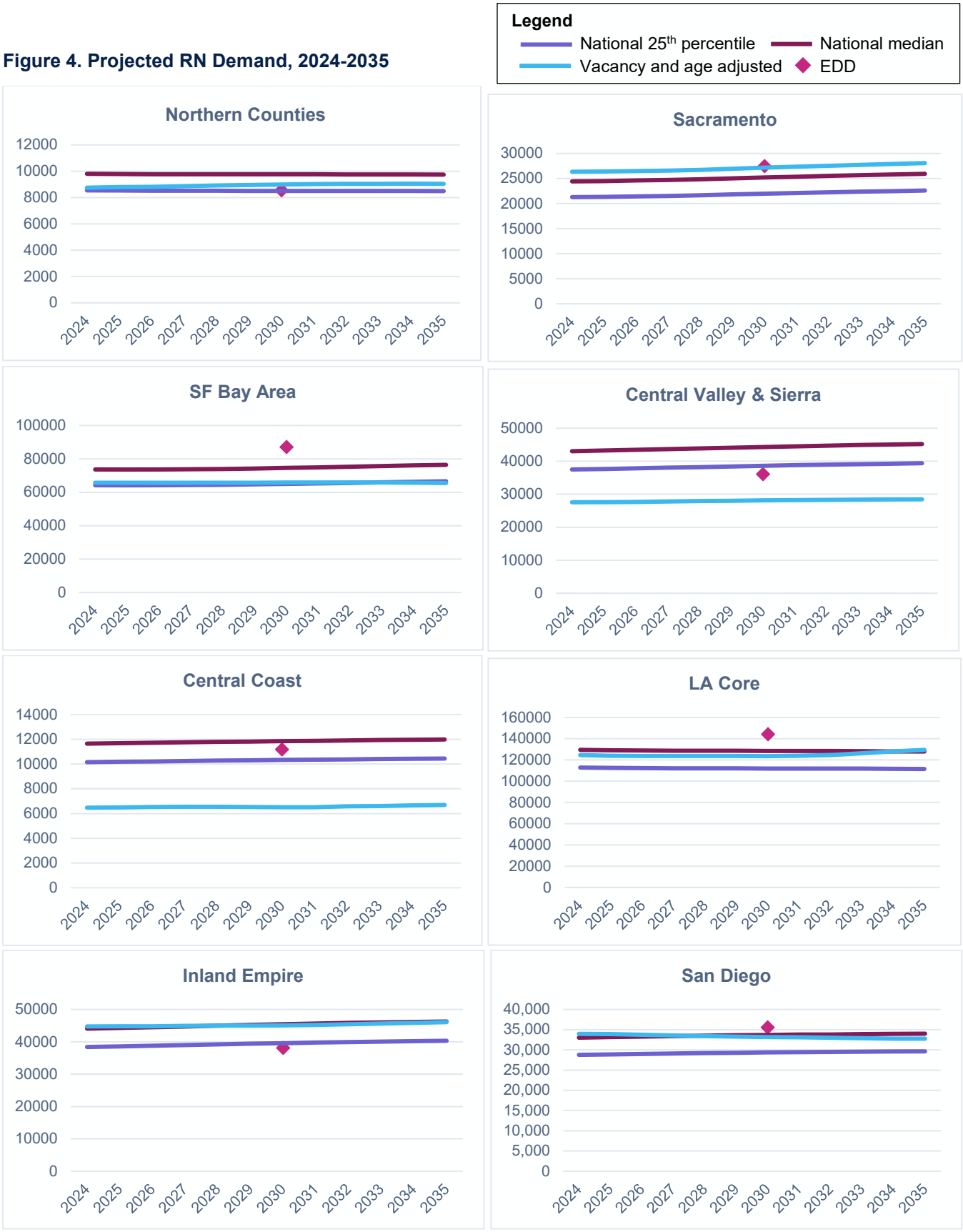
To calculate baseline demand, current RN FTEs were adjusted by the vacancy rate using data from the Hospital Association of Southern California's Health Care Workforce Report. This quarterly report surveys hospitals statewide and can be used to calculate regional vacancy rates. An alternative source of vacancy data is the Employment Development Department's Online Job Vacancy Statistics Dashboard (EDD, 2024). In November, 2024, the Dashboard reported 20,058 job postings for RNs. This is smaller than the number of RN vacancies reported earlier that year by the Hospital Association of Southern California (27,318 statewide). This difference could be explained by (1) vacancies being lower in non-hospital settings, and thus using hospital vacancies to extrapolate for all RN jobs produces too high an estimate; (2) employers make one posting for multiple positions, and thus postings underestimate vacancies; or (3) vacancy rates declined between the first quarter and November 2024. For this report, the Hospital Association vacancy rate was used. Each region's current RN FTEs were multiplied by the region's vacancy rate to obtain current demand.

To calculate growth in demand, the first step was to obtain the total number of hospital patient discharges in 2022 (the most recent data available) from short-term, acute-care hospitals in each region (HCAI, 2024c). In order to estimate the total number of patient days per age group (10-year ranges), these data were multiplied by the average length of stay per age group, as reported by Hospital National Inpatient Statistics (AHRQ, 2024). To calculate the rate of hospital utilization per age group, the total number of patient days per age group was divided by the estimated population of each age group in the region. Age-specific population estimates and forecasts were sourced from the California Department of Finance (2024). These rates of patient days per age group were then applied to the population projections to forecast total patient days by age group.

Demand Projection Results

Figure 4 presents the projected FTE demand of RNs for each region of California from 2024 through 2035, for projections based on fixed FTE-to-population ratios and vacancy- and age-adjusted ratios, and the 2030 projection published by the California EDD. There is notable variation across regions regarding which demand projection is higher and how they compare to the EDD projection for 2030. The vacancy and age-adjusted projections reflect current levels of demand, but gaps between these projections and the national benchmarks may indicate that demand is falling short of need. In the Northern Counties, the vacancy and age-adjusted projection is slightly higher than the EDD projection for 2030, is above the national 25th percentile, but is below the national median. In contrast, in Sacramento the vacancy and age-adjusted projection is higher than the national median and similar to the EDD projection. For the San Francisco Bay Area, Los Angeles Core, and San Diego/Imperial regions, the EDD projections are notably higher than any of the other projections. In the San Francisco Bay Area, the vacancy and age-adjusted projection is similar to the national 25th percentile, while it is similar to the national median in the Los Angeles Core and San Diego regions. For the Central Valley and Sierra and the Central Coast, the vacancy and age-adjusted projection is lower than all other projections. For the Inland Empire, the EDD projection is similar to the national 25th percentile, while the vacancy and age-adjusted projection is similar to the national median.

Figure 4. Projected RN Demand, 2024-2035



Comparing Supply and Demand for RNs

Figures 5, 6, and 7 and Tables 15, 16, and 17 present the projections of FTE RN supply and the forecasts of FTE RN demand based on vacancy and age-adjusted ratios as well as the national median for 2024, 2030, and 2035. In 2024, all regions of California have a shortage of RNs compared with both measures of demand, except for the Central Valley and Central Coast, where supply exceeds the age and vacancy-adjusted demand estimate but falls short of the national median. The shortages relative to the national median range from 5.4% in the Inland Empire to 35.7% in the Central Coast.

Figure 5. Estimated RN FTE Supply and Demand, 2024

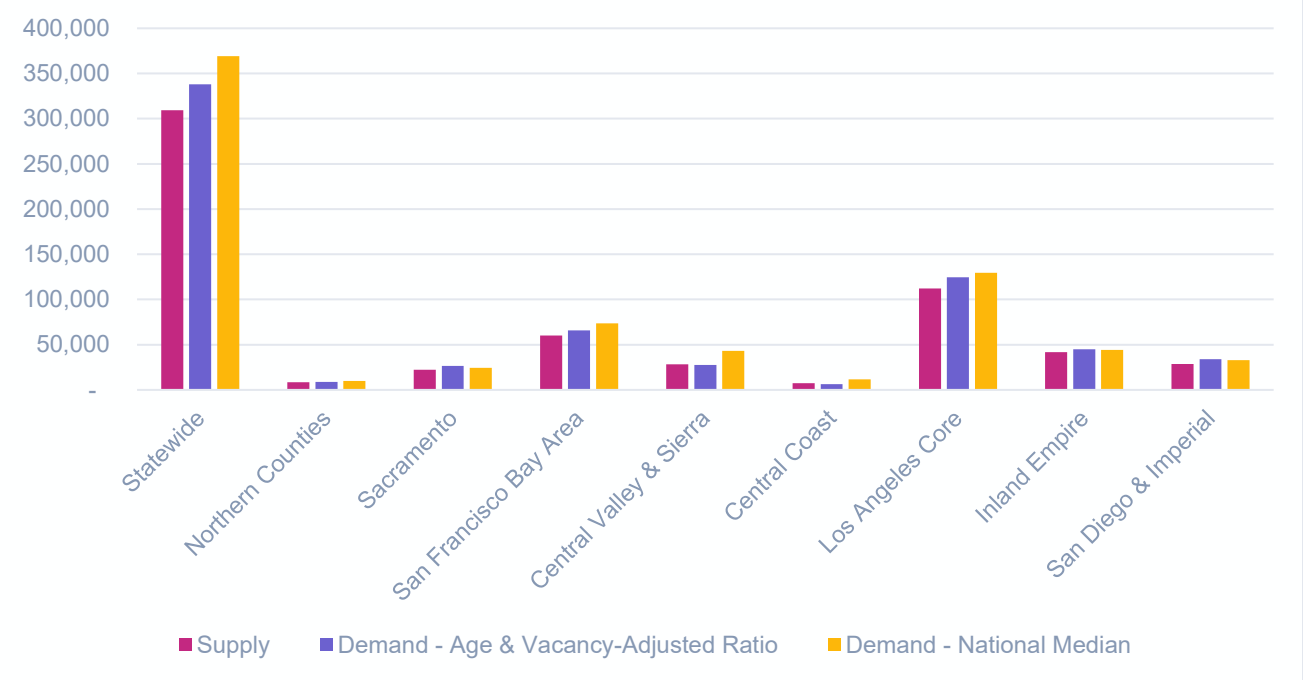


Table 15. Projected RN FTE Supply and Demand, 2024

	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Supply	8,504	22,385	60,165	28,380	7,496	112,038	41,684	28,815
Demand: Vacancy & Age-Adj Ratio	8,751	26,351	65,734	27,576	6,474	124,516	44,751	33,962
Gap	-2.8%	-15.1%	-8.5%	2.9%	15.8%	-10.0%	-6.9%	-15.2%
Demand: National Median	9,804	24,431	73,664	43,057	11,653	129,485	44,070	33,018
Gap	-13.3%	-8.4%	-18.3%	-34.1%	-35.7%	-13.5%	-5.4%	-12.7%

Note: Negative gaps indicate shortage; positive gaps indicate surplus.

By 2030, shortages are projected to have ended in all regions for the vacancy and age-adjusted demand estimate, except for in San Francisco Bay Area, where a 1.1% shortage remains. However, shortages relative to the national median benchmark persist for the San Francisco Bay Area, Central Valley and Sierra, Central Coast, and Los Angeles Core regions.

Figure 6. Projected RN FTE Supply and Demand, 2030

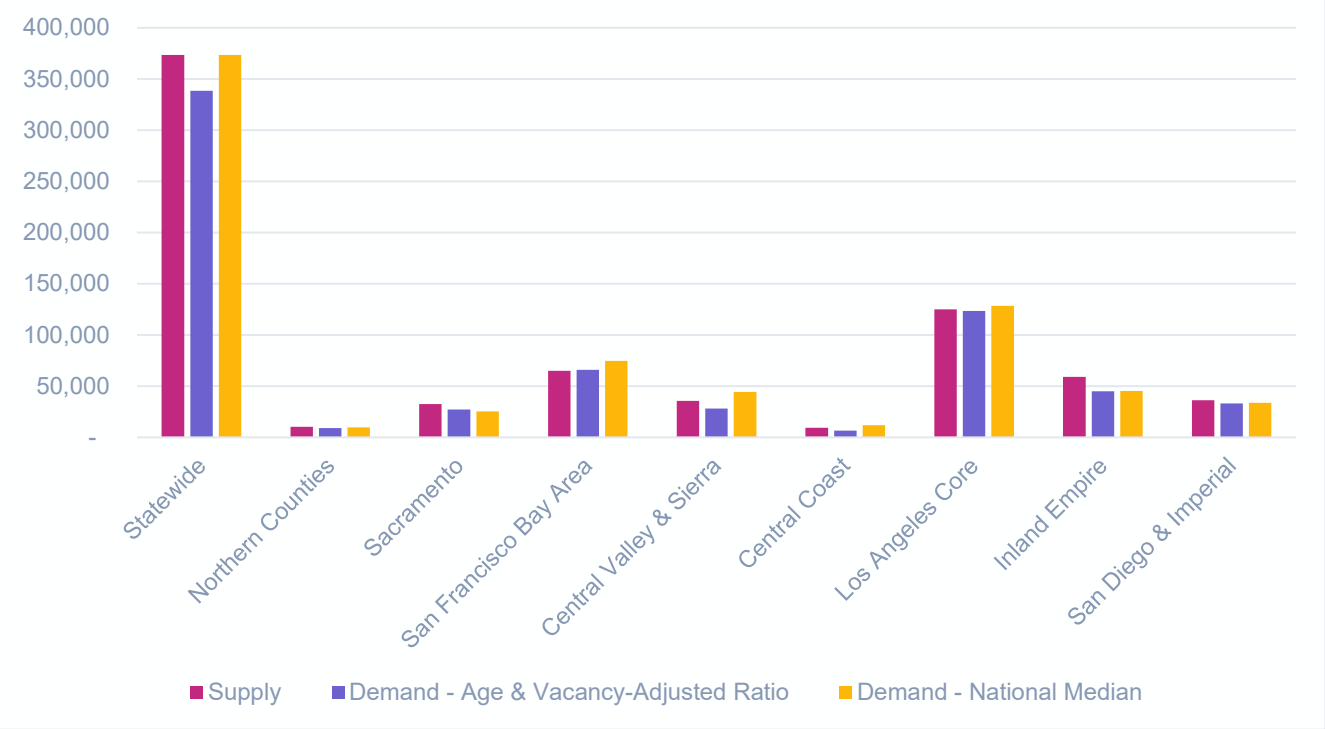


Table 16. Projected RN FTE Supply and Demand, 2030

	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Supply	10,418	32,361	65,154	35,606	9,343	124,916	59,203	36,347
Demand: Vacancy & Age-Adj Ratio	8,990	27,157	65,884	28,132	6,506	123,562	45,073	33,180
Gap	15.9%	19.2%	-1.1%	26.6%	43.6%	1.1%	31.3%	9.5%
Demand: National Median	9,763	25,208	74,542	44,331	11,855	128,517	45,429	33,695
Gap	6.7%	28.4%	-12.6%	-19.7%	-21.2%	-2.8%	30.3%	7.9%

Note: Negative gaps indicate shortage; positive gaps indicate surplus.

In 2035, the projections indicate that no regions will have a shortfall of supply relative to the vacancy and age-adjusted demand projections. However, the San Francisco Bay Area, Central Valley and Sierra, and Central Coast regions are projected to continue to have a shortfall relative to the national median benchmark.

Figure 7. Projected RN FTE Supply and Demand, 2035

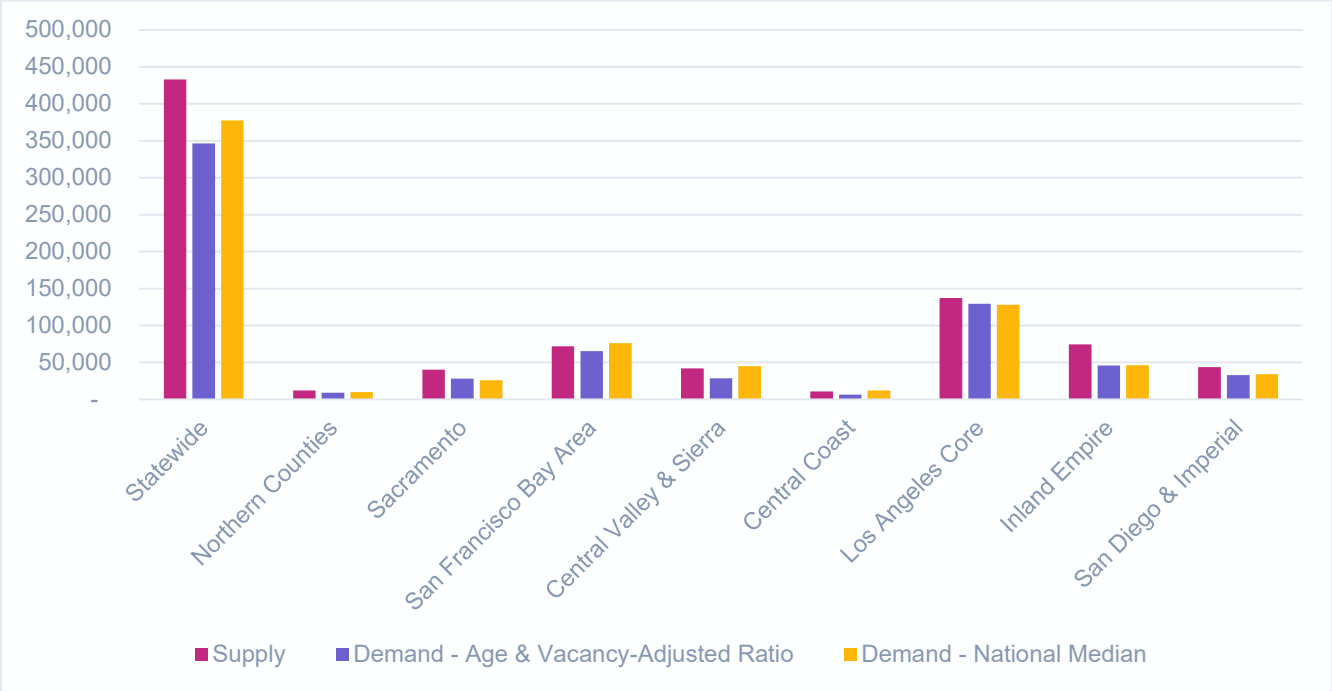


Table 17. Projected RN FTE Supply and Demand, 2035

	Northern Counties	Sacramento	SF Bay Area	Central Valley/Sierra	Central Coast	Los Angeles Core	Inland Empire	San Diego & Imperial
Supply	12,102	40,374	71,768	42,039	10,964	137,300	74,598	43,742
Demand: Vacancy & Age-Adj Ratio	9,042	28,078	65,535	28,463	6,696	129,459	46,080	32,768
Gap	33.8%	43.8%	9.5%	47.7%	63.8%	6.1%	61.9%	33.5%
Demand: National Median	9,743	25,941	76,403	45,233	11,986	127,955	46,262	34,002
Gap	24.2%	55.6%	-6.1%	-7.1%	-8.5%	7.3%	61.3%	28.6%

Note: Negative gaps indicate shortage; positive gaps indicate surplus.

Additional factors that affect regional RN shortages

The projected movement of new graduates across regions before licensure has a significant influence on projections of regional shortages. The Los Angeles Core region is estimated to lose 16.4% of its younger new graduates to other regions each year, and the Northern Counties are estimated to lose 25.3%. These losses contribute to long-term projections of slower supply growth. Conversely, the Sacramento and Inland Empire regions are estimated to receive a large proportion of new graduates from other regions, which contributes to projected rapid supply growth in these regions. Future analyses should examine the counties to which new graduates locate in detail in order to develop more stable projections of regional movements of new graduates.

Some RNs travel across regions for work, which could result in fewer or more nurses working in each region. It is likely that some of the shortfall in the Los Angeles Core region is filled by RNs who live in the Inland Empire, for

example. Commuting patterns will depend on the proximity of regional borders as well as relative wages between regions. If there is a shortage of RNs in a region, wages are likely to grow more rapidly, which can induce RNs from neighboring regions to commute or relocate.

Another factor that may affect the supply of RNs is that some are also advanced practice RNs – nurse practitioners (NPs), certified nurse-midwives (CNMs), and nurse anesthetists (CRNAs). Both the supply and demand projections are based on RN-to-population ratios that include all categories of RNs. Future analyses could disaggregate these types of nurses, although it should be noted that some advanced practice RNs work in "regular" RN roles.

Policy Implications

Statewide forecasts have projected that a shortage exists now but that it will abate over the next few years. These regional projections indicate that all regions of California face a shortage of RNs, but the degree of shortage varies widely, as does projected growth of RN supply. Although all regions are projected to have a balance between supply and demand based on vacancy and age-adjusted projections, gaps between the vacancy and age-adjusted projections and the national median benchmarks suggest that demand for RNs – and perhaps health care infrastructure as a whole – is below population need. This is particularly true for the Central Valley and Central Coast regions, where the projected ratio of RNs per 100,000 population is lower than every other region. The San Francisco Bay Area is also projected to have very slow growth of its RN workforce, which could lead to persistent (but small) shortages.

These projections could change if any of the variables in the model change. The most important changes that could change the projections are increases or decreases in: (1) the number of graduates from RN education programs, (2) inter-regional migration, including of new graduates, and/or (3) employment rates of RNs. These factors, and any other potential influences on regional nursing supply, such as the limited pool of faculty, limited availability of clinical education placements, and faculty salaries that are not competitive with clinical practice positions, should be monitored continuously.

Regional health care and education leaders should track the employment paths of recent nursing graduates as they develop specialized skills to fill the roles of experienced nurses who will retire in the near future. Moreover, they should monitor new student enrollments in nursing programs, as well as the degree to which employers are reliant on contract personnel and commuters, to determine whether and the extent to which local RN education programs should expand.

References

Agency for Healthcare Research and Quality (AHRQ). 2024. HCUPnet, Healthcare Cost and Utilization Project. Agency for Healthcare Research and Quality, Rockville, MD. https://datatools.ahrq.gov/hcupnet.

Auerbach, David I., Peter I. Buerhaus, & Douglas O. Staiger. 2022. A Worrisome Drop in the Number of Young Nurses. Health Affairs Forefront, April 13, 2022. https://www.healthaffairs.org/do/10.1377/forefront.20220412.311784

Auerbach, David I., Peter I. Buerhaus, & Douglas O. Staiger. 2024. Projecting the Future Registered Nurse Workforce After the COVID-19 Pandemic. JAMA Health Forum, 5 (2): e235389. https://jamanetwork.com/journals/jama-health-forum/fullarticle/2815057

Blash, Lisel, & Joanne Spetz. 2024. 2022-2023 Annual School Report: Data Summary and Historical Trend Analysis. Sacramento, CA: California Board of Registered Nursing. https://rn.ca.gov/pdfs/education/schoolrpt22-23.pdf.

California Department of Finance. 2024. Population Projections (Baseline 2023), County Population Projections (2020-2070), P-2C County Population by Sex and Age Group. Sacramento, CA: California Department of Finance. https://dof.ca.gov/forecasting/demographics/projections/.

California Department of Health Care Access and Information (HCAI). 2024a. Health Workforce Research Data Center Annual Report to the Legislature, January 2024. Sacramento, CA: Department of Health Care Access and Information. https://hcai.ca.gov/wp-content/uploads/2024/04/Health-Workforce-Research-Data-Center-Annual-Report-to-the-Legislature-January-2024.pdf.

California Department of Health Care Access and Information (HCAI). 2024b. Presentation: Agenda Item 8a: Nursing Workforce: Modeling Updates and County-Level Findings. California Health Workforce Education and Training Council Meeting, November 4, 2024. Sacramento, CA: Department of Health Care Access and Information. https://hcai.ca.gov/wp-content/uploads/2024/11/Agenda-Item-8a-Nursing_Modeling-updates-and-county-level-findings_Nov_2024_Council_Mtg.pdf.

California Department of Health Care Access and Information (HCAI). 2024c. Inpatient Discharges Pivot Profile, 2022. Sacramento, CA: Department of Health Care Access and Information. https://hcai.ca.gov/data/healthcare-utilization/inpatient/.

California Economic Strategy Panel. 2006. California Economic Strategy Panel Regions. Sacramento, CA: California Economic Strategy Panel. https://www.breakthroughcommunities.info/wp-content/uploads/2020/12/cesp_regions_report.pdf.

California Employment Development Department (EDD). 2022. 2020-2030 Local Employment Projections. Sacramento, CA: Labor Market Information Division, Employment Development Department. https://labormarketinfo.edd.ca.gov/data/employment-projections.html.

California Employment Development Department (EDD). 2024. Online Job Vacancy Statistics Dashboard. Sacramento, CA: Labor Market Information Division, Employment Development Department. https://labormarketinfo.edd.ca.gov/data/help-wanted-online(hwol)/online-job-ads-data.html.

Chu, Lela & Joanne Spetz. 2024. California Board of Registered Nursing 2022 Survey of Registered Nurses. Sacramento, CA: California Board of Registered Nursing. https://rn.ca.gov/pdfs/forms/survey2022.pdf.

Health Resources and Services Administration (HRSA). 2023. Workforce Projections. Rockville, MD: U.S. Department of Health and Human Services, Health Resources and Services Administration. https://data.hrsa.gov/topics/health-workforce/workforce-projections.

Health Resources and Services Administration (HRSA). 2024a. State of the U.S. Health Care Workforce, 2024. Rockville, MD: U.S. Department of Health and Human Services, Health Resources and Services Administration. https://bhw.hrsa.gov/data-research/review-health-workforce-research.

Health Resources and Services Administration (HRSA). 2024b. National Sample Survey of Registered Nurses. Rockville, MD: U.S. Department of Health and Human Services, Health Resources and Services Administration. https://bhw.hrsa.gov/data-research/access-data-tools/national-sample-survey-registered-nurses.

Hospital Association of Southern California. 2024. Health Care Workforce Report, Data Collected 1st Quarter, January 1-March 31. Los Angeles, CA: Hospital Association of Southern California.

Scheffler, Richard M., Tim Bruckner, & Joanne Spetz. 2012. The Labour Market for Human Resources for Health in Low- and Middle-Income Countries. World Health Organization Human Resources for Health Observer Series No. 11. Geneva, Switzerland: World Health Organization. https://www.who.int/publications/m/item/9789241503914.

World Health Organization. 2016. Health Workforce Requirements for Universal Health Coverage and the Sustainable Development Goals. Geneva, Switzerland: World Health Organization. https://iris.who.int/bitstream/handle/10665/250330/9789241511407-eng.pdf.