Forecasts of the Registered Nurse Workforce in California

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Overview

This study uses data from two surveys conducted in California, along with other data sources, to assess the current and future supply and demand of RNs. We find that, although RN employment rates have remained steady over the past four years, many older RNs have left nursing. In addition, there has been an increase in the proportion of RNs that intends to retire or quit nursing within the next two years. RNs report high rates of burnout and many are considering leaving their current position. Supply and demand projections estimate that a shortage of RNs now exists but will diminish over the next four years as RN education enrollments continue to rise. However, there are scenarios in which RN supply does not increase as much as projected, creating a risk of longer-term shortages.

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This study uses data from two surveys conducted in California, along with other data sources, to assess the current and future supply and demand of RNs and to learn how the coronavirus pandemic is affecting this essential workforce.

Methods

Data from the 2022 Survey of California Registered Nurses and final data from the California Board of Registered Nursing 2021-2022 Annual School Survey were analyzed to produce an update to RN supply and demand forecasts for California. Additional data from the California Board of Registered Nursing's licensing records, the California Department of Finance, and the California Department of Health Care Access and Information were used in the projection models. Supply projections were based on a stock-and-flow model and demand projections were based on historic RN employment and rates of health care utilization by population age group.

Results

Data from the 2022 Survey of California Registered Nurses indicate that overall RN employment has remained stable over the past four years but that many older RNs have left nursing. In addition, there has been an increase in the proportion of RNs that intends to retire or quit nursing within the next two years. Projected increases in new enrollments and graduations from RN education programs and a higher rate of migration of RNs into California from other states are anticipated to drive growth in the RN workforce, even as there are projected to be increases in rates of RNs moving to other states and allowing their licenses to lapse. The analysis indicates there is currently a shortage of RNs, but the gap is projected to close by 2027.

Discussion

The current shortage of RNs is projected to close by 2027 due to rising numbers of nursing enrollments. However, the shortage could persist if newly graduated RNs and experienced nurses are not retained in the workforce. High rates of burnout may lead to greater turnover and departures from nursing, which could make the shortage continue or worsen. Employers need to redouble their efforts to retain experienced RNs and develop career paths for newly-graduated RNs to ensure their successful transition into the workforce. They also need to rapidly develop and implement strategies to mitigate the potential harm caused by the current shortage.

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. Concerns about shortages intensified during the COVID-19 pandemic. Anecdotal reports and survey research indicate that some RNs decided to stop working in healthcare positions to recover emotionally from the high stress of working during the pandemic. In addition, nursing education programs reported in spring 2020 that their students were unable to continue their clinical education due to worries about infection risks within hospitals. Education programs adopted clinical simulation training and shifted didactic courses to online platforms but ultimately struggled to modify their programs. Some programs deferred starting a new cohort of nursing students in the 2020-2021 academic year, while others reduced new fall enrollments to ensure adequate physical distance between students and faculty in the classroom. In addition, some accepted students deferred their admission because they did not want to engage in remote education. Together, these changes could undermine the progress made over the past 20 years toward higher nurse-to-population ratios and a balanced nursing labor market. Nationwide, hospitals and other healthcare settings are reporting lower staffing ratios, more overtime, and greater use of travel nurses to fill staffing gaps.

This study uses data from the 2022 Survey of California Registered Nurses and the 2021-2022 California Board of Registered Nursing Annual School Survey, along with other data sources, to assess the current and future supply and demand of RNs and to explore how the coronavirus pandemic is affecting this essential workforce in the nation's most populous state.

Methods

Data from the two statewide surveys and additional administrative records were analyzed to generate updated projections of future supply and demand for RNs in California.

The Survey of California Registered Nurses has been conducted every two years since 2014. The survey is sent by email to a sample of 8,000 RNs who have active California licenses. Non-respondents receive the survey by postal mail six weeks after the initial email. The survey questionnaire includes items about employment, education, intention to retire or quit, and demographics. The analysis presented in this report is based on the 3,090 RNs who responded to the survey, of whom 2,912 lived in California. All analyses presented in this report are weighted to represent the total population of RNs licensed by California.

The California Annual School Survey is a comprehensive survey of all RN education programs in California. Data from the 2021-2022 survey were used in this analysis. All nursing education programs in California responded to the 2021-2022 survey.

These two surveys were combined with administrative data provided in March 2023 by the California Board of Registered Nursing (BRN). Administrative data included the number of RNs changing their license status between active, inactive, and delinquent, the number of RNs having licenses from other states endorsed in California, and the number of RNs educated outside California receiving their first licenses from California.

Supply projections are based on a stock-and-flow model and demand projections are based on historic RN employment and rates of health care utilization by population age group. More information about the model is provided in the technical appendix.

Results

Registered Nurse Employment

Based on the BRN 2022 survey, we estimate that 80.2% of California-resident RNs were employed in nursing in spring 2022 (Figure 1). There was essentially no change in the overall employment rate between 2018 and 2022, as the difference between these estimates is within the margin of error of the RN survey. In 2022, 13.2% of working RNs reported that they held more than one job, which was higher than in 2020 (11.9%) and 2018 (10.8%).

Figure 1. Percentage of California-resident RNs employed in nursing, 2006-2022
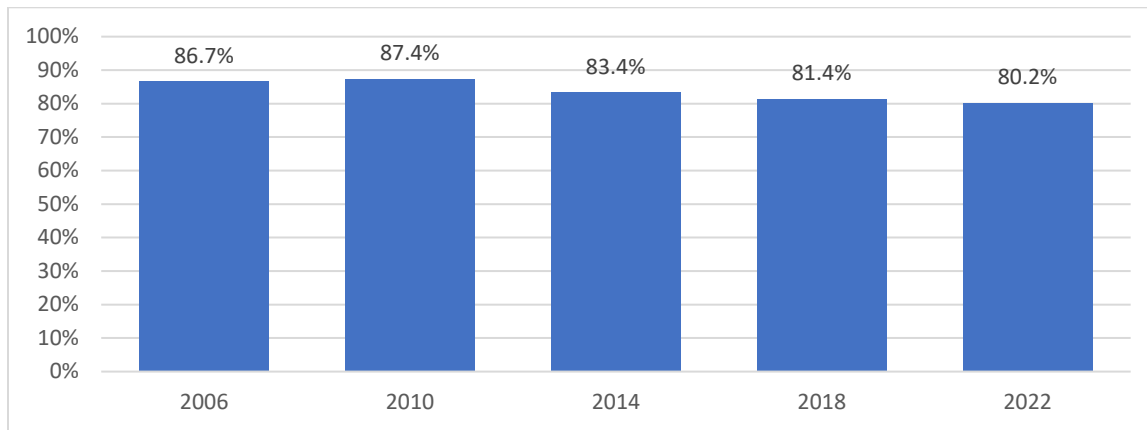
There have been notable changes in employment rates for some age groups (Figure 2). The employment rates for nurses under 35 years old, 40 to 44 years old, and 60 to 64 years old were higher in 2022 than in 2018. The employment rates were lower in 2022 than in 2018 for nurses aged 35-39 years and 45-59 years.

Figure 2. Percentage of California-resident RNs employed in nursing, by age group, 2006-2022
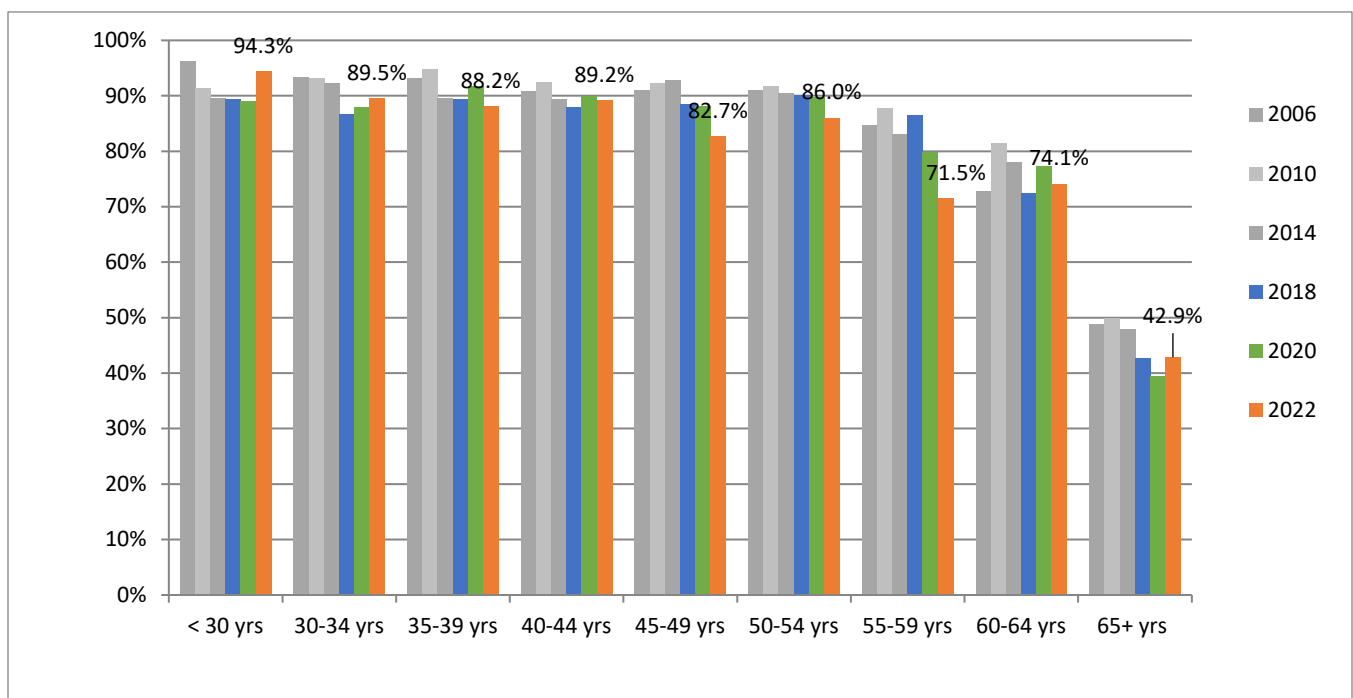
Figure 3 shows changes in the employment status of RNs in their principal nursing position. Overall, there has been little change in the percentage of RNs who are regular employees. Between 2018 and 2022 there were insignificant increases in the percentages of RNs who were self-employed and working as temporary or traveling nurses.

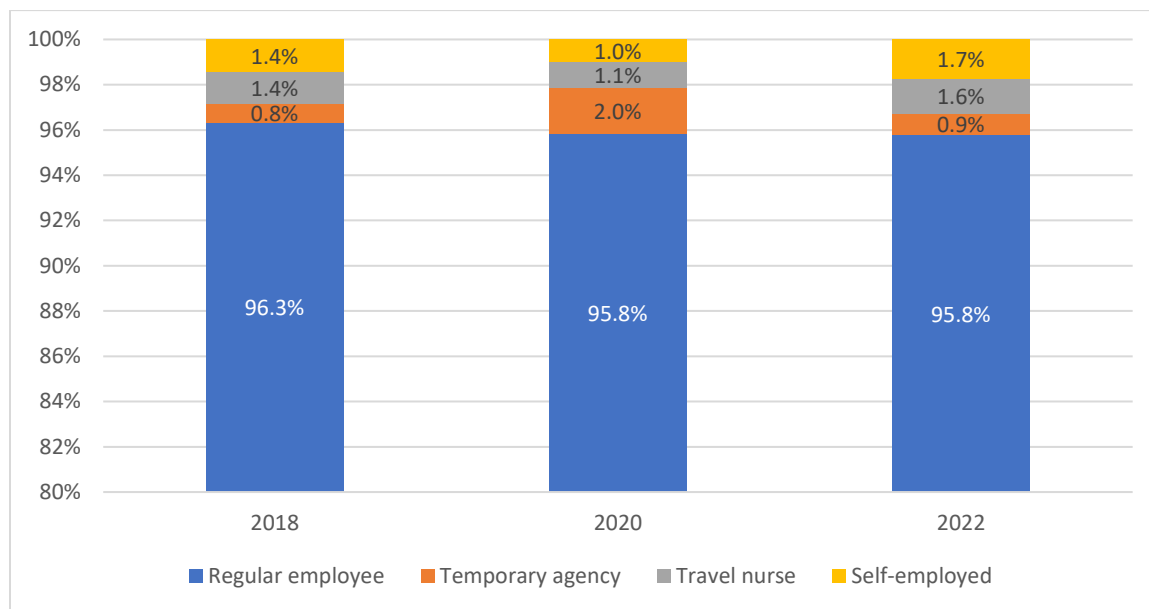**Figure 3. Employment status of California-resident RNs in principal nursing position, 2018-2022**

Figure 4 shows the average number of hours worked per week by all employed RNs between 2012 and 2022, which has not changed much over the past decade. This number was 36.3 hours per week in 2022, compared to 36.8 hours per week in 2018 and 36.0 hours per week in 2012.

Figure 4. Average hours worked per week for California-resident RNs, 2012-2022
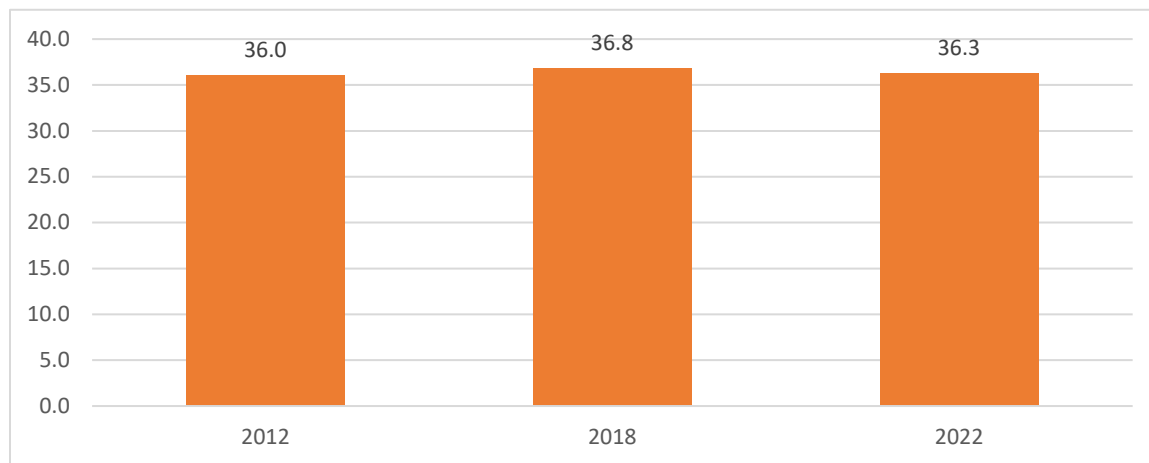
Figure 5 reports the percentage of employed RNs who plan to retire or leave nursing in the next two years, by age group. It shows there has been a notable increase in the percentage of RNs aged 55 to 64 years who reported plans to retire or quit in the next two years, from 11.4% in 2018 to 14.1% in 2022. The percentage of RNs aged 65 years and older who reported plans to quit or retire in the next two years has remained stable. In 2022, 2.8% of RNs 35 to 44 years old and 3.8% of RNs 44 to 54 years old indicated they plan to retire or leave nursing in the next two years, which is higher than in any past survey. However, the differences between 2022 and prior years are within the survey's margin of error and should be interpreted with caution.

Figure 5. Percentage of employed California-resident RNs who plan to retire or leave nursing in the next 2 years, 2018-2022
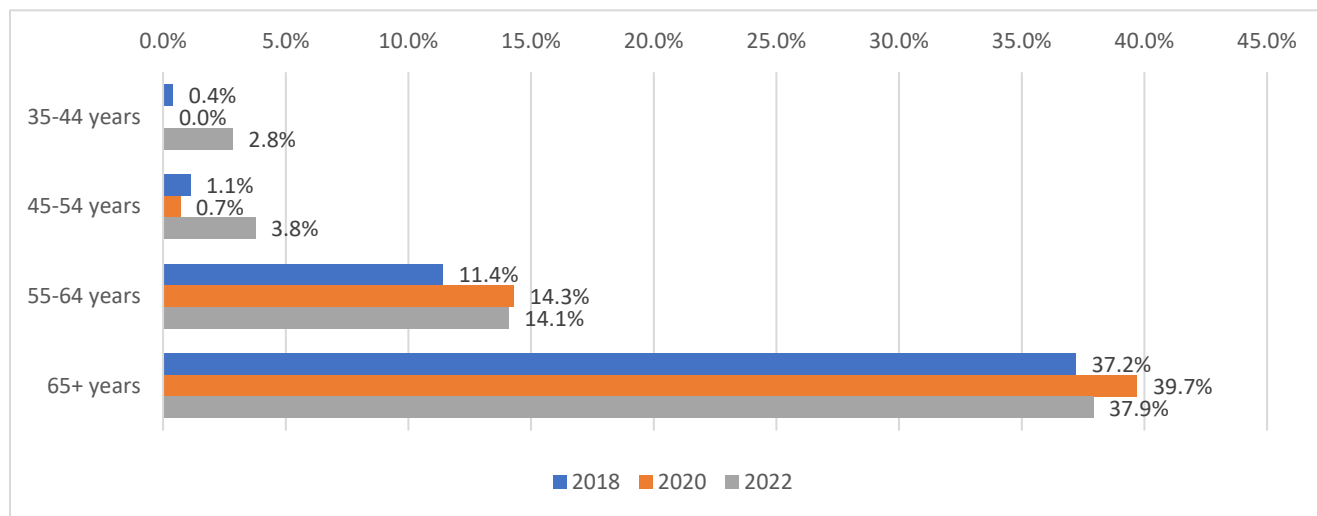
Although most RNs plan to remain in the nursing profession for at least the next two years, many intend to change jobs. As seen in Figure 6, 22.2% of all employed RNs residing in California said it is "reasonably likely" they will leave their principal nursing position in the next two years, and 13% said they are "definitely leaving." RNs who were 65 years and older were the most likely to indicate plans to leave their current position, which reflects the high percentage that plans to retire in the next two years. The high percentage of RNs under 35 years old that is at least reasonably likely to leave their current position (45.9%) should be noted by employers.

Figure 6. Intentions of RNs to remain in or leave their principal nursing position within two years, 2022
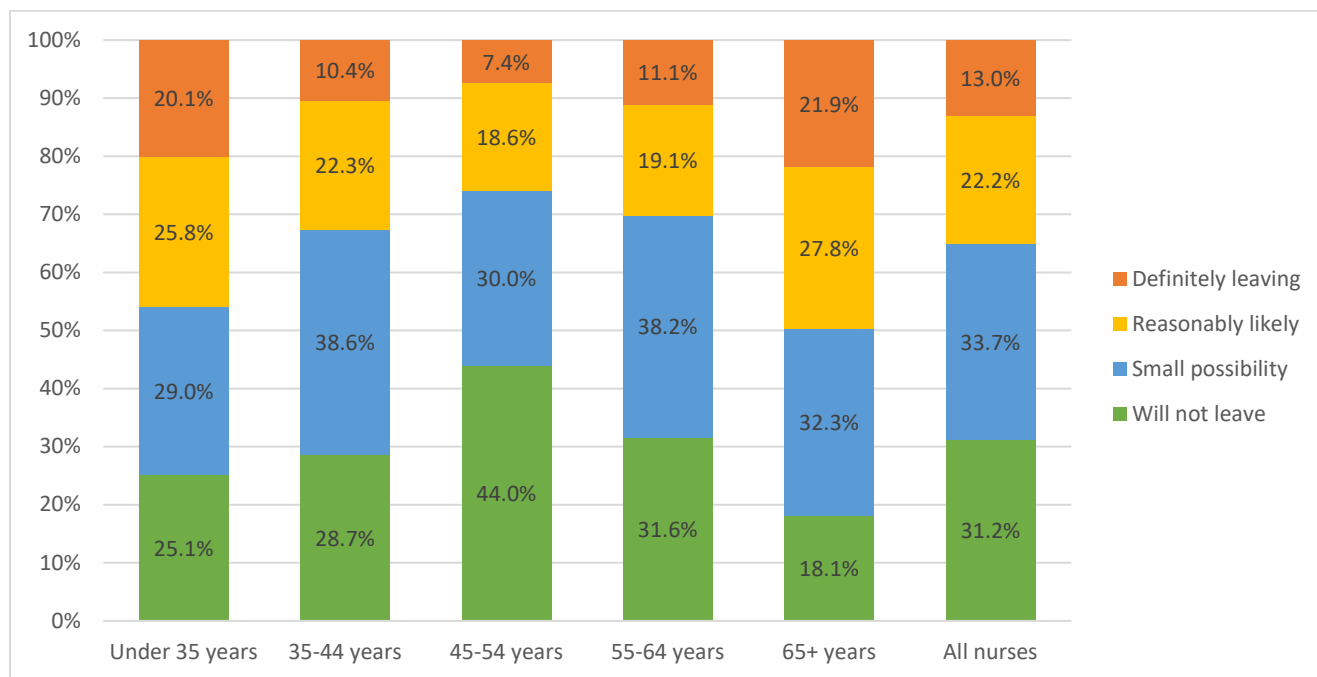
The 2022 survey included a question about burnout, asking nurses: "Overall, based on your definition of burnout, how would you rate your level of burnout?" Figure 8 presents their responses. A worrisome percentage of RNs reported that they feel completely burned out (5.7%) or are at the next-highest burnout level (8.5%).

Figure 8. Nurse ratings of their level of burnout
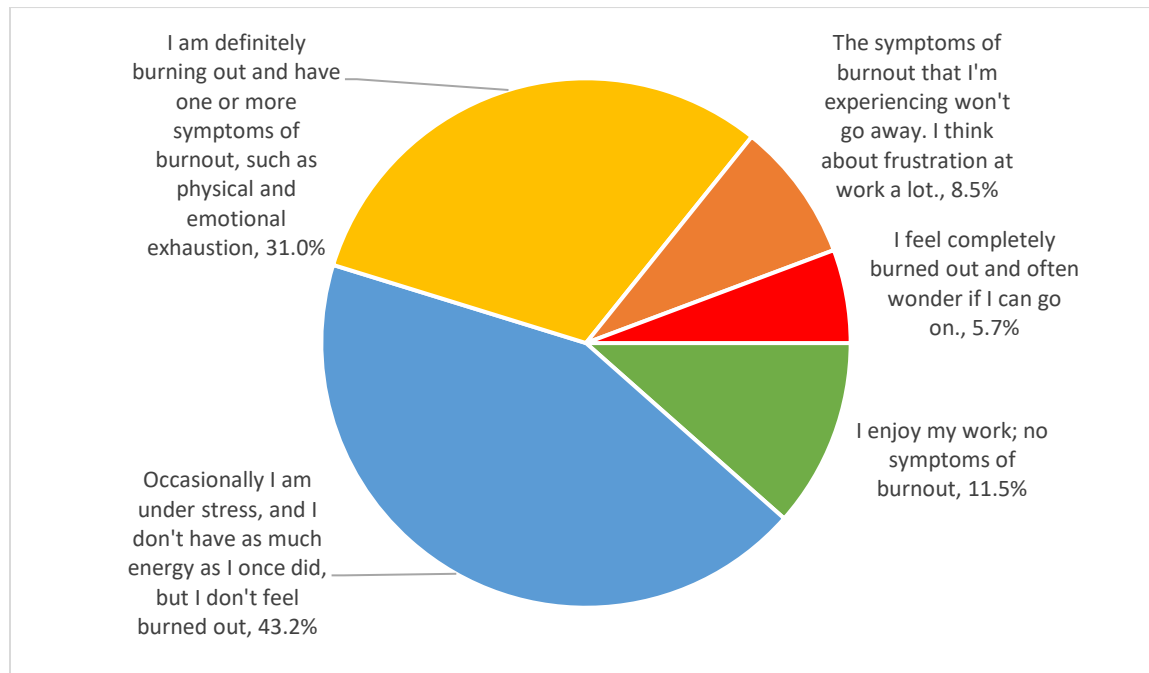
Figure 9 presents RNs' ratings of their burnout by age group. The highest level of burnout is reported by 7.4% of RNs under 35 years old and 5.7 of RNs 35 to 44 years old. Overall, high burnout scores (indicated by yellow, orange, and red in the figure) are most prominent among RNs under 45 years old. This is consistent with the relatively high percentage of RNs in this age group that is likely to leave their current position within the next two years.

Figure 9. Perceptions about support and respect from the organizations in which RNs work, 2022
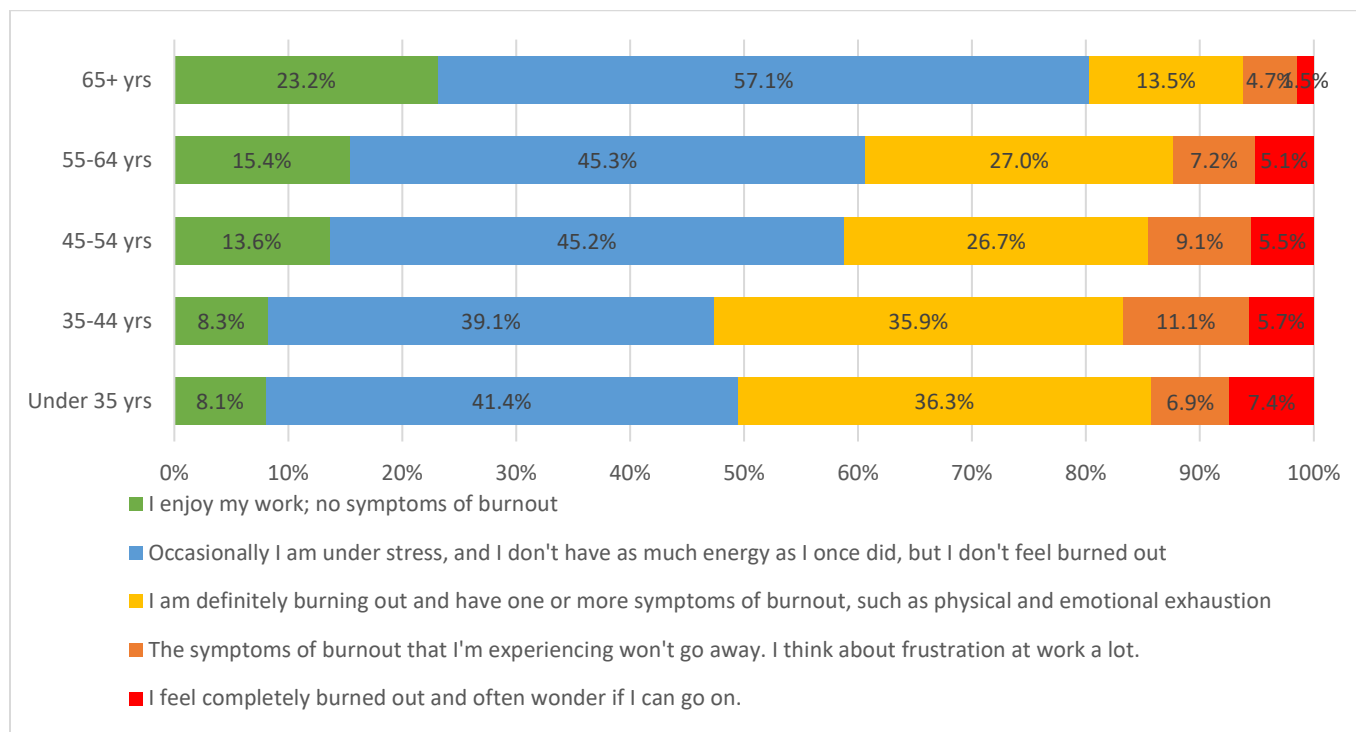
Registered Nurse Education

In a survey fielded in fall 2022, California's nursing schools provided information about their enrollments and graduations for the 2021-2022 academic year. Note that one large program did not report some data in 2019-2020 and 2020-2021, resulting in what appears to be a very large increase in enrollments between 2020-21 and 2021-2022; this jump is due to the missing data.

Many schools were impacted by the loss of access to clinical sites during the pandemic and shifted instruction to online modalities to reduce virus transmission. As seen in Table 1, there was a decrease in enrollment spaces available between the 2018-19 and 2020-21 academic years, with a loss of 529 spaces (-3.6%). There was an even larger decrease in total new enrollments, with a decline of 1,146 students (-7.6%). However, enrollments recovered by the 2021-22 academic year, surpassing enrollments in 2018-19. It is possible that enrollments recovered earlier, but data are missing for one large program during the intervening years. The growth in enrollments have been primarily in bachelor's degree programs (26.3% between 2018-19 and 2021-22) and private colleges/universities (29.1%). Since the 2019-20 academic year, there has been an increasing number of spaces available that have not been filled, reaching 3,776 unfilled spaces in the 2021-22 academic year.

Table 1. Change in new enrollments in California RN education programs between 2018-19 and 2020-21 academic years

	2018-19 new enrollment	2019-20 new enrollment	2020-21 new enrollment	2021-22 new enrollment	Percentage change 2018-19 to 2021-22
Spaces available	**14,897**	**15,204**	**14,368**	**20,388**	**36.9%**
Total enrollments	**15,150**	**15,007**	**14,004**	**16,612**	**9.7%**
Associate degree enrollments	7,014	6,852	5,941	6,533	-6.9%
Bachelor's degree enrollments	7,266	7,242	7,133	9,179	26.3%
Master's degree enrollments	870	913	930	900	3.4%
Public program enrollments	8,103	7,944	6,866	7,511	-7.3%
Private program enrollments	7,047	7,063	7,138	9,101	29.1%

Figure 10 presents new enrollments in RN education programs in the 2021-22 academic year and schools' projections of their enrollments for the 2022-23 and 2023-24 academic years. All program types anticipate growth over the next two years.

Figure 10. New and projected enrollments in RN education programs, 2020-21 through 2022-23
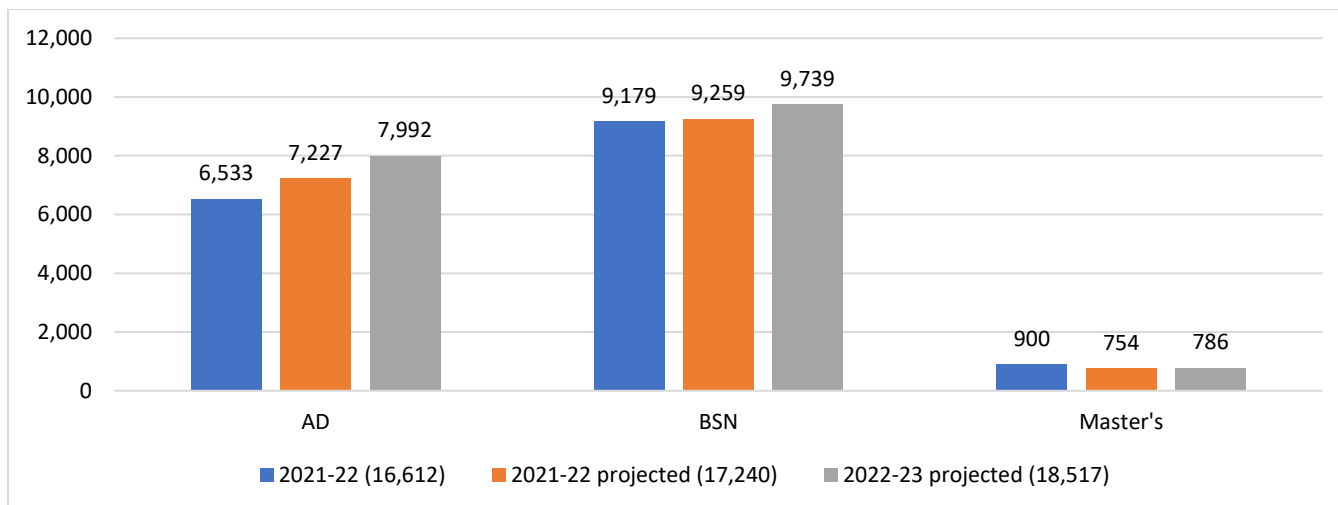
Projections of Future Supply and Demand for RNs

The future supply and demand for RNs were projected using the RN Survey and School Survey data described above, as well as other data sources detailed in Appendix A. The best projection indicates that there is a shortage of 16,905 full-time equivalent (FTE) RNs in 2023, but that the gap between supply and demand will close by 2027. By 2038, RN supply is projected to reach 426,919 FTEs, while demand is projected to be 336,136 FTE RNs. Note, however, that there are scenarios in which California's RN supply shrinks – this could occur if more nurses move out of California to work and/or more choose to shop working in nursing than projected based on historic data. Given the high rates of burnout among younger RNs, there is a risk that the supply of RNs does not rise as rapidly as projected, although it's unlikely that it would be as low as the lowest projection presented in Figure 11.

Some of the gap between supply and demand is now filled by traveling RNs who live in other states and work in California for short periods of time. The 2022 RN survey indicates that approximately 17,219 RNs traveled to California in the prior year and 29,015 plan to travel to work in California over the next two years. Of those who traveled to California in the past year, they worked an average of 42.5 hours per week for 5.5 months, resulting in 8,385 FTE supply, filling half of the estimated gap.

Note that some RNs were not working in nursing but seeking employment in 2022. Data from the 2022 RN survey indicate that approximately 5,175 RNs were seeking employment, which would fill about 31% of the current shortfall. Another 4,795 RNs indicated they planned to seek nursing employment within the year.

Figure 11. Projected supply and demand of RN full-time equivalent employment, 2023-2038
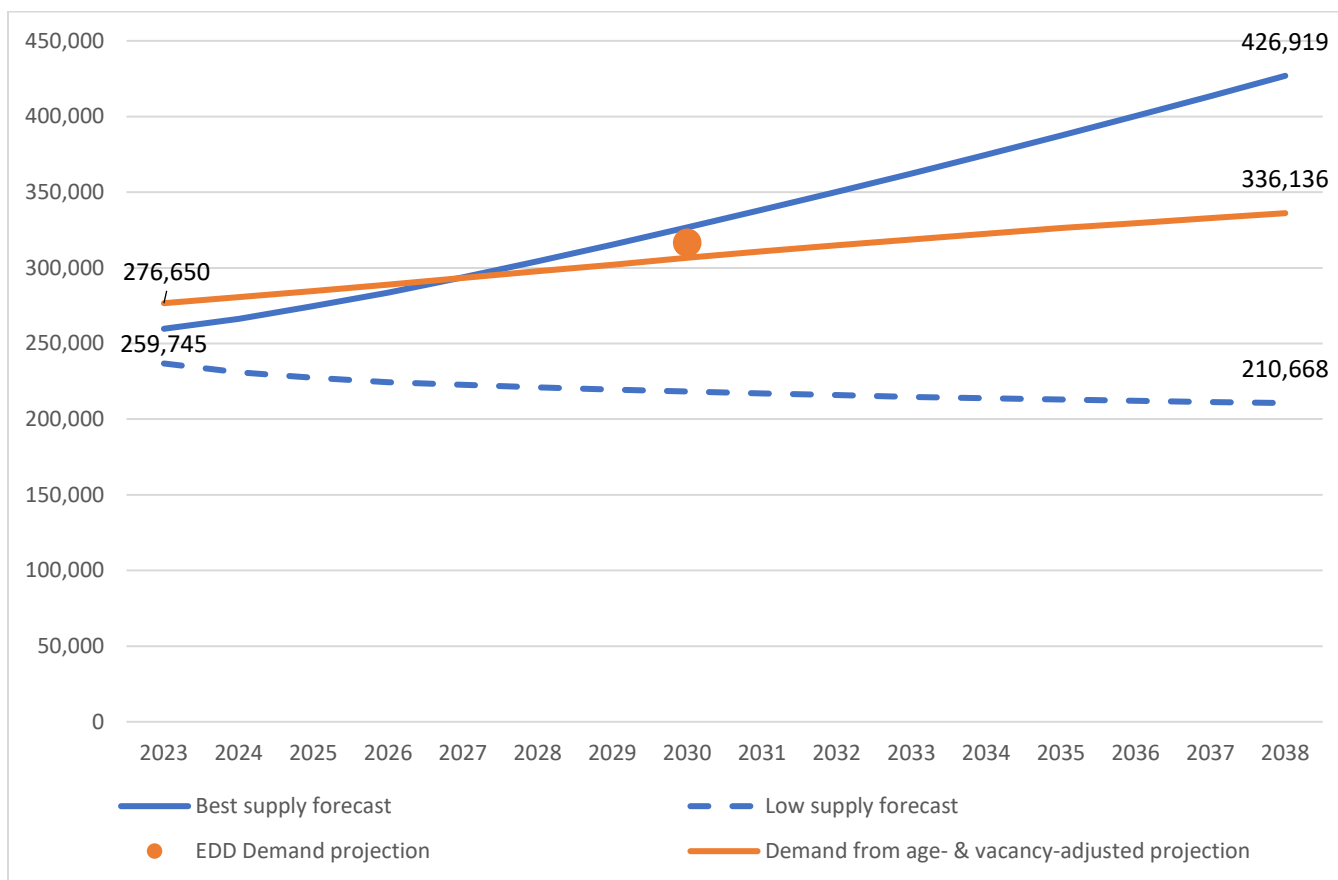
Discussion

Our analysis indicates that there is currently a shortage of RNs in California. Between 2020 and 2022, many RNs – particularly those with more experience – left the nursing workforce. Although overall RN employment rates have been stable since 2018, they have declined among RNs 45 years and older. In addition, in 2022 a larger proportion of RNs reported they intend to retire or quit within the next two years compared with 2018, including among younger nurses. Burnout rates among nurses, particularly those younger than 45 years old, are high and many RNs report they are likely to leave their current nursing position.

The current shortage of RNs is projected to close by 2027 due to rising numbers of nursing enrollments. After decreases in new RN education enrollments and graduations during the pandemic, RN schools have returned to growth. This growth has been concentrated in private and bachelor's degree programs. The numbers of new graduates are anticipated to be sufficient in numbers to fill open jobs in the long-term, with supply matching demand by 2027.

Several limitations need to be considered. First, the projections include assumptions about retirement patterns and other departures from RN work that may not hold true in the long term. The RN shortage could persist beyond 2027 if newly graduated RNs and experienced nurses are not retained in the workforce. High rates of burnout may lead to greater turnover and departures from nursing, which could make the shortage continue or worsen.

Second, these are statewide analyses and projections, and do not reveal important regional differences that have been previously reported. Regional projections will be developed and published in a future report.

Third, the projections assume that most newly graduated RNs will obtain licenses and become available to work in California. However, if newly enrolled RNs have difficulty completing their programs on time and newly graduated RNs have difficulty passing the national licensing examination, supply will be attenuated. Recent data indicate that on-time completion rates dropped between 2020-21 and 2021-22 and attrition rates increased; these changes were greatest among private and bachelor's degree programs. In addition, first-time board exam pass rates declined during the pandemic and have not recovered. In the 2021-22 academic year, BSN programs and private programs had the lowest average pass rates. Given that the growth in RN education in California has primarily come from BSN and private programs, the declines in on-time completion and first-time board exam pass rates are worrisome.

Shortages of RNs – even if short-lived – have significant consequences for patients and for our healthcare system. Low RN staffing levels are associated with greater risk of hospital-acquired infections, readmissions, and death. Shortages of RNs also have financial repercussions as employers have to increase wages to attract permanent employees and pay for traveling nurses to fill staffing gaps. A number of policy strategies have been recommended to alleviate the challenges faced by the RN workforce, including specifying standards to ensure high-quality, safe, and supportive work environments to increase RN retention. In addition, healthcare organizations can implement a variety of evidence-based approaches to mitigate burnout among their workforce, including improving communication, establishing wellness initiatives, offering individual and group counseling, providing services such as childcare and transportation assistance, offering workplace flexibility, ensuring adequate protective equipment and supplies, and developing peer support programs.

Our results are consistent with other studies that have reported concerns about nurses' stress during and after the pandemic and the risk of greater numbers leaving their jobs or leaving nursing entirely. Healthcare workers have reported increases in the prevalence of depression, anxiety, and insomnia, which will require sustained interventions to ensure nurses' health and long-term productivity. Employers need to redouble their efforts to retain experienced RNs and develop career paths for newly-graduated RNs to ensure their successful transition into the workforce. They also need to rapidly develop and implement strategies to mitigate the potential harm caused by the current shortage.

A. Technical Appendix

The forecasts of RN supply and demand are based on models that were initially developed in 2005 and have been refined as new data and methods have become available.
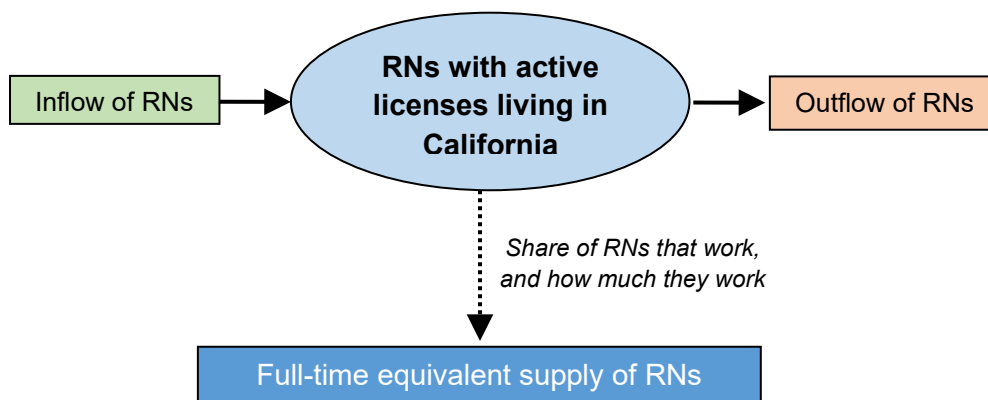
The Supply of RNs

The RN workforce constantly changes with the entrance of newly-graduated nurses, the migration of nurses to and from other 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:

- Inflows of nurses: Additions to the number of RNs in California
    - Graduates from California nursing programs
    - Graduates of nursing programs in other states who obtain their first RN license in California
    - Internationally-educated nurses who immigrate to California and obtain their RN license
    - Interstate migration of RNs to California
    - Changes from inactive to active license status
    - Changes from delinquent to active license status
- Outflows of nurses: The departure of RNs from the California RN population
    - Migration out of California (to another state or country)
    - Movements from active to inactive or lapsed license status
- Labor force participation factors: Decisions to work, and how much to work
    - Proportion of RNs that works in nursing
    - Average number of hours worked per week by RNs working in nursing

Figure A1 illustrates the supply model, commonly called a "stock-and-flow model." The number of RNs with active licenses (light blue oval) is the "stock" of nurses available to work. This number grows with inflows (green rectangle) and decreases with outflows (orange rectangle). Estimates of the labor supply of RNs (dark blue rectangle) are derived from the stock of RNs potentially available to work in nursing and how much they choose to do so. This final supply 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 A1. A model of the supply of RNs

Method of Calculating RN Supply

Changes in the inflows, outflows, and employment decisions of nurses will lead to changes in the overall supply of RNs. The age distribution of the workforce also affects supply; younger RNs are more likely to be employed in nursing and older RNs are more likely to work part-time or not at all. Thus, the model examines the employment patterns of 13 distinct age groups: 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. Each year, one-fifth of RNs in each age category move into the next (older) age category, until they reach the oldest age category.[1] For each year, the estimated numbers of RNs flowing into the workforce are added to each age group and the estimated outflows are subtracted, resulting in a forecast of the new stock of RNs for each age group for the following year. Finally, employment rates and average hours worked per week in nursing are applied to the estimated stock of RNs in each age group to obtain estimated FTE supply. This calculation is iterated through 2035 to obtain yearly forecasts of RN supply.

For some factors in the supply model, differing estimates are available, with no indication of which estimate is most reliable. For other factors, there is uncertainty as to whether current data are applicable to what might happen in the future. For variables with such uncertainty, a range of estimates is offered representing the highest and lowest plausible values. In the final models, a "best estimate" for each parameter is used, usually the average of the low and high estimates.

Estimates of Supply Model Factors

Stock of RNs

Data on the stock of RNs was obtained from the California Board of Registered Nursing (BRN). On March 17, 2023, California licenses were held by 436,976 RNs, of whom 359,699 had California addresses and 77,277 had out-of-state addresses. On June 19, 2019, there were 439,670 RNs with active California licenses, of whom 358,865 had California addresses. For the purposes of these forecasts, the California-resident population is defined as the supply of nurses; the role of nurses who travel from other states to work in California is discussed in the report narrative.

Table A1 compares 2023 and 2019 data. The total number of licensed nurses grew only 0.2% between 2019 and 2023, which is notably lower than found in prior analyses. Growth of RNs with California addresses was 1.6% between 2017 and 2019, 3.6% between 2015 and 2017, and 3.8% between 2013 and 2015. For the projection model, the number of RNs with active licenses and California addresses was divided into 13 age groups. The number of RNs with California addresses increased for some age groups and decreased for others. The largest rates of increase were for ages 70 to 75 years (28%) and 50-54 years (24.1%). The largest decreases were for ages under 25 years (-62.5%) and 25-29 years (-26.5%).

Table A1. Counts of actively-licensed RNs living in California, by age group, June 2019 and March 2022

Age Group	June 19, 2019		March 17, 2023		Change 2019-2023
	Count	% of Total	Count	% of Total	
Under 25	3,554	0.99%	1,332	0.37%	-62.5%
25-29	25,834	7.20%	18,997	5.28%	-26.5%
30-34	44,800	12.48%	41,292	11.48%	-7.8%
35-39	45,341	12.63%	51,752	14.39%	14.1%
40-44	41,313	11.51%	45,961	12.78%	11.3%
45-49	45,330	12.63%	42,906	11.93%	-5.3%
50-54	35,392	9.86%	43,910	12.21%	24.1%
55-59	36,150	10.07%	33,132	9.21%	-8.3%
60-64	39,718	11.07%	32,800	9.12%	-17.4%
65-69	26,103	7.27%	28,375	7.89%	8.7%
70-74	10,316	2.87%	13,204	3.67%	28.0%
75-79	3,729	1.04%	4,468	1.24%	19.8%
80+	1,285	0.36%	1,570	0.44%	22.2%
Total	358,865	100.00%	359,699	100.00%	0.2%

Source: California Board of Registered Nursing license records.

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[1] All but the youngest and oldest age groups span 5 years, and if nurses are evenly distributed across those five years, 20% - or 1 in 5 – would move to the next age group each year. The youngest age group spans 7 years, but there are few RNs under 20 years old; thus, the 20% assumption seems reasonable for this group as well.

Graduates from California pre-licensure nursing programs

According to the BRN Annual School Report, there were 13,372 new graduates from California RN programs in the 2021-2022 academic year. Table A2 presents the numbers of new enrollments and graduates from the past 10 Annual Schools Reports. 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.

Table A2. Numbers of new pre-licensure RN student enrollments and graduates from California nursing programs, 2012-2013 through 2021-2022

Survey year	Number of new student enrollments	Growth in new student enrollments	Number of graduates	Growth in graduates
2012-2013	13,181	-3.6%	11,292	4.4%
2013-2014	13,226	0.3%	11,291	-0.01%
2014-2015	13,318	0.7%	11,119	-1.5%
2015-2016	13,152	-1.2%	11,191	0.7%
2016-2017	13,597	3.4%	11,302	1.0%
2017-2018	14,154	4.1%	11,890	5.2%
2018-2019	15,150	7.0%	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%

Source: Blash, L, Spetz, J. 2020-2021 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, February 25, 2022.

We used the enrollment data to project future numbers of RN graduates. We assumed that new student enrollments in each year are associated with graduations two years later. Associate degree (AD) programs are designed so that students can complete the nursing component of the degree in two years, and in most non-accelerated Baccalaureate of Science Nursing Degree (BSN) programs, students are formally enrolled in nursing major courses during their last 2.5 to 3 years.

From the 2016-2017 through 2021-2022 school years, graduates averaged 87.1% of the number of student enrollments two years prior. We used this rate to estimate the number of future graduates. As actual enrollments after 2021-2022 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 2023-2024). These estimates were multiplied by 87.1% to obtain the forecasted number of graduates for 2024-2025 and 2025-2026. Our low estimate of growth in RN education after 2025-2026 is 0%, the high estimate is 1%, and the best estimate is 0.5%. Actual and projected numbers of graduates from 2018-2019 through 2025-2026 are presented in Table A3.

Table A3. Numbers and predicted numbers of pre-licensure RN enrollments and graduates from California nursing programs

Academic year	Actual/forecasted new student enrollments	Actual/forecasted number of graduates
2018-2019	15,150*	11,857*
2019-2020	15,002*	12,714*
2020-2021	14,004*	12,304*
2021-2022	16,612*	13,372*
2022-2023	17,240	12,199
2023-2024	18,517	14,471
2024-2025		15,018
2025-2026		16,130

* Actual number of student enrollments and graduates based on Annual Schools Report.

Graduates from other states who obtain their first license in California

Each year, some graduates of nursing programs in other states obtain their first RN license in California. According to the BRN, 1,132 out-of-state graduates obtained their first license from California in 2022; this is the high estimate of out-of-state graduates who move to California. BRN records indicate that 984 of these nurses had California addresses; this is the low estimate. The best estimate for the inflow of new graduates from other states is the average of the high and low estimates: 1,058 nurses. This estimate is more than double that from the 2019 forecasts, which was 544.

Immigration of internationally-educated nurses

BRN records report that 1,426 internationally-educated nurses passed the National Council Licensure Examination for RNs (NCLEX-RN) in 2022 and received initial licensure as RNs in California. Of these, 1,084 had a California residence; the remainder lived in other states or countries. In our supply model, the total number of 2022 international graduates that received initial licensure in California was used as the high estimate of the number of immigrants; the number that lived in California was used as the low estimate. The best estimate was the average of the high and low estimates: 1,255 internationally-educated RNs immigrate to California each year. This number is higher than the 2017 and 2019 estimates of 603 and 851. However, these figures are much lower than the peak of 4,107 during the first decade of the 2000s.

Age distributions of new graduates

Inflows of new graduates are added to the stock of RNs by age group. The BRN Annual School Report uses an uneven set of age groups for new California graduates: 18-25, 26-30, and then 10-year age groups for graduates over age 30. To create consistent groups of graduates for the forecasting model, graduates were allocated into five-year groups. Table A4 presents estimates of the age distribution of new graduates from California RN education programs. RN graduates from nursing programs in other states seeking initial licensure as RNs in California were assumed to have the same age distribution as California graduates.

BRN records of internationally-educated nurses who receive their initial US licensure in California include the birth years of these nurses. The age distribution of internationally-educated RNs who lived in California and obtained licenses in 2022 is presented in the last column of Table A4; these data were used to forecast the age distribution for all internationally-educated RNs receiving first licenses in California.

Table A4. Age distributions of new graduates from California and international RN programs

Age group	Graduates of US RN programs	Internationally-educated graduates
18-25*	34.2%	2.5%
26-29*	29.3%	11.6%
30-34	14.7%	30.6%
35-39	11.9%	29.3%
40-44	4.9%	12.3%
45-49	3.2%	8.0%
50-54	1.1%	3.0%
55-59	0.5%	2.0%
60-64	0.2%	0.6%
65+	0.0%	0.1%

* The age groups for internationally-educated RNs are "Under 25" and 25-29. The Annual Schools Survey reports graduates aged 61 and older; the projection model assumes these graduates are all 60-64 years old and no graduates are 65 years or older.

Interstate migration of RNs to California

Estimates of interstate migration to California were developed in two ways. First, BRN licensing records from 2020 were compared with those from 2022. There are two components of interstate migration to California: (1) RNs who already have a California license and move to the state, and (2) RNs who obtain a new California

license and move to the state. To measure this first component, 2020 and 2022 licensing files were compared to identify nurses who had California licenses in both years, but who lived outside California in 2020 and resided in California in 2022. Over the two-year period, the difference was 7,980, which is higher than the change between 2018 and 2020 (5,604). This figure was divided by two to get an estimate of one-year change (3,990 RNs). The second component was determined by counting the number of RNs who were newly licensed and had California addresses between 2020 and 2022 (43,992 RNs) and dividing by two to get the one-year average number (21,996 RNs). The number of new graduates in the 2021-2022 academic year (13,372) was then subtracted from this number to estimate the number of experienced RNs moving to California from other states in 2022.

All data were reported by age group, and the RNs identified for both components were allocated across age groups. To obtain an estimate of in-migration as a percentage of the current workforce, the number of RNs migrating from other states was divided by the total number of RNs in each age group. In the model, multiplying this percentage by the total projected number of RNs allows the estimates of in-migration to increase as the workforce of California (and, presumably, the United States) grows. Table A5 provides the estimates for each age group. Note that the estimated number and rate of in-migration is negative for the youngest age group (-145%; 913 RNs); this is likely because some newly-graduated nurses have not yet completed the licensing process or may have moved to another state to obtain their first license. This negative value is not used in the model, as explained below.

Table A5. Estimates of the number of nurses moving to California based on comparison of 2020 and 2022 licensing records

Age Category	A. Number licensed both years who moved to California (2020-2022)	B. Number licensed in 2022 but not 2020	C. Total of RNs moving to California 2020-2022 (A+B) divided by 2	D. Number of RN graduates 2020-2021	Estimated annual in-migration (C-D)	In-migration rate
Under 25	20	5,261	2.641	4,571	-1,931	-145.0%
25-29	953	11,434	6.194	3,914	2,279	12.0%
30-34	1,587	8,632	5,110	1,966	3,143	7.6%
35-39	1,275	5,142	3,209	1,591	1,617	3.1%
40-44	845	2,973	1,909	661	1,248	2.7%
45-49	621	2,135	1,378	428	950	2.2%
50-54	618	1,769	1,194	144	1,050	2.4%
55-59	593	1,548	1,071	72	998	3.0%
60-64	618	1,748	1,183	24	1,159	3.5%
65 and older	850	3,350	2,100	0	1,180	7.4%

Sources: California Board of Registered Nursing license records, 2020 & 2022

Alternate estimates of interstate migration were computed from BRN records of nurses requesting license endorsement from another state into California. Table A6 presents the number of RNs requesting endorsement to California in 2022 who had permanent addresses in California and the number requesting endorsement with permanent addresses anywhere.

Table A6. Requests for license endorsement into California, 2022

Age Category	Residing in California		Residing anywhere	
	# requesting endorsement	Endorsements as % of total RNs	# requesting endorsement	Endorsements as % of total RNs
Under 25	292	21.9%	905	67.9%
25-29	994	5.2%	8,392	44.2%
30-34	1,057	2.6%	7,116	17.2%
35-39	748	1.5%	4,891	9.5%
40-44	405	0.9%	3,105	6.8%
45-49	281	0.7%	2,427	5.7%
50-54	203	0.5%	1,965	4.5%
55-59	108	0.3%	1,113	3.4%
60-64	77	0.2%	609	1.9%
Over 64	46	0.1%	228	0.8%

Sources: California Board of Registered Nursing license records, 2021

Table A7 summarizes the three different estimated rates of in-migration. The low estimate was the rate of endorsement requests for only those with California addresses. The high estimate was half of the rate of all endorsement requests, as prior research found that 49% of RNs requesting endorsement to California intended to live and work in the state; the remaining RNs either never worked in California or worked only temporarily in California (as traveling nurses). The best estimate used the rate calculated from licensing records, except for the youngest age group for which, due to the negative estimate, the endorsement rate for RNs with California addresses was used.

Table A7. Projected rates of in-migration to California

Age Category	California address endorsement rate (Table A6)	Overall endorsement rate (Table A6)	In-migration (Table A5)	Low estimate	High estimate	Best estimate
Under 25	21.9%	67.9%	-145.0%	21.9%	34.0%	21.9%
25-29	5.2%	44.2%	12.0%	5.2%	22.1%	12.0%
30-34	2.6%	17.2%	7.6%	2.6%	8.6%	7.6%
35-39	1.5%	9.5%	3.1%	1.4%	4.7%	3.1%
40-44	0.9%	6.8%	2.7%	0.9%	3.4%	2.7%
45-49	0.7%	5.7%	2.2%	0.7%	2.8%	2.2%
50-54	0.5%	4.5%	2.4%	0.5%	2.2%	2.4%
55-59	0.3%	3.4%	3.0%	0.3%	1.7%	3.0%
60-64	0.2%	1.9%	3.5%	0.2%	0.9%	3.5%
Over 64	0.1%	0.8%	7.4%	0.1%	0.4%	7.4%

Movements from inactive and lapsed to active license status

Data were obtained from the BRN on the number of RNs with California addresses, by age category, changing from inactive to active license status in 2022. This total has ranged from a low of 189 nurses in fiscal year 2002-03 to a high of 971 nurses in calendar year 2018. The 2021 data were used to estimate the number and age distribution of RNs changing from inactive to active license status (Table A8).

The BRN provided data on the number and age distribution of RNs whose licenses were lapsed and later were reactivated. In 2022, 3,890 RNs living in California reactivated their licenses, which is lower than in 2016 and 2018 (5,489 and 5,829). The rate of reactivation was computed by dividing the number of RNs reactivating their

licenses in each age group by the total number of actively licensed RNs in the age group (Table A9). The average rate of license reactivation was 1.1% of the total number of licensed RNs living in California.

Table A8. Number and age distribution of RNs changing status from inactive to active license status, 2021

Age Category	Number	Percent	Age Category	Number	Percent
<30	10	1.4%	55-59	47	6.8%
30-34	45	6.5%	60-64	60	8.6%
35-39	70	10.1%	65-69	126	18.1%
40-44	61	8.8%	70-74	104	14.9%
45-49	62	8.9%	75+	51	7.3%
50-54	60	8.6%	Total	696	100.0%

Source: California Board of Registered Nursing license records, 2021.

Table A9. Number and rate of RNs reactivating lapsed licenses, 2021

Age Category	Number	Rate	Age Category	Number	Rate
<30	161	0.8%	55-59	312	0.9%
30-34	328	0.8%	60-64	375	1.1%
35-39	523	1.0%	65-69	478	1.7%
40-44	423	0.9%	70-74	324	2.5%
45-49	360	0.8%	75+	212	3.7%
50-54	384	0.9%	Total	3,890	1.1%

Source: California Board of Registered Nursing license records, 2021.

Migration out of California (to another state or country)

Estimates of migration out of California were developed in two ways. First, BRN licensing records from 2020 were compared with those from 2022. Nurses who had California licenses in both years but who lived in California in 2020 and resided outside California in 2022 were counted by age group and divided by two to get an estimate of one-year out-migration (4,285 RNs). The number of RNs moving to other states was higher in 2022 than in 2018 (2,445 RNs). The number of RNs moving to other states in 2022 was divided by the total number of RNs in each age group to obtain estimates of out-migration as a percentage of the current workforce. In the model, multiplying this percentage by projected numbers of RNs allows the estimated numbers of nurses moving out of California to grow with the size of the workforce.

Alternative estimates of migration out of California were developed from BRN records of nurses requesting license endorsements to other states in 2022. Some nurses who requested outgoing endorsements had in-state addresses at the time of their requests and others had out-of-state addresses. Both numbers were divided by the numbers of RNs in each age group to estimate of the rates of out-migration. The best estimate is the average of the three estimated out-migration rates (Table A10). The low estimate is the out-migration rate based on endorsement requests for all addresses, which estimates the highest numbers moving out of California and thus leads to smaller projected numbers of RNs. The high estimate is based on comparing 2020 and 2022 licensing files, which produces the lowest estimate of out-migration and thus higher future projections.

Movements from active to inactive or lapsed license status

Estimates of the rate at which actively-licensed RNs allow their licenses to lapse were computed from California BRN license records. These estimates 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.

Table A10. Estimates of the annual number of nurses moving out of California

Age Category	Licensed both years, had California address in 2020 but not 2022		Endorsement requests with California address		Endorsement requests for all addresses		Best estimate (average of all rates)
	Number	Rate	Number	Rate	Number	Rate	
Under 25	9	0.1%	219	3.6%	293	4.8%	1.9%
25-29	215	0.7%	914	2.9%	1,877	6.0%	2.6%
30-34	554	1.1%	1,321	2.6%	2,745	5.5%	2.6%
35-39	558	1.0%	1,180	2.2%	2,521	4.6%	2.1%
40-44	456	1.0%	838	1.8%	1,863	4.1%	1.7%
45-49	386	0.9%	633	1.4%	1,518	3.4%	1.3%
50-54	394	0.9%	611	1.5%	1,437	3.4%	1.6%
55-59	486	1.4%	468	1.4%	1,166	3.5%	1.6%
60-64	562	1.6%	379	1.1%	965	2.8%	1.2%
65-69	439	1.6%	164	0.6%	465	1.6%	1.1%
70-74	172	1.4%	42	0.3%	116	1.0%	0.7%
75 & older	50	0.9%	13	0.2%	28	0.5%	0.4%
TOTAL	**4,277**	**1.1%**	**6782**	**2.2%**	**14994**	**3.9%**	**2.4%**

Sources: California Board of Registered Nursing license records, 2020 & 2022

Two approaches were used to estimate the rates at which RNs allow their licenses to lapse. First, the BRN provided data on the number of RNs with California addresses who changed their license status to inactive or allowed their license to lapse in 2022; this number was much lower in 2022 than in 2018 (13,318 vs. 16,317). Second, BRN licensing records from 2020 were compared with those from 2022. Nurses who had California licenses and residences in 2020 but were not in the license file in 2022 were counted as an estimate of the number of lapsed licenses over a two-year period for each age group. These numbers were divided by 2 to estimate annual counts and rates. As seen in Table A11, these rates were similar to the rates calculated from the records provided by the BRN for nurses 25 to 69 years old, and lower than indicated by BRN records for nurses under 25 years old and 75 years and older. In the model, the higher rate is used as the best estimate because it produces a more conservative estimate of future supply.

Table A11. Estimated annual rates of RNs allowing licenses to lapse or become inactive

Age Category	Changes to inactive or delinquent status, 2022		RNs active in 2020 but not in license file in 2022, divided by 2	
	Number	Rate	Number	Rate
Under 25	31	3.4%	76	5.7%
25-29	386	2.5%	424	2.2%
30-34	813	2.5%	690	1.7%
35-39	993	2.5%	688	1.3%
40-44	778	2.2%	494	1.1%
45-49	599	1.9%	516	1.2%
50-54	644	2.0%	552	1.3%
55-59	753	2.9%	946	2.9%
60-64	1514	5.8%	2,438	7.4%
65-69	3214	12.9%	3,589	12.6%
70-74	2239	17.1%	2,028	15.4%
75-79	892	22.9%	865	19.3%
80+	462	30.2%	354	22.5%
TOTAL	**13,318**		**13,656**	

Source: California Board of Registered Nursing license records, 2020, 2021, and 2022.

Supply Forecasts of California's RN workforce

To create a forecast of the total number of RNs with active licenses in California, the model assumes that one-fifth of RNs in each age category move into the next age category every year after 2023. The number of new graduates and RN migration from other states and countries were added for each age group. Projected future graduations were based on RN education program projections, as described above. For the low forecast and best forecast, however, we subtracted 1,931 graduates, based on the gap between the number graduating and growth in the under 25 category between 2020 and 2022. For all age groups, nurses were subtracted based on the estimated outflows described above. The basic formula is:

Forecasted Supply of CA RNs next year =

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

This calculation was used to produce a forecast of the total active RN population residing in California through 2035. The model projects that California will have 577,766 active resident RNs by 2038, as shown in Figure A2. This is higher than the 2019 forecast of 493,038 RNs. This difference is largely due to higher projected numbers of new graduates and a higher rate of migration of nurses from other states, offsetting increases in the projected rates of migration out of California and younger nurses allowing their licenses to lapse.

As noted above, there was a range of plausible estimates for several of the inflow and outflow parameters in the model. Figure A2 presents the range of supply estimates that result when the highest and lowest plausible supply forecasts are calculated. The rapid growth of the RN workforce in the high forecast is largely driven by higher rates of graduation growth and migration from other states, coupled with lower rates of lapsed licenses. The declining supply in the low forecast results from stalled growth in program enrollments, low rates of migration to California from other states, and high migration of nurses out of California. These alternate forecasts provide a sense of how changes in the variables impact the range of possible supply outcomes.

Figure A2. Forecasted number of RNs with active licenses residing in California, 2023-2038
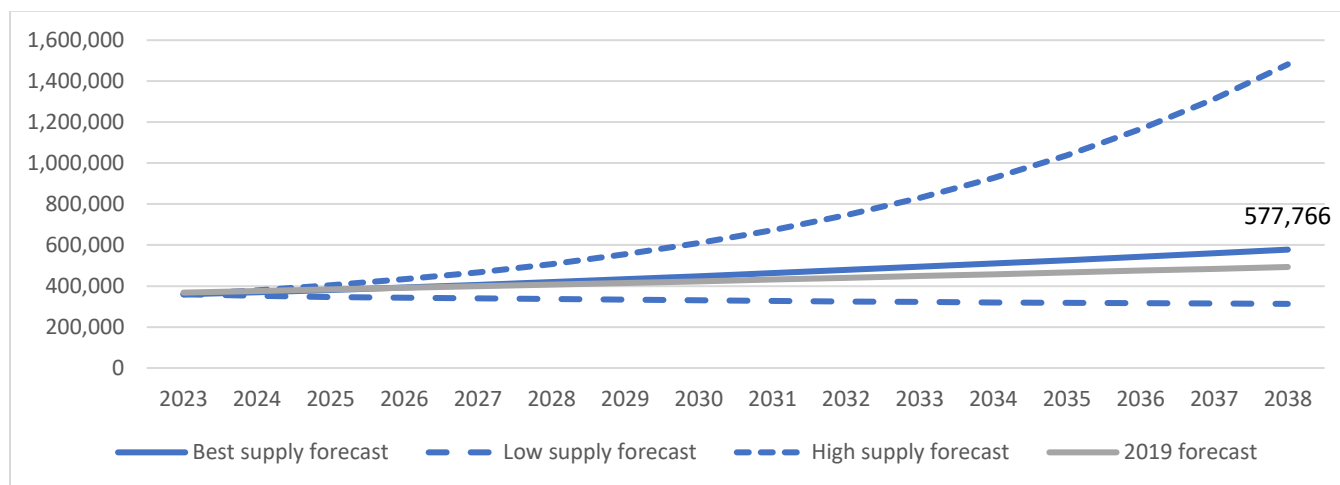
The forecasted number of RNs with active licenses does not account for the variation in hours worked by RNs and the fact that some RNs with active licenses do not work in nursing. Data from the BRN Surveys of California Registered Nurses were used to estimate the proportion of RNs living in California with active licenses that are employed in nursing, by age category. In the 2022 data, the estimated employment rates range from a high of 94.2% for RNs 25 years and younger to a low of 32.8% for RNs aged 75-79 years. Employment rates by age groups have varied over time, and thus we consider a range of potential employment rates in the projections. The low estimate of the employment rate for each age group is the lowest employment rates measured in biennial BRN Surveys between 2016 and 2022. The high estimate is the highest of these six rates. The best estimate is the average of employment rates between 2016 and 2022 (see Table A12).

Table A12. Employment rates for RNs residing in California

| Age Category	Share Employed, 2022	Low Estimate	High Estimate	Best Estimate
Under 25	94.2%	92.6%	95.5%	94.3%
25-29	89.9%	87.3%	95.4%	90.3%
30-34	88.3%	86.7%	93.8%	89.0%
35-39	88.5%	88.5%	93.8%	90.1%
40-44	87.8%	86.7%	92.6%	88.7%
45-49	87.0%	87.0%	93.4%	89.2%
50-54	89.1%	89.1%	90.4%	90.0%
55-59	77.8%	77.8%	87.3%	83.2%
60-64	75.5%	72.4%	77.0%	75.3%
65-69	43.7%	43.7%	59.2%	50.8%
70-74	36.6%	30.9%	43.3%	36.7%
75-79	32.8%	26.6%	32.8%	29.7%
80+	40.0%	17.1%	40.0%	29.1%

In the supply model, data from the Surveys 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 A13. As with the estimates of the employment rate, the high estimate is the highest of the number of hours worked from 2016 through 2022 and the low estimate is the lowest of these years. The best estimate is the average across these years.

Table A13. Average hours worked per week by RNs residing in California

Age Category	Hours Worked per Week, 2022	Low Estimate	High Estimate	Best Estimate
Under 25	36.6	36.6	42.4	39.5
25-29	35.0	35.0	37.3	36.4
30-34	34.9	34.5	37.0	35.7
35-39	33.4	33.4	35.8	35.2
40-44	34.2	34.2	37.0	35.8
45-49	33.6	33.6	38.0	35.9
50-54	35.4	35.4	37.5	36.6
55-59	32.6	32.6	37.5	35.8
60-64	32.1	32.1	37.5	35.2
65-69	30.8	29.1	34.4	31.8
70-74	26.2	25.0	28.3	26.5
75-79	20.7	15.0	22.8	20.3
80+	19.1	7.5	26.9	17.7

Figure A3 presents projected high, low, and best estimates of FTE supply based on the estimates of the future count of RNs. The forecast projects there will be 426,919 FTE RNs in 2038, which is similar to the 400,705 projected in 2019.

Figure A3. Forecasted full-time equivalent supply of RNs, 2023-2038
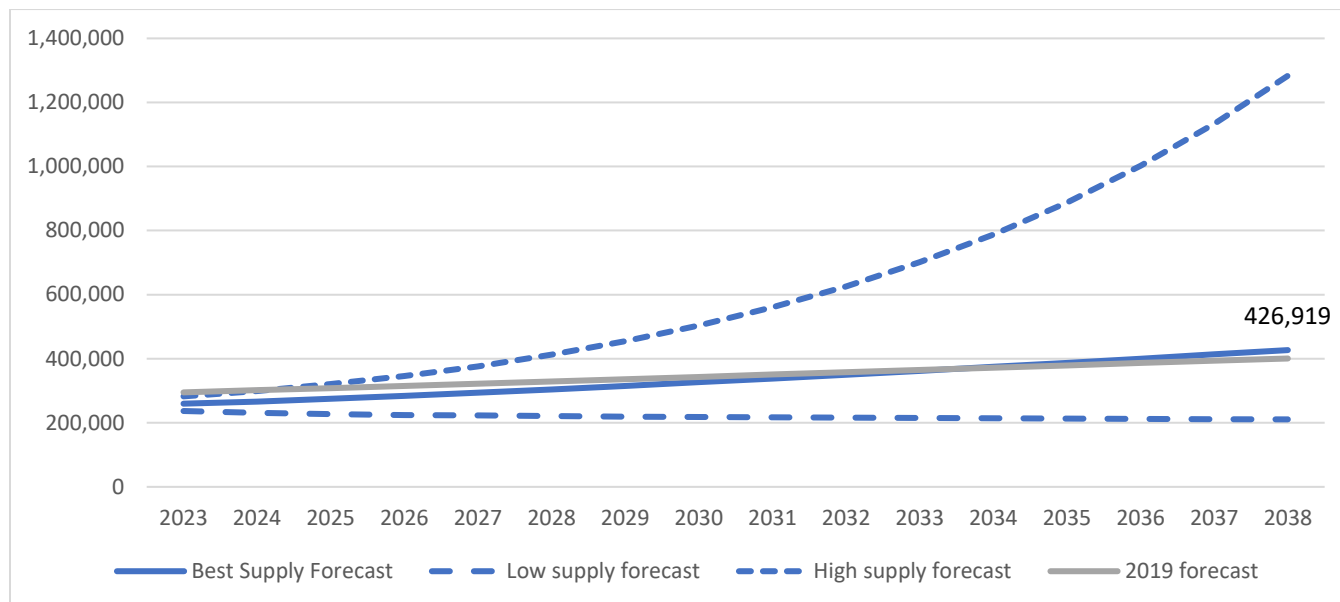
The Demand for RNs

The demand for RNs can be conceptualized and measured 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 that should dictate the need for health care workers. For example, the World Health Organization has established a goal of countries having a minimum of 2.28 skilled health care workers per 1,000 population. Similarly, health care leaders can target a stable number of nurses per capita, a level developed by an expert panel, or a goal based on comparisons with other US states.

It is important to recognize, however, that population need is not the same thing as economic demand. Nurses and other health professionals are not free, and the cost of employing them must be weighed against other uses of resources. A nurse employer might want to hire more nurses but may not have sufficient income from patient care services to afford more nurses. An employer might have resources that could be used to hire more nurses but might think that upgrading electronic health records or in hiring patient navigators will produce more value to patients. The demand for nurses is ultimately derived from economic forces, which may not align with population needs.

For this report, several different measures of demand (or need) are considered in order to develop a range of plausible estimates of future demand for RNs. The approaches used are:

- Fixed benchmarks based on current RN-to-population ratios in California
- Fixed benchmarks based on US RN-to-population ratios
- Demand forecasts based on projected growth of hospital patient days, employment in hospitals, and future population growth and aging
- An employment forecast for 2030 published by the California Employment Development Department

Demand projections based on RNs per capita

One frequently used benchmark of the need for RNs is the number of employed RNs per 100,000 population. For decades, California has had one of the lowest ratios of employed RNs per 100,000 population in the United States. Table A14 presents the ratios of licensed resident RNs as reported by the U.S. National Sample Survey of Registered Nurses in 2018 divided by 2021 population for the states with the 10 highest and 10 lowest ratios. California had the 10th lowest ratio (995 RNs per 100,000), which is a notable improvement from its past ranking

with the 4th lowest. Some nursing advocates have argued that California's ratio should be closer to the 25th percentile (1,030 RNs per 100,000) or even the national average (1,179 RNs per 100,000). Using population projections from the California Department of Finance, we calculated the numbers of RNs that would be required to reach these benchmarks, as well as to maintain the current ratio.

Note that since 2004, California is the only state with minimum nurse staffing ratios in acute care hospitals and has better health outcomes for most indicators than national averages. Thus, there is no empirical reason to think that California's nursing workforce should be at a higher RN-to-population ratio than it is today.

The main shortcomings of targeting a fixed number of RNs per population are that (1) the target is arbitrarily defined and (2) the ratio does not account for changes in the demographics and health of the population. The current number of nurses per capita may be too high or too low, and a target number based on a national average or other source might not reflect the unique population and health care system of California. In addition, fixed nurse-to-population ratios do not account for increases in the demand for health care services associated with population aging.

Table A14. Licensed RNs per 100,000

States with the lowest ratios	Licensed RNs per 100,000	States with the highest ratios	Licensed RNs per 100,000
Nevada	686	District of Columbia	1,824
Idaho	771	Missouri	1,636
South Carolina	781	Massachusetts	1,562
Washington	903	Hawaii	1,522
Utah	923	Minnesota	1,480
New Mexico	924	Ohio	1,478
Texas	937	Pennsylvania	1,446
Georgia	940	Iowa	1,418
Oregon	986	Wisconsin	1,402
California	995	Michigan	1,358

Source: National Sample Survey of Registered Nurses, 2018, data on the sample frame used for the survey, divided by state population in 2021.

Demand projections that account for population aging and current vacancy rates

The second approach to forecasting demand for RNs used in this study was designed to account for changes in the demand for health care services associated with the aging of the population. Hospital utilization patterns were used as a proxy of overall health care utilization. First, the 2021 total number of patient discharges per 10-year age group at short-term acute-care hospitals was obtained from the California Department for Healthcare Access and Information.[2] To estimate the total number of patient days per age group in California, these data were multiplied by the average length of stay per age group, as reported in the 2020 Hospital National Inpatient Statistics. We then divided the number of patient days by the age-specific population estimates to obtain utilization rates for each age group. These utilization rates were then applied to population projections to forecast future total patient days per age category and rates of projected growth in hospital patient days. We calculated the number of RNs that would be required to maintain a stable ratio of RNs-to-patient days in the future.

This estimate of future demand for RNs is based on the premise that current RN employment levels are optimal and that there is not a shortage. However, the Hospital Association of Southern California has reported that the hospital vacancy rate for RNs was 8.2% in the second quarter of 2023. We increased our projected demand for

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[2] The age groups are under 1, 1-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, and 80 and older.

RNs by this percentage to account for what may be a current shortage of RNs. Note that vacancy rates may overestimate the actual degree of shortage because some amount of "churn" in labor markets is normal.

California Employment Development Department forecasts

The most recent projection by the California Employment Development Department (EDD) indicates that there will be 358,900 registered nurse jobs in California by 2030. The EDD projection does not distinguish between full-time and part-time jobs. To estimate FTE employment from the EDD projection, the adjustment of 0.881 is used, which is the average number of hours worked per week by California RNs in 2022 (35.25) divided by 40. The FTE projection for 2030 is thus 316,300.

Comparing the demand forecasts

Figure A4 compares alternative demand forecasts of full-time equivalent RNs. These forecasts estimate that the FTE demand for RNs in 2023 ranges between 254,040 (if it is assumed the current employed RN-to-population FTE ratio is optimal) and 327,236 (if one assumes California should be at the national average RN-to-population ratio). Demand in 2037 is forecasted to be between 272,091 (to maintain the current FTE RN-to-population ratio) and 350,488. The lower figures are not likely to accurately represent total future demand because they do not account for additional demand caused by the aging of the population. The projection that accounts for population aging and current vacancies, estimates that demand is currently 276,650 and will reach 336,136 by 2018. The EDD forecast for 2030 is higher than that produced by maintaining the current RN-to-population ratio and slightly above the age- and vacancy-adjusted projection.

Figure A4. Forecasted full-time equivalent demand for RNs, 2023-2038