Forecasts of the Registered Nurse Workforce in the Northern Region of California

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Abstract

The Northern region of California, which consists of the counties north of the San Francisco Bay Area and Sacramento region, has a growing supply of registered nurses (RNs) due to expansion of local RN education programs. A small shortage of RNs may exist now in this region, but it will dissipate rapidly, even when accounting for population growth, aging of the population, and rising shares of RNs who enter advanced practice.

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Background

Recent data suggest that a shortage of registered nurses (RNs) may be emerging in California. The Fall 2017 Survey of Nurse Employers found that many Chief Nursing Officers are experiencing difficulty recruiting RNs for specialized positions and that more than 85% of hospitals reported demand for RNs being greater than the available supply (Chu, Bates, & Spetz 2018). Hospital vacancy rates have been rising since 2013, reaching 6.3% in 2017. There also has been growth in the share of newly-graduated RNs reporting they are employed within 12 months of licensure, increasing from 59% in 2013 to 81% in 2017 (HealthImpact 2018). There is variation across regions in the reported difficulty of finding qualified staff, with some employers suggesting there is a surplus of recently-graduated nurses and others indicating severe shortfalls of nurses at all levels of experience.

Rising retirement rates contribute to the challenge of recruiting nurses, particularly those with specialized skills and experience (Buerhaus & Auerbach 2011). In addition, the implementation of the most significant components of the Affordable Care Act (ACA) – an expansion of Medi-Cal and the implementation of the Covered California health insurance exchange to facilitate insurance enrollment – reduced the share of nonelderly Californians without health insurance from 16.2% in 2011 (Charles 2015) to 8.1% in 2015 (Cohen et al. 2016). Growing numbers of insured people will demand more health care services, which in turn drives demand for health professionals, including RNs. Moreover, the ACA established programs to encourage improved care management in order to deliver health care more efficiently and effectively; this type of care provides incentives for health care systems to increase their utilization of RNs (Spetz 2014).

This report provides forecasts of regional RN supply and demand in the Northern region of California, based on a statewide projection model developed for the California Board of Registered Nursing (BRN).

The data used to construct the model were derived from the 2016 BRN Survey of Registered Nurses (Spetz, Chu, & Jura 2017), the 2015-2016 BRN Annual Schools Report (Blash & Spetz 2018), and BRN license records. The supply forecast is compared with several benchmarks of demand, including national ratios of RNs per capita, estimates of future hospital utilization, and projections published by the California Employment Development Department (EDD 2017).

Definition and Description of the Northern Region

The Northern region of California is defined by the counties north of the San Francisco Bay Area and Sacramento region: Butte, Colusa, Del Norte, Glenn, Humboldt, Lake, Lassen, Mendocino, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Tehama, and Trinity. This region corresponds to the combined Employment Development Department regions of Chico Metropolitan Statistical Area (MSA), North Coast, North Valley, Northern Mountain, and Redding MSA. There are 33 short-term general, children's, and specialty hospitals in the region, as well as five associate degree (AD) and two bachelor's degree (BSN) RN education programs.

The Supply of RNs

In February 2018, there were 10,503 RNs with current, active licenses living in the Northern region. 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:

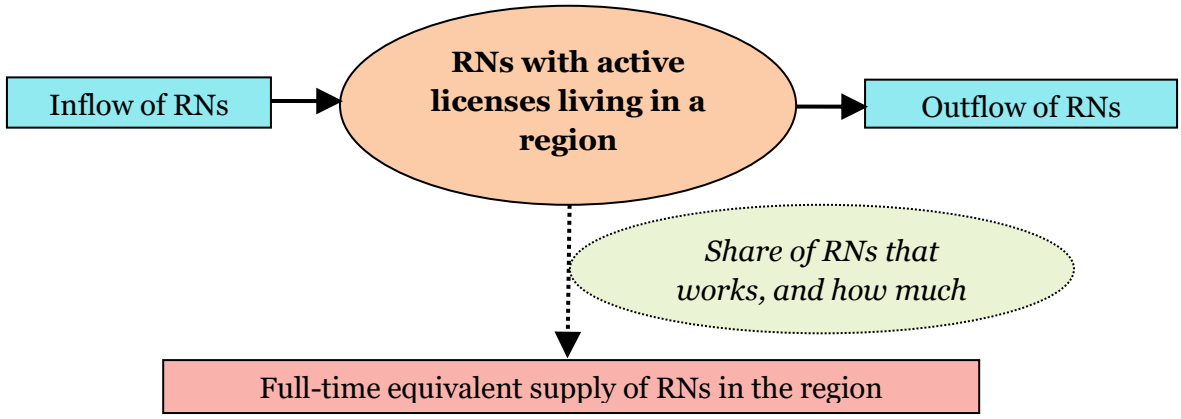
1) Inflows of nurses: Additions to the number of RNs in the region
    a) Graduates from regional nursing programs
    b) Graduates of nursing programs in other states and regions who obtain their first RN license in California and move to the region
    c) Internationally-educated nurses who immigrate to the region and obtain their RN license
    d) Inter-regional and interstate migration of RNs
    e) Changes from inactive to active license status
    f) Changes from lapsed to active license status
2) Outflows of nurses: The departure 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) Share of RNs with active licenses that work in nursing
    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."

Method of calculating RN supply

As inflows, outflows, and employment decisions change over time, so does the RN workforce. The total supply of employed RNs is determined by the age distribution of the stock of RNs, as well as of

Figure 1. A model of the supply of RNs



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. The youngest age group (under 25) spans 7 years, but because there were so few RNs under 20 years old in 2018, the 20% assumption is used for this group as well.

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 a forecast 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.

It is important to acknowledge sources of variability and uncertainty in the supply model. For example, in 2010 and 2012, a greater share of nurses over age 60 was employed as compared with prior years. This increase was likely the result of older nurses delaying retirement due to declines in the value of their retirement savings (Buerhaus & Auerbach 2011). More recent data indicate that employment of nurses in this age group has returned to lower pre-recession levels (Spetz, Chu, & Jura 2017). However, it also is possible that "baby boomer" nurses have different intentions regarding retirement than did previous generations, and that higher rates of employment in older age groups will reemerge as a result. This variability in estimated employment participation rates contributes to uncertainty in the supply model. Thus, a range of estimates representing the highest and lowest plausible values is used. In the final models, the "baseline estimate" for each parameter is the average of the low and high estimates, unless otherwise noted.

Stock of RNs in 2018

Data describing the number of RNs with active licenses in February, 2018, were obtained from the BRN. At that time, 10,503 RNs had active licenses and an address in the Northern region. Table 1 presents the number of actively licensed RNs living in the region for each age group.

Table 1. Counts of actively-licensed RNs living in the Northern region, by age group, February, 2018

Source: California BRN licensing records.

Age group	Count	% of total
Under 25	95	0.9%
25-29	558	5.3%
30-34	1,070	10.2%
35-39	1,108	10.6%
40-44	973	9.3%
45-49	1,015	9.7%
50-54	1,028	9.8%
55-59	1,361	13.0%
60-64	1,606	15.3%
65-69	1,099	10.5%
70-74	428	4.1%
75-79	126	1.2%
80+	36	0.3%
Total	**10,503**	**100.0%**

Graduates from RN education programs

RN education programs in the Northern region produced 363 new graduates during the 2016-2017 academic year, according to the BRN Annual School Report (Blash & Spetz 2018). Growth in new student enrollments leads to growth in graduates in future years. AD programs are designed so that students can complete the nursing component of the degree in two years, and in most BSN programs, students are formally enrolled in nursing major courses during the last two to three years of the program; the duration is shorter for accelerated BSN programs. In general, student enrollment changes translate to changes in the number of RN graduates two to three years in the future.

To predict the number of future graduates, actual new student enrollments in a given year were compared with the number of graduates two years later. In the Northern region over the period 2012-2013 through 2016-2017, on average, the number of graduates totaled 92.9% of the number of new student enrollments two years prior. This average rate was used to estimate the number of future graduates as a function of new enrollments.

Forecasting the number of graduates beyond the 2018-2019 academic year is difficult because total new student enrollments after 2016-2017 are not yet known. As part of the BRN Annual School Survey, schools are asked to estimate future new student enrollment. For example, in the 2016-2017 survey, schools were asked to report expected student enrollment totals for the 2017-2018 and 2018-2019 academic years. Schools in the region estimated that 2017-2018 new student enrollments would be 493 and that 2018-2019 new student enrollments would be 505. These estimates were multiplied by 92.9% to obtain the forecasted number of graduates for 2019-2020 and 2020-2021. The forecast model assumes that new student enrollments will be stable after the 2018-2019 academic year. Actual numbers of graduates from 2012-2013 through 2016-2017 and predicted numbers of graduated from 2017-2018 through 2020-2021 are presented in Table 2.

Table 2. Actual and forecasted numbers of new RN enrollments and graduations

Source: 2016-2017 BRN Annual Schools Report: Data Summary and Historical Trend Analysis, 2018.

Academic year	Actual/forecasted new student enrollments	Actual/forecasted number of graduates
2012-2013	377*	367*
2013-2014	362*	329*
2014-2015	366*	350*
2015-2016	351*	347*
2016-2017	373*	363*
2017-2018	493	326
2018-2019	505	347
2019-2020		458
2020-2021		469

* Actual enrollments/graduates.

Graduates from nursing programs in other states and countries

Each year, some graduates of nursing programs in other states obtain their first RN license in California. According to the BRN, in 2016, 12 such out-of-state graduates had an address in the Northern region. Additionally, in 2016, the BRN reported that 703 internationally-educated nurses passed the National Council Licensure Examination for RNs (NCLEX-RN) and received initial licensure as an RN in California, one of whom had an address in the Northern region.

Age distributions of new graduates and licensees

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 graduates: 18-25, 26-30, and then ten-year age groups for graduates over age 30. To be consistent with the forecasting model, the region's new graduates were allocated into five-year age groups and assumed that graduates of nursing programs in other states who obtain initial RN licensure in California have the same age distribution as the region's graduates.

BRN records of internationally-educated nurses who received initial U.S. licensure in California include the birth year, so these nurses were added to the model by age group. Table 3 presents the age distribution of new RN graduates used in the model.

Inter-region and interstate migration of RNs

Estimates of migration to the Northern region were calculated from BRN licensing files for 2016 and 2018, as well as from BRN records of nurses requesting endorsement of their out-of-state license to California in 2016. Inter-region migration was calculated by counting the total number of RNs who lived outside the Northern region in 2016 (including those with out-of-state addresses), who then reported a mailing address within the Northern region in 2018, and dividing this number by two to obtain an annual average for each age group. This was added to the number of RNs who requested endorsement of their license from another state in 2016 and reported a Northern region address.

Table 3. Estimated age distributions of new graduates

Sources: 2016-2017 BRN Annual Schools Report: Data Summary and Historical Trend Analysis, 2018, & California BRN licensing files.

Age group	Graduates of US RN programs	Internationally-educated graduates
18-25	29.8%	0.0%
26-29	23.1%	0.0%
30-34	16.7%	100.0%
35-39	16.7%	0.0%
40-44	5.5%	0.0%
45-49	5.5%	0.0%
50-54	1.2%	0.0%
55-59	1.2%	0.0%
60-64	0.3%	0.0%
65+	0.0%	0.0%

The region's in-migration rate was computed as the sum of RNs who migrated to the Northern region divided by the total number of actively licensed RNs residing in the region in 2018 (per BRN licensing records). These data are presented in Table 4.

Table 4. Movement of RNs into Northern region

Source: California BRN licensing records.

Age group	Average annual number moving to region 2016-18	Number requesting endorsement	Total as a share of RNs living in region
Under 25	7	8	15.8%
25-29	45	13	10.4%
30-34	57	28	7.9%
35-39	34	15	4.4%
40-44	33	5	3.9%
45-49	38	12	4.9%
50-54	45	10	5.4%
55-59	55	5	4.4%
60-64	44	7	3.1%
Over 64	25	1	1.5%
Total	**383**	**104**	

Movements from inactive and delinquent to active license status

BRN data were obtained describing the number of RNs changing from inactive to active license status and from delinquent to active status in 2016, by age group. These data are presented in Table 5.

Table 5. Number and age distribution of RNs changing status from inactive or delinquent to active license status, Northern region, 2016

Source: California BRN licensing records.

Age group	Count	% of total
Under 30	1	0.3%
30-34	11	3.8%
35-39	18	6.1%
40-44	20	6.8%
45-49	23	7.8%
50-54	27	9.2%
55-59	38	13.0%
60-64	60	20.5%
65-69	54	18.4%
70-74	28	9.6%
75+	13	4.4%
Total	**293**	**100.00%**

Migration out of the region

Estimates of migration out of the Northern region to other regions or states were derived from 2016 and 2018 BRN licensing files. Out-migration was calculated by taking the total number of RNs in each group who lived in the Northern region in 2016, but then reported a mailing address outside of the region in 2018, and dividing it by two to obtain an annual average. The region's out-migration rate was computed as the sum of RNs who left the Northern region divided by the total number of actively licensed RNs residing in the region in 2018, by age group (per BRN licensing records). Table 6 presents the rates used in the model.

Table 6. Estimated annual rates of RNs migrating out of the Northern region

Source: California BRN licensing records.

Age group	Average annual number moving to region 2016-18	Total as a share of RNs living in region
Under 25	8.5	9.0%
25-29	40.5	7.3%
30-34	32	3.9%
35-39	30.5	2.8%
40-44	29	3.0%
45-49	24	2.4%
50-54	31	3.0%
55-59	36.5	2.7%
60-64	28	1.7%
65-69	20	1.8%
70-74	8	1.9%
75+	0	0.0%
Total	**288**	

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 BRN licensing files for 2016 and 2018. The number of RNs who lived in the Northern region in 2016 but who were no longer actively licensed in 2018 was calculated and divided by two to obtain an annual average for each age group. This was divided by the number of RNs in each age group in 2018 to obtain the rates at which RNs allow their licenses to lapse or become inactive. The data are presented in Table 7.

Table 7. Estimated annual rates of RNs allowing licenses to lapse or become inactive

Source: California BRN licensing records.

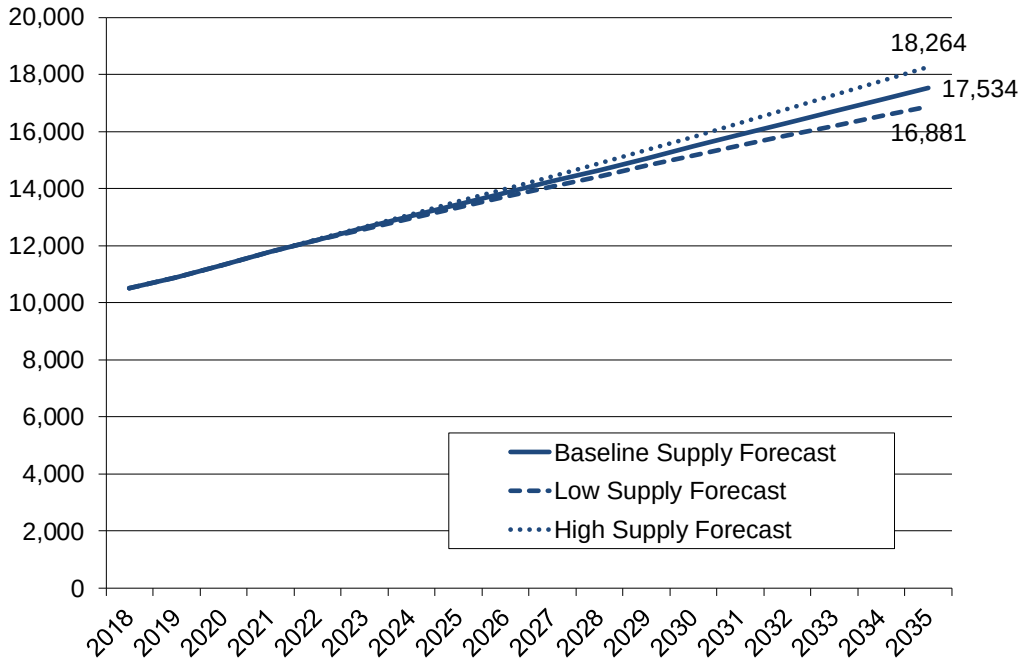
Age group	Average annual number changing to lapsed/inactive status 2016-18	Total as a share of RNs living in region
Under 25	3.5	3.7%
25-29	15.5	2.8%
30-34	22.5	2.1%
35-39	21	1.9%
40-44	23	2.4%
45-49	20	2.0%
50-54	28	2.7%
55-59	49	3.6%
60-64	101.5	6.3%
65-69	118	10.7%
70-74	82	13.9%
Total	**484**	

Supply forecasts of the region's RN workforce

Figure 2 presents the supply forecasts based on the projection model described above. A range of supply estimates were calculated; the baseline forecast assumes that RN education programs maintain the number of graduates, after 2022, the low forecast assumes that RN graduations shrink by 1% per year, and the high model assumes that graduations increase by 1% per year after 2022.

The forecasted number of RNs with active licenses does not account for variation in hours worked, or the fact that some RNs with active licenses do not work in nursing. Employment rates by age groups have varied since 2008, likely due to the economic recession that began in late 2007. During the recession, younger nurses were employed at lower rates and older nurses were employed at higher rates than in other years. To account for variation in employment rates over time, multiple years of data were examined. The proportion of RNs in the Northern region employed in nursing in 2016, by age group, was calculated from the 2016 BRN Survey of RNs. Statewide employment rates by age group were obtained from BRN Surveys of RNs from 2008 through 2016 (Spetz, Chu, & Jura 2017). The employment rate used for the "low" forecast was the lowest of these employment rates, and the

Figure 2. Forecasted number of RNs with active licenses residing in the Northern region



employment rate used for the "high" forecast was the highest of these rates. The baseline estimate is the average of the low and high rates and is presented in Table 8.

Table 8. Employment rates of RNs in the Northern region

Source: Spetz, J, Chu, L, Jura, M. 2017. 2016 Survey of Registered Nurses. Sacramento, CA: California Board of Registered Nursing.

Age group	Actual region 2016	Low estimate	High estimate	Baseline estimate
Under 25	28.3%	28.3%	100.0%	64.1%
25-29	92.9%	92.9%	97.4%	95.1%
30-34	94.2%	92.1%	95.5%	93.8%
35-39	91.0%	91.0%	95.2%	93.1%
40-44	100.0%	89.7%	100.0%	94.8%
45-49	97.4%	92.1%	97.4%	94.7%
50-54	89.7%	89.7%	91.1%	90.4%
55-59	90.6%	85.3%	90.6%	87.9%
60-64	58.8%	58.8%	78.5%	68.6%
65-69	45.1%	45.1%	65.2%	55.1%
70-74	44.4%	40.5%	46.2%	43.3%
75-79	25.0%	25.0%	36.0%	30.5%
80+	100.0%	10.0%	100.0%	55.0%

The supply model also utilized data from the 2016 BRN Survey of RNs to calculate average usual hours worked per week in all nursing jobs in the Northern region, by age group, as well as statewide average hours per week from 2008 through 2016 (Spetz, Chu, & Jura 2017). Estimated hours per week were divided by 40 to obtain the average full-time equivalent employment (FTE) for each age group. In the forecasts, the high for each age group is the highest of these FTE rates and the low estimate is the lowest of the FTE rates. The baseline estimate is the average of the high and low estimates and are presented in Table 9.

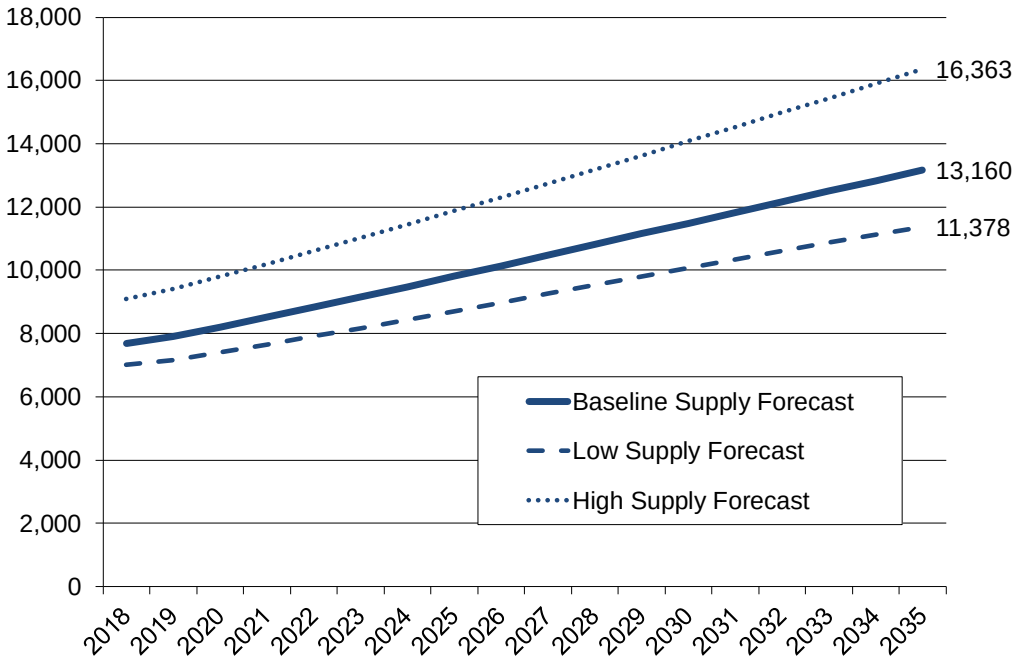
Table 9. Hours worked per week by employed RNs in the Northern region

Source: Spetz, J, Chu, L, Jura, M. 2017. 2016 Survey of Registered Nurses. Sacramento, CA: California Board of Registered Nursing.

Age group	Actual region 2016	Low estimate	High estimate	Baseline estimate
Under 25	35.4	35.4	47.1	41.2
25-29	36.0	35.8	37.0	36.4
30-34	31.5	31.5	37.3	34.4
35-39	36.3	35.3	36.3	35.8
40-44	33.5	33.5	37.0	35.3
45-49	38.1	36.7	38.1	37.4
50-54	37.4	36.9	38.0	37.5
55-59	36.8	36.6	38.1	37.4
60-64	36.4	35.3	36.4	35.8
65-69	35.1	32.0	35.1	33.6
70-74	26.5	24.0	26.5	25.2
75-79	26.9	18.8	26.9	22.8
80+	24.0	22.8	31.1	26.9

Figure 3 presents projected high, low, and baseline estimates of FTE supply of actively licensed RNs for the Northern region. These estimates in 2035 range from 11,378 to 16,363, demonstrating the importance of assumptions about education program growth and labor force participation of RNs.

Figure 3. Forecasted full-time equivalent supply of RNs, 2018-2035



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 goal of countries needing a minimum of 2.28 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 2006). 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 other uses of 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 to patients. In this context, demand for nurses is derived from economic forces, which may not be aligned with population needs.

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

- Fixed benchmarks based on current RN-to-population ratios in the region
- Fixed benchmarks based on U.S. RN-to-population ratios
- Demand forecasts based on 2015 hospital patient days, employment in hospitals, and future population growth and aging
- Regional employment forecasts for 2024 published by the California Employment Development Department (EDD 2017)

Forecasts 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 capita in the U.S., usually ranking in the bottom 5 nationwide. Many policy advocates have supported efforts to increase California's FTE employment of RNs per capita to be on par with that of other states, targeting either the current 25th percentile ratio (916 RNs per 100,000) or the national average ratio (1,038 RNs per 100,000). Data on the current and forecasted population of the Northern region (California Department of Finance 2018) were used to calculate the number of RNs that would be needed to maintain the current RN-to-population ratios, reach the 25th percentile ratio, and reach the national average ratio.

The main shortcoming of targeting a fixed number of RNs per population, such as a national average, 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 hospital staffing of RNs per patient day

A second approach to forecasting demand for RNs is to use current hospital utilization and staffing patterns to estimate growth in future demand for RNs. The first step in this process was to obtain the total number of hospital patient discharges in 2015 (the most recent data available) from short-term, acute-care hospitals in the Northern region (Office of Statewide Health Planning and Development 2016). 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 2014).

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 (2018). These rates of patient days per age group were then applied to the population projections to forecast total patient days by age group.

To produce forecasts of hospital demand for RNs, RN hours per patient day were calculated using OSHPD's Hospital Annual Financial Data (Office of Statewide Health Planning and Development 2017). In 2016, a total of 7,157,667 productive RN hours were reported by hospitals in the Northern region. The number of RN hours per discharge was calculated by dividing total productive RN hours by the number of patient days in 2017, resulting in an estimated 14.14 productive RN hours per patient day. Multiplying the number of productive RN hours per patient day by the forecasted total number of patient days produces an estimate of hospital-based RN hours needed in the future. To equate these estimates to FTE jobs, RN hours were divided by 1,768 (average annual productive hours per FTE), resulting in 4,048 FTE RN employment in 2017

The calculations described above provide demand forecasts for only one type of care setting (hospitals), and only for a subset of hospitals (long-term hospitals and federal hospitals are not included in the calculations). The 2016 BRN Survey of Registered Nurses indicates that total FTE employment in the Northern region was 7,528 (Spetz et al. 2017); thus, total RN employment was 1.86 times greater than hospital RN employment. To forecast total demand for RNs, it was assumed that total RN demand would continue to be 1.86 times greater than hospital RN demand in future years. The projections indicate there will be a need for 4,881 FTE RNs in hospitals and 9,076 FTE RNs throughout the region in 2035.

Employment Development Department forecasts

The most recent projection by the California Employment Development Department (EDD) indicates that there will be 8,720 RN jobs in the Northern region in 2024 (California Employment Development Department 2018). The EDD projection does not distinguish between full-time

and part-time jobs. To estimate the FTE employment implied by the EDD projection, an adjustment factor of 0.884 was used, which is the average number of hours worked per week by RNs in the region in 2016 (35.35), divided by 40 (Spetz, Chu, and Jura 2017). This results in a projected 7,706 FTE jobs across the region in 2024.

Comparing the demand forecasts

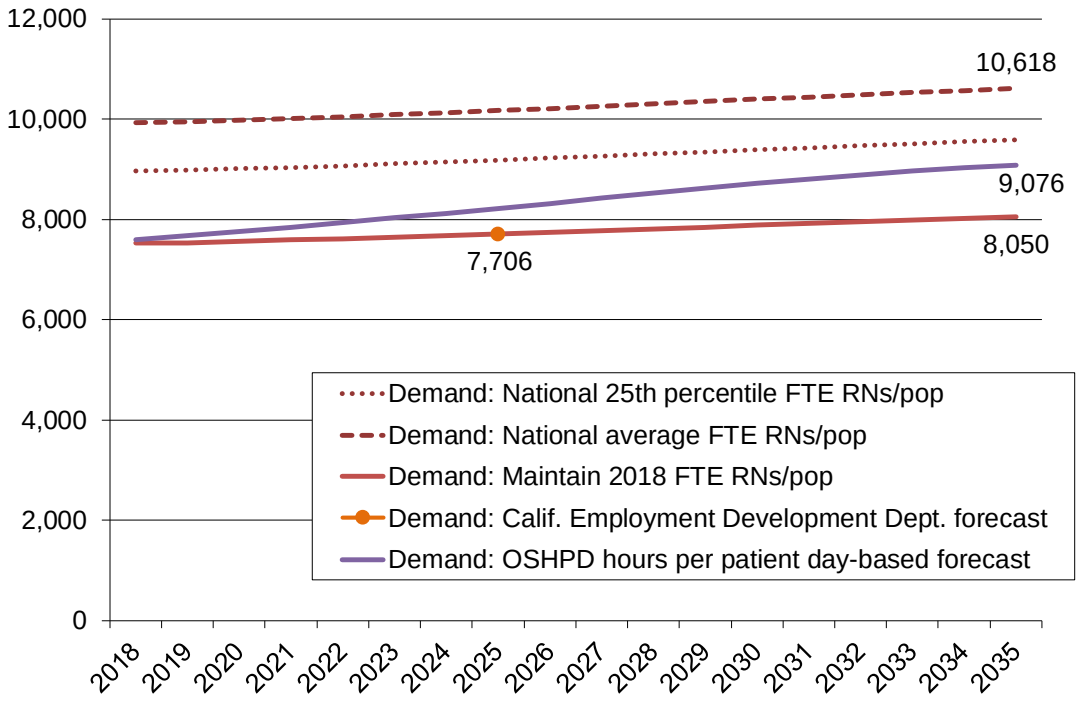
Figure 4 compares alternative forecasts of demand for full-time equivalent RNs. In order to maintain the current RN-to-population ratio in the Northern region, 8,050 FTE RNs will be needed in 2035. The forecast based on projected growth in hospital utilization resulted in 9,076 FTE RNs needed in 2035. To reach the national average ratio of RNs per population, 10,618 FTE RNs will be needed in 2035. Figure 4 also shows that the projected number of FTE RN jobs in 2024 derived from EDD is along the trajectory of demand based on maintaining the region's current RN-to-population ratio.

Comparing Supply and Demand for RNs

Figure 5 compares the baseline supply forecast and the low supply forecast with three alternate demand forecasts: (1) demand based on attaining the national per capita ratio at the 25th percentile; (2) demand based on attaining the national average per capita ratio; and (3) demand based on forecasted growth in hospital patient days. All forecasts are for FTE employment.

The baseline supply forecast estimates that in 2018 there were 7,680 FTE RNs available to work; the low supply forecast estimates there were 7,005 FTEs. The projections of RN demand based on hours per patient day (OSHPD data) indicate there was demand for 7,599 RNs that year, suggesting the market was fairly balanced. However, it is worth noting that RN supply in 2018 was 16.7% lower than demand based on the national per capita ratio at the 25th percentile, which may indicate that current demand for RNs is lower than optimal. In the long term, the baseline supply forecast predicts that nurse

Figure 4. Forecasted full-time equivalent demand for RNs, 2018-2035



supply will increase more rapidly than the Northern region's population as a whole, and RN supply will reach the national 25th percentile of FTE RNs per 100,000 by 2023. The low projection of supply also indicates that it is likely the Northern region will have adequate supply in the future.

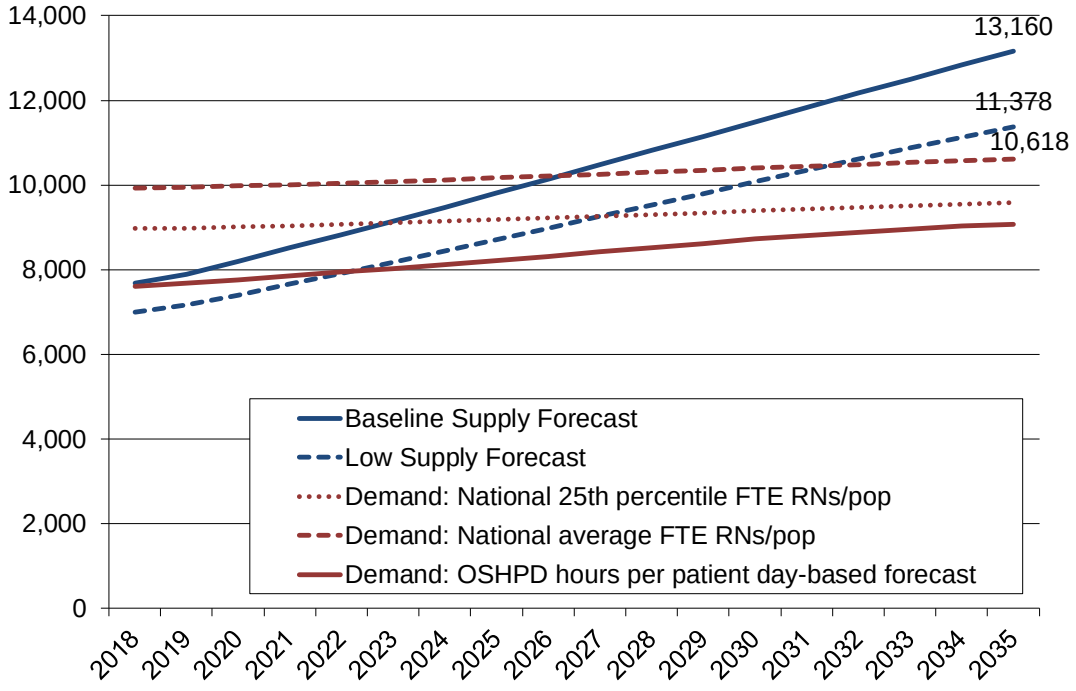
Additional factors that affect regional RN shortages

Some RNs travel across regions for work, which could result in fewer or more nurses working in the Northern region. Data from the 2016 BRN Survey of RNs indicates that 90.3% of employed RNs who lived in the Northern region also worked in the region. Approximately 385 RNs worked in the Sacramento region (4.9%), 328 worked in the San Francisco Bay Area (4.1%), and 54 worked in the Los Angeles area (0.7%). Conversely, some nurses living in other regions worked in the Northern region: approximately 467 from Sacramento, 21 from the San Francisco Bay Area, and 325 from the Los Angeles area. In sum, in 2016 the Northern region had similar numbers of RNs crossing regional boundaries to work in the area versus to work outside the area.

A second factor that may affect the supply of RNs is that some are also advanced practice RNs (APRNs) – nurse practitioners (NPs), certified nurse-midwives (CNMs), clinical nurse specialists (CNSs), and nurse anesthetists (CRNAs). Both the supply projections and the projections of demand for RNs based on RN-to-population ratios and hospital patient utilization treat all these APRNs as RNs. The EDD projection does not include APRNs. In the Northern region, 4.1% of RNs are NPs, 0.4% are CNMs, and 0.2% are CRNAs. If these APRNs are not considered part of the RN supply, together they reduce the region's baseline supply by approximately 4.7% (400 RNs).

Hospital employment data sourced from OSHPD were examined to identify the number of RN hours worked by contract personnel in 2016. Use of contract staff by hospitals may indicate the degree to which hospitals are experiencing a shortage of RNs with the skills required for open positions. However, since contract personnel are used to fill gaps during staff vacations and leaves of absence, as well as normal seasonal fluctuations in hospital utilization, this is not a perfect measure of the magnitude of RN shortage. The OSHPD data indicated that the average

Figure 5. Forecasted full-time equivalent supply and demand for RNs, 2018-2035



share of hospital RN hours provided by contract staff in the Northern region was 8.6%, which was the highest regional rate across the state and equivalent to a total of 197 FTE RNs.

Overall assessment of RN labor market in the region

Together, data on inter-regional commuting, the size of the advanced practice workforce, and the employment of agency personnel suggest that RN supply in the Northern region might be 400 fewer than the model calculation, and demand might be approximately 200 greater in 2018. The baseline supply and demand forecasts estimate that the region has balanced RN supply and demand, but the addition of inter-region commuting and use of contract RNs suggests that the Northern region may have a shortage of up to 500 FTE RNs (6.6%) in 2018. However, this shortage will dissipate in the near future since RN supply is projected to grow more rapidly than demand.

Policy Implications

The Northern region of California appears to have a small shortage of RNs in 2018, but recent growth in RN education programs will ensure adequate supply in the near future. Even if there is growth in the share of RNs who become APRNs in the Northern region, RN supply will grow more rapidly than demand, allowing health care systems the opportunity to employ nurses in a wide variety of roles that fully utilize their skills in direct patient care, care management, patient education, home health, and ambulatory care.

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; and/or (3) employment rates of RNs. These factors and any other potential influences on the Northern region's 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, to determine whether and to what extent local RN education programs should expand.

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