Forecasts of the Registered Nurse Workforce in California

October 30, 2015

Prepared for the California Board of Registered Nursing

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Executive Summary

This report presents supply and demand forecasts for the Registered Nurse (RN) workforce in California from 2015 through 2035. These new forecasts are based on data from the 2014 California Board of Registered Nursing (BRN) Survey of Registered Nurses, the 2013-2014 BRN Annual Schools Report, data extracted from the BRN license records, and other state and national data sources. The 2015 forecasts indicate that supply of and demand for RNs are fairly well-balanced, and the market will continue to be balanced in the future if current enrollment and state-to-state migration patterns are stable.

The forecasts of RN supply take into account the aging of the RN workforce, new graduates (including those from out-of-state and international nursing programs), interstate flows of RNs, and changes in license status. These new forecasts of supply incorporate new data for these factors. One important change relative to the 2013 forecasts is that data from the BRN license records were extracted using the new BreEZe system.

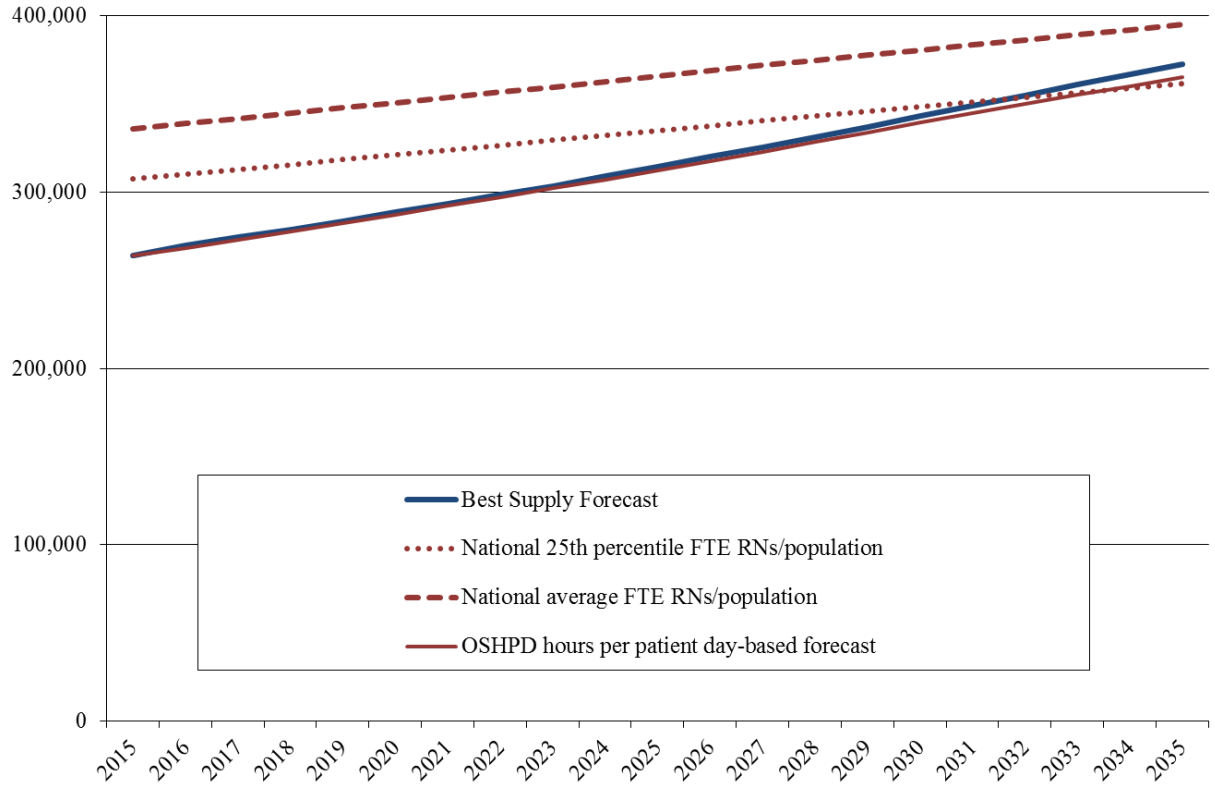
The demand forecasts are based on national numbers of RNs per 100,000 population. The demand for RNs can be measured and forecasted in many ways, reflecting disparate notions of what demand is or should be. Demand can be measured through benchmarks, such as the number of nurses per capita. Other demand forecasts may examine rates of population growth and population aging. Directly surveying of employers also can illuminate current demand for nursing positions. We developed several alternate forecasts of demand, using national RN-to-population data and estimating future hospital utilization in California. We also examined forecasts from the California Employment Development Department. The demand estimates produced from these different strategies provide a range of possible scenarios for the future.

The Executive Summary Exhibit indicates that whether California experiences a shortage of RNs in the future depends on the measure of demand selected for comparison with supply. The forecasting model produces a range of supply forecasts; the "Best Supply Forecast" is based on the midpoint of most of the parameters in the model; thus it lies between the highest and lowest forecasts. In the figure, the supply forecast is compared with three different estimates of demand: (1) the 2013 national 25th percentile of full-time equivalent RNs per population; (2) the 2013 national average of full-time equivalent RNs per population; and (3) a forecasting of demand based on current hospital utilization by age group. In 2015, the statewide RN labor supply may be slightly lower than demand, which is consistent with employer surveys that indicate some hospitals are having difficulty recruiting experienced nurses for specific units such as emergency departments, operating rooms, and intensive care. Overall, California's RN supply is forecasted to match demand reasonably well over the next two decades if the number of RN graduates remains stable and state-to-state migration patterns do not change substantially.

Policymakers should be cautioned that the 2015 BRN forecasts represent a twenty-year period and are not intended to reflect rapidly changing economic and labor market conditions. They also do not measure variations across regions of California; it is possible that some regions of the state will experience shortages even while others have a surplus of RNs. The forecasts are based on the most current data available, but the factors that affect RN supply and demand are unlikely to remain static. The most important possible changes include: (1) the number of graduates from RN education programs; (2) inter-state migration; and (3) employment rates of older RNs. California leaders should observe closely the employment paths of recent nursing graduates who are entering a difficult job market and may choose to leave California or leave the

nursing profession entirely. It has been reported in other surveys that employers have been reluctant to hire new graduates in recent years, while reporting emerging shortages of nurses with specific clinical skills. These employers will need to invest in training newly-graduated RNs to ensure an adequate future workforce and prevent discouraged new graduates from seeking employment in other states. Moreover, policy and education leaders should monitor new enrollments in nursing programs, which are projected to drop slightly and could decline more as state colleges and universities face tight budgets and as potential students hear there might not be enough nursing jobs. California will need to maintain the present number of nursing graduates in order to meet long-term health care needs.

Executive Summary Exhibit: Projected full-time equivalent supply of and demand for RNs, 2015-2035.



Introduction

The labor market for registered nurses (RNs) has been characterized by cycles of shortage and surplus since World War Two. The most recent period of shortage began in the late 1990s (Buerhaus, 1998), and persisted through 2007. Periods of nursing shortage generate significant challenges because they drive up the cost of health care as wages rise (Spetz and Given, 2003), and because patient outcomes are impacted by the level of nurse staffing in hospitals and other care facilities (Kane & Shamliyan, 2007; Institute of Medicine, 2011; Penoyer, 2010).

Since 2010, however, data have indicated that California's long-standing RN shortage ended, at least temporarily. Surveys of California hospital Chief Nursing Officers have reported that they perceive there is slightly greater RN supply than demand. This change in the labor market has been attributed to several trends. First, nursing school enrollments expanded substantially in California, more than doubling between 2001 and 2010 (Bates, Keane, & Spetz, 2011). This expansion of RN supply would have alleviated the shortage in many regions on its own. In addition, the national economic recession further mitigated the shortage by leading to an increase in the workforce participation of RNs who would otherwise retire or reduce their hours for work. It has been estimated that nearly all the hospital employment increase in the past decade can be attributed to growth in RN supply during economic recessions (Buerhaus and Auerbach, 2011). The economic recession also reportedly dampened demand for newly-graduated nurses. In late 2010, a survey of Chief Nursing Officers found that there were fewer than 6,500 full-time equivalent vacant positions for RNs statewide (Bates, Keane, & Spetz 2011) while the 2010 BRN Survey of Registered Nurses indicated that nearly 7,700 RNs were seeking employment (Spetz, Keane, & Herrera, 2011).

More recent data suggest the labor market may be shifting again. The fall 2014 Survey of Nurse Employers found that a growing share of Chief Nursing Officers is experiencing difficulty recruiting RNs for specialized positions, and that more than 68 percent of hospitals reported demand for RNs being greater than the available supply (Bates, Chu, & Spetz, 2015). Hospital vacancy rates in fall 2014 were higher than in fall 2010, rising to 4.6 percent from 3.4 percent. These data are consistent with the widespread expectation that the economic recovery would lead those nurses who had delayed retirement, re-entered the labor force, or increased their hours of work due to the economic recession to retire or reduce their employment as the economy recovers (Buerhaus & Auerbach 2011). In fact, the 2014 BRN Survey of RNs found 33.1 percent of RNs plans to retire or reduce their hours of nursing work within the next five years, compared with 24.7 percent in 2010 (Spetz et al., 2015).

At the same time, 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 percent in 2011 to 13.6 percent in 2014 (Charles, 2015). Growing numbers of insured people will demand greater health care services, although the types of services needed are likely to change. In addition, the ACA established programs to encourage improved care management in order to deliver health care more efficiently and effectively (Spetz, 2014). These and other changes have introduced uncertainty regarding the future supply and demand for RNs.

This report updates forecasts of RN supply and demand in California, which were first developed for the California Board of Registered Nursing (BRN) in 2005 and subsequently updated in 2007, 2009, 2011, and 2013 (Spetz and Dyer, 2005; Spetz, 2007; Spetz, 2009; Spetz, 2011; Spetz, 2013). New data from the 2014 BRN Survey of Registered Nurses (Spetz et al., 2015), the 2013-2014 BRN Annual Schools Report (Waneka, Bates, and Spetz, 2015), and BRN license records were used to update the model of RN supply. The demand estimates are informed by surveys of employers conducted from 2010 through 2014 with support from the Gordon and Betty Moore Foundation (Bates, Chu, & Spetz 2015), as well as national data describing RN employment.

The Supply of RNs

As of June 30, 2015, there were 433,551 licensed RNs in California. California's RN workforce consists of nurses with active California licenses, who are allowed to work as RNs within the state. There were 396,915 RNs with current and active licenses on April 9, 2015, of whom 340,788 resided in California. For the purposes of these forecasts, we consider the California-resident population as the supply of available nurses; the role of nurses who travel to work in California from other states is discussed later in the report.

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

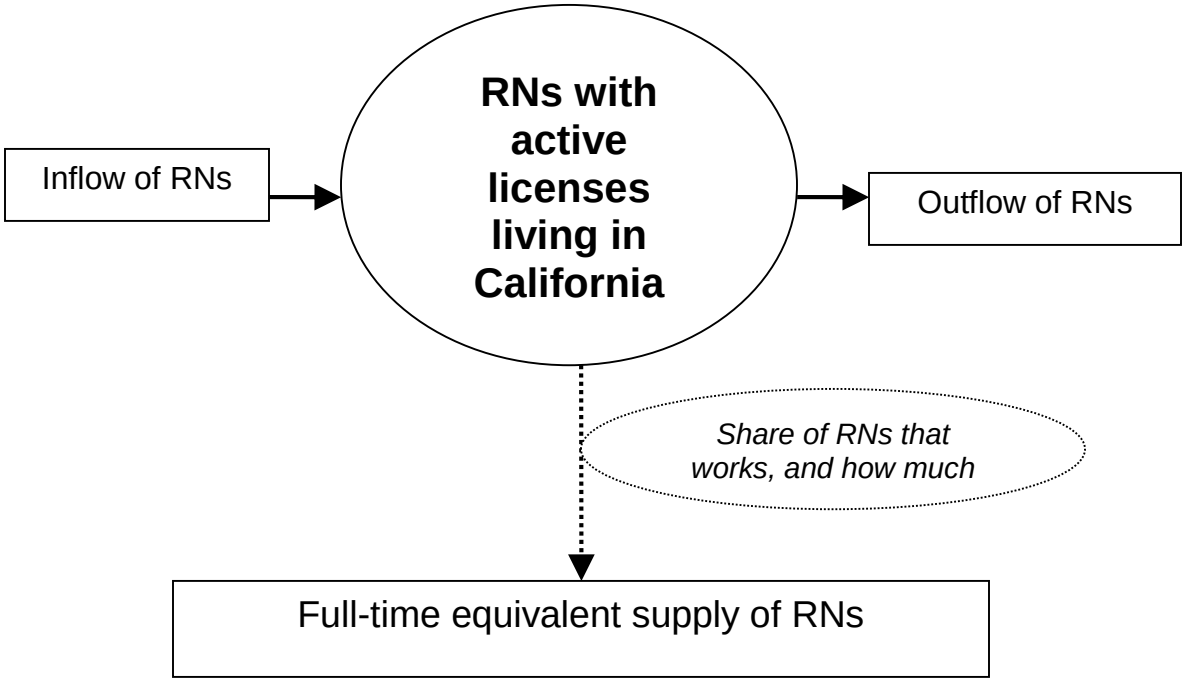
- Inflows of nurses: Additions to the number of RNs in California.
    - Graduates from California nursing programs;
    - Graduates of nursing programs in other states who obtain their first RN license in California;
    - Internationally-educated nurses who immigrate to California and obtain their RN license;
    - Interstate migration of RNs to California;
    - Changes from inactive to active license status; and
    - Changes from delinquent to active license status.
- Outflows of nurses: The departure of RNs from the California population.
    - Migration out of California (to another state or country); and
    - Movements from active to inactive or lapsed license status, which includes nurses who do not move out of California but who retire or otherwise permanently leave nursing.
- Labor force participation factors: Decisions to work, and how much to work.
    - Share of RNs with active licenses and California residence that works in nursing; and
    - Average number of hours worked per week by RNs working in nursing.

The inflows are added to the number of RNs living in California 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. Exhibit 1 illustrates this model of the supply of RNs in California, 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. At first glance, it seems clear that as long as the inflow of RNs is greater than the outflow, the RN workforce will grow over time. However, such a comparison between total inflow and outflow does not take into account the aging of the RN workforce. The age distributions of the stock of RNs and each inflow and outflow component affect supply. Thus, the model "ages" each age cohort to capture the impact of age on the supply forecast.

Exhibit 1: A model of the supply of RNs.



In the supply model, the number of RNs with active licenses who reside in California 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, 70-79, and 80 and older. We assume that one-fifth of RNs in each age category moves into the next (older) age category in the subsequent year, until they reach the oldest age category.[1] We add the inflow estimates to and subtract the outflow estimates from each age group of RNs to obtain a forecast of the new stock of RNs for the next year. Finally, we apply rates of employment and hours worked per week in nursing to the estimated stock of RNs to obtain estimated FTE supply. This calculation is iterated through 2035 to obtain our yearly forecasts of California's 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 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. More recent data suggest that employment of nurses in this age group is returning to pre-recession levels. However, it also is possible that "baby boomer" nurses have different intentions regarding retirement than did previous generations, and the higher rate of employment in this age group will persist regardless of economic circumstances. For variables with such uncertainty, a range of estimates is offered representing the highest and lowest values. In the final models, the "best estimate" for each parameter is the average of the low and high estimates, unless otherwise noted.

Estimates of Supply Model Factors

Stock of RNs in 2015

Data describing the number of RNs with active licenses were obtained from the BRN for April 9, 2015. At that time, 340,788 RNs had active licenses and a California address. The 56,127 RNs with addresses outside California were not included in the stock of RNs because California's border regions are generally rural and thus few nurses commute regularly from out of state. Some nurses might intermittently come to California as traveling nurses, thus supplanting the state's supply, but these are not part of the regular stock of RNs. Traveling nurses are discussed in more detail below.

The number of RNs with active licenses and California addresses was divided into 13 age groups, as seen in Exhibit 2. Three RNs who resided in California did not have age data recorded in the licensing file provided by the BRN and are excluded from the table and subsequent analyses. The same age groups are used throughout the model. Exhibit 2 compares the 2015 data to that from 2013. The total number of licensed RNs living in California grew by 12,506 (3.8%). This is the second consecutive reduction in the growth rate of California's RN workforce; between 2009 and 2011, there was 6.2 percent growth in licensed California-resident RNs, and between 2011 and 2013 there was 5.6 percent growth. The number of licensed California-resident RNs increased in all age groups under age 50, with particularly large growth rates

[1] All but one age group spans 5 years, so 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 were few RNs under 20 years old in 2013; thus, the 20% assumption seems reasonable for this group as well.

among RNs 25 to 29 years old (17.3%) and 30 to 34 years old (15.0%). The number of RNs decreased at least 5 percent for all age groups 70 years and older.

Exhibit 2: Counts of actively-licensed RNs living in California, by age group, April 9, 2015, and February 28, 2013

	April 9, 2015		February 28, 2013	
Age Group	Count	% of Total	Count	% of Total
Under 25	4178	1.23%	2,531	0.77%
25-29	27,363	8.03%	23,335	7.11%
30-34	38,173	11.20%	33,206	10.12%
35-39	36,880	10.82%	34,878	10.62%
40-44	43,292	12.70%	41,097	12.52%
45-49	36,080	10.59%	33,718	10.27%
50-54	36,750	10.78%	37.099	11.30%
55-59	43,848	12.87%	45,083	13.73%
60-64	39,071	11.46%	38.876	11.84%
65-69	21,453	6.30%	22,521	6.86%
70-74	9,044	2.65%	10,181	3.10%
75-79	3,373	0.99%	4,056	1.24%
80+	1,280	0.38%	1,698	0.52%
Total	340,785	100.00%	328,279	100.00%

Source: California Board of Registered Nursing license records.

Graduates from California nursing programs

According to the 2013-2014 BRN Annual Schools Report, there were 11,291 new graduates from California nursing programs in the 2013-2014 school year (Waneka, Bates, & Spetz 2015). Exhibit 3 presents the numbers of enrollments and graduates from the past ten Annual Schools Reports. Growth in RN new student enrollments leads to growth in graduates in future years. Associate Degree Nursing (ADN) programs are designed so that students can complete the nursing component of the degree in two years. In most Baccalaureate of Science Nursing Degree (BSN) programs, students are formally enrolled in nursing major courses during the last 2.5 to 3 years of the pre-licensure BSN degree program, unless the program is an accelerated BSN program. Thus, student enrollment changes translate to changes in the number of graduates two to three years in the future.

To predict the number of future graduates, actual new student enrollments for each year of the Annual Schools Report were compared with the number of graduates two years later. From 2007-2008 through 2013-2014, graduates averaged 81.9 percent of the number of student enrollments two years prior (a small decrease from the 83.8 percent "productivity rate" used in the 2013 forecasts). This is the rate used to estimate the number of future graduates; thus the forecasted number of graduates in 2015-2016 is 81.9 percent of the known student enrollments from 2013-2014.

Exhibit 3: New student enrollments and number of graduates from RN education programs, 2004-2005 through 2013-2014

Survey year	Number of new student enrollments	Growth in new student enrollments	Number of graduates	Growth in graduates
2004-2005	8,926	14.1%	6,677	8.4%
2005-2006	11,131	24.7%	7,528	12.8%
2006-2007	12,709	14.2%	8,317	10.5%
2007-2008	12,961	2.0%	9,580	15.2%
2008-2009	13,988	7.9%	10,570	10.3%
2009-2010	14,228	1.7%	11,512	8.9%
2010-2011	13,939	-2.0%	10,666	-7.4%
2011-2012	13,677	-1.9%	10,814	1.4%
2012-2013	13,181	-3.6%	11,292	4.4%
2013-2014	13,226	0.3%	11,291	-0.01%

Source: Waneka, Bates, & Spetz, 2015. 2013-2014 Annual School Report Data Summary and Historical Trend Analysis.

Forecasting the number of graduates beyond the 2015-2016 academic year is difficult because total new student enrollments for 2014-2015 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 2013-2014 survey, schools were asked to report expected student enrollment totals for the 2014-2015 and 2015-2016 academic years. Schools estimated that 2014-2015 new student enrollments would be 12,162 (an 8.0 percent decline relative to the previous year), and that 2015-2016 new student enrollments would be 12,177. These estimates were multiplied by 81.9 percent to obtain the forecasted number of graduates for 2016-2017 and 2017-2018. The forecasts assume that nursing student enrollments will be stable after the 2015-2016 academic year. In the forecasting model, the "low" estimate of growth in RN education after 2015-2016 is -1%, the high estimate is 1%, and the "best" estimate is 0%. Actual and predicted number of graduates from 2010-2011 through 2017-2018 are presented in Exhibit 4.

Exhibit 4: Predicted number of graduates based on new student enrollments

Academic year	Actual/forecasted new student enrollments	Forecasted number of graduates
2010-2011	13,939*	10,666*
2011-2012	13,677*	10,814*
2012-2013	13,181*	11,292*
2013-2014	13,226*	11,291*
2014-2015	12,162	10,795
2015-2016	12,177	10,832
2016-2017		9,960
2017-2018		9,972

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

Note: Forecasts of student enrollments are provided by RN programs in the Annual Schools Survey. The forecasted number of graduates is 81.9 percent of enrollments two years prior. Source: Waneka, Bates, and Spetz, 2015. 2013-2014 Annual School Report Data Summary and Historical Trend Analysis.

Graduates from nursing programs in 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, in 2014, 310 out-of-state graduates obtained their first license from California; this is the high estimate of out-of-state graduates who move to California. BRN records also indicate that 271 of these nurses are living in California; this is the low estimate. The "best estimate" for the inflow of new licensees from other states is the average of the high and low estimates: 291 nurses. This estimate is lower than that from the 2013 forecasts, which was 629.

Immigration of internationally-educated nurses

In 2014, the BRN reported that 760 internationally-educated nurses passed the National Council Licensure Examination for RNs (NCLEX-RN) and received initial licensure as an RN in California, 457 of whom also had a California residence; the remainder lived in other states or countries. In the supply model, we use the total number of 2014 international graduates receiving initial licensure in California as the high estimate of the number of immigrants; we use the number that lives in California as the low estimate. The best estimate is the average of the high and low estimates: 609 internationally-educated RNs immigrate to California each year. Note that this number is lower than in prior years; since the 1997-1998 fiscal year, the number of first licenses issued to internationally-educated nurses has ranged between 1,145 and 4,107 annually. The lower number reported in 2014 is consistent with other reports that international recruitment of nurses slowed significantly after 2008 (Bates, Chu, & Spetz, 2015).

Age distributions of new graduates

Inflows of new graduates are added to the stock of RNs by age group. The BRN Annual Schools Report uses an uneven set of age groups for new California graduates: 18-25, 26-30, and then ten-year age groups for graduates over age 30. To create consistent groups of graduates in the forecasting model, we allocated the graduates into five-year groups. Exhibit 5 shows how new graduates from California nursing programs were distributed by age group. RN graduates from nursing programs in other states seeking initial licensure as an RN in California are assumed to have the same age distribution as California graduates.

BRN records of internationally-educated nurses who receive initial U.S. 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 2014 is presented in the last column of Exhibit 5; these data are used to forecast the age distribution for all internationally-educated RNs receiving first licenses in California.

Exhibit 5. Estimated age distribution of new graduates from California RN programs

Age group	Graduates of US RN programs	Internationally-educated graduates
18-25*	27.2%	3.3%
26-29*	30.0%	26.3%
30-34	16.0%	25.6%
35-39	12.6%	15.1%
40-44	6.2%	14.9%
45-49	4.7%	6.8%
50-54	1.9%	4.8%
55-59	1.2%	2.6%
60-64	0.4%	0.4%
65+	0.0%	0.2%

* The age groups for internationally-educated RNs are "Under 25" and 25-29.
Sources: Waneka, Bates, and Spetz, 2015, 2013-2014 Annual School Report Data Summary and Historical Trend Analysis; 2014 California BRN licensing records.

Interstate migration of RNs to California

Estimates of interstate migration to California were developed in two ways. The low estimate of interstate migration was computed from BRN records of nurses requesting license endorsement from another state into California. Exhibit 6 presents the number of RNs requesting endorsement to California in 2014 who have permanent addresses in California. The rate of movement into California is based on the ratio of the number who requested endorsement into California in 2014 divided by the number licensed and residing in California in 2015 (from BRN licensing records).

Exhibit 6. Requests for license endorsement into California, 2014 (Low estimate)

Age Category	Number requesting endorsement & living in California (2014)	RNs requesting endorsement (2014) as a percentage of RNs living in California (2015)
Under 25	186	4.45%
25-29	2,803	10.24%
30-34	2,066	5.41%
35-39	1,262	3.42%
40-44	991	2.29%
45-49	814	2.26%
50-54	682	1.86%
55-59	628	1.43%
60-64	367	0.94%
Over 64	136	0.39%

Sources: California Board of Registered Nursing license records, 2014; BRN license records, 2015.

An alternate estimate of interstate migration is based on data from the 2008 Bureau of Health Workforce's National Sample Survey of Registered Nurses (NSSRN), which is the most recent year available. The NSSRN asked respondents about their current and former state of residence with the following questions:

(1) Where do you currently reside?

(2) Did you reside in the same city/town a year ago?

(3) If the person does not live in the same place as one year previously: Where did you reside a year ago?

Using the variables corresponding to these questions in the 2008 NSSRN and applying sample weights, we were able to estimate the number and age distribution of RNs who did not reside in California in 2007, but did so in 2008. The number moving to California between 2007 and 2008 is divided by the estimated number of RNs residing in California in 2007 to obtain a rate of migration into California. Exhibit 7 presents these estimates.

Exhibit 7. Estimated movements from other states to California, 2007-2008

Age Category	Number moving to California, 2007-2008	Number of RNs in California, 2007	Percent of RNs moving to California
Under 25	1,569	3,326	47.16%
25-29	4,146	18,125	22.87%
30-34	5,311	24,793	21.42%
35-39	4,811	31,111	15.46%
40-44	2,556	30,128	8.48%
45-49	3,246	38,383	8.46%
50-54	1,869	43,684	4.28%
55-59	2,161	37,339	5.79%
60-64	760	22,893	3.32%
65-69	183	13,500	1.36%
70-74	196	6,213	3.16%

Source: Bureau of Health Workforce, 2010.

Note that during 2007 and early 2008, California's economy was growing rapidly and both the U.S. and California economies were strong. Rates of migration from other states were likely to have been higher at that time than we might expect in the future. Thus, we estimate future migration with more weight to recent patterns of endorsement requests, and de-emphasize the 2007-2008 estimates from the NSSRN. We calculate the "best estimate" as:

Best estimate = 0.1*high estimate + 0.9*low estimate

We also use this estimate as the "high estimate." The "low estimate" is the inter-state migration rate calculated from the 2014 BRN data.

Movements from inactive to active license status

We obtained data from the BRN, by age category, on the number of RNs with California addresses changing from inactive to active license status for 2014. The total has ranged from a low of 189 nurses in 2002-2003 to a high of 796 nurses in 2011-2012. The 2014 data are used to estimate the number and age distribution of RNs changing from inactive to active license status (Exhibit 8).

Exhibit 8. Number and age distribution of RNs changing status from inactive to active license status, 2014

Age Category	Number	Percent	Age Category	Number	Percent
<30	14	2.3%	55-59	82	13.2%
30-34	48	7.7%	60-64	80	12.9%
35-39	61	9.8%	65-69	51	8.2%
40-44	81	13.0%	70-74	35	5.6%
45-49	75	12.1%	75+	30	4.8%
50-54	65	10.5%	Total	622	100.0%

Source: California Board of Registered Nursing license records, 2014.

Movements from lapsed to active license status

The BRN provided data on the number and age distribution of RNs whose licenses were lapsed and later were reactivated. In 2014, 392 RNs living in California reactivated their licenses. 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. These data are presented in Exhibit 9.

Exhibit 9. Number and rate of RNs reactivating lapsed licenses, 2014

Age Category	Number of reactivated licenses	Rate of reactivation
<30	5	0.02%
30-34	17	0.04%
35-39	17	0.05%
40-44	42	0.10%
45-49	37	0.10%
50-54	32	0.09%
55-59	49	0.11%
60-64	63	0.16%
65-69	57	0.27%
70-74	40	0.44%
75+	33	0.71%

Source: California Board of Registered Nursing license records, 2014.

Migration out of California (to another state or country)

Data were obtained from BRN records on applications for outgoing endorsements in 2014, by age group. Some of these people requesting outgoing endorsement had in-state addresses at the time of the request, and others had out-of-state addresses. Both of these numbers were divided by the numbers of RNs in each age group in 2015 to obtain estimates of the rate of migration out of California. Exhibit 10 presents the rates used in the model. The "best estimate" is the average of the two estimated out-migration rates.

Exhibit 10. Estimated annual rates of RNs migrating out of California.

Age Category	BRN estimate – CA addresses	BRN estimate – all addresses	Best estimate 2015	Best estimate 2013
Under 25	2.9%	4.4%	3.7%	4.1%
25-29	2.6%	5.1%	3.8%	4.7%
30-34	2.2%	4.8%	3.5%	3.6%
35-39	1.7%	3.8%	2.8%	2.4%
40-44	1.2%	2.7%	2.0%	1.8%
45-49	1.0%	2.6%	1.8%	1.7%
50-54	1.0%	2.5%	1.7%	1.5%
55-59	0.8%	2.1%	1.4%	1.3%
60-64	0.6%	1.7%	1.2%	0.9%
65-69	0.6%	1.6%	1.1%	0.7%
70-74	0.2%	0.9%	0.6%	0.4%
75-79	0.1%	0.3%	0.2%	0.1%
80+	0.0%	0.0%	0.0%	0.0%

Source: California Board of Registered Nursing license records, 2014.

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 and the NSSRN. 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.

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 2014. These data were provided in age groups up through "80 and older"; we assumed this rate applies to all age groups over 75 years. Estimates of the rate at which nurses leave the pool of actively licensed RNs were calculated as the number of RNs with a non-active license divided by the number of current active RNs. Exhibit 11 presents the rates used in the supply model.

Exhibit 11. Estimated annual rates of RNs changing from active to inactive or lapsed license status, by age category.

Age Category	BRN Data (Best Estimate) 2015	Best Estimate 2013
<30	1.0%	0.35%
30-34	1.7%	0.43%
35-39	1.6%	0.40%
40-44	1.2%	0.37%
45-49	1.6%	1.01%
50-54	1.6%	1.74%
55-59	2.1%	2.82%
60-64	3.9%	3.85%
65-69	10.0%	8.33%
70-74	15.8%	9.71%
75-79	23.3%	10.88%
80+	23.3%	10.88%

Sources: California Board of Registered Nursing license records, 2014.

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 moves into the next age category every year after 2015. In this manner, the workforce is "aged." For the age group 80 years and older, 20% of those 75 to 79 years older in the previous year enter, and people leave this age group (and other) based on the estimated outflows described above. For each age category, the basic formula is:

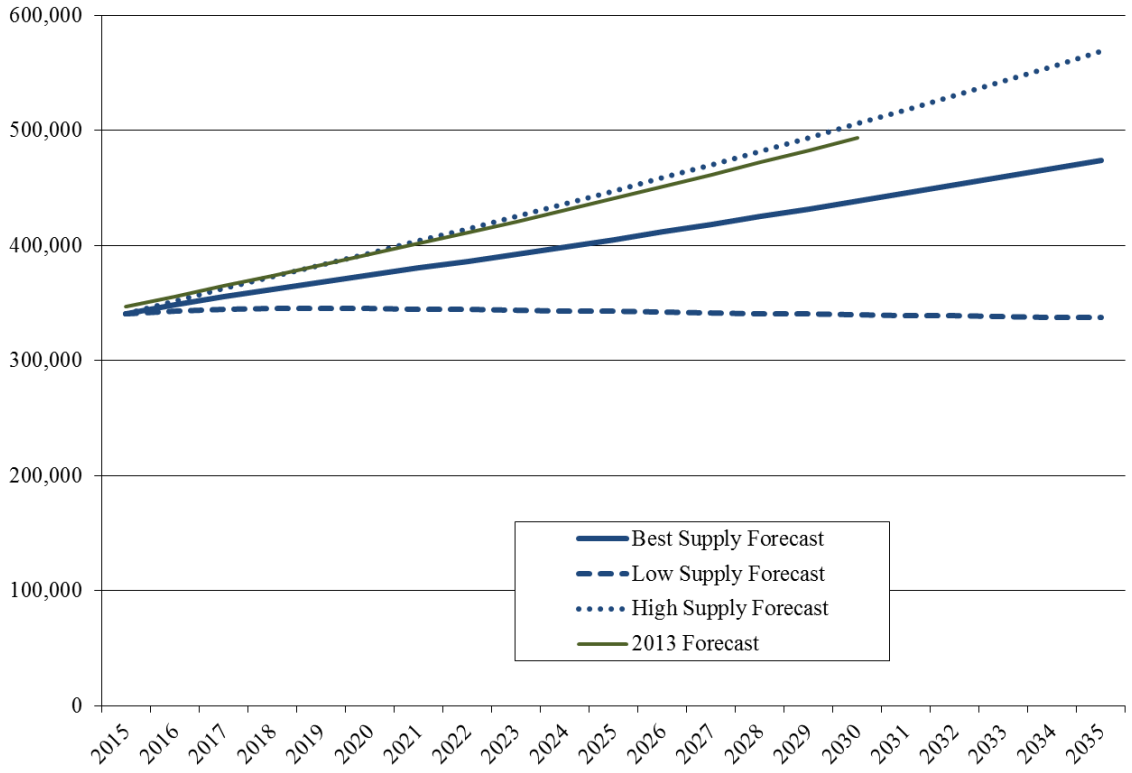
Forecasted Supply of CA RNs =
Current supply of RNs as of 2015 + Estimated total inflows – Estimated total outflows.

This formula is used to produce a forecast of the total active RN population residing in California through 2035. We estimate that California will have 474,059 active resident RNs by 2035, as shown in Exhibit 12. The new forecasts also project there will be 438,571 active resident RNs in 2030, which is 10% smaller by comparison with the 2013 forecast of 493,563 RNs by 2030. This difference is largely due to recent decreases in the number of RN graduates and lower interstate migration of nurses.

As noted above, there was a range of plausible estimates for several of the inflow and outflow parameters in the model. Different sources of data provided different estimates of migration to California, migration from California, changes from active to inactive license status, and the projected number of new nursing graduates. Exhibit 12 presents the range of supply estimates that result when the highest and lowest possible supply forecasts are calculated. The parameters underlying the highest forecast are likely implausible, and the rapid growth of the RN workforce in the high forecast is largely driven by a very high rate of migration to California from other states. Nonetheless, these forecasts are useful to provide a sense of the range of

possible supply outcomes that could occur given potential changes in any or several of the variables identified above.

Exhibit 12. Forecasted number of RNs with active licenses residing in California, 2015-2035.



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 2014 BRN Survey of RNs were used to estimate the proportion of RNs living in California with active licenses that are employed in nursing, by age category. The estimated employment rates range from a high of 92.8% for RNs aged 45 to 49 to a low of 25.1% for RNs 80 years and older. 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. The low estimate of the employment rate is the lowest of four rates: the employment rates used in the 2009, 2011, and 2013 surveys, and the 2014 BRN Survey. The high estimate is the highest of these four rates. The best estimate is the average of the low and high rates and is presented in Exhibit 13.

In the supply model, the 2014 BRN Survey of RNs was used to estimate the average usual hours worked per week in all nursing jobs for each age category by active RNs who resided in California and were employed in nursing. This is to account for variation in hours worked by RNs. These estimated hours per week are divided by 40 to obtain the average full-time equivalent employment (FTE) for each age category. The data used for this calculation is presented in Exhibit 14. As with the estimates of the employment rate, the high estimate is the

higher of the number of hours worked in 2014, and the hours used for the 2009, 2011, and 2013 forecasts, and the low estimate is the lower of these four. The best estimate is the average of the high and low estimates.

Exhibit 13. Employment rates for RNs residing in California, 2014

Age Category	Share Employed, 2014	Low Estimate, 2015	High Estimate, 2015	Best Estimate, 2015
Under 25	88.6%	89%	100%	94.3%
25-29	89.6%	90%	97%	93.5%
30-34	92.2%	92%	95%	93.8%
35-39	89.5%	89%	95%	92.3%
40-44	89.3%	89%	91%	90.2%
45-49	92.8%	92%	93%	92.7%
50-54	90.4%	90%	91%	90.3%
55-59	83.1%	83%	88%	85.3%
60-64	78.0%	76%	78%	77.0%
65-69	56.7%	57%	65%	60.9%
70-74	38.0%	38%	43%	40.5%
75-79	28.3%	28%	36%	32.2%
80+	25.1%	23%	25%	24.2%

Source: Spetz, et al., 2015, BRN 2014 Survey of Registered Nurses.

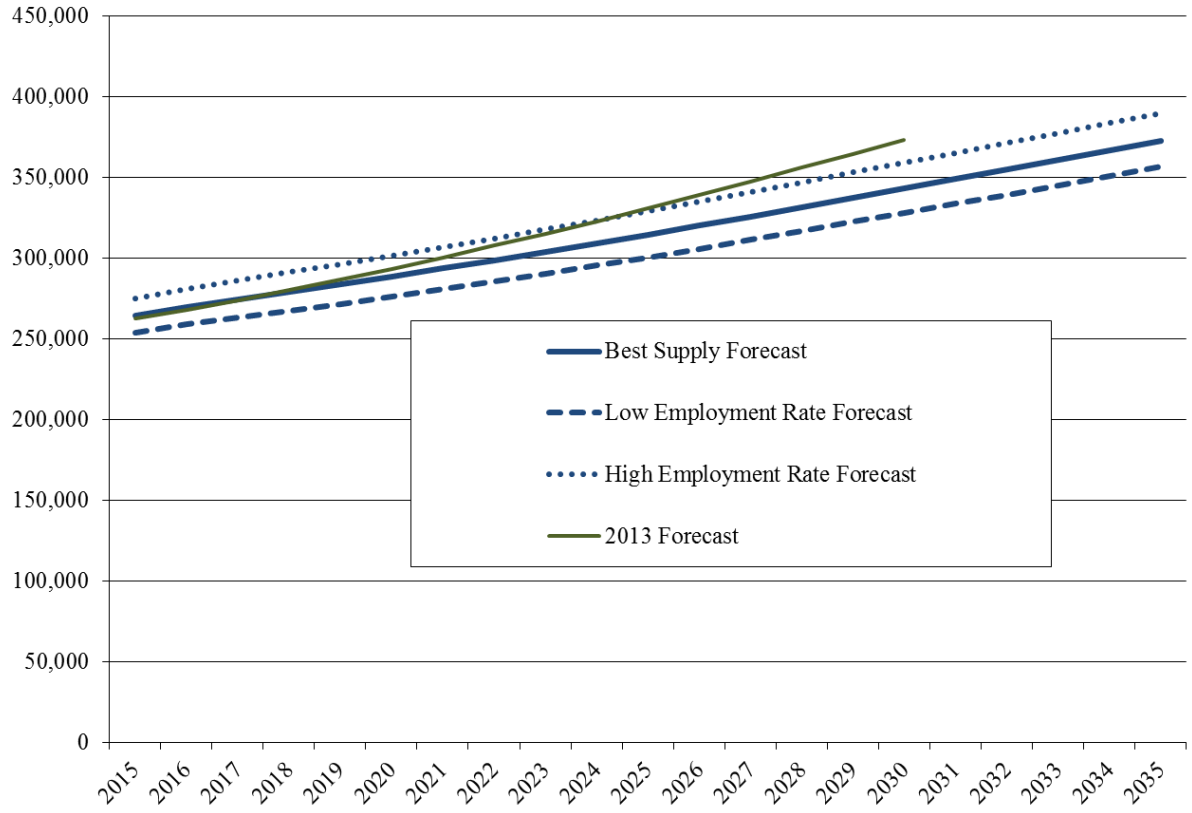
Exhibit 14. Average hours worked per week by RNs residing in California, 2014

Age Category	Hours worked per week, 2014	Low Estimate, 2015	High Estimate, 2015	Best Estimate, 2015
Under 25	37.8	37.8	47.1	42.4
25-29	37.0	35.8	37.0	36.4
30-34	37.3	35.8	37.3	36.5
35-39	35.3	35.3	36.2	35.8
40-44	36.6	36.4	37.0	36.7
45-49	38.1	36.7	38.1	37.4
50-54	38.0	36.9	38.0	37.5
55-59	38.1	36.6	38.1	37.4
60-64	35.4	35.3	35.5	35.4
65-69	33.6	32.0	33.6	32.8
70-74	25.4	24.0	26.0	25.0
75-79	26.4	18.8	26.4	22.6
80+	22.8	22.8	31.1	26.9

Source: Spetz, et al., 2015, BRN 2014 Survey of Registered Nurses.

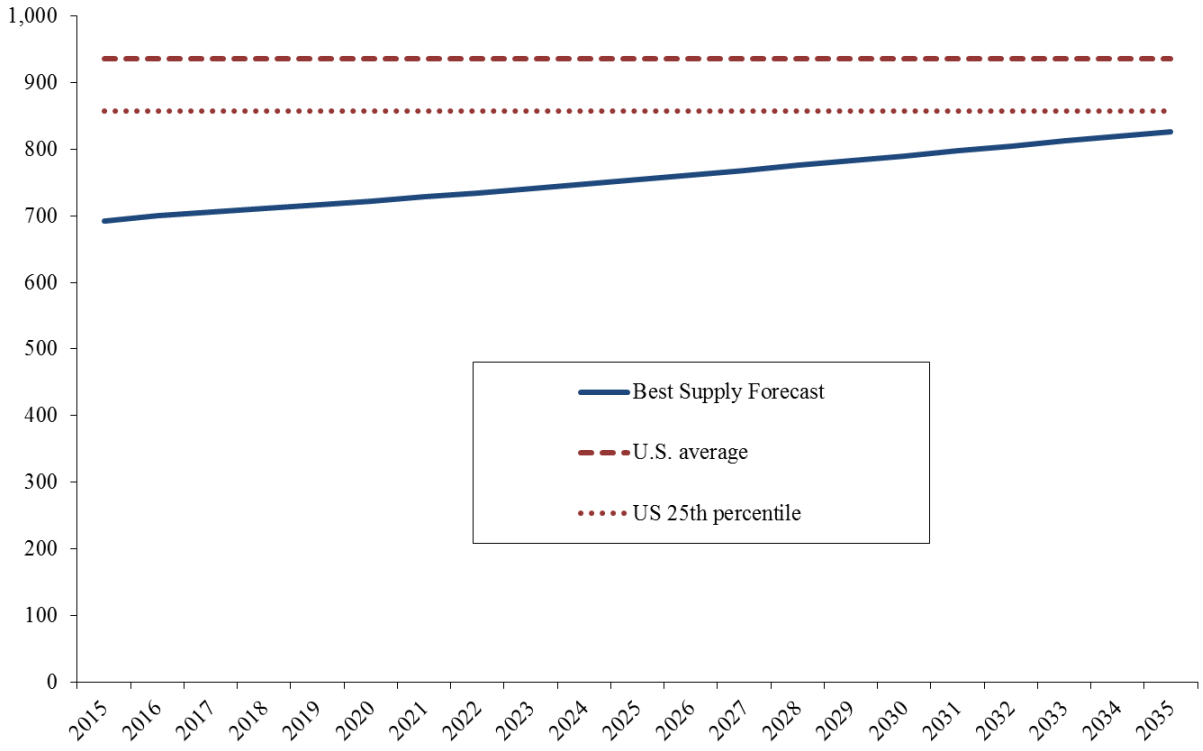
Exhibit 15 presents projected high, low, and best estimates of FTE supply, based on the best estimates of the future count of RNs. The 2015 forecast is slightly lower than that of 2013, reflecting the declines in the forecasted total number of RNs discussed above.

Exhibit 15. Forecasted full-time equivalent supply of RNs, based on "best estimate" forecasted count of RNs, 2015-2035.



The supply forecasts and U.S. Census Bureau projections of total population in the state can be used to calculate the number of employed RNs per 100,000 people in the population for the years 2015 through 2035 (Exhibit 16). We compared these projections to the number of employed RNs per 100,000 population in 2013, as computed from the American Community Survey (U.S. Bureau of the Census, 2014). In 2013, there was an average of 936 employed RNs per 100,000 U.S. residents. The 25th percentile across all states was 857 employed RNs per 100,000 residents. Exhibit 16 compares the projected RN-per-100,000 population ratio to the 2013 U.S. average and 25th percentile. By 2030, California's ratio is expected to approach the national 25th percentile.

Exhibit 16. Forecasted employed RNs per 100,000 population, 2015-2035



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 that should dictate the need 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 percent of deliveries being attended by a skilled birth attendant (WHO 2006). Similarly, policymakers could target a stable number of nurses per capita based on the current number of nurses per capita, a goal developed by an expert panel, or a goal based on comparisons with other U.S. 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 its patient care services to afford more nurses. An employer might have resources that could be used to hire more nurses, but might think that investment in an electronic medical record will produce more value to patients. The demand for nurses is essentially derived from economic forces, which may not be aligned 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 U.S. RN-to-population ratios
- An employment forecast published by the California Employment Development Department for 2022
- Demand forecasts based on 2014 hospital patient days, employment in hospitals, and future population growth and aging

These approaches are informed by surveys of RN employers conducted from fall 2010 through 2014, and by other recent analyses of the effect of health insurance expansion in California.

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 (California Institute for Nursing and Health Care, 2006). For decades, California has had one of the lowest ratios of employed RNs-per-100,000 population in the United States, and California ranked 46th in 2013 based on data from the American Community Survey (U.S. Bureau of the Census, 2014). Exhibit 17 presents the 2013 ratios of working RNs per 100,000 population for the 10 lowest ratio and 10 highest-ratio states. Many policy advocates have supported efforts to move California's full-time equivalent employment of RNs toward the current 25th percentile nationwide (857 RNs per 100,000) or even the national average (936 RNs per 100,000). These benchmarks were compared with the current and forecasted population of California (California Department of Finance, 2014) to project need for RNs to remain at current RN-to-population ratios, to reach the 25th percentile ratio, and to attain the national average ratio.

Exhibit 17. Working RNs per 100,000, from the 2013 American Community Survey

States with the lowest ratios of RNs per 100,000	Ratio	States with the highest ratios of RNs per 100,000	Ratio
Idaho	638	New Hampshire	1,351
Nevada	648	South Dakota	1,343
New Mexico	678	North Dakota	1,244
Utah	706	Rhode Island	1,237
California	752	Nebraska	1,214
Vermont	765	Maine	1,190
Colorado	798	Massachusetts	1,170
Arizona	814	Ohio	1,143
Georgia	817	Minnesota	1,128
Oklahoma	821	Pennsylvania	1,120

Source: U.S. Department of the Census, American Community Survey, 2013. Note: States with small sample sizes have greater margin of error in the estimated RN-to-population ratio.

Forecasts based on hospital staffing of RNs per patient day

The main shortcoming of targeting a fixed number of RNs per population is that the target is arbitrarily defined. The current number of nurses per capita may not be a large enough number to deliver health care needs, and if there is a shortage of nurses, the number may not be as large as economic demand. Likewise, a target number based on a national average or other source might not reflect the unique population and health care system of California. An additional shortcoming is that fixed nurse-to-population ratios do not account for increases in the demand for health care services associated with population aging. However, this approach has the benefit of being easy to understand and adjust, and provides a clear indication of how California's supply compares to national levels of supply.

A second approach to forecasting demand for RNs uses current hospital utilization and staffing patterns to estimate future demand. First, the 2014 total number of hospital patient discharges, per ten-year age group, at short-term acute-care hospitals was obtained (Office of Statewide Health Planning and Development, 2015).[2] In order to estimate the total number of patient days per age group, these data were then multiplied by the average length of stay per age group, as reported by the 2010 National Hospital Discharge Survey (National Center for Health Statistics, 2011).

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. Age-specific population estimates and forecasts were gathered from the California Department of Finance (2014). Dividing patient days by population provides the number of patient days per population, per age group. These rates of patient days were then applied to the population projections to get estimates of total patient days by age category.

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, 2014). In 2013, a total of 210,835,410 productive RN hours were reported. The number of RN hours per discharge was calculated by dividing these hours by the number of discharges in 2014, resulting in 12.26 productive RN hours per patient day. Multiplying the number of productive RN hours per patient day by the forecasts of the total number of patient days produces a forecast of RN hours needed in the future. To equate these estimates to FTE jobs, RN hours are divided by 1768 (average annual productive hours per FTE).

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 based on OSHPD data). The OSHPD data estimate that there were 119,251 FTE hospital positions in 2014. Calculations based on the 2014 BRN Survey of Registered Nurses find that total FTE employment was 259,346 in that year (Spetz et al., 2015). Together, these figures indicate that 46 percent of jobs were in the types of hospitals included in the OSHPD data. The hospital-based projections of future RN demand were thus augmented to maintain this 46 percent ratio in future years. The projections indicate there will be a need for 167,930 FTE RNs in hospitals, and 365,214 FTE RNs statewide, in 2035.

[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.

Employment Development Department forecasts

The most recent projection by the EDD indicates that there will be 306,100 registered nurse jobs in California by 2022 (California Employment Development Department, 2014). The EDD projection does not distinguish between full-time and part-time jobs. To estimate the FTE employment implied by the EDD projection, we use the adjustment of 0.913, which is the average number of hours worked per week by California RNs (36.5, from the 2014 BRN Survey of Registered Nurses) divided by 40 (Spetz et al., 2015). The FTE projection for 2022 is thus 271,378, which is slightly lower than the EDD's projection of 275,782 jobs in 2020.

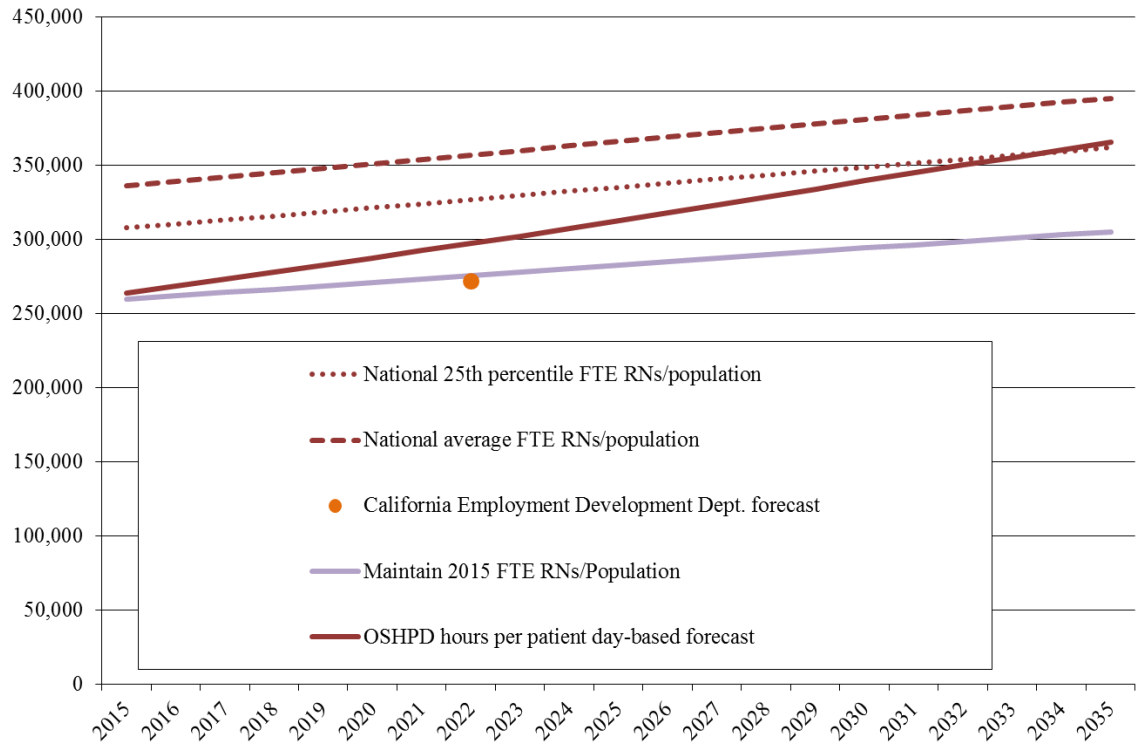
Potential effects of the Affordable Care Act

The implementation of the Affordable Care Act (ACA) has increased access to health insurance, and likely will increase demand for health care services (Coffman and Ojeda, 2010). It is unclear how the ACA might affect the demand forecasts for RNs in California. Most registered nurses do not provide primary care services, and thus the main area of anticipated growth in demand may not impact them as much as other health professionals. However, demand for RNs in other roles such as care coordination may increase (Fraher, Spetz, and Naylor, 2015). Recent analyses found that the ACA is likely to account for less than 10 percent of new demand for RNs (Spetz, Jacobs, et al., 2014), but if the RN role in care coordination increases so that employers demand 10 percent more of them by 2022, an additional 22,000 RNs will be needed (Oberlin et al., 2015). Given the uncertainty about how many RNs will be used in care coordination, versus community health workers, health coaches, and other providers, we did not formally adjust our demand forecasts. We discuss the implications of new care delivery models in the concluding section of this report.

Comparing the demand forecasts

Exhibit 17 compares all aforementioned demand forecasts of full-time equivalent RNs. The forecasts estimate that the FTE demand for RNs in 2015 ranged from 234,516 to 286,985. Demand in 2030 is forecasted to be between 291,679 and 350,166. These lower figures are not likely to accurately represent total future demand, because they do not account for additional demand caused by future population growth and aging. The EDD forecast for 2020 is lower than that produced by targeting the national 25th percentile of RN-to-population ratios, and slightly higher than that calculated from estimated future patient days when calibrated using employment data from the BRN.

Exhibit 18. Forecasted full-time equivalent demand for RNs, 2015-2035.



Comparing Supply and Demand for RNs

Through most of the 2000s, there was a widespread perception that California faced a significant long-term shortage of RNs, and forecasts published by the BRN were consistent with this perception. Since the 2005 forecasts were published, yearly number of RN graduates have more than doubled. The forecasts published in 2011 reflected part of this improvement in the number of RN graduates, and indicated that California had closed the gap between RN supply and demand. The rapid onset of the economic recession that began in December 2007 led to concerns that RN supply was exceeding demand, although in the long term another RN shortage could emerge. The 2013 forecasts indicated that supply and demand were likely to be balanced through 2030, although post-recession changes in employment, retirement, and graduation rates could bring about a shortage or surplus.

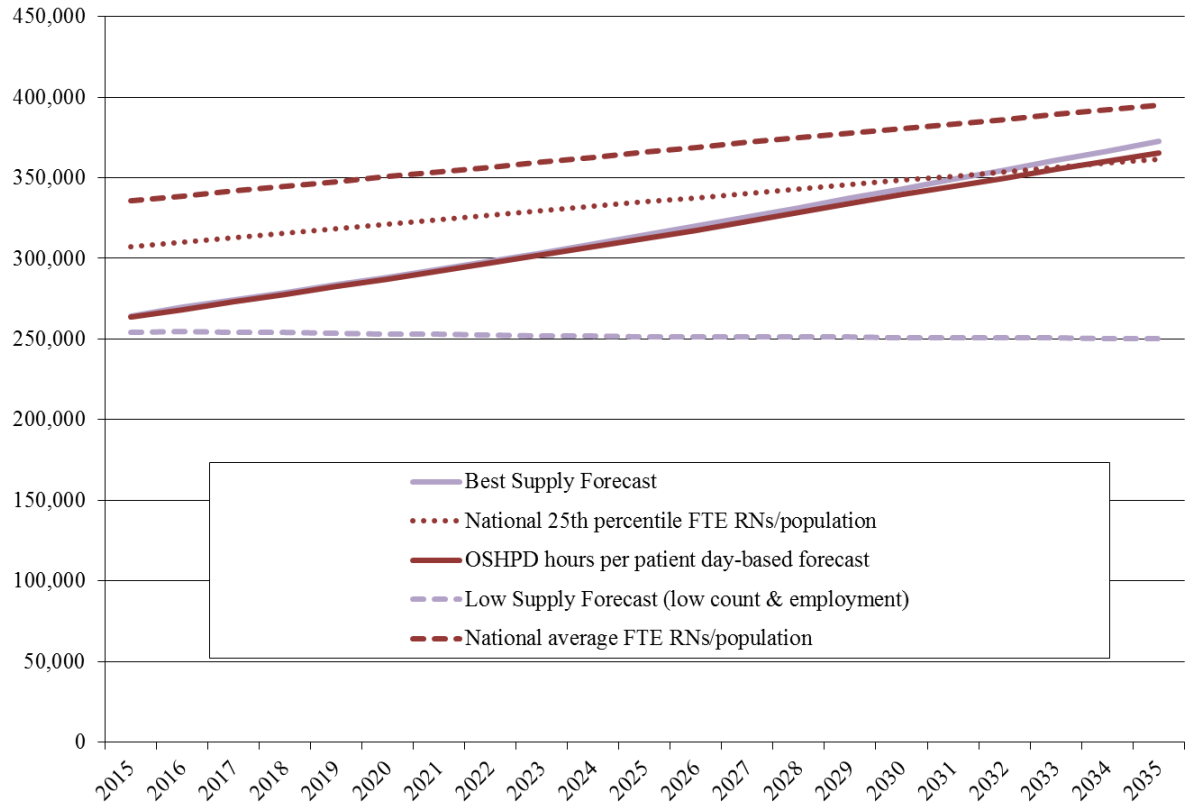
Exhibit 18 presents the new 2015 "best" supply forecast and low supply forecast, along with three alternate demand forecasts: (1) based on striving to reach the national 25th percentile, (2) based on the national average, and (3) based on forecasted growth in hospital patient days. All forecasts are for full-time equivalent employment. The best estimate is that in 2015 there were 264,199 FTE RNs available to work, and the patient days-based demand estimate is that there were 263,852 positions to be filled. This suggests a small surplus of RNs in 2015. This is consistent with employer survey data that indicate in some parts of California, employers perceive a surplus of recently-graduated RNs, even though they are having difficulty filling specialized nursing positions (Bates, Chu, and Spetz, 2015).

In the long-term, the best supply forecast predicts that nurse supply will rise more rapidly than California's population as a whole, and RN supply will reach the national 25th percentile of FTE RNs per 100,000 by 2032. The demand forecast based on hospital utilization is nearly perfectly aligned with projected supply. However, the low estimate of supply indicates that it is possible that California will enter another period of RN shortage that could persist for decades. Which scenario prevails will depend on a number of factors:

- Whether the number of RN graduates is sustained at the current level or decline
- Whether inter-state migration leads to more nurses entering California than leaving
- Whether older RNs continue to work at higher rates than in the past
- Whether younger RNs are able to work at rates similar to 2008, rather than the lower rates of 2010 and 2012

If recently-graduated RNs have difficulty finding employment, it is likely that many will leave California in search of work. If this occurs, the higher rate of migration out of California will depress long-term supply. Whether older RNs will continue to work at a higher rate than in the past and younger RNs will find jobs in California will likely depend on the rate of economic recovery and the willingness of California employers to invest in the development of newly-graduated RNs.

Exhibit 19. Forecasted full-time equivalent supply of and demand for RNs, 2015-2035.



Comparison of the 2015 Forecasts with Previous Forecasts

The forecasts presented here use a similar methodology to that used previously by Coffman, Spetz, Seago, Rosenoff, and O'Neil (2001), Spetz and Dyer (2005), Spetz (2007), Spetz (2009), Spetz (2011), and Spetz (2013). The magnitude of the projected shortage changed dramatically over time. In 2005, California had a substantial shortage of RNs, ranging between 6,872 and 21,161 RN FTEs. This shortage grew by 2007, reaching at least 10,294 RN FTEs. However, due to growth in the number of new RN student enrollments, the 2007 forecasts predicted that the shortage would be reduced over time, and that California would surpass the national average of RN FTEs per 100,000 population (825) by 2022. The 2009 forecasts were similar to those of 2007.

The 2011 forecasts indicated that supply would rise more rapidly than had been previously estimated, in part due to continued growth in RN education program new student enrollments, and in part due to greater employment of nurses during the economic recession. The forecasts suggested that it was possible that a surplus of RNs would emerge in the late 2020s. However, these new 2015 forecasts do not project a future surplus of RNs, largely due to the flattening of student enrollments in RN education programs. Supply is anticipated to grow at a rate roughly equivalent to demand growth.

The California BRN forecasts can be compared with the 2014 U.S. Bureau of Health Workforce forecasts of RN supply and demand, which included state-specific projections (U.S. Bureau of Health Workforce, 2014). The national forecast model estimated that in 2025, the demand for RNs in California would be 393,600 FTE RNs, and the supply would be 389,900 FTE RNs. The BRN forecasts estimate that supply will be only 314,398 FTE RNs in 2025, and demand will be approximately 312,361 FTE RNs in 2025 (based on the hospital utilization forecast). The Bureau of Health Workforce's projections of California supply and demand are consistently higher than the BRN forecast models. For example, the national model estimated that the 2012 FTE supply of California RNs was 277,000, which is considerably higher than the BRN model's estimate that there were 264,199 FTE RNs in 2015. The national model relies upon a national data source, the American Community Survey, that has less detailed information than the BRN Survey of Registered Nurses, which may account for some of the difference between the BRN and national projections.

Policy Implications

The 2005 forecast report advised that "The only plausible solution to the RN shortage, based on our preliminary analyses, appears to be continued efforts to increase the numbers of graduates from California nursing programs." This recommendation was acted upon by state leaders. Significant increases in state funding for expanded educational capacity of nursing programs, increased funding for equipment, use of updated instructional technologies, and other educational investments had a favorable impact on addressing the RN shortage in California. Between the academic years 2004-2005 and 2009-2010, the number of nursing graduates increased 72 percent, exceeding 11,500 new RN graduates in 2009-2010. The total number of graduates has stabilized since then, ranging from 10,666 in 2010-2011 to 11,292 in 2013-2014. However, the number of graduates is projected to drop below 10,000 per year by 2016-2017 due to lower new student enrollments. If future numbers of student enrollments and graduates continue to decline, a shortage could re-emerge.

Changes in the demand for RNs also could lead to a future shortage or surplus. If emerging care delivery models, such as accountable care organizations and patient-centered medical homes, lead to greater use of RNs in care management roles, demand for RNs could rise above the projections presented in this report. A recent report by Oberlin and colleagues (2015) found that if health care organizations increase employment of RNs by 10 percent to serve in care management roles, overall demand would increase by about 22,000 jobs in California (which may include some part-time jobs) – about 6.5 percent relative to 2015 employment. This would be a relatively small change in demand, which would likely emerge slowly enough over time that nursing education programs could respond by increasing student enrollment.

Policymakers should be cautioned that the 2015 BRN forecasts represent the long-term and are not intended to reflect rapidly changing economic and labor market conditions. They also are based on the most currently available data; the factors that affect RN supply and demand are unlikely to remain static. The most important possible changes include: (1) the number of graduates from RN education programs; (2) inter-state migration; and (3) employment rates of both newly-graduated and older RNs. These factors and any other potential influences on California's nursing shortage, 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.

California leaders should closely observe the employment paths of recent nursing graduates who are entering a difficult job market and may choose to leave California. Moreover, they should watch new student enrollments in nursing programs, which dropped slightly in recent years and could continue to decline as state colleges and universities face tight budgets and as potential students hear there might not be enough nursing jobs. California will need to maintain the present number of nursing graduates in order to meet long-term health care needs.

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Acronyms

ACA – Affordable Care Act of 2010

BHW – Bureau of Health Workforce, Health Resources and Services Administration, U.S. Department of Health and Human Services

BRN – California Board of Registered Nursing

EDD – California Employment Development Department

FTE – Full-time Equivalent

NCLEX-RN – National Council Licensure Examination – Registered Nurses (NCLEX is a registered trademark and/or servicemark of the National Council of State Boards of Nursing, Inc.)

NSSRN – National Sample Survey of Registered Nurses (last conducted in 2008)

OSHPD – California Office of Statewide Health Planning and Development

RN – Registered Nurse

UCSF – University of California San Francisco