Forecasts of the Registered Nurse Workforce in California

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Executive Summary

This report presents supply and demand forecasts for the Registered Nurse (RN) workforce in California from 2007 through 2030. These new forecasts are based on data from the 2006 California Board of Registered Nursing Survey of Registered Nurses, the U.S. Bureau of Health Professions 2004 National Sample Survey of RNs, and data extracted from the California Board of Registered Nursing's license records. The 2007 forecasts indicate that the shortage of RNs identified in 2005 has narrowed, and will continue to narrow in the foreseeable future, provided that recent expansion of RN education programs is maintained.

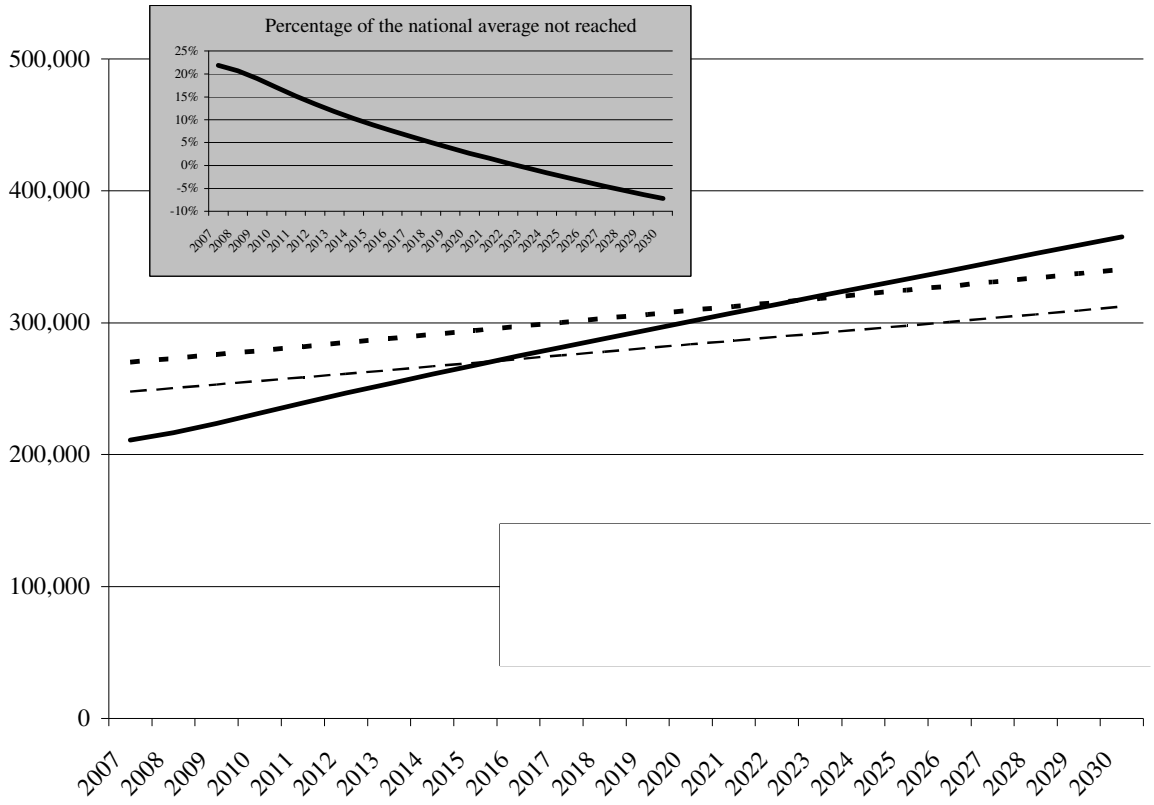
The forecasts of RN supply take into account the aging of the RN workforce, the number of new RN graduates seeking licensure in California (including those from out-of-state and international nursing programs), interstate flows of RNs, and changes in license status. The demand forecasts are based on national numbers of RNs per 100,000 population. The demand forecasts are compared to the forecast published by the California Employment Development Department, as well as an alternate forecast developed using data from the California Office of Statewide Health Planning and Development and the California Department of Finance.

The forecasts indicate that California faces a shortage of RNs at this time; the magnitude of this shortage ranges between 10,294 and 59,027 full-time equivalent (FTE) RNs in 2007 depending on whether demand is forecasted based on estimated health industry demand for RNs under current labor market conditions, or based on the national average number of FTE RNs per 100,000 population. Some of California's shortage is being ameliorated by traveling nurses, who are estimated to have provided 3,910 FTEs in 2006.

Between 2003-2004 and 2007-2008, nursing graduations will have increased 68.7 percent, reaching a projected number of over 10,000 new RN graduates per year. This expansion is due to significant increases in state funding for expanded educational capacity of nursing programs, increased funding for equipment, use of updated instructional technologies, and other needed educational resources that have had a favorable impact on addressing the RN shortage in California. If the expansion of RN education programs and other program augmentations are maintained, immigration of internationally-educated nurses does not change, and inter-state migration rates are constant, this shortage will steadily narrow. California will reach the 25th percentile nationwide of the number of full-time equivalent RNs per 100,000 (756.5) by 2016, and California will surpass the national average of FTE RNs per 100,000 population (825) by 2022. If the number of new graduations from California RN programs increases beyond currently estimated rates of growth, these benchmarks will be reached sooner.

Policymakers should be cautioned that the 2007 BRN forecasts are based on current data and trends; the factors that affect RN supply and demand are unlikely to remain static. Continuous tracking of factors that affect the nursing workforce allows the BRN to adjust supply and demand projections as needed, identify the degree to which California's workforce strategies have been successful in reducing the nursing shortage, and pinpoint new approaches to sustain progress in narrowing the gap between RN supply and demand. Strategies that continuously attract people into nursing, particularly young people, may be among the most effective to support and sustain in the long term.

Executive Summary Exhibit: Projected full-time equivalent supply of and demand for RNs, 2007-2030. (Inset: Percentage of national average FTE RNs per 100,000 not reached)



Introduction

This report updates forecasts of the Registered Nurse (RN) workforce in California developed in 2005 by the University of California, San Francisco, for the California Board of Registered Nursing (BRN) (Spetz and Dyer, 2005). The new forecasts are based on data from the 2006 BRN Survey of Registered Nurses (Spetz, Keane, and Hailer, 2007), the 2004 U.S. Bureau of Health Professions (BHPr) National Sample Survey of RNs (Bureau of Health Professions, 2007), and data extracted from the BRN's license records. The forecasts indicate the shortage of RNs identified in 2005 still exists, but will narrow over the next years, provided the recent expansion of RN education programs is sustained at approximately 15 percent growth through 2009 and 2 percent annual growth thereafter.

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. The demand forecasts are based on national numbers of RNs per 100,000 population. The demand forecasts are compared to a forecast published by the California Employment Development Department, as well as an alternate forecast developed using data from the California Office of Statewide Health Planning and Development (OSHPD) and the California Department of Finance (DOF).

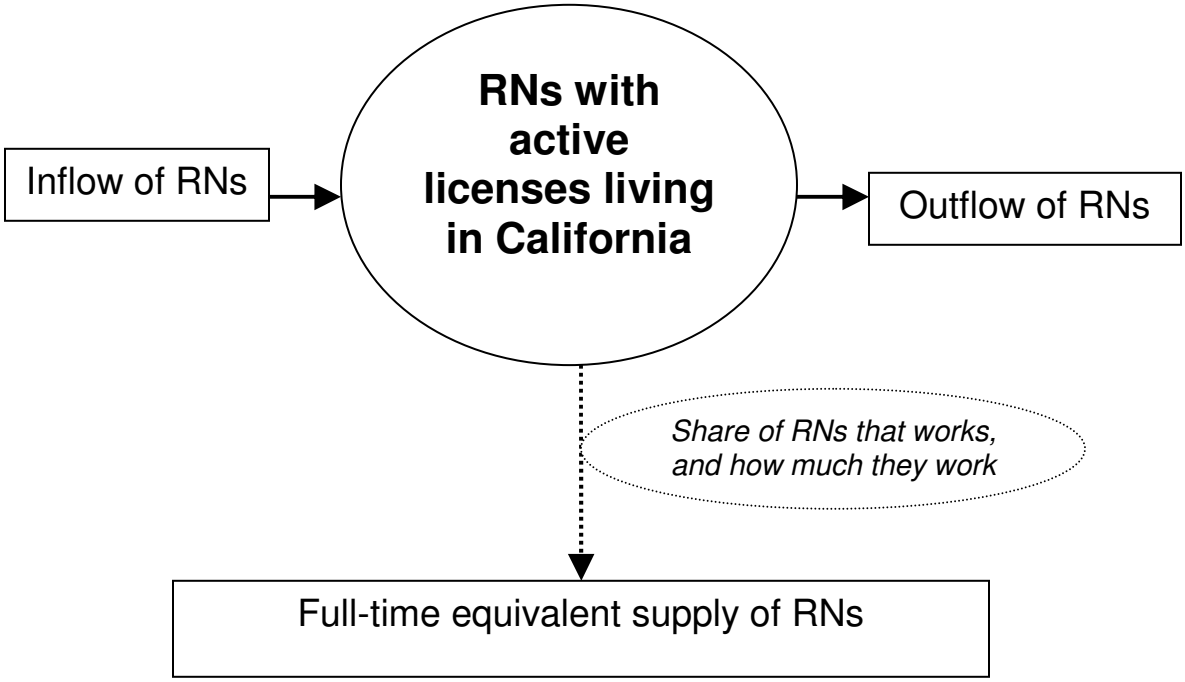
This report explains the structure of the 2007 forecasting model, how the parameters of the model were estimated, and findings concerning the future supply of California's RN workforce relative to future demand.

The Supply of RNs

Basic Structure of the Supply Forecast Model

California's RN workforce constantly changes due to a variety of factors described as "inflows" and "outflows" of RNs. Inflows result in additions to the number of RNs in California, and outflows represent the departure of RNs from the California population. In the model used to forecast supply, the factors that drive the inflow and outflow of RNs are measured to develop estimates of the total numbers of RNs that will enter and leave the labor force each year. These inflows and outflows are added to and subtracted from the number of RNs with active licenses who were California residents as of July 2007. The number of RNs with active licenses – 275,658 – is considered the "stock" of RNs potentially available to work. The supply forecast model also provides a description of the age distribution of the RNs, and estimates the inflow and outflow of RNs for each age category. Estimates of the total supply of RNs are derived from the total number of RNs potentially available to work and how much they work in nursing. This number is expressed as full-time equivalent employment, or FTEE, in the model. Figure 1 illustrates this model of the supply of RNs in California, commonly called a "stock-and-flow model."

Exhibit 1: A model of the supply of RNs.



Factors that comprise the key parameters in this model are:

- Inflows
  - 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
  - Migration out of California (to another state or country); and
  - Movements from active to inactive or lapsed license status.
- Employment rates
  - 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.

As the factors (model components) 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.

Method of Calculating RN Supply

In the supply model, the number of RNs with active licenses who reside in California is first divided into 12 age categories: under 30, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 70-79, and 80 and older. Second, we assume that one-fifth of RNs in each age category moves into the next (older) age category each year. Third, we add the inflow estimates to and subtract the outflow estimates from each age group of RNs. Fourth, we apply rates of employment and hours worked per week in nursing to the estimates of RNs with active licenses to obtain FTEE supply. We do this for each year through 2030 to obtain our 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. In these cases, the highest and lowest estimates are identified, thus providing a range within which the "best estimate" resides.

Estimates of Supply Model Factors

Baseline supply of RNs in 2007

Data on the number of RNs with active licenses were obtained from the BRN. On July 27, 2007, 275,658 RNs had active licenses and a California address according to BRN records. Another 49,253 RNs had active California licenses but lived in other states or countries. Since the focus of this model is on the long-term supply of RNs in California, we use the number of active RNs residing in California as our initial stock of RNs. The potential for RNs with California licenses but non-California residence to supplement California's supply as traveling nurses is discussed below.

The number of RNs with active licenses and California addresses was divided into 12 age groups, as seen in Exhibit 2. These age groups are used throughout the model.

Exhibit 2: Counts of actively-licensed RNs living in California, by age group, July 27, 2007.

Age Group	Count	% of Total	Age Group	Count	% of Total
Under 30	21,003	7.62%	55-59	36,614	13.28%
30-34	27,179	9.86%	60-64	22,893	8.30%
35-39	32,173	11.67%	65-69	11,984	4.35%
40-44	30,191	10.95%	70-74	5,534	2.01%
45-49	38,333	13.91%	75-79	1,972	0.72%
50-54	46,940	17.03%	80+	842	0.31%
			Total	275,658	100.00%

Source: California Board of Registered Nursing license records

Graduates from California nursing programs

Data on new graduates from California nursing programs who receive their first RN license in California were obtained from the BRN. According to the 2005-2006 BRN Annual School Report, there were 7,528 new graduates from California nursing programs in the 2005-2006 school year (Waneka and Spetz, 2007). Over the past several years, there has been substantial growth in new enrollments in RN education programs; Exhibit 3 presents the numbers of enrollments and graduates from the past five Annual Schools Reports.

Growth in RN program enrollments will lead to growth in graduations in future years. In order to estimate growth in RN graduates for the next few years, one can assume that most RN education programs last two to three years. Associate Degree programs, which accounted for 71 percent of graduates in the 2005-2006 academic year (Waneka and Spetz, 2007), are designed so students can complete the nursing component of the degree in two years. In most baccalaureate 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 degree program. Thus, enrollment changes will translate to graduation changes two to three years into the future.

Exhibit 3: Enrollments and graduations from RN education programs, 2001-2002 through 2005-2006.

Survey year	Number of new enrollments	Number of graduations
2001-2002	6,422	5,346
2002-2003	7,457	5,623
2003-2004	7,825	6,158
2004-2005	8,926	6,677
2005-2006	11,131	7,528

Source: Waneka and Spetz, 2007, 2005-2006 Annual School Report Data Summary and Historical Trend Analysis.

To predict future graduations, enrollments for each year of the Annual Schools Report were compared with graduations two years later. Graduations were, on average, 93.3 percent of the number of enrollments two years prior. This rate was used to estimate future graduations, as presented in Exhibit 4.

Exhibit 4: Predicted growth in graduations based on known growth in enrollments.

Academic year	Number of enrollments	Forecasted graduations
2004-2005	8,926	6,677*
2005-2006	11,131	7,528*
2006-2007		8,332
2007-2008		10,391

* Actual number of graduations based on Annual Schools Report. Forecasted graduations are 93.3 percent of enrollments two years prior.
Source: Waneka and Spetz, 2007, 2005-2006 Annual School Report Data Summary and Historical Trend Analysis.

Graduations after the 2007-2008 academic year are more difficult to estimate, because enrollments for 2006-2007 are not yet known. For the 2005-2006 Annual Schools Report, schools were asked to estimate their enrollments for 2006-2007. They estimated enrollments to be 15,176, representing a 36.3 percent rate of growth. When these growth estimates are examined in detail, it appears that some programs expected their programs to double in size in one year. Historical data suggest that a more plausible estimate of enrollment growth for the 2008-2009 academic year would range from 10 percent (the growth rate between 2003-2004 and 2004-2005) and 25 percent (the growth rate between 2004-2005 and 2005-2006). In the models, these values are the "low" (10%) and "high" (25%) estimates, with 15 percent growth being the "best estimate." After the 2008-2009 academic year, graduation growth is estimated to range from zero percent to two percent, with one percent being the "best estimate." It is unknown whether this rate of growth will occur or be sustained in the future.

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. In the 2005-2006 fiscal year, 828 out-of-state graduates obtained their first license in California. BRN records also indicate that 132 of the 828 RNs requested to have their license endorsed to another state within three months of obtaining their initial RN license. It is not known if the RNs who requested outgoing endorsement ever worked in California. In the forecasting model, the high estimate of out-of-state graduates who obtain their first license as an RN from California is 828; the low estimate subtracts the 132 outgoing endorsements to predict 696 out-of-state graduates that obtain initial licensure in California. The "best estimate" for this inflow of new licensees is 762, which is the average of the high and low estimates.

Immigration of internationally-educated nurses

In the 2005-2006 fiscal year, 4,062 internationally-educated nurses passed the NCLEX-RN exam and received initial licensure as an RN in California. Since the 1997-1998 fiscal year, the number of first licenses issued to internationally-educated nurses has ranged from 1,145 to 4,107. In the supply model, the 2005-2006 data are used as the high estimate of the number of immigrants. In the 2005-2006 fiscal year, 752 of the internationally-educated nurses who obtained their first U.S. license in California also requested endorsement to another state within three months of licensure. It is not known if any of the RNs who requested outgoing endorsement ever worked in California. California may be a "pass-through" state for some internationally-educated nurses seeking to move to the United States because California is one of only a few states that does not require Commission on Graduates of Foreign Nursing Schools (CGFNS) certification to sit for the licensure examination. Thus, the low estimate of immigration subtracts 752 from the high estimate of 4,062, arriving at a low estimate of 3,310 internationally-educated RNs migrating to California annually through 2030. The best estimate is the average of the high and low estimates: 3,686 internationally-educated RNs per year.

Age distribution of graduates from RN education programs

The ages at which new graduates enter the labor supply are an important component of the model. The BRN Annual Schools Report does not use the same age categories for new California graduates as the forecasting model, so the age groups were redistributed to estimate the age distribution of new graduates in the supply forecasting model. Nurses with unknown ages were excluded from the calculations, and it was assumed that no graduates are over 64 years old. Exhibit 5 shows the redistributed age breakdown of new graduates from California nursing

programs. Note that 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 licensure in California include the birthdates of these nurses. The age distribution of internationally-educated RNs in 2005-2006 is presented in the last two columns of Exhibit 5; these data are used as the forecast of 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.

Graduates of US RN programs				Internationally-educated graduates	
Annual Schools Report data		Estimates for the forecasting model			
Age Category	Percent	Age Category	Percent	Age Category	Percent
18-25	26.2%	<30	60.77%	<30	14.9%
26-30	22.9%	30-34	12.75%	30-34	22.0%
31-40	20.6%	35-39	12.75%	35-39	20.0%
41-50	8.9%	40-44	5.51%	40-44	9.8%
51-60	2.1%	45-49	5.51%	45-49	9.1%
Over 60	0.1%	50-54	1.30%	50-54	6.3%
Unknown	19.2%	55-59	1.30%	55-59	17.2%
		60-64	0.12%	60-64	0.5%
		65-69	0.00%	65-69	0.2%
		Over 69	0.00%	Over 69	0.00%

Source: Waneka and Spetz, 2007, 2005-2006 Annual School Report Data Summary and Historical Trend Analysis.

Interstate migration of RNs to California

Estimates of interstate migration to California were developed in two ways. One estimate of interstate migration was computed from BRN records of nurses requesting license endorsement from another state into California. Some of these RNs may not have moved permanently to California; hence, this is the high estimate of migration to California. Exhibit 6 presents the number of RNs requesting endorsement to California, and presents this number as a share of the estimated total number of RNs living outside California as reported in the 2004 National Sample Survey of Registered Nurses (Bureau of Health Professions, 2007).

The low estimate of interstate migration is based on data from the 2004 BHPr National Sample Survey of RNs. The National Sample Survey asked respondents about their current and former state of residence by asking: (1) where do you currently reside? (question 61); (2) Did you reside in the same city/town a year ago? (question 62); and (3) if the answer to question 62 is "no," Where did you reside a year ago? (question 63). Using the variables corresponding to these questions in the 2004 National Sample Survey of RNs and applying sample weights, we were able to estimate the number and age distribution of RNs who did not reside in California in 2003, but did so in 2004. The share moving to California between 2003 and 2004 is divided by the estimated number of RNs residing in other states in 2003 to obtain a rate of migration into California by out-of-state RNs. Note that no RNs 70 years or older in the National Sample

Survey moved to California between 2003 and 2004; thus, in the models, no nurses are predicted to migrate to California after age 69 years. Exhibit 7 presents these estimates.

Exhibit 6. Requests for license endorsement into California, 2005-2006.

Age Category	Number requesting endorsement	Number of RNs in other states, 2003	Percent of RNs living in other states requesting endorsement
<30	2,554	193,180	1.32%
30-34	1,964	192,940	1.02%
35-39	1,542	226,090	0.68%
40-44	1,082	318,611	0.34%
45-49	1,101	391,572	0.28%
50-54	980	348,207	0.28%
55-59	2,708	239,356	1.13%
60-64	261	126,687	0.21%
Over 64	81	70,738	0.11%

Sources: California Board of Registered Nursing license records, FY 2005-2006; Bureau of Health Professions, 2007.

Exhibit 7. Estimated movements from other states to California, 2003-2004.

Age Category	Number moving to California, 2003-2004	Number of RNs in other states, 2003	Percent of RNs moving to California
<30	1,891	193,180	0.979%
30-34	1,571	192,940	0.814%
35-39	742	226,090	0.328%
40-44	655	318,611	0.206%
45-49	605	391,572	0.154%
50-54	707	348,207	0.203%
55-59	834	239,356	0.348%
60-64	108	126,687	0.086%
65-69	160	70,738	0.228%

Source: Bureau of Health Professions, 2007.

Rates of migration to California are a function of the population of RNs residing in other states. Thus, an estimate of the future *national* RN population is required. Three sources of data were examined to obtain this estimate. First, the Bureau of Health Professions forecasts of RN supply and demand, published in 2002 (National Center for Health Workforce Analysis, 2002), predicts that the number of employed RNs in other states was 11.27 times the number in California in 2000, and was 11.37 times the number of California RNs in 2005. Second, the Bureau of Labor Statistics forecasted the number of jobs in registered nursing in 2004 and 2014 (Bureau of Labor Statistics, 2006-2007); these data estimate that the multiplier was 9.55. Third, the analogous computation with the National Sample Survey of Registered Nurses of 2004 estimates that the multiplier was 11.37.

The estimates of the number of nurses residing outside California as a multiple of the number in California were used to estimate the total non-California population of RNs that might move to California each year. The low estimate is that the non-California RN population is 9.55 times the California population; the high estimate is 11.37 times the California population. These multipliers are combined with each of the rates of movement presented in Exhibits 6 and 7 to obtain the estimated inflow of RNs from other states as a *rate* of the California RN population. These rates are presented in Exhibit 8. The "best estimate" is the average of the four rates, as presented in the last column of Exhibit 8.

Exhibit 8. Rates of migration of RNs to California from other states as a function of the California RN population.

	National multiplier = 9.55		National multiplier = 11.37		
	Low estimate	High estimate	Low estimate	High estimate	Best estimate
Under 30	9.3%	8.2%	11.1%	9.8%	9.6%
30-34	7.8%	6.3%	9.3%	7.6%	7.7%
35-39	3.1%	4.3%	3.7%	5.1%	4.0%
40-44	2.0%	2.1%	2.3%	2.5%	2.2%
45-49	1.5%	1.8%	1.8%	2.1%	1.8%
50-54	1.9%	1.8%	2.3%	2.1%	2.0%
55-59	3.3%	7.1%	4.0%	8.4%	5.7%
60-64	0.8%	1.3%	1.0%	1.5%	1.2%
65-69	2.2%	0.7%	2.6%	0.8%	1.6%
70-74	0.0%	0.0%	0.0%	0.0%	0.0%
75-79	0.0%	0.0%	0.0%	0.0%	0.0%
80+	0.0%	0.0%	0.0%	0.0%	0.0%

Sources: California Board of Registered Nursing license records, FY 2005-2006; Bureau of Health Professions, 2007; Bureau of Labor Statistics, 2002; National Center for Health Workforce Analysis, 2002.

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 the most recent four fiscal years. The total has ranged from 189 in 2002-2003 to 208 in 2005-2006. The 2005-2006 data are used to estimate the number and age distribution of RNs changing from inactive to active license status (Exhibit 9). Nurses 65 years and older who change status are assumed to be between 65 and 69 years old, and that no nurses 70 years and older change to active license status.

Exhibit 9. Number and age distribution of RNs changing status from inactive to active license status, 2005-2006.

Age Category	Number	Percent	Age Category	Number	Percent
<30	0	0.0%	50-54	7	2.3%
30-34	2	0.6%	55-59	17	5.5%
35-39	2	0.6%	60-64	37	12.0%
40-44	3	1.0%	65+	231	75.0%
45-49	9	2.9%	Total	308	100.0%

Source: California Board of Registered Nursing license records, FY 2005-2006.

Movements from lapsed to active license status

The Board of Registered Nursing provided data on the number and age distribution of RNs whose licenses were lapsed at least six months and later were reactivated. In the 2005-2006 fiscal year 1,347 RNs reactivated their licenses after a six-month or longer lapse. 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 10. The model assumes that the nurses 65 years and older who change status are between 65 and 69 years old, and that no nurses 70 years and older change to active license status.

Exhibit 10. Number and rate of RNs with licenses lapsed at least six months reactivating their license, 2005-2006.

Age Category	Number	Population of Active RNs	Rate
<30	37	21,003	0.18%
30-34	145	27,179	0.53%
35-39	178	32,173	0.55%
40-44	175	30,191	0.58%
45-49	230	38,333	0.60%
50-54	227	46,940	0.48%
55-59	167	36,614	0.46%
60-64	91	22,893	0.40%
65+	97	20,332	0.48%

Source: California Board of Registered Nursing license records, FY 2005-2006.

Migration out of California (to another state or country)

Low and high estimates of migration out of California were created with data from the 2004 National Sample Survey of Registered Nurses and California BRN records of nurses requesting outgoing endorsement. The low estimate is based on analysis of the 2004 National Sample Survey data. The same variables used to calculate migration of RNs into California were used to calculate migration out of California. First, estimates of the number and age distribution of RNs who moved out of California between 2003 and 2004 were computed. Then, the number and age distribution of RNs who resided in California in 2003 were tabulated. Finally, for each age category, the estimated share of RNs who moved out of California between 2003 and 2004 was calculated by dividing the number who moved out of California by the total number in California in 2003. No RNs over 69 years old in the National Sample Survey relocated out of California, so the rate for age groups over 69 is assumed to be zero.

The BRN provided information on applications for outgoing endorsements in 2005-2006, by age group. These numbers were divided by the numbers of RNs in each age group in 2007. Exhibit 11 presents the rates used in the model. As with other variables in the supply model, the best estimate is the average of the high and low estimates.

Exhibit 11. Estimated annual rates of RNs migrating out of California.

Age Category	High Estimate	Low Estimate	Best Estimate
<30	10.2%	6.8%	8.5%
30-34	7.9%	6.7%	7.3%
35-39	6.0%	5.0%	5.5%
40-44	2.8%	3.8%	3.3%
45-49	2.8%	2.8%	2.8%
50-54	1.6%	2.2%	1.9%
55-59	0.8%	7.6%	4.2%
60-64	3.3%	1.2%	2.3%
65+	2.5%	0.9%	1.7%

Source: California Board of Registered Nursing license records, FY 2005-2006; Bureau of Health Professions, 2007.

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 National Sample Survey of Registered Nurses. 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, by age category, on the number of RNs with California addresses who changed their license status to inactive or allowed their license to lapse in the 2005-2006 fiscal year. These data were provided in age groups up through "65 and older". The number of RNs who allowed their licenses to lapse or become inactive was divided by the number of current active RNs to produce initial estimates of the rate at which nurses leave the pool of actively licensed RNs.

The 2000 and 2004 National Sample Survey of RNs were used to obtain an alternative estimate of movements from active to inactive license status, and to obtain estimates for age groups 65 years and older. First, the number of RNs who were U.S. residents in 2000 was calculated, by age category. The number of RNs (U.S. residents only), by age category, who responded in the 2004 survey that they received their first U.S. license between 2000 and 2004 was added to this figure. Then the number of RNs who were U.S. residents in 2004, by age category, was calculated for age categories four years older than those tabulated in 2000. The formula for estimating the number going "inactive" is: Number of RNs in 2004 – Number of RNs in 2000 – Number newly licensed between 2000 and 2004.

The formula with which one can translate these four-year estimates into yearly rates of going inactive is: yearly rate = $1-(1-\text{rate})^{0.25}$. If the yearly rate was negative (as it was for three age categories), it was assumed to be zero. For nurses under 65 years old, the average of the BRN-based estimate and the NSSRN-based estimate was used to compute the rate at which nurses' license go inactive or lapse. For nurses 65 years and older, the NSSRN estimates were used, because BRN estimates were not available. Exhibit 12 presents the rates used in the supply model.

Exhibit 12. Estimated annual rates of RNs changing from active to inactive or lapsed license status, by age category.

Age Category	BRN Estimate	NSSRN Estimate	Best Estimate
<30	0.57%	0.00%	0.28%
30-34	1.25%	1.04%	1.14%
35-39	1.39%	0.00%	0.70%
40-44	1.45%	0.00%	0.73%
45-49	1.48%	0.00%	0.74%
50-54	1.41%	0.00%	0.70%
55-59	1.70%	0.76%	1.23%
60-64	2.73%	4.83%	3.78%
65-69	10.41%	11.06%	10.74%
70-74		14.31%	14.31%
75-79		19.99%	19.99%
Over 79		27.61%	27.61%

Sources: California Board of Registered Nursing license records, FY 2005-2006; Bureau of Health Professions, 2007; Spratley et al., 2001.

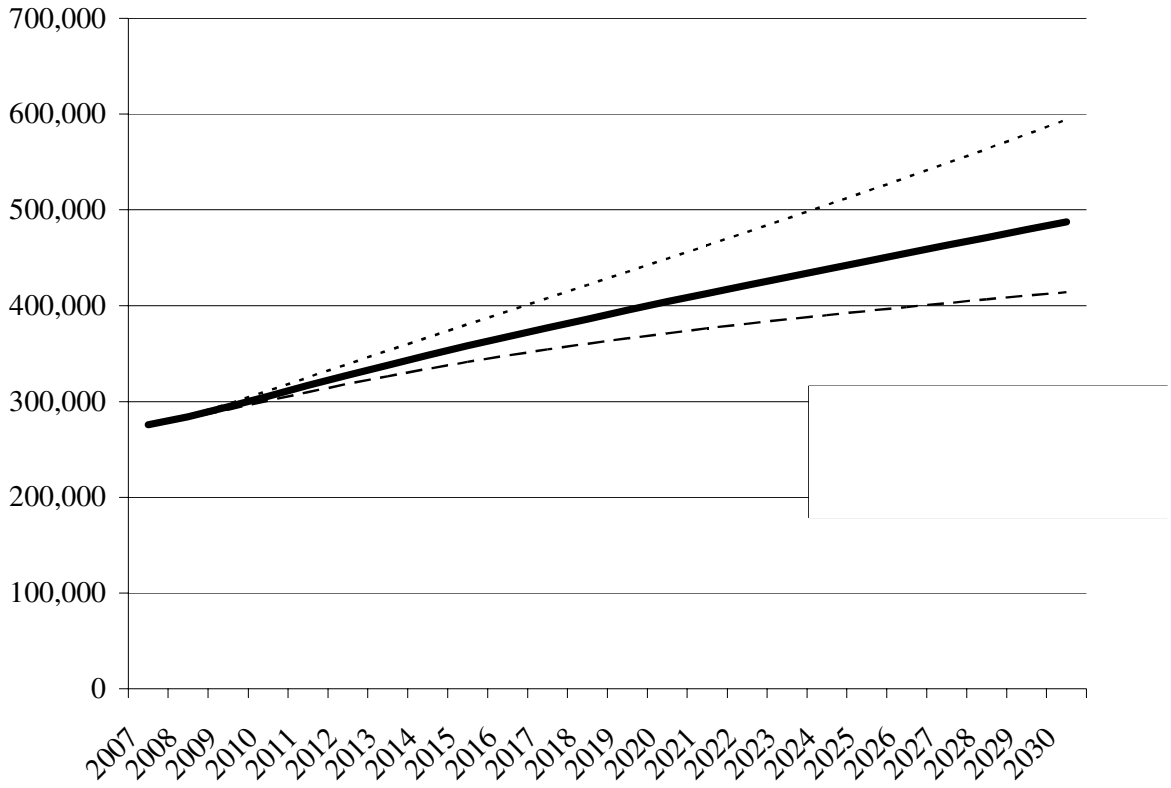
Supply Forecasts of California's RN workforce

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 2007. In this manner, the workforce is "aged." For the 80 years and older category, 100% of the previous year remains and 20% of those 75 to 79 years older in the previous year enter. For each age category, the basic formula is: Current supply of RNs as of 2007 + Estimated total inflows – Estimated total outflows. This formula is used to produce a forecast of the total active RN population residing in California through 2030.

We estimate that California will have 414,017 active resident RNs by 2030, as shown in Exhibit 13. This is a substantial increase from the 297,024 RNs forecasted for 2030 in the BRN forecast report published in 2005. Growth in the RN workforce is expected to be more rapid than forecasted previously primarily due to substantial and sustained growth being reported by California nursing education programs.

As noted above, there was a range of plausible estimates for several inflow and outflow parameters of 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 13 presents the range of supply estimates that results when the highest and lowest possible supply forecasts are calculated. The parameters underlying the highest forecast are likely implausible, as are those for the lowest forecast. 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 13. Forecasted number of RNs with active licenses residing in California, 2007-2030.



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; Using data from the 2006 BRN Survey of RNs (question 3), the proportion of RNs living in California with active licenses that are employed in nursing was estimated for each age category. The estimates range from 96.2% of RNs under age 30 to 26.4% of RNs aged 75 to 79 years. To account for variation in hours worked by RNs, the 2006 BRN Survey of RNs was used to estimate the average usual hours worked per week for each age category (question 4b) by active RNs who reside in California and were employed in nursing. These estimated hours per week are divided by 40 to obtain the average full-time equivalent employment (FTEE) for each age category. The data used for this calculation is presented in Exhibit 14. The projected FTEE supply estimates from these calculations are presented in Exhibit 15.

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 2007 through 2030 (Exhibit 16)(U.S. Census Bureau, 2005). The calculation method is comparable to that used by the federal government, and based on data from the National Sample Survey of RNs (Bureau of Health Professions, 2007). The report summarizing the 2004 National Sample Survey of RNs estimates that there were 825 employed RNs per 100,000 US residents in 2004. The calculated figure for California was 589 RNs per 100,000 population, placing California at the lowest level among all states. The supply model presented here estimates that there are 647 employed RNs per 100,000 population in California. The difference between the California and federal estimate arises primarily because the National Sample Survey of RNs estimates that only 82.7 percent of California's RNs are employed in nursing, whereas the BRN 2006 Survey of RNs estimates that 86.7 percent of RNs are working in nursing. The supply model presented here predicts that, in the long term, California's RN-per-100,000 ratio will rise to 750 by 2015 and 895.5 by 2030. The national average number of RNs per 100,000 in 2004 was 825.

Exhibit 14. Employment rates and average hours worked per week by RNs residing in California.

Age Category	Share Employed	Average Hours per Week
<30	96.2%	36.9
30-34	93.3%	35.4
35-39	93.2%	35.4
40-44	90.8%	35.9
45-49	90.9%	35.2
50-54	90.9%	36.5
55-59	84.6%	36.2
60-64	72.7%	35.2
65-69	57.1%	29.0
70-74	41.2%	26.6
75-79	26.4%	11.4
Over 79	67.1%	9.9

Source: Spetz, Keane, and Hailer, 2007, BRN 2006 Survey of Registered Nurses.

Exhibit 15. Forecasted full-time equivalent supply of RNs, 2007-2030.

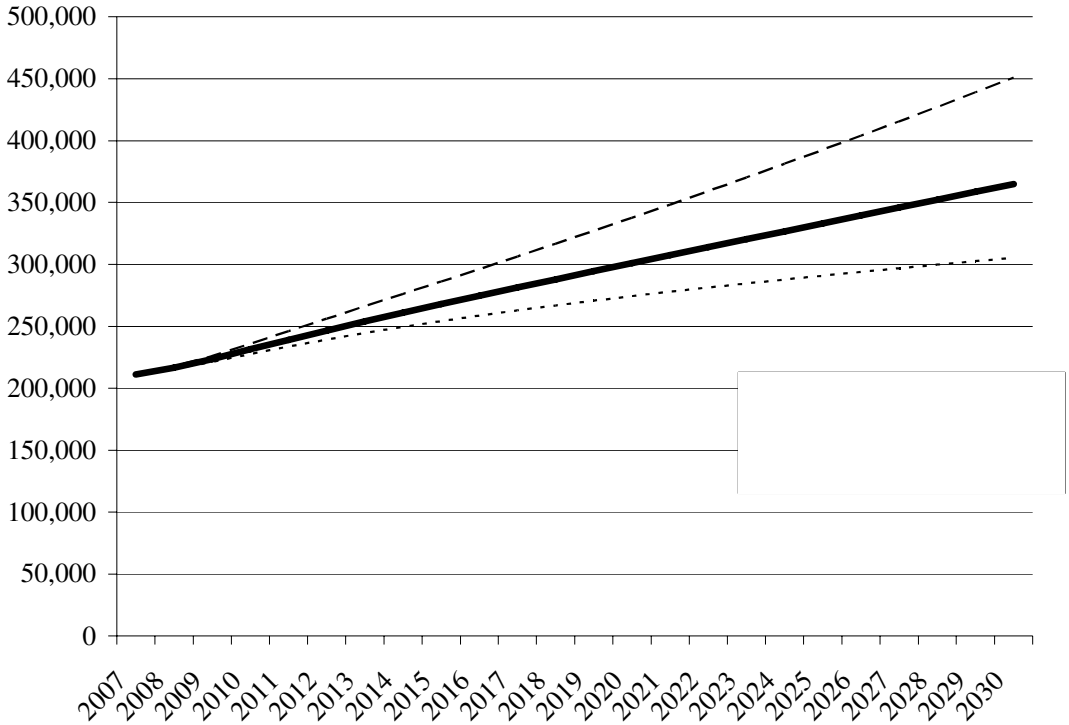
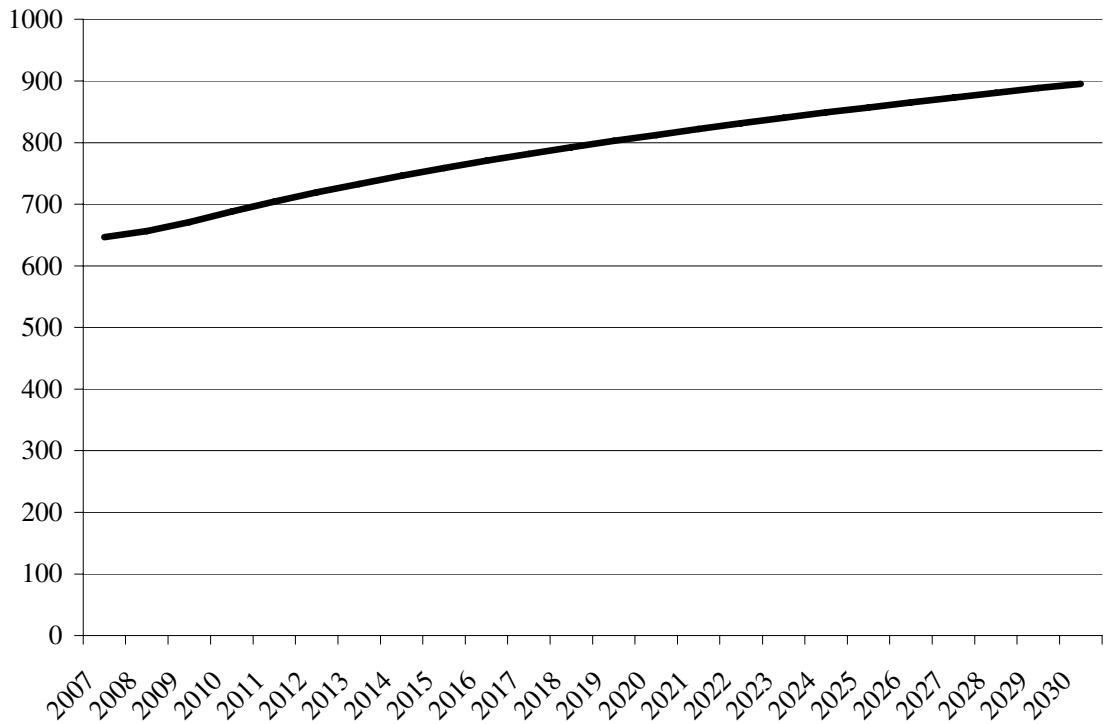


Exhibit 16. Forecasted employed RNs per 100,000 population.



The Demand for RNs

The demand for RNs can be measured and forecasted in many ways. For this analysis, several strategies to estimate future demand for RNs were examined, including the use of forecasts from national levels of RNs per 100,000 population, other agencies' demand forecasts, and forecasts based on projected growth in demand for health services.

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). This metric is reported by the U.S. Bureau of Health Professions in the National Sample Survey of Registered Nurses report (Bureau of Health Professions, 2007). California has had one of the lowest employed RNs-per-100,000 ratios in the United States for over ten years; many researchers and policy experts believe California's employed RN-per-100,000 population should be closer to the 25th percentile nationwide (756 employed RNs per 100,000),[1] or even the national average (825 employed RNs per 100,000). The number of employed RNs per 100,000 can be converted to FTEE using data from the National Sample Survey of RNs; in 2004, nurses worked an average of 1,848 hours per year, which equates to 0.89 FTEs per working RNs. The 25th percentile of FTEE RNs per 100,000 is thus 672, and the national average is 733. These benchmarks were compared with the current and forecasted population of California (U.S. Census Bureau, 2005) to obtain projected current and future need for RNs. The main shortcomings of these two methods of estimating demand for RNs are that (1) the use of benchmarks of the 25th percentile and national average are arbitrary because it is not known how many RNs are truly needed to achieve population health goals, and (2) these ratios do not account for well-documented increases in the demand for health services associated with population aging.

The 2006 projections by the California Employment Development Department (EDD) indicate that there will be 252,912 registered nurse jobs in California by 2014 (California Employment Development Department, 2006). The Employment Development Department forecast does not distinguish between full-time and part-time jobs, so this figure cannot be equated to the full-time equivalent employment used in the BRN's 2007 forecasts.

A third approach to forecasting demand for RNs uses current hospital utilization and staffing patterns to estimate future demand. First, the number of hospital patient days per ten-year age group was obtained from the OSHPD Inpatient Hospital Discharge Data for 2005 (Office of Statewide Health Planning and Development, 2006).[2] Then, age-specific population forecasts were gathered from the U.S. Census Bureau (U.S. Census Bureau, 2006-2007). Dividing 2005 patient days by 2005 population provides the number of patient days per population, per age group. These rates of patient days can be applied to future population projections to get forecasts of patient days by age category. To produce forecasts of hospital demand for RNs, RN hours per patient day were obtained from OSHPD's Hospital Annual Financial Data for 2005 (Office of Statewide Health Planning and Development, 2007). Average RN hours per patient day in 2005 were 11.68. Multiplying the RN hours per patient day figure of 11.68 to the patient day forecasts produces a forecast of RNs hours needed in the future. To equate these hours to FTEEs, RN hours are divided by 1768 (average annual productive hours

[1] At the 25th percentile, 12 states have employed RN-per-100,000 ratios that are lower, and 37 have RN-per-100,000 ratios that are higher.

[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.

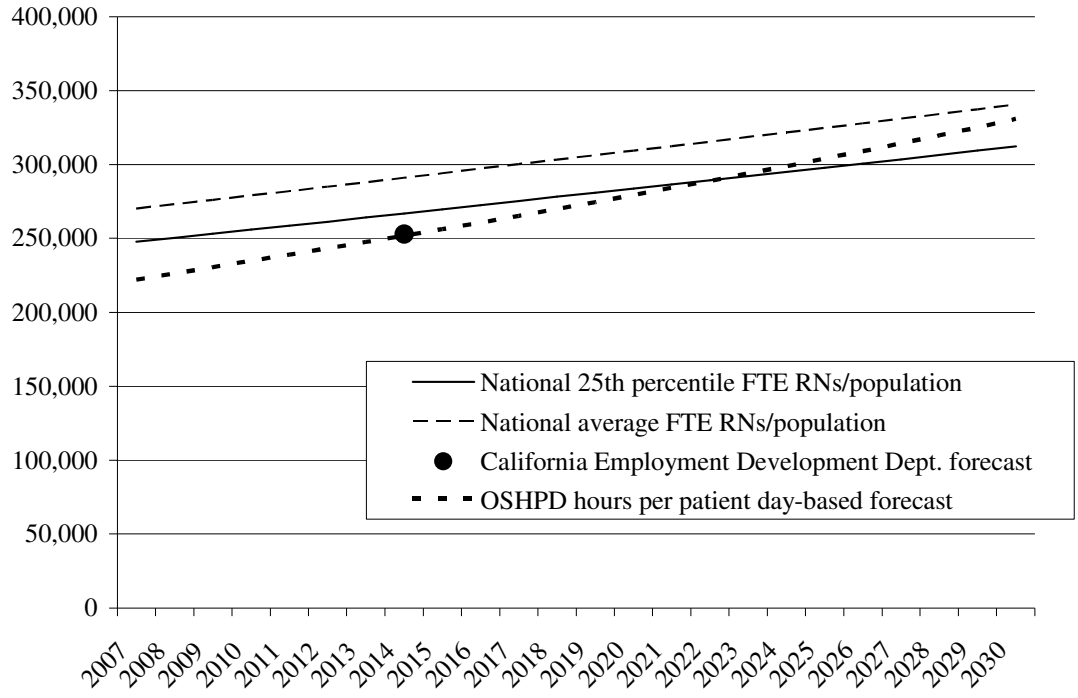
per FTE). This provides demand forecasts for only one type of employer (hospitals). Data from the BRN 2006 Survey of RNs were used to measure the share of RNs that work in hospital nursing positions represented in the OSHPD data. The share of RNs working in hospitals was computed (62.7%), and the share of hospital RNs with a job title that was not management, advanced practice nursing, or case management/utilization review/quality improvement was obtained (77.9% in acute units; 63.3% in other departments). These numbers indicate that 47.8 percent of all RNs work in staff nurse positions in hospitals. The forecasts of FTEE demand are adjusted to represent the full population of RNs with the formula:

Total FTEE = (Hospital FTEE) / 0.478

The main shortcoming of the forecast based on projected demand for hospital care is that it is based on hospital staffing patterns in the 2005 OSHPD report, which pre-dates the implementation of richer nurse-to-patient staffing requirements under AB 394. In March 2005, hospitals were expected to staff one licensed nurse per 5 patients in medical and surgical units, as compared with the one nurse per 6 medical-surgical patients required in January 2004. Thus, this forecast is probably somewhat lower than current and future demand for RNs.

Exhibit 17 compares all aforementioned demand forecasts of full-time equivalent RNs. The forecasts estimate that the demand for RNs in 2007 ranged from 221,422 to 270,155. Demand in 2030 is forecasted to be between 312,166 and 340,432. The OSHPD-based forecast produces an estimate similar to that of the Employment Development Department; this similarity is not surprising, since both are based on current demand for RNs. The forecasts based on national FTE RNs-per-100,000 benchmarks are somewhat higher than the other forecasts; these forecasts may better represent true population needs.

Exhibit 17. Forecasted full-time equivalent demand for RNs, 2007-2030.

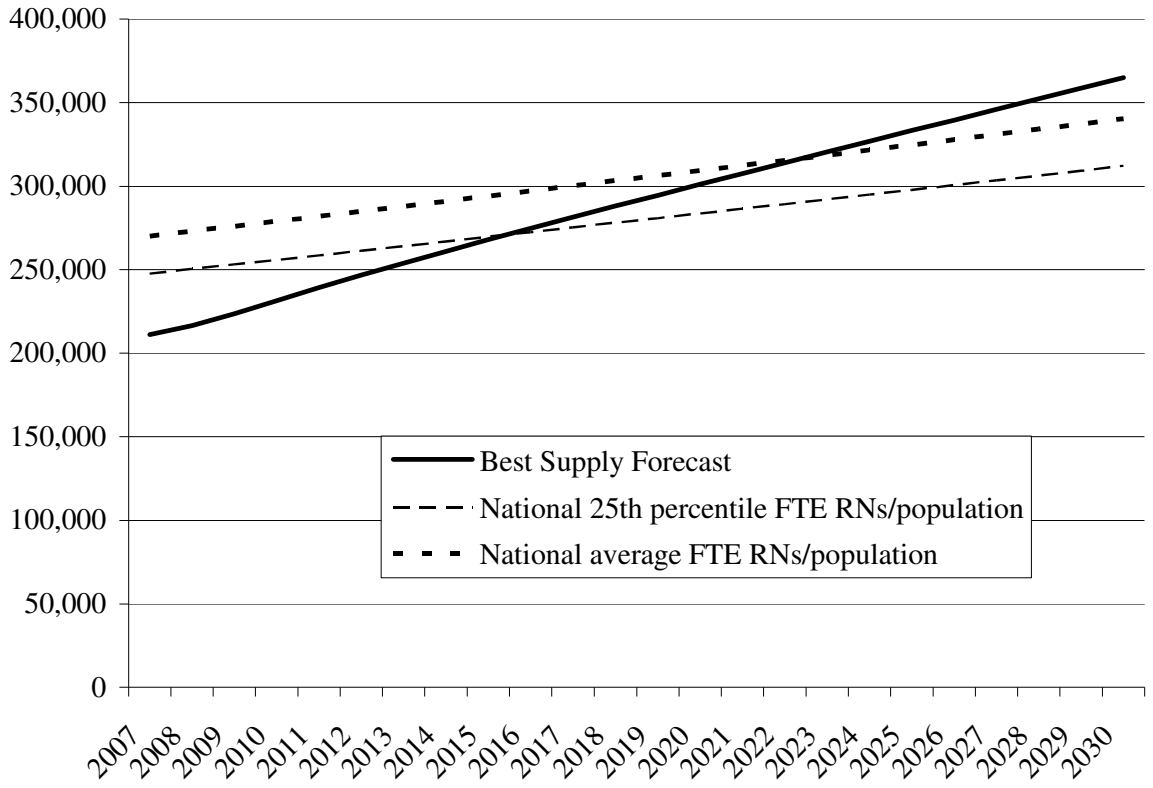


Comparing Supply and Demand for RNs

There is a widespread perception that California faces a significant shortage of RNs at this time, and previous forecasts predicted that the shortage would worsen unless steps were taken to increase the supply of RNs. Since the 2005 forecasts were published, RN graduations have increased 22 percent, and they are anticipated to increase an additional 38 percent by the end of the 2007-2008 academic year. The national supply of RNs also has improved, largely due to increased graduations from RN education programs (American Association of Colleges of Nursing, 2006).

Exhibit 18 presents the best supply forecast for 2007, and demand forecasts based on the goals of California reaching the 25th percentile of nationwide FTE RNs per 100,000, and the national average of FTE RNs per 100,000. California faces a shortage of RNs at this time; the magnitude of this shortage is estimated to range between 10,294 FTEs (OSHPD-based forecast) to 59,027 FTEs (national average RNs per 100,000). However, if the expansion of RN education programs is maintained, immigration of foreign-educated nurses does not change, and inter-state migration rates are constant, this shortage will narrow. By 2016, California will reach the 25th percentile nationwide of FTE RNs per 100,000 (756.5); by 2022, California will surpass the national average (825). If the number of new graduations from California RN programs increases further, these benchmarks will be reached sooner.

Exhibit 18. Forecasted full-time equivalent supply of and demand for RNs, 2007-2030.



The estimate that there is a shortage of *at least* 10,294 RNs in 2007 raises the question of how patient care needs are met in the current environment. Some of the shortage is addressed by the employment of traveling nurses, who have California licenses, live outside California, and come to the state for short times to work. In 2006, 44,018 RNs had active California licenses but lived in other states or countries. The 2006 BRN Survey of Registered Nurses found that 20.8 percent of RNs who lived outside of California worked in California in the previous year. Thus, 9,156 RNs worked in California in 2007, for an average of 5.09 months and 40.27 hours per week. Thus, these traveling RNs filled 3,909.8 full-time equivalent jobs in 2006.

Comparison of the 2005 and 2007 Forecasts

The forecasts presented here use a more detailed methodology than those published previously by Coffman, Spetz, Seago, Rosenoff, and O'Neil (2001), and Spetz and Dyer (2005). More importantly, the magnitude of the projected shortage has changed dramatically between the 2005 and 2007 forecasts. In 2005, the estimated shortage ranged between 6,872 and 21,161 FTE RNs; in 2007, the shortage is estimated to be at least 10,294 RN FTEs. However, while the 2005 forecasts predicted that the shortage would worsen continuously, reaching up to 122,223 FTEs by 2030, the new forecasts find that the shortage will improve, and California will surpass the national average of RN FTEs per 100,000 population (825) by 2022.

Several changes have been made for the 2007 forecasting model, which are improvements over the 2005 model. First, the new model allows the number of RN graduations to change over time, with specific estimates of RN graduation growth through 2009-2010, and a fixed growth rate of two percent after 2010. This change accounts for rapidly growing RN education program enrollments and the expected resulting rise in graduations.

The second change to the model involves the inter-state migration of RNs. In the 2005 model, migration of out-of-state RNs into California was a fixed number of nurses per year (5,224). However, the outflow of RNs from California to other states was a rate of the number of RNs in California. Thus, as the RN population in California grew, the model estimated that more RNs would leave California, but there was not growth in the number coming into California. This inflow should be modeled as a share of the national RN workforce, but the only published forecasts of the national RN workforce are based on data that are seven years old. In this new forecasting model, the national RN population is predicted to be a multiple of the California RN population, and the rate of migration of RNs into California is a rate based on the California RN population. This change results in growth in California's RN supply being larger than previously forecasted. As long as the national RN population grows, this change to the model is an improvement over the previous model.

Third, the new forecasting model has separate parameters measuring the number of RNs who transition from inactive to active status, and from lapsed to active status. The previous model combined these groups. Although this is important information to know, this change is not likely to be consequential to the model's predictions.

Finally, the new forecasting model breaks the previous oldest age group – nurses 65 years and older – into four age group: 65 to 69 years, 70 to 74 years, 75 to 79 years, and 80 years and older. This refinement ensures that the model accounts for the aging of the RN workforce more accurately.

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 government. Significant increases in state funding for expanded educational capacity of nursing programs, increased funding for equipment, use of updated instructional technologies, and other needed educational resources have had a favorable impact on addressing the RN shortage in California. Between 2003-2004 and 2007-2008, nursing graduations will have increased 68.7 percent, reaching a projected number of over 10,000 new RN graduates per year.

Nonetheless, policymakers should be cautioned that the 2007 BRN forecasts are based on current data and trends; the factors that affect RN supply and demand are unlikely to remain static. The most important possible changes include: (1) the number of graduations from RN education programs; (2) the number of foreign-educated nurses who immigrate to California; (3) inter-state migration; and (4) population needs for health services. 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. Continuous tracking of these factors allows the BRN to adjust supply and demand projections as needed, identify the degree to which California's workforce strategies have been successful in reducing the nursing shortage, and identify new approaches to sustain progress in narrowing the gap between RN supply and demand. Strategies that continuously attract people into nursing, particularly young people, may be among the most effective to support and sustain in the long term.

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Acronyms

BHPr – Bureau of Health Professions, part of the Health Resources and Services Administration in the U.S. Department of Health and Human Services

BRN – California Board of Registered Nursing

CA – California

FTEE – Full-time Equivalent Employment

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

OSHPD – California Office of Statewide Health Planning and Development

RN – Registered Nurse

UCSF – University of California San Francisco