Available online at www.sciencedirect.com

ScienceDirect

Nurs Outlook xxx (2016) 1–7

Nursing Outlook

www.nursingoutlook.org

How fast will the registered nurse workforce grow through 2030? Projections in nine regions of the country

David I. Auerbach, PhD[a,*], Peter I. Buerhaus, PhD, RN, FAAN[a], Douglas O. Staiger, PhD[b,c]

[a] Center for Interdisciplinary Health Workforce Studies, College of Nursing, Montana State University, Bozeman, MT

[b] Department of Economics, Dartmouth College, Hanover, NH

[c] National Bureau of Economic Research, Cambridge, MA

ARTICLE INFO

Article history:
Received 30 May 2016
Revised ■ ■ ■
Accepted 4 July 2016

Keywords:
Workforce
Supply
Registered Nurses

ABSTRACT

Background: After an unprecedented increase in nursing school enrollment and graduates in the past 10 years, projected shortages of nurses have been erased at a national level. However, nursing markets are local, and an uneven distribution of health care providers of all types is a longstanding feature of health care in the United States.

Purpose: The purpose of this study was to understand how the outlook for future registered nurse (RN) supply varies regionally across the United States.

Methods: We apply our nursing supply model to the nine U.S. Census Divisions to produce separate supply forecasts for each region.

Discussion: We find dramatic differences in expected future growth of the nursing workforce across U.S. regions. These range from zero expected growth in the number of RNs per capita in New England and in the Pacific regions between 2015 and 2030 to 40% growth in the East South Central region (Mississippi, Alabama, Tennessee, Kentucky) and in the West South Central region (Texas, Oklahoma, Arkansas, Louisiana).

Conclusion: Assuming growth in the demand for RNs per population, some regions of the United States are expected to face shortfalls in their nursing workforce if recent trends do not change.

Cite this article: Auerbach, D. I., Buerhaus, PeterI., & Staiger, D. O. (2016, ■). How fast will the registered nurse workforce grow through 2030? Projections in nine regions of the country. Nursing Outlook, ■(■), 1-7. http://dx.doi.org/10.1016/j.outlook.2016.07.004.

Introduction

After a decade-long unprecedented expansion in nursing school enrollments, the outlook for the nursing workforce has turned from one of dire shortages to near-balance and even a small surplus according to one forecast (Auerbach, Buerhaus, & Staiger, 2015; Spetz, 2015; U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, National Center for Health Workforce Analysis, 2014). However, these national-level assessments belie substantial differences at the subnational level. Researchers recently projected the future supply of full-time equivalent (FTE) registered nurses (RNs) through 2030 according to four regions of the country—Northeast, South, Midwest, and West (Buerhaus, Auerbach, Staiger, & Muench, 2013). The

* *Corresponding author:* David I. Auerbach, 34 Emerson St, Newton, MA 02458.
E-mail address: davea@alum.mit.edu (D.I. Auerbach).

http://dx.doi.org/10.1016/j.outlook.2016.07.004

study found substantial differences in outlook in each region, with states in the Midwest and South having younger RN workforces and much higher expected supply growth relative to the region's population growth through 2030 (17.4% per capita and 10.8% per capita, respectively). In contrast, the size of the RN workforces in the West and Northeast regions was projected to decline relative to the growth of their overall population (−2.5% per capita and −6.0% per capita).

This article provides regional projections of the number of FTE RNs based on workforce data through 2014. Unlike the previous regional forecasts published in 2013, the projections reported here extend that analysis by further dividing the country into nine census divisions. These more detailed forecasts provide agencies and stakeholders with more actionable information at a local level. We find strikingly different patterns by region suggesting some areas of the United States may be facing large shortages over the next decade while others are poised to readily meet the growing demands of an aging population.

Methods

Data

The workforce projection model requires information on the age of RNs, their employment status, hours worked, and the age and size of the U.S. population. Data on the age and employment of RNs were obtained from the Current Population Survey (CPS) and the American Community Survey (ACS). The CPS is a household-based, nationally representative survey of over 100,000 individuals administered monthly by the Bureau of the Census. The CPS has asked detailed questions about employment (including occupation and hours worked) since 1973 and is used by the Department of Labor to estimate current trends in unemployment, employment, and earnings. When the monthly surveys are aggregated to a yearly basis, the CPS provides data on approximately 3,000 RNs per year.

The ACS, which began reporting data in 2001, is modeled after the long form of the decennial census. Although it contains fewer questions than the CPS, the ACS obtains much larger sample sizes—approximately 12,000 RNs from 2001 to 2004 and roughly 35,000 RNs per year thereafter (after the sampling frame was expanded). These larger sample sizes enable workforce trends in nursing to be analyzed with greater accuracy. Consequently, the projection model uses data from the ACS data rather than the CPS data beginning in 2001.

The data analyzed included all individuals between the ages of 23 and 69 years who reported being employed as an RN during the week of the survey between 1979 and 2014 ($N = 70,201$ in the CPS, $N = 366,927$ in the ACS). To be consistent with previous projections, RNs reporting working fewer than 30 hr in a typical week were recorded as .5 FTEs. These data were used to estimate the number of FTE RNs of each single year of age who were working in each year of our data. To make estimates representative of the U.S. noninstitutionalized population, observations were weighted by sampling weights provided by the CPS and ACS. Additional data on the U.S. population by year, state, and age between 1979 and 2014 were obtained from the U.S. Bureau of the Census. Forecasts of the U.S. population through 2030 by age were obtained from projections prepared by the U.S. Bureau of the Census.

Statistical Analysis

CPS and ACS data were used to estimate the number of FTE RNs by age and year. These estimates were subsequently used in a projection model that was run separately for each of nine regions within the United States (Figure 1). The model predicts the proportion of the population in a given birth cohort that will be working as RNs at each age as the product of a cohort effect (defined by birth year) and an age effect. Cohort effects refer to the propensity of individuals born in any given year to work as RNs and capture changes across birth cohorts in the perceived attractiveness of a nursing career relative to other occupations. Age effects refer to the relative propensity of RNs to be working at different ages and capture life-cycle patterns such as retirement and the tendency of female RNs to work less during childbearing years. Thus, the proportion of any particular cohort working as RNs at a given age is the product of the propensity of that cohort to choose nursing as a career and the propensity of RNs to be working at that age.

Estimation

Analysis of variance was used to estimate the age and cohort effects for each U.S. region. The dependent variable in the model was the logarithm of the number of FTE RNs of every age between 23 and 69 years for every year between 1979 and 2014 (46 years of age times 36 years equals 1,656 total observations) divided by the regional U.S. population in that given year-age cell. The analysis of variance model estimated main effects for cohort (birth year) and age, and two interaction effects to capture instances where the life-cycle pattern of nursing careers changed: the shift toward older ages of first entry into the workforce by cohorts born after 1965 (Auerbach, Buerhaus, & Staiger, 2007) and the shift toward older ages of retirement starting roughly in the early 2000s (Auerbach, Buerhaus, & Staiger, 2014). All statistical analyses were performed using Stata, version 14.1.

Projections

Estimates of age and cohort effects were used to project the numbers of FTE RNs through 2030. We assumed that age effects in future years will be the same as those

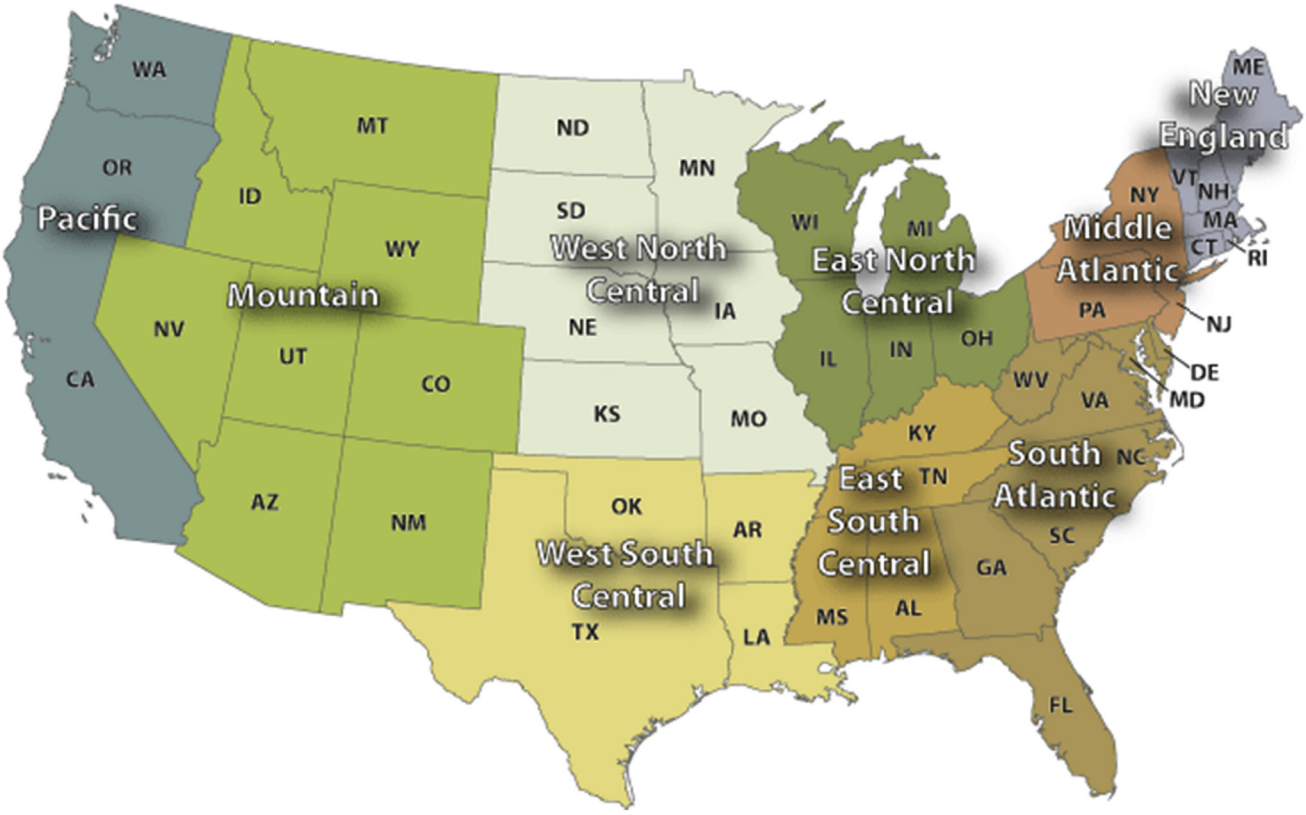

Figure 1 – U.S. states and census divisions ("regions") used in this article.

observed in the most recent cohorts and that the cohort effect for future cohorts (entering the workforce after 2014) will equal the average of the five most recent cohorts observed (i.e., the 1987 through 1991 birth cohorts, who were first observed at age 23 years in 2010–2014). Based on these age and cohort effects, we project the proportion of the U.S. population in each birth cohort that will be working as RNs at each age and multiply by census population projections for that age and year to obtain total FTE RNs. These projections assume that the cohorts already in the workforce will follow the same lifecycle pattern as that observed in recent cohorts and that the size of new cohorts entering the workforce will remain constant at recently observed levels. To generate projections at a regional level, states were grouped into the nine regions shown in Figure 1.

Model Validation

To ensure further confidence in the model's forecasting ability at the regional level of analysis, we performed a validation exercise in which we applied the model to workforce data through 2009 only and forecast supply growth in each region between 2009 and 2014. We then compared these forecasts with *actual* supply growth in each region over this time period. Despite the fact that there is uncertainty in our supply estimates and that there are numerous factors that affect supply that cannot be explained by the model, it performed quite well. The region that the model had forecast, as of 2009, to grow the fastest in nursing FTE between 2009 and 2014 (the South Central region) was, in fact, the region that grew the fastest. The region that was forecast to grow second slowest (New England) turned out to be the slowest growing region. Overall, the correlation between the model's forecast and actual growth between 2009 and 2014 was .42. In contrast, a simple straight-line forecast method that calculated each region's observed supply growth from the previous 5 years (2004–2009) and projected that growth forward from 2009 to 2014 failed to predict actual supply growth by region. In fact, the correlation was negative (–.43) when comparing forecasts using this simple method with actual supply growth. That is, regions with high growth between 2004 and 2009 tended to have low growth between 2009 and 2014; a phenomenon foreseen by the model but missed by a naïve extrapolation.

Findings

Figure 1 shows the nine regions of the country used in this analysis and the states represented within each region.

These regions vary in total population (2015) from just under 15 million (New England) to 63 million (South Atlantic) and are commonly used by the U.S. Census Bureau to describe regional demographic trends.

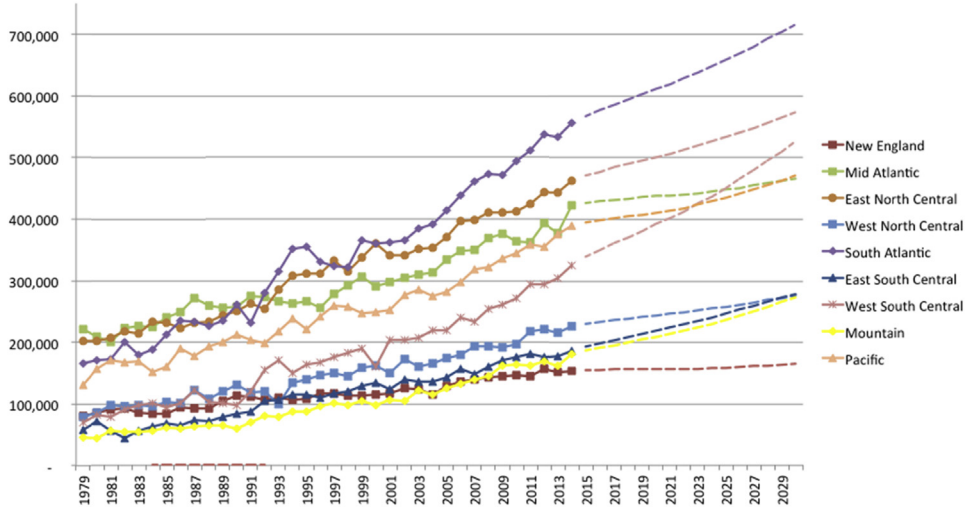

Figure 2 – Actual (1979–2014) and forecast (2015–2030) FTE RN supply, by region. FTE, full-time equivalent; RN, registered nurse. Source: Authors' calculations and modeled projections based on data from the U.S. Census Bureau.

Figure 2 displays trends in nursing supply (solid lines) on an FTE basis from 1979 to 2014 and shows each region's forecast of FTE RNs (dotted lines) from 2015 to 2030.

FTE RN supply grew strongly in all regions from 1979 to 2014, though rates of growth varied fourfold from 90% in New England and the Mid-Atlantic regions to 368% in the West South Central region. While the number of RNs was similar in New England and the West South Central in 1979 (80,000 and 70,000, respectively), by 2014, there were twice as many RNs in the West South Central region as in New England (325,000 vs. 153,000). These divergent rates of growth reflect a number of differences across regions—primarily differences in the rate of entry of RNs into nursing and the age patterns of working RNs (they also reflect differing population growth by region, which are factored out separately in Figure 3). The underlying causes of different rates of entry into nursing by region are still not well understood, however.

Future forecasts in the number of RNs by region are shown in the dotted lines in the right half of Figure 2. These forecasts reflect the same underlying factors mentioned previously and are described more specifically in the Methods section. They are dependent, for example, on recent trends in entry into nursing education programs in the region, the age and work patterns of existing RNs, and the interactions between these factors. These different underlying factors lead to strikingly different forecast trajectories, as is evident in the figure; for example, very rapid projected growth in the West South Central region compared with almost no growth projected in New England.

Figure 3 summarizes the 2015 to 2030 growth forecasts both in absolute numbers of RNs and in the growth of RNs relative to the growth of the population in each of the nine regions (i.e., RNs per capita). These data are also summarized in Table 1 (available online at www.nursingoutlook.org).

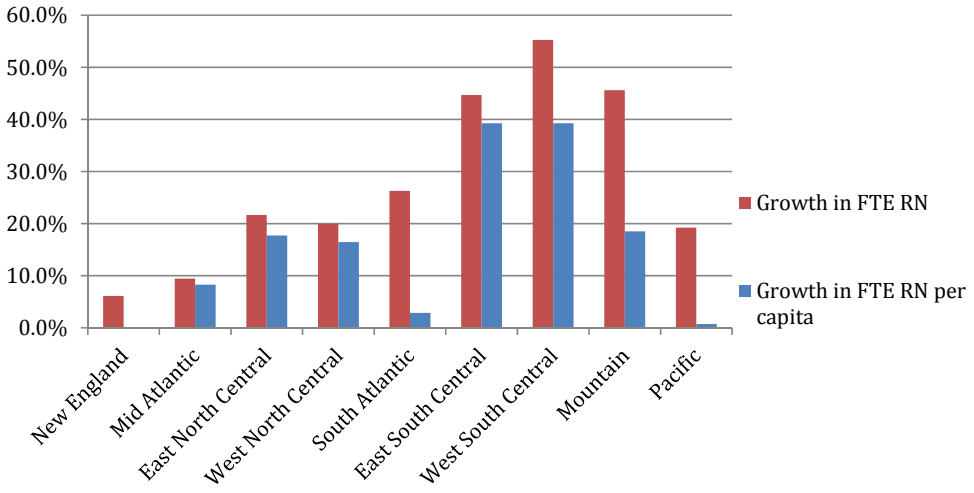

Figure 3 – Total and per capita growth in FTE RN, 2015 to 2030. FTE, full-time equivalent; RN, registered nurse. Source: Authors' calculations and modeled projections based on data from the U.S. Census Bureau.

Differences in rates of population growth by region lead to even greater variation in the forecast growth in per-capita RNs by region: from zero growth in New England and the Pacific regions and 2.9% growth in the South Atlantic to almost 40% growth in RNs per capita in the East and West South Central regions.

To better understand what underlies the substantial variation in growth by region, we next highlight differences in the ages of RNs and in trends in recent entry into the workforce by region. Figure 4 arrays regions from left to right by those with the oldest RNs on the left and compares to both observed growth rates from 2009 to 2014 and forecast RN growth rates from Figure 3.

The regional patterns highlight the strong relationship between the age distribution of RNs in each region and past and future expected growth. The New England region has the oldest RNs, with 45% older than 50 years, 32% younger than 40 years, and an average age of 46 years. That region also saw the lowest rate of growth in RN supply from 2009 to 2014 among the regions and is projected to grow the slowest from 2015 to 2030. At the other extreme, the West South Central region is essentially the inverse, with 42% of RNs younger than 40 years and 32% of RNs older than 50 years, an average age of just under 43 years has the fastest-growing regional growth in RN supply between 2009 and 2014 and is expected to increase the fastest between 2015 and 2030.

Age does not explain the full picture of the RN workforce, however. For example, the mountain region states have the third-oldest RN population but are projected to grow among the fastest. This is partly because there has been rapid growth in entry in those states in the last decade, meaning that there is a relatively large and growing group of younger RNs aging into their most productive years spent in the workforce—ages 40s and 50s. We estimated net entry into and exit from the RN labor force by region each year and found large differences. In New England, a region that averaged just under 140,000 FTE RNs from 2001 to 2014, roughly 4,500 RNs entered the labor force each year over that time and 1,800 RNs exited. In contrast, in the West South Central region, which averaged 250,000 RNs over this period, more than three times as many new RNs entered the workforce each year (14,000) while a similar number left (2,200) as in New England. The mountain region had similar numbers of RNs over this period as New England but averaged new entry of 7,350 RNs per year, or 62% more than New England. These figures for all regions are enumerated in Table 1.

We can use a different measure of how interest in nursing varies by region to further understand why regions are faring differently in the growth of their nursing workforce. A core parameter of the forecast model measures the likelihood of someone born in a given year to eventually work as an RN. As we have reported elsewhere that measure hit a relative peak nationally with individuals born in 1955, the height of the baby boom when nursing was a dominant choice of profession among women (Buerhaus, Staiger, & Auerbach, 2009). However, there has been substantial regional variation in this measure. As shown in Figure 5, in the New England region, the likelihood of individuals born after 1955 to become RNs dipped and then rose again, just matching the 1955 level with individuals born in the late 1980s. In the West South Central region, individuals born in the 1970s and 1980s were increasingly more likely to become RNs as the 1955 cohort. Someone born in 1990 living in the West South Central region was twice as likely to work as an RN as someone born in 1955 in that region.

Discussion

While the nursing workforce continues to increase in size overall, there are strikingly different workforce dynamics in different areas of the country. At the extremes, New England has the oldest RNs in the United States (45% are over age 50 years), has experienced

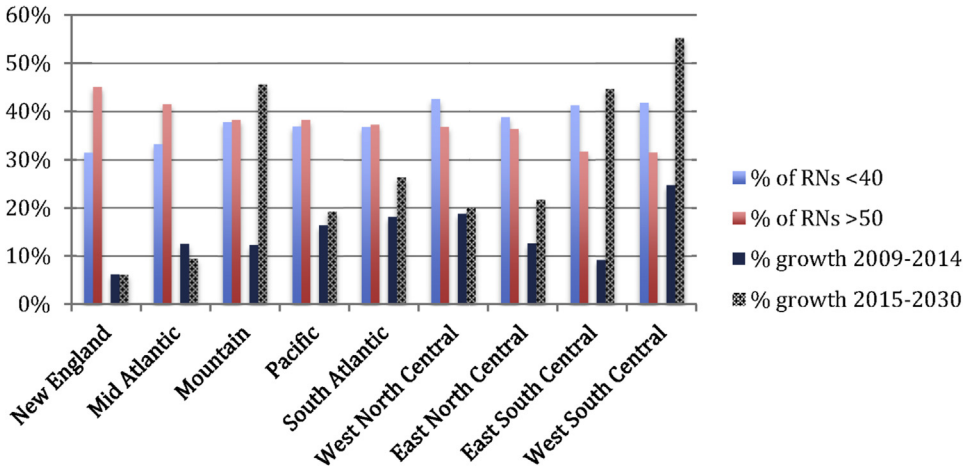

Figure 4 – Age distribution and forecast growth for each U.S. region. Source: Authors' calculations and modeled projections based on data from the U.S. Census Bureau.

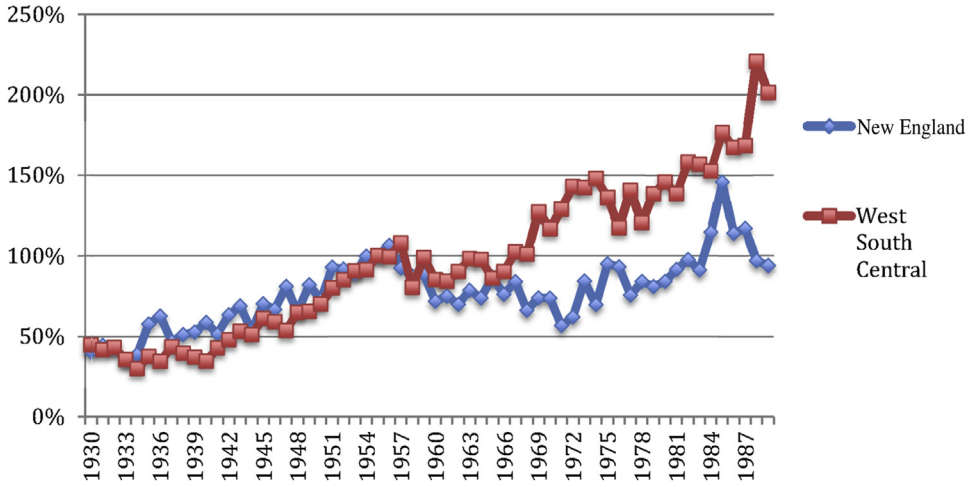

Figure 5 – Difference in cohort effects by region. Source: Authors' calculations and modeled projections based on data from the U.S. Census Bureau.

relatively low rates of entry into nursing with incoming cohorts equal in size to the peak baby boomer cohorts, and is projected to have the same number of RNs per capita in 2030 as today. At the other end, the West South Central region of the United States (Texas, Oklahoma, Arkansas, Louisiana) has the youngest RNs in the United States (35% are over 50 years), has experienced rapid rates of entry into nursing with incoming cohorts double the size of the baby boomer cohorts, and is projected to increase its numbers of RNs per capita by more than 40% by 2030.

Regional forecasts do have an additional source of uncertainty compared with national forecasts—the possibility of RNs moving between regions to mitigate imbalances of supply and demand (Siow & Ng, 2013). While we know that such movement occurs, sometimes aided by temporary staffing agencies, there is likely only a small percentage of RNs with the ability and willingness to move—indeed, our model shows that regional imbalances have tended to persist. Furthermore, the validation exercise described in the Methods section confirms that the forecasting model can successfully forecast regional trends based on repeated observations of regional supply.

We can trace back the different regional patterns to difference in entry and age structure of the nursing workforce by region. But, the underlying root causes of these differences are not clear. We have previously described long-run trends in the nursing workforce as related to overall trends in health care markets and payment systems, as well as underlying factors in the economy that can make nursing careers more or less attractive relative to other career choices (Buerhaus et al., 2009). We have also noted that in the last decade, there have been a number of new nursing school openings, particularly for-profit schools (Auerbach, Staiger, Muench, & Buerhaus, 2013). While the areas where these schools have chosen to locate could be a response to underlying demand in those areas, there could also be idiosyncratic reasons in some cases that are not necessarily demand related. We continue to seek to understand the underlying causes of differences in supply growth.

Whatever the case, there are important implications of such striking differences in supply growth implied by our forecasts. For example, population aging will tend to increase the need for RNs, and regions are expected to age at different rates. In fact, the region that is aging most rapidly (New England) is also the region with the lowest forecast RN supply growth. The U.S. Census Bureau has forecast that the percent of the population over age 65 years will increase by 7.8 percentage points (from 14.0% to 21.8%) in New England between 2010 and 2030. The West South Central region is aging less rapidly, with an expected 5.4 percentage point increase in the population over age 65 years (from 11.4% to 16.8%). Previous research has associated an increase in aging with an increase in demand for health care providers (Petterson et al., 2012).

Implications for Policy

Having a picture of the projected future supply of RNs at the regional level vs. the national level has implications for planning and workforce policy. For example, health care delivery organizations in the New England region should anticipate a tighter labor market in the near future than other areas. Retirement of RNs may occur more quickly and be more difficult to absorb for health care organizations. Policy makers in this and other regions we have identified may want to move more aggressively to seek to increase the capacity of the nursing education system, promote nursing careers, attract RNs from other areas, and help organizations retain RNs and decrease turnover. State health workforce centers may be a useful vehicle through which to undertake these and other related efforts.

Finally, the uneven future growth of the RN workforce by region of the country also means that implementation of health reforms may be adversely affected, particularly those linked to an adequate supply of RNs. Delivery system changes that are likely to depend on an adequate supply of nurses include those aimed at increasing accountability for quality, costs, and population health (e.g., accountable care organizations); increasing health education and prevention, expanding insurance coverage (via increasing Medicaid enrollments and federal and state exchanges), shifting payment away from fee-for-service toward value-based payment, and increasing use of health information technology. Being aware of the future projections in RN supply growth at a regional level can provide information needed by workforce planners to assess the timing and likely success of implementing such reforms.

Acknowledgment

This work was funded by the Gordon and Betty Moore Foundation.

Supplementary Data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.outlook.2016.07.004.

REFERENCES

Auerbach, D. I., Buerhaus, P. I., & Staiger, D. O. (2015). Will the RN workforce weather the retirement of the baby boomers? *Medical Care, 53*, 850–856.

Auerbach, D. I., Buerhaus, P. I., & Staiger, D. O. (2014). Registered nurses are delaying retirement, a shift that has contributed to recent growth in the nurse workforce. *Health Affairs, 33*, 1474–1480.

Auerbach, D. I., Buerhaus, P. I., & Staiger, D. O. (2007). Better late than never: Workforce supply implications of later entry into nursing. *Health Affairs, 26*, 178–185.

Auerbach, D. I., Staiger, D. O., Muench, U., & Buerhaus, P. I. (2013). The nursing workforce in an era of health care reform. *New England Journal of Medicine, 368*, 1470–1472.

Buerhaus, P. I., Auerbach, D. I., Staiger, D. O., & Muench, U. (2013). Projections of the long-term growth of the registered nurse workforce: A regional analysis. *Nursing Economics, 31*, 13–17.

Buerhaus, P., Staiger, D., & Auerbach, D. (2009). *The future of the nursing workforce in the United States: Data, trends and implications*. Boston, MA: Jones & Bartlett Publishers.

Petterson, S. M., Liaw, W. R., Phillips, R. L., Jr., Rabin, D. L., Meyers, D. S., & Bazemore, A. W. (2012). Projecting US primary care physician workforce needs: 2010-2025. *The Annals of Family Medicine, 10*, 503–509.

Siow, E., & Ng, J. (2013). Internal migration of nurses in the United States: Migratory prompts and difference in job satisfaction between migrants and non-migrants. *Nursing Economics, 31*, 128.

Spetz, J. (2015). Too many, too few, or just right? Making sense of conflicting RN supply and demand forecasts. *Nursing Economics, 33*, 176.

U.S. Department of Health and Human Services, Health Resources and Services Administration, National Center for Health Workforce Analysis. (2014). Rockville. Maryland: The Future of the Nursing Workforce: National- and State-Level Projections, 2012-2025.