*Peter I. Buerhaus*
*David I. Auerbach*
*Douglas O. Staiger*
*Ulrike Muench*

# Projections of the Long-Term Growth of the Registered Nurse Workforce: A Regional Analysis

## EXECUTIVE SUMMARY

▶ Providing regional projections of the RN workforce will allow underlying differences in the age structure of the RN workforce to become more visible.

▶ By providing regional-level projections, it will also be possible to identify those regions whose RN workforce is expected to grow at a slower rate relative to other regions.

▶ States in the South and Midwest have a greater supply of younger-aged RNs available to replace fewer numbers of older-age RNs compared to other regions.

▶ In contrast, the Northeast and West have fewer younger RNs currently in their workforce yet a relatively larger number of older age RNs to replace.

▶ These differences in age structure may be partly due to differences in nursing school enrollment and expansion in nursing education capacity across regions.

▶ This information can help guide national and state health workforce planners, employers, educators, and others in developing policies and initiatives that may impact nursing supply in their states.

**T**HE MOST RECENT NATIONAL projection of the long-term supply of registered nurses (RNs) found that the RN workforce will begin to grow during the latter part of the current decade and then grow rapidly between 2020 and 2030 (Auerbach, Buerhaus, & Staiger, 2011). This expected growth is attributed largely to the recent and unexpected surge of younger-aged people becoming RNs. Prior to this new projection, all previous projections indicated the future number of RNs would either decrease in size by 2020 (Buerhaus, Staiger, & Auerbach, 2000) or, at best, the growth in the number of RNs would plateau around 2015 and remain at this level for the next 15 years (Auerbach, Buerhaus, & Staiger, 2007). Given the expected increase in the demand for health care and for nurses over this period, the latest projections indicating growth in the long-term national supply of RNs is a significant workforce development.

Expanding the size of the future RN workforce requires the number of entrants flowing into the workforce to exceed the number of nurses flowing out of the workforce. Nationally, approximately 850,000 RNs are between

*PETER I. BUERHAUS, PhD, RN, FAAN,* is Valere Potter Professor of Nursing, and Director, Center for Interdisciplinary Health Workforce Studies, Institute for Medicine and Public Health, Vanderbilt University Medical Center, Nashville, TN.

*DAVID I. AUERBACH, PhD, MS,* is a Full Policy Researcher, RAND Corporation, Boston, MA.

*DOUGLAS O. STAIGER, PhD,* is a John French Professor in Economics, Department of Economics, Dartmouth College, Hanover, NH, and a Research Associate, National Bureau of Economic Research, Cambridge, MA.

*ULRIKE MUENCH, PhD, RN,* is a Postdoctoral Fellow, Center for Interdisciplinary Health Workforce Studies, Vanderbilt University School of Nursing, Institute for Medicine and Public Health, Vanderbilt University Medical Center, Nashville, TN.

the ages 50-64 (a third of the RN workforce). These RNs were born in the baby boom generation and, because many of them are expected to retire by 2020, the outflow from the nursing workforce will be substantial. Therefore, for the size of the RN workforce to grow in the future, two dynamics must occur. First, the outflow of older and retiring RNs must be replaced by an equal number of new, inflowing RNs. Second, on top of this inflowing replacement, additional RNs need to enter into the workforce. Together, this inflow of nurses will expand the total size of the RN workforce. Having large numbers of younger-aged people becoming RNs is key to long-term growth.

When developing the most recent long-term national projections of the size of the RN workforce, notable differences in the age structure of the current RN workforce were observed. For example, in some states the number of younger-aged RNs as a proportion of the state's total RN workforce was considerably larger relative to other states. Similarly, other states had a noticeably larger proportion of their RN workforce over the age of 50 relative to other states. Consequently, when producing national projections of the RN workforce, the variation in the age structure of RNs within states is masked.

The purpose of this article is to decompose national long-term projections of the RN workforce into regional-level projections (that is, for the four major census regions of the United States: Northeast, Midwest, South, West). Providing regional projections will allow underlying differences in the age structure of the RN workforce to become more visible. By providing regional-level projections, it will also be possible to identify those regions whose RN workforce is expected to grow at a slower rate relative to other regions. This information can help guide national and state health workforce planners, employers, educators, and others in developing policies and initiatives that may impact nursing supply in their states.

## Data and 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 U.S. Census Bureau (Department of Labor, Bureau of Labor Statistics, 2011a). 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 (Department of Labor, Bureau of Labor Statistics, 2011b). 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 30,000 RNs per year thereafter (after the sampling frame was expanded) compared to roughly 3,000 RNs per year obtained in the CPS. 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 64 who reported being employed as an RN during the week of the survey between 1973 and 2010 (*N*=68,611 in the CPS, *N*=239,500 in the ACS). To be consistent with previous projections, RNs reporting working fewer than 30 hours in a typical week were recorded as 0.5 full-time equivalents (FTE). 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. non-institutionalized 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 1973 and 2010 were obtained from the U.S. Census Bureau. Forecasts of the U.S. population through 2030 by age were obtained from projections prepared by the U.S. Census Bureau (2011).

*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 adapted to be run separately for each of four regions within the United States (see Table 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 captures 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

**Table 1.**
**Assignment of Sates by Region of the United States**

| Regions of the United States | States within Each Region |
|---|---|
| Northeast | MA, NH, VT, ME, RI, CT, NY, PA, NJ |
| Midwest | WI, MI, IL, IN, OH, MO, ND, SD, NE, KS, MN, IA |
| South | DE, MD, DC, VA, WV, NC, SC, GA, FL, KY, TN, MS, AL, OK, TX AR, LA |
| West | ID, MT, WY, NV, UT, CO, AZ, NM, AK, WA, OR, CA, HI |

propensity of RNs to be working at that age.

*Estimation.* ANOVA 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 64 for every year between 1973 and 2010 (42 years of age times 38 years equals 1,596 total observations) divided by the regional U.S. population in that given year-age cell. The ANOVA model estimated main effects for cohort (birth year) and age, and interaction effects between ages under 30 and a dummy variable for cohorts born after 1965. The interaction effects capture the shift toward older ages of first entry into the workforce by cohorts born after 1965, as found in earlier analyses (Buerhaus, Auerbach, & Staiger, 2009). All statistical analyses were performed using STATA 11.1.

*Projections.* Estimates of age and cohort effects were used to project the numbers of FTE RNs through 2030. We assumed age effects in future years will be the same as those observed in the most recent cohorts and the cohort effect for future cohorts (entering the workforce after 2010) will equal the average of the five most recent cohorts observed (the 1983 through 1987 birth cohorts, who were first observed at age 23 in 2006-2010). 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 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 four regions shown in Table 1.

To test the validity of the projection methodology at the regional level, we ran the projection model as if data were only available up to the year 2000, and used the same above projection methodology to project the RN workforce for the years 2001 to 2010. We then compared those results to the actual workforce size observed during those years. The predictions were reasonably close to observed workforce growth, despite unexpected growth and entry into nursing during this period which are attributed to the effects of the national recessions in 2001 and 2007-2009 (Buerhaus et al., 2009). On average, for each year between 2001 and 2010, the forecasted workforce size deviated from the observed workforce by 14% in the Northeast, 2% (Midwest), 7% (South), and 2% (West).

**Results**

*Current age structure.* Significant differences in the age struc-
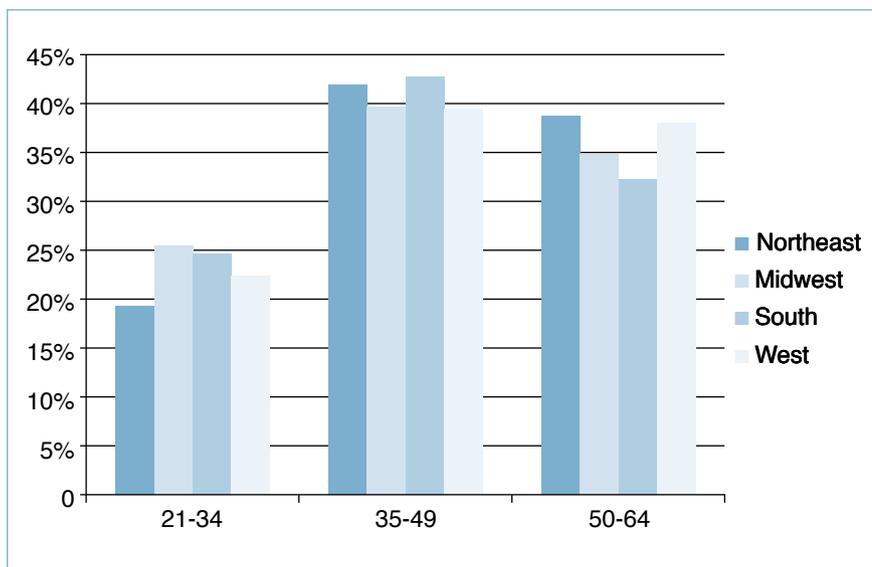
ture of the current RN workforce are apparent when states are analyzed by region of the country. Figure 1 shows states in the South and Midwest regions have younger nursing workforces than in the Northeast and West regions of the country. For example, between 2006 and 2010, 19% of RNs in the Northeast region were age 34 or younger compared to 25% in the South and Midwest. Further, 39% of RNs in the Northeast were age 50 or older compared to 32% and 34% in the South and Midwest. When analyzing smaller regions, such differences become starker; for example, the average age of an RN ranged from 42.4 in the East South Central division (comprising Tennessee, Kentucky, Mississippi, and Alabama) compared to 45.1 for an RN in New England. A larger percentage of younger-aged RNs implies a greater ability to replace older RNs in the workforce and suggests more rapid entry into the workforce among young RNs.

*Current and projected size of the RN workforce.* In the 1980s and 1990s, the Northeast had the highest ratios of RNs per capita in the United States. By 2010, however, the ratio of RNs per capita in the Midwest region had grown to match the Northeast, reaching roughly 925 RNs per 100,000 U.S. residents compared to 850 in the South and 715 in the West.
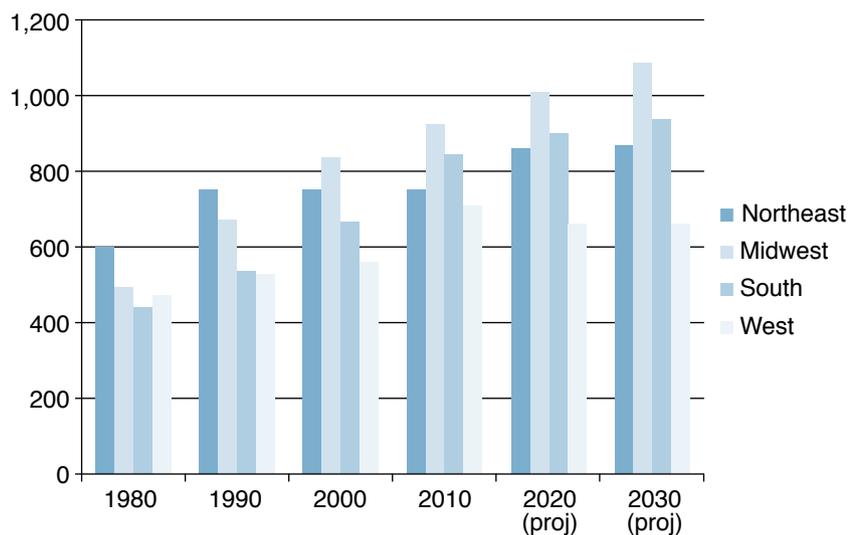
To estimate whether these trends will continue over the next 2 decades, the projection model (described in the methods section) uses data shown in Figure 1 together with estimates of the future size of the region's population, estimates of the future propensity of the population to become nurses, and estimates of future RNs to be working throughout their lifespan to project the future growth in the per capita RN workforce through 2030.

As shown in Figure 2, the higher growth in the Midwest and South is expected to continue. Given the greater proportion of

## Figure 1.
## Age Distribution of Current Registered Nurse Workforce by Region of the United States, 2006-2010



## Figure 2.
## Actual Supply and Projections of the Size of Per Capita Registered Nurses by Region of the United States, 1973-2030



leave the Midwest with 1,085 RNs per 100,000 residents in 2030, the South with 940, the Northeast with 870, and the Western region with just under 700.

### Discussion and Implications

The difference in the regional growth of the RN workforce is explained by the larger proportion of younger RNs in the South and Midwest combined with smaller proportions of RNs over age 50 in these same regions. Stated differently, states in the South and Western regions have a greater supply of younger-aged RNs available to replace fewer numbers of older-aged RNs compared to other regions. In contrast, the Northeast and West have fewer younger RNs currently in their workforce yet a relatively larger number of older-aged RNs to replace. Those differences in age structure may be partly due to differences in nursing school enrollment and expansion in nursing education capacity across regions.

These regional growth differences exacerbate existing differences in RN supply. For example, in 2010, for a given population, the West had 80% of the RN supply on a per capita basis when compared to the rest of the United States; that is, four RNs per capita for every five RNs per capita in other regions. By 2030, that disparity per capita RN supply is expected to be 50% greater in the Midwest than in the West. Those differences are similar in size as those for physicians in the United States by region (American Association of Medical Colleges, 2011) and could potentially threaten nurse-sensitive outcomes and quality of care.

These differences in the age structure of the RN workforce have implications for workforce development in all regions of the county. State workforce centers located in the relatively slower-growth regions (the West and Northeast) might consider actions to recruit entrants into the nursing

younger-aged RNs in the South and Midwest relative to other regions, the RN workforce through 2030 is expected to grow faster in the Midwest (17.4% per capita growth) and South (10.8%) compared to the West and Northeast from 2010 to 2030, which are pro-

jected to decline in per-capita RN supply (by 2.5% and 6.2%, respectively) (see Figure 2). Those differential rates of growth, driven by the different exit and entry rates into the RN workforce as revealed in each region's differing age structure, are projected to

profession, particularly younger-aged people. State workforce centers in these regions could also increase efforts to educate public and private sector policymakers about the age structure of their states and the implications for growing their state's future RN workforce. Information could be disseminated about the need to replace the state's aging RN workforce with younger RNs, as well as to attract additional RNs so the total size of the RN workforce will expand. Such actions will help lower the future costs, time, and uncertainty associated with having to recruit RNs from states where the nursing workforce is growing faster.

States in relatively slower RN growth regions may also consider their nursing education capacity. Knowing their state is located in a relatively slower RN growth region, expanding the capacity of education programs could help increase the future production of RNs. Capacity could be achieved by expanding the size of current education programs, developing new education programs, or both. Conversely, health workforce planners in higher RN growth regions of the country can anticipate efforts to recruit RNs they are producing by states in the lower-growth regions.

The pressure to speed up the growth in the future RN workforce in states in the Northeast and West will depend importantly on the regions' expected future demand for RNs. These demand estimates will be particularly important given the implementation of health care reforms in the coming years and the expected 32 million Americans who will obtain health insurance in 2014.

Fortunately, projections of the future demand for RNs are being developed by the Health Resources and Services Administration's Center for National Health Workforce Analysis. When these projections become available in 2013, state workforce centers and nursing edu-cation programs should carefully compare those projections with projected growth in their state or region's supply of RNs. $

## REFERENCES

American Association of Medical Colleges. (2011). *2011 state physician workforce data book*. Washington, DC: Center for Workforce Studies.

Auerbach, D., Buerhaus, P., & Staiger, D. (2007). Better late than never: Workforce supply implication of later entry into nursing. *Health Affairs, 26*(1), 178-185.

Auerbach, D., Buerhaus, P., & Staiger, D. (2011). Surge in those ages 23-26 entering the registered nurse work force means that supply is growing faster than projected. *Health Affairs, 30*(12), 2286-2292.

Buerhaus, P., Staiger, D., & Auerbach, D. (2000). Implications of a rapidly aging registered nurse workforce. *The Journal of the American Medical Association, 283*(22), 2948-2954.

Buerhaus, P., Auerbach, D., & Staiger, D. (2009). The recent surge in nurse employment: Causes and implications. *Health Affairs (Web Exclusive),* w657-668.

Department of Labor, Bureau of Labor Statistics. (2011a). *American Community Survey (ACS) questions and answers.* Washington, DC: Author. Retrieved from http://www.bls.gov/lau/acsqa.htm

Department of Labor, Bureau of Labor Statistics. (2011b). *Labor force statistics from the Current Population Survey*. Washington, DC: Author. Retrieved from http://www.bls.gov/cps/

U.S. Census Bureau. (2011). *Population estimates.* Washington, DC: Author. Retrieved from http://www.census.gov/popest/data/state/totals/2011/index.html