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TRENDS

By David I. Auerbach, Peter I. Buerhaus, and Douglas O. Staiger

Registered Nurse Supply Grows Faster Than Projected Amid Surge In New Entrants Ages 23–26

ABSTRACT The vast preponderance of the nation's registered nurses are women. In the 1980s and 1990s, a decline in the number of women ages 23–26 who were choosing nursing as a career led to concerns that there would be future nurse shortages unless the trend was reversed. Between 2002 and 2009, however, the number of full-time-equivalent registered nurses ages 23–26 increased by 62 percent. If these young nurses follow the same life-cycle employment patterns as those who preceded them—as they appear to be thus far— then they will be the largest cohort of registered nurses ever observed. Because of this surge in the number of young people entering nursing during the past decade, the nurse workforce is projected to grow faster during the next two decades than previously anticipated. However, it is uncertain whether interest in nursing will continue to grow in the future.

Ten years ago we identified a fundamental shift in the composition of the registered nurse (RN) workforce.[1] There had been a dramatic decrease in the number of young women (ages 23–26) becoming registered nurses as career opportunities for women outside of nursing expanded. Between 1983 and 1998 the proportion of the RN workforce younger than age 30 plummeted from 30 percent to 12 percent, while the average age of working registered nurses increased by 4.5 years, from 37.4 to 41.9 years.

Unless this trend was reversed, the size of the RN workforce was projected to eventually decrease as large numbers of registered nurses would retire and not be replaced by younger cohorts. Using estimates that were available at the time of the future need for registered nurses, shortfalls of 20 percent, or approximately 400,000 RNs, were expected by 2020. These shortfalls grew even larger when those requirements were subsequently updated.[2]

There is some evidence to suggest that these trends have reversed over the past decade, as nursing has become a more attractive career choice. As a consequence of the projected registered nurse shortages, national recruitment initiatives were launched to raise awareness of the opportunities in nursing and promote the attractiveness of the nursing profession.[3,4]

At the same time, growth in two-year associate degree education programs and innovations in baccalaureate programs were attracting increasing numbers to nursing, particularly among women in their late twenties and early thirties. These trends were reflected in increasing overall enrollments in undergraduate nursing degree programs during much of the past decade.[5–7]

Finally, there have been a few reports suggesting that those enrollment trends have resulted in increases in the number of young working registered nurses.[8,9] However, there has been no systematic analysis of recent trends in the number of such RNs entering the workforce and the implications of those trends for the future.

In this study we investigated recent employment trends in the number and age of registered nurses, based on more than thirty-five years of annual survey data from the Census Bureau's Current Population Survey and American Community Survey. We used data from the American Community Survey, which included large samples of RNs, to analyze recent trends in the number of young registered nurses and to project the future age and supply of RNs per capita through 2030.

Study Data And Methods

Data on the employment of registered nurses from 1973 to 2009 were obtained from the Current Population Survey and the American Community Survey. The Current Population Survey is a household-based, nationally representative survey of more than 100,000 people administered monthly by the Census Bureau.[10] It is used extensively by the Department of Labor to estimate current trends in unemployment, employment, and earnings.

We have used Current Population Sur-

vey data in prior work to estimate employment trends for registered nurses and to project the ages and supply of RNs and physicians.[11–12] We used data from 1973–78 from the Current Population Survey's annual May surveys and data from 1979 through 2000 from its Outgoing Rotation Group Annual Merged Files—which is an annual sample compiled by the National Bureau of Economic Research that contains data on the hours and earnings (and other) questions asked of respondents once per calendar year.

The American Community Survey, which began reporting data in 2001, is modeled after the long form of the decennial census. Although it contains fewer questions than the Current Population Survey, it has a much larger sample size.[13] The Current Population Survey samples approximately 3,000 registered nurses per year. In contrast, the American Community Survey surveyed approximately 12,000 RNs in each year from 2001 to 2004, and roughly 30,000 RNs in each year starting in 2005 (when the sample was enlarged).

Because these larger sample sizes allow for recent workforce trends to be analyzed with greater accuracy, we used the American Community Survey data rather than the Current Population Survey data beginning in 2001. The basic occupation and employment questions are similar in both surveys and generate similar estimates of total RN employment for the overlapping years.

The data we analyzed included all people ages 23–64 who reported being employed as a registered nurse during the week of the survey, between 1973 and 2009 ($N = 68,611$ in the Current Population Survey; $N = 206,247$ in the American Community Survey). As in prior work, we assigned registered nurses reporting fewer than thirty hours worked in a typical week as 0.5 full-time equivalent. These data were used to estimate the number of full-time-equivalent RNs of each age who were working in each year. To make estimates representative of the US noninstitutionalized population, observations were weighted by sampling weights provided by the Current Population Survey and the American Community Survey.

Additional data on the US population by year and age between 1973 and 2009,[14] and forecast through 2030,[15] were obtained from the Census Bureau.

Sampling errors for estimates of full-time-equivalent registered nurses and for the growth in employment between years were calculated using formulas provided by the Bureau of Labor Statistics and the Census Bureau.[16,17] All p values were based on two-tailed tests of significance. Details of our forecasting model are described elsewhere.[7]

Briefly, the model used a regression analysis where the dependent variable was the logarithm of the number of full-time equivalents produced by registered nurses of every age in the group ages 23–64, for every year between 1973 and 2009 (for example, age forty-two years times thirty-seven years equals 1,554 total observations), divided by the total US population in that given year-age cell. The independent variables were dummy variables for each single-year birth cohort (for example, RNs born in 1955), each single year of age, and an interaction term that captured the shift toward older ages of first entry (for example, the average age of new RN graduates was twenty-four for those graduating in the early 1980s and has since risen to over thirty)[8] into the workforce by cohorts born after 1965.

The forecast model was first estimated on observed data and was then used to forecast the future workforce by applying the observed pattern of workforce participation by age to future cohorts and assuming that future cohorts would have the same propensity to become registered nurses as the five most recently observed cohorts.

Study Results

TREND ANALYSIS The number of young registered nurses, ages 23–26, decreased nearly 50 percent from a peak of more than 190,000 full-time equivalents in 1979 to below 110,000 by 1991 (Exhibit 1). The number of young RNs remained low throughout the following decade, falling to a low of 102,000 in 2002.

However, since 2002 the number of young registered nurses has grown at a rate not seen since the 1970s. Between 2002 and 2009 the number of full-time-equivalent RNs ages 23–26 increased steadily by 62 percent (95% confidence interval: 42, 82; $p < 0.001$) to approximately 165,000 full-time equivalents. We examined characteristics of registered nurses newly entering the workforce in 2009 versus 2001–02 and did not find large or significant differences in characteristics such as sex, nationality, or ethnicity (data available upon request).

Some of the decrease in the number of young registered nurses during the late 1980s resulted from a secular shift toward older entry into nursing (age twenty-seven and older) that was observed for people born in the mid-1960s,[5,8] rather than decreased interest in nursing. Thus, despite the sharp decrease in the number of registered nurses ages 23–26 throughout the 1980s and 1990s, there was only a modest decline in the number of working registered nurses in their late twenties, as illustrated in Exhibit 2.

For example, among those born in 1956, there were 47,000 full-time-equivalent registered nurses at age twenty-five employed in 1981. Four years later, there were 8,000 additional full-time-equivalent RNs observed from this same cohort (now twenty-nine years old), reflecting the combination of additional workforce entry and any changes in labor-force participation.

Twenty years later, this figure had fallen to just 26,000 registered nurses observed among twenty-five-year-olds in 2001. But four years later, that cohort gained 17,000 additional full-time equivalents. Since 2001, not only has the trend toward later entry held, but, as noted in Exhibit 1 and mirrored in Exhibit 2, the declining entry among young registered nurses has reversed. This suggests that the cohorts born in the 1980s will far surpass those of the 1950s.

Exhibit 2 suggests that recent cohorts who supplied more full-time-equivalent registered nurses at young ages continued to supply more RNs as these cohorts aged. To investigate this pattern in more detail, Exhibit 3 plots the number of registered nurses observed between ages twenty-three and thirty for each of the most recent two-year birth cohorts (those born in 1978–79 through those born in 1984–85). The cohort lines are roughly parallel as each two-year cohort ages, with the more recent cohorts having higher full-time equivalents at every age. Thus, growth in full-time equiva-

EXHIBIT 1

Trend In The Number Of Full-Time-Equivalent Registered Nurses Ages 23–26, 1973–2009
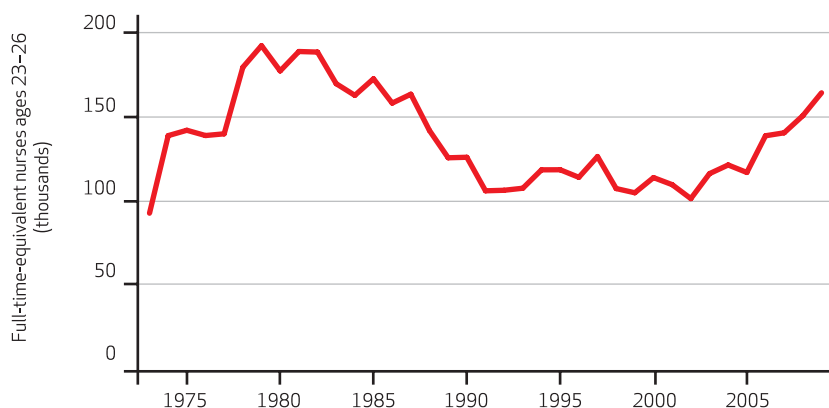
SOURCE Authors' analysis derived from the Current Population Survey (1973–2000) and the American Community Survey (2001–09). NOTE The line connects annual estimates of the number of full-time-equivalent registered nurses ages 23–26 in each year.

lents at young ages is indicative of larger cohorts in the future.

PROJECTIONS Incorporating the trends shown in Exhibits 1–3, we used the model described earlier to project the numbers of full-time-equivalent RNs at each age through the year 2030. The model assumes that each cohort will follow a similar life-cycle pattern of production (the age effect), so that the number of full-time-equivalent registered nurses at advanced ages can be projected based on those observed at young ages (consistent with the evidence in Exhibit 3).

Exhibit 4 plots the actual and projected number of total full-time-equivalent registered nurses per 100,000 US residents from 1973 to 2030. The observed number per capita more than

doubled from 1973 to 2009. The in-sample predictions from our model follow the actual data fairly closely, although the number of observed full-time equivalents tends to be higher than predicted in economic downturns such as in the early 1980s, early 1990s, and 2008–09, when RNs temporarily reentered the labor force in response to economic uncertainty.[9]

ASSUMPTIONS To project the number of full-time-equivalent registered nurses per capita, we made the assumption, as noted in the methods description, that future cohorts will follow the same workforce participation and work-effort patterns as they age as did prior cohorts born after 1965. In addition, we make three different projection assumptions about the size of future cohorts—specifically, those who were under age twenty-three in 2009 and thus not yet observed in our data.

The baseline projection assumes that registered nurse production from future cohorts will resemble the most recently observed five cohorts—specifically, that the size of future cohorts will equal the average of the last five observed cohorts. We also plotted two alternative projections for the size of new cohorts: a pessimistic projection in which the size of new cohorts revert to the lower levels observed in the 1990s, and an optimistic projection in which the future cohorts continue to grow in size at a rate of 2 percent per year. For example, entering cohorts in ten years will be 20 percent larger than the most recent one observed: those born in 1986.

The baseline projection suggests that supply per capita will remain fairly stable through 2030, at just more than 800 full-time-equivalent registered nurses per 100,000 residents. The absolute size of the RN workforce (not per capita) is projected to grow by approximately 24 percent between 2009 and 2030, which is roughly the rate of projected population growth over this period. In this projection, the large retiring cohorts of baby-boomer registered nurses are being replaced by entering cohorts that will eventually be even larger, leading to a steady increase in the size of the workforce.

However, if the recent surge in entry subsides and interest in nursing reverts to what it was among cohorts born in the

EXHIBIT 2

Numbers Of Full-Time-Equivalent Registered Nurses At Age 25 And Additional Registered Nurses Four Years Later, For Selected Cohorts Of Birth, 1956–84
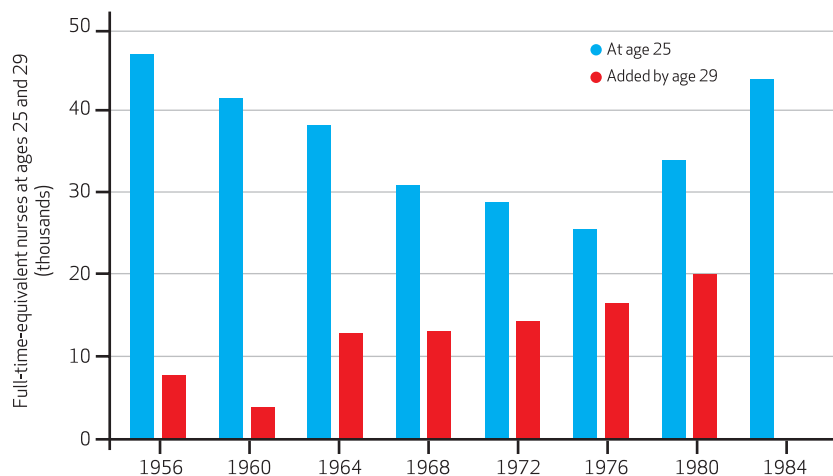
SOURCE Authors' analysis derived from the Current Population Survey (1973–2000) and the American Community Survey (2001–09). NOTES The left-most bar of each pair represents the number of full-time-equivalent (FTE) registered nurses working at age 25 and born in the year shown. The right-most bar represents the additional FTE observed at age 29 for registered nurses born in the same year (FTE at age 29–FTE at age 25). Years are birth years or cohorts. Registered nurses born in 1984 will not be 29 until 2013.

1970s, then the number of registered nurses per capita will decline after 2010 as retiring baby-boomer RNs are replaced with smaller entering cohorts. Under this more pessimistic scenario, the number of full-time-equivalent registered nurses per 100,000 US residents would drop approximately 12 percent below today's level, to about 365,000 RNs (13 percent) below the baseline projection by 2030.

If, in a more optimistic scenario, entry into nursing continues growing at a rate of 2 percent per year—which is still considerably less than the rate of growth in the size of young cohorts over the past seven years—then the number of full-time-equivalent registered nurses per capita would continue to grow at a rate similar to that observed during the past three decades and would exceed 1,000 full-time-equivalent RNs per 100,000 residents by 2030.

Implicit within these projections is an underlying age structure of the registered nurse workforce. In 1985 the baby-boomer cohorts had recently entered the workforce and heavily tilted the distribution toward the young end: The largest age groupings of working RNs were in their twenties and thirties. Fifteen years later, in 2000, the same

baby-boomer cohorts were now in their forties and continued to dominate the age composition of the workforce.

Several years from now, in 2015 (according to the baseline projection), those registered nurses will be mostly in their fifties and the workforce will

be 44.1 years old, on average—just under its maximum age of 44.2, which we project it will reach in 2012. Under this scenario, more than 200,000 registered nurses will be ages 60–64—seven times the number in 1985. In 2030 the age distribution of the registered nurse

The Number Of Full-Time-Equivalent Registered Nurses, By Age, For Recent Two-Year Birth Cohorts
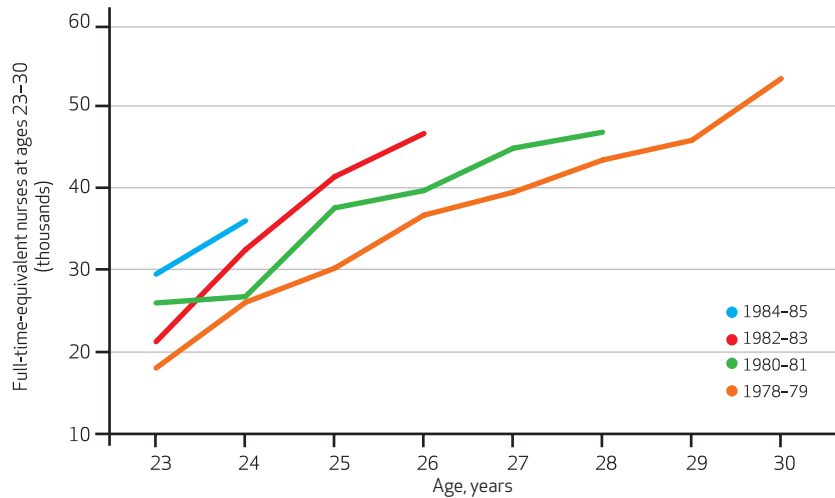
SOURCE Authors' estimates derived from the American Community Survey (2001–09). **NOTE** Each line connects annual estimates of the number of full-time-equivalent registered nurses at a given age, averaged over two birth-year cohorts.

Actual And Projected Total Registered Nurse Full-Time Equivalents Per 100,000 US Residents, 1973–2030
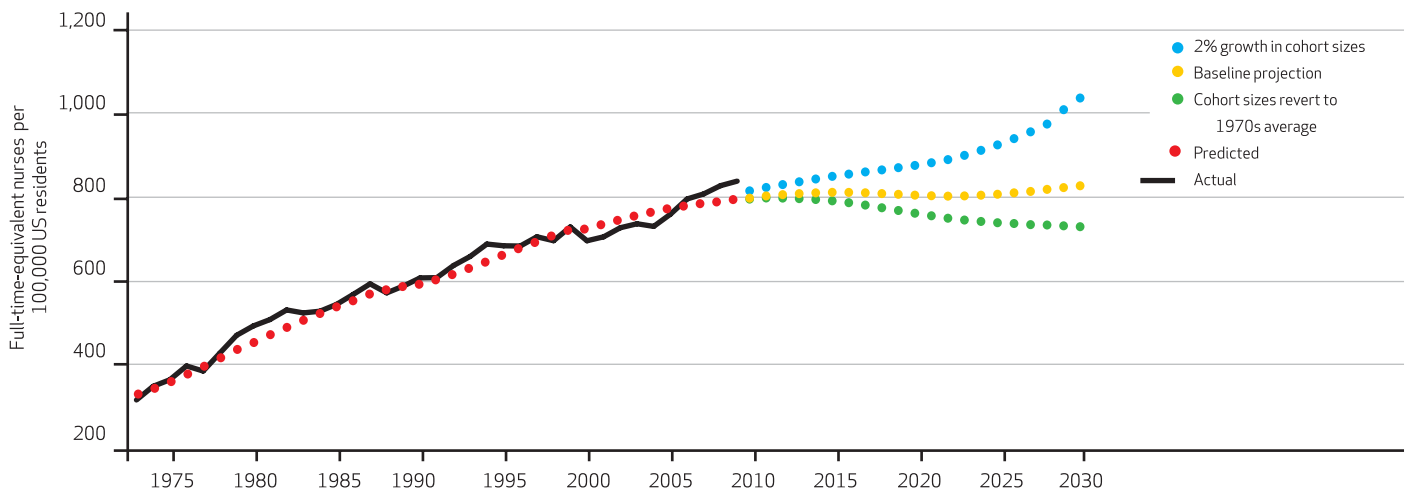
SOURCE Authors' analysis of data derived from the Current Population Survey (1973–2000) and the American Community Survey (2001–09). Population estimates and projections are from the Census Bureau. **NOTES** Standard errors on annual estimates are 21–24 percent for 1973–78, 17–19 percent for 1979–2000, and 8–13 percent for 2001–09. Predictions for 1973–2009 were derived from the model described in the Study Data and Methods section. Projections for 2010–30 are based on three alternative scenarios, as described in the text. The solid black line connects annual estimates from 1973 through 2009 of the total number of full-time-equivalent registered nurses per 100,000 US residents in each year.

workforce will return to a more "normal" distribution. The baby boomers will be mostly retired, and the registered nurses born in the 1980s who are rapidly entering nursing today will be the largest group in the RN workforce and will be in their forties.

Discussion

After more than a decade of low entry rates into nursing by young people, the number of young registered nurses in the workforce has risen dramatically since 2002. Whereas only recently we observed the smallest cohorts entering nursing in twenty-five years, today the youngest cohorts of nurses entering the workforce are projected to be the largest in history by the time they reach middle age. They will provide 30 percent more full-time-equivalent RNs than the baby-boomer cohorts who are now nearing retirement.

Because of this sharp turnaround in the number of young people becoming nurses, the nurse workforce is projected to grow faster over the next two decades than previously anticipated. Instead of declining in absolute and per capita terms as previously projected, the nurse workforce is now projected to grow at roughly the same rate as the population through 2030.

The difference between our current projections and earlier projections are largely attributable to two unanticipated changes in entry into nursing. Ten years ago, projections assumed that future cohorts would continue to produce registered nurses at the low average rate observed during the 1990s. In fact, this was overly pessimistic, as recent cohorts have responded rapidly to growing opportunities in nursing.

In addition, the earlier projections did not foresee the growing numbers of people entering nursing in their late twenties and thirties. This trend has been accommodated by two-year associate degree programs and accelerated nursing degree options offered by baccalaureate degree programs. These earlier projections therefore underestimated the number of registered nurses that would be produced by cohorts who were still under age thirty in the 1990s. Roughly half of the difference in the projections is because of the increase in the number of people entering nursing at these later

ages that began to occur in the later 1990s. The rest is because of the unexpected increase in the number of young people (ages 23–26) entering nursing, observed during the past decade.

Whether our supply projections imply future shortages of RNs depends on estimates of future needs. The Health Resources and Services Administration's most recent estimates (made in 2004) projected an increase in the need for registered nurses per capita of roughly 0.76 percent per year.[2] Assuming this level of growth per year to meet future needs, the United States would require just under 1,000 full-time-equivalent RNs per 100,000 US residents by 2030, or 3.6 million by 2030.

Our projections suggest that the supply of registered nurses will be roughly 15 percent below this projected 2030 need if entry into nursing remains at recent levels. However, they also suggest that the supply of RNs would surpass this demand, reaching just over 1,000 full-time-equivalent registered nurses per 100,000 residents, if entering cohort sizes continue to grow at current levels, or 2 percent per year.

The Health Resources and Services Administration has not updated its projections of future registered nurse requirements. Its current projections do not incorporate developments such as the passage in 2010 of the Affordable Care Act or potential shortages of primary care physicians, both of which are likely to increase the future need for registered nurses.

The aging of the US population—from 13 percent older than age sixty-five in 2010 to 19 percent in 2030—is also likely to increase the demand for registered nurses at greater rates than in the past. Thus, updated estimates of the future need for RNs are likely to project growing future shortages.

Conclusion

Our analysis highlights the fact that projections of the future size of the registered nurse workforce depend critically on the recent and projected trends in the number of people entering the profession. The availability of the American Community Survey data, with its large samples of RNs, has improved projections by increasing the precision with

which we can identify recent trends in the number of young registered nurses.

As noted above, the entry of young registered nurses into the profession is on the rise. However, there remains considerable uncertainty about whether interest in nursing will continue to grow in the future. There also continue to be a number of forces, both positive and negative, influencing the future nursing supply.

On the negative side, there continue to be bottlenecks in nursing education that could narrow the future pipeline of nurses below optimal levels. According to the American Association of Colleges of Nursing, the number of qualified applicants turned away from entry-level baccalaureate nursing programs grew from 16,000 in 2003 to 38,000 in 2007 and to 55,000 in 2010.[18] (This tally does not count those entering associate degree programs, which graduate a roughly similar number of registered nurses each year.) This phenomenon occurred despite a large increase in the number of available seats in entry-level baccalaureate programs, which increased from 20,000 in 2000 to nearly 65,000 in 2010.[19,20]

On the positive side, nursing education programs have developed innovations to increase the appeal of nursing and to make entry into the profession more attainable. For example, accelerated degree programs have been aimed at people with degrees in other fields and have had an impact not anticipated a decade ago. In particular, the number of accelerated programs for earning a bachelor of science in nursing increased from 84 to 231 over the same period. The amount of federal funds appropriated through the Title VIII Nursing Workforce Development programs, which are the primary source of federal funding for nursing education and provide funds for baccalaureate- and master's-level nursing education and loan repayment, tripled from $80 million in 2001 to $240 million in 2010.[21]

In addition, information about the opportunities in nursing—as well as projected shortages that would tend to raise wages—appear to have influenced the career choices among recent cohorts. Similar market signals may continue to encourage entry into nursing in the future.

A complicating factor is that the recent surge of registered nurses into the workforce because of the recession has made it harder for young RNs to find jobs. This phenomenon may in fact discourage some from entering the profession, although it is unclear whether it will do so and whether the trend will continue.[9] It is also unclear to what extent federal and state support for nursing education is key to continued program and enrollment growth.

Finally, even if the nursing workforce does continue to grow, it is unclear whether we are producing the workforce ideally suited for population needs. Two recent Institute of Medicine reports highlighted specific future nursing needs. They noted the need for registered nurses trained in geriatric care, to care for an aging population; for RNs who are comfortable in ambulatory care settings, to meet increasing demand for primary care in the face of a slow-growing primary care physician workforce; and for a nurse workforce with a diversity more closely matched to that of the population as a whole.[22,23]

Nevertheless, at least in the near future, there is likely to be continued growth of the nurse workforce, at a rate projected to grow more rapidly during the next two decades than previously anticipated. ■

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ABOUT THE AUTHORS: DAVID I. AUERBACH, PETER I. BUERHAUS & DOUGLAS O. STAIGER

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In this month's *Health Affairs*, David Auerbach and coauthors report on their study exploring the rate at which young registered nurses, ages 23–26, have been entering the nursing field. They found that between 2002 and 2009, the number of these RNs increased by 62 percent, reversing a period of decline in the 1980s and 1990s. The authors say that this uptick could result in the largest cohort of registered nurses ever observed.

"Back in 2000, we published a paper in the *Journal of the American Medical Association* that predicted an acute nursing shortage," says Auerbach. "Organizations such as Johnson & Johnson and HRSA [Health Resources and Services Administration] started gearing up to promote nursing. It's unusual to see a turnaround like this, and what that points to is an incredible policy story: We forecast a problem, and it got fixed."

Auerbach, a health economist at RAND Health, is currently engaged in a number of projects reflecting his interests in the health care workforce, health care costs, and the coverage effects of health reform. He also serves as an external adjunct faculty member of the Center for Interdisciplinary Health Workforce Studies at Vanderbilt University.

From 2003 to 2010 Auerbach was a principal analyst in the Health and Human Resources Division of the Congressional Budget Office (CBO). He holds a doctorate in health policy, with an economics concentration, from Harvard University, as well as two master's degrees—one in technology and policy from the Massachusetts Institute of Technology, and the other in chemistry from the University of California, Berkeley.

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