

# Examination of State-level Changes in the Pharmacist Labor Market Using Census Data

Surrey M. Walton; Katherine K. Knapp; Laura Miller; Glen T. Schumock

J Am Pharm Assoc. 2007;47(3):348-357. ©2007 American Pharmacists Association

Posted 06/11/2007

## Abstract and Introduction

### *Abstract*

**Objective:** To examine long-term changes in the U.S. pharmacist labor market across states.

**Design:** Retrospective cohort study.

**Setting:** The United States as a whole and individual states in 1990 and 2000.

**Participants:** Pharmacists and pharmacy school graduates from Census data and previous research, respectively.

**Intervention:** Retrospective analysis of 5% Public Use Microdata Samples data on pharmacists from the 1990 and 2000 U.S. Census surveys, information on migration among states between 1995 and 2000, and previous research on pharmacy school graduates.

**Main Outcome Measures:** Changes in pharmacist counts and wages, as well as migration of pharmacists across states and pharmacy school graduates by state.

**Results:** From 1990 to 2000, the ratio of pharmacists to 100,000 population increased from 70 to 76, but 13 states experienced declines in this datum, and overall changes in pharmacist counts varied considerably among states. The average wage, expressed in 2000 U.S. dollars, for pharmacists increased from \$26.58 per hour to \$33.80 per hour (17%), while the average wages of nonpharmacist college graduates increased from \$26.37 to only \$28.76 (9%). Wage changes varied across states.

**Conclusion:** According to the Census, the number of pharmacists per 100,000 population varied substantially across states. This variance in supply across states is not converging or easily explained. Overall, the shortage had a clear impact on the pharmacist labor market, yet this effect was not consistent across states.

### *Introduction*

Available evidence indicates that, since 1998, there has been a national shortage in the labor market for pharmacists and that the shortage continues to be substantial.<sup>[1-5]</sup> Employers in most states continue to report difficulties in filling pharmacist positions, and a national survey reported an upturn in vacancies during the past year.<sup>[5]</sup> The development of longitudinal datasets has enabled some tracking of trends before and during the shortage, including changing pharmacist workforce characteristics and work patterns; however, little is known about long-term supply changes across states.<sup>[4-7]</sup>

Along with trends across time, state-level research is important because pharmacy practice is regulated at the state level and, historically, there have been large differences in pharmacists per population across states.<sup>[8]</sup> Efforts to describe and better understand factors that influence state-level differences in the labor market for pharmacists have recently been undertaken. For example, a recent analysis examined differences across states in terms of filled pharmacist positions relative to the population.<sup>[9]</sup> Analyses assessing differences in market conditions for pharmacists across four specific states have also been published.<sup>[10,11]</sup> Vacancy rates, difficulty in filling positions, and more recently a direct survey measure of the severity of the pharmacist shortage are examples of available measures related to the pharmacist shortage at the state level.<sup>[3]</sup> However, state-level data and analyses regarding the pharmacist workforce remain scarce. Furthermore, the most current and comprehensive predictive supply model provides estimates at the national rather than state level.<sup>[7]</sup>

Economic principles suggest that employers in states affected by the shortage would tend to raise wages and subsequently attract pharmacists from lower-wage states. Therefore, migration and long-term changes in pharmacist salaries are fundamental to understanding the shortage at the state level. Reports of periodic salary surveys have appeared along with anecdotal evidence of salary and bonuses during the shortage period, though most of these reports do not control for pharmacist age and education level, and very few offer comparisons between pharmacist salaries and salaries of other groups.<sup>[12,13]</sup> Overall, little examination has been made of salary changes across time at the national and state level.

In addition to migration, the number of new graduates from pharmacy programs is an important source of supply change that varies considerably across states. A recent study showed large differences in the number of pharmacy school graduates across states, even when adjusted for population.<sup>[14]</sup> Currently, many states are undergoing pharmacy education program expansion in an effort to increase graduates and hence ameliorate the shortage.

## Objectives

The purpose of this study was to examine long-term changes in the U.S. pharmacist labor market across states. Specifically, our three objectives were to

1. Analyze in-state pharmacy school graduates, state-level migration of pharmacists between 1995 and 2000, and changes in the number of pharmacists by state between 1990 and 2000;
2. Examine pharmacist migration patterns by age; and
3. Measure long-term changes in the wages of pharmacists and variation in wages across states.

## Conceptual Framework

Considering a variety of possible sources of change in the supply of pharmacists is important when looking at labor market dynamics. The main sources of change examined in this study included increased pharmacy school graduates, increased net migration of pharmacists, and increased pharmacists returning from other professions or from being unemployed or retired. The relative size of supply changes and the relative contribution of migration, pharmacy school graduates, and in-state market supply changes in any particular state can be expected to vary based on numerous factors related to the costs and benefits of living in any particular state, as well as state-level policies related to pharmacy and state-level investments in the supply of pharmacists.

Wage rates in general are important indicators for market changes, and these can be compared among similarly skilled workers to help identify factors driving market changes. In this scenario, wages are viewed as an incentive to work in pharmacy and as an indicator of the demand for pharmacist services. Underlying this analysis of long-term trends in the pharmacist market is the emergence of the mainly demand-driven national market shortage of pharmacists in the middle to late 1990s. A demand-driven market shortage occurs when demand increases are larger than available supply, exerting upward pressure on wages. In general, a simultaneous increase in relative wages and the number of pharmacists suggests a demand-driven market shortage of pharmacists.

If a pharmacist shortage had affected all states to similar degrees, then basic economic theory suggests that wages would rise over time in all states and that supply would respond in all states. However, the relationship between wages and supply changes is more difficult to predict if such a shortage does not occur in any particular state. For example, if the supply of pharmacists is shifting substantially in a particular state (perhaps because of an expanded pharmacy education program), higher numbers and, accordingly, relatively lower wages could result.

In addition to considering long-term changes in numbers and wages of pharmacists across states, part of this analysis was devoted to an examination of migration rates for pharmacists relative to the population across age ranges. Given that costs of moving tend to increase with age (location-specific investments create benefits that are difficult to uproot), one would expect migration to decline with age. Aside from such a general trend, again basic economic theory does not provide a clear prediction for pharmacist migration relative to the population. Because the skills required to be a pharmacist are more transferable than those associated with many other occupations, pharmacists may be expected to migrate at a comparably higher rate. However, if the tendency is for pharmacists to develop more site-specific skills (such as opening an individual practice with local clients), then they may be less inclined to migrate than other members of the workforce.

## Methods

### Data

The majority of the analyses in this study were based on the 5% Public Use Microdata Samples (PUMS) from the 1990 and 2000 U.S. Census surveys;<sup>[15,16]</sup> these data provide a new source of information about the pharmacist workforce at

both the national and state levels. The PUMS data are individual level and include self-reported information on age, gender, educational attainment, race, occupation, salary, state of residence, and state of primary employment. The 2000 PUMS data also contain information on where the individual lived in 1995, allowing an analysis of worker migration across state lines—an important variable for tracking one possible response to a workforce shortage. Further, the PUMS data contain sampling frequency weights, which allow estimation of total counts by occupation at the state level. The sample size ( $n = 10,346$  in 2000 and  $8,502$  in 1990), roughly 5% of all pharmacists, is substantially larger than other recent datasets used to study workforce issues at the national level. Most recent studies have not had a sufficient sample size to address state-level differences. Finally, PUMS data from the 2000 U.S. Census can be compared with equivalent data from the 1990 U.S. Census to provide insights into overall changes in the market for pharmacists over time.

PUMS data were used to estimate the following information at the state level: pharmacist counts in 1990 and 2000, pharmacist salaries in 1990 and 2000, and in-migration and out-migration between 1995 and 2000. The PUMS data were also used in some instances to compare pharmacist earnings with subsections of the nonpharmacist population that share similar observable characteristics (see below). In addition, as an important scaling factor, many of the descriptive analyses incorporated total state populations, which also come from the 1990 and 2000 U.S. Census, but are taken from published statistics rather than calculated from the 5% PUMS datasets.<sup>[17,18]</sup> To complement the Census data, information on the number of pharmacy school graduates per state was used from previous research.<sup>[14]</sup>

### *Sample Selection and Variable Definitions*

Pharmacists were selected from the 1990 and 2000 Census data based on self-reported occupation; this included both employed and unemployed individuals. Fields indicating age and number of years of schooling were also used in record selection. The analyses focused on pharmacists 21 years of age or older who had, at minimum, a bachelor's degree. Age and education selection criteria were intended to reduce measurement error from miscoded or misidentified occupation. To make comparisons with the general population in terms of wages, total PUMS data (i.e., the total population) were used with the same restrictions on age and education.

We accounted for pharmacists' state of residence. Migration was measured using the "migration state" field in the Census data, which indicates where a person lived up to 5 years before a given Census year. In cases where "migration state" was different from the current state of residence, the person was considered to have migrated. The Census also provided information on total earnings from salary as well as weeks worked and hours per week. In addition, the data included information on demographic characteristics related to wages, such as educational attainment, age, gender, and race. Because many factors related to location may affect salaries, pharmacist salaries at the state level were compared with salaries of college-educated nonpharmacists of working age. The comparison group is meant to approximate the opportunity cost of practicing pharmacy using market earnings of similarly skilled workers in other occupations. In all salary calculations, a minimum hourly wage of \$6.00 was used to help minimize measurement error. For consistency, 1990 salary data were converted to 2000 dollars using an inflator (1990 values were multiplied by 1.32) from the Bureau of Labor Statistics.<sup>[19]</sup>

### *Analyses*

Various descriptive analyses were conducted to characterize state-level differences in the number of pharmacists and sources of change in the number of pharmacists across states, as well as comparisons of the number of pharmacists to the overall population in a state. Rates of migration across age for all pharmacists were examined. Descriptive statistics were also calculated for inflation-adjusted wages of pharmacists relative to inflation-adjusted wages of college-educated nonpharmacist workers in general.

## **Results**

The sample of pharmacists in the Census projects to a total pharmacist workforce of 217,408 in 2000. This estimated pharmacist population, based on weights from the Census sample, compares well with other estimates in the literature.<sup>[2,7,20,21]</sup>

**Table 1** shows population counts and the percentage of the population older than 65 years by state. The vast majority of states experienced population growth. In addition, all states had a steady or slightly increasing percentage of the population that was older than 65 years. **Table 2** shows the number of pharmacists per 100,000 population by state in 1990 and 2000. Nationally, the ratio of pharmacists to 100,000 population increased from 70 to 76, but 13 states experienced declines, and the overall change in pharmacist counts varied considerably among states.

Table 3 shows cumulative pharmacy school graduates from 1990 to 1995, cumulative pharmacy school graduates from 1995 through 2000, net in-migration overall and for those younger than 30 years between 1995 and 2000, and changes in the number of pharmacists between 1990 and 2000. All values are adjusted by state populations in 1990. Alaska, Delaware, Hawaii, Maine, Nevada, New Hampshire, and Vermont did not produce any new pharmacy school graduates in the 1990s, and the District of Columbia, North Dakota, and Rhode Island produced the most pharmacy school graduates per population count. The state with the largest number of pharmacy school graduates was New York, and the state with the largest rate of net in-migration was Florida. Figure 1 shows the percentage change in the number of pharmacists per 100,000 population across the United States. Relatively high increases in the pharmacist numbers are observed fairly consistently across time in the western-most states and in the Southeast; however, as shown in Table 4, the sources of change in those areas appear to be different.

Comparative salary information across time for pharmacists and the general population revealed that, nationally, salaries grew significantly for pharmacists between 1990 and 2000 and that pharmacists earned substantially more than the general population of working, college-educated Americans. Specifically, the average wages (in 2000 U.S. dollars) for pharmacists increased from \$26.58 per hour to \$33.08 per hour (17% increase), while the average wages for all college graduates increased from \$26.37 to \$28.76 (9% increase). Table 4 shows wage changes by state.

Despite the general U.S. market clearly moving towards substantial. In 32 states, a demand-driven shortage is evidenced by increases in relative wages and relative numbers of pharmacists. Reductions in both relative wages and pharmacist counts occurred in only two states (Wyoming and North Carolina). A reduction in supply is suggested by the increased relative wages along with fewer pharmacists per 100,000 population observed in a fair number of states.

## Discussion

Despite the general U.S. market clearly moving towards higher pharmacist salaries, the variation across states was substantial. In 32 states, a demand-driven shortage is evidenced by increases in relative wages and relative numbers of pharmacists. Reductions in both relative wages and pharmacist counts occurred in only two states (Wyoming and North Carolina). A reduction in supply is suggested by the increased relative wages along with fewer pharmacists per 100,000 population observed in a fair number of states.

Specific reasons for the differing pharmacist totals are beyond the scope of the analyses but may result from variance in the underlying demand for pharmacist services or different delivery methods of pharmaceutical care across states. For example, relatively high pharmacist growth in Florida may be related to population growth, particularly among those older than 65 years. There may also have been changes in the demand for specific pharmacist services, such as counseling on specific products, that were not captured in the data used here. In contrast, technology changes such as mail-service delivery may explain why certain states had small positive or even negative changes in numbers of pharmacists during this period. Two important areas for future research are to examine the productivity of pharmacists across states and differences in the general provision of services across states. Are pharmacists in the West more productive, such that fewer are needed per population, or are they providing fewer services?

Younger pharmacists are more likely to migrate than older pharmacists and the population in general. This suggests that state policy regarding migration would tend to have the greatest effect on younger pharmacists. High levels of migration from a state by younger pharmacists does not necessarily mean lower overall supply if there are large numbers of pharmacy school graduates in a state. Overall, with the recent opening of new pharmacy schools and colleges and the expansion of existing programs, the total number of graduates per year has been increasing.<sup>[22]</sup> The relatively high migration levels for young pharmacy school graduates suggest that future dynamics in this labor market are important to track.

Despite increased numbers of pharmacists, the demand-driven shortage clearly has had a major impact on the market. Substantial increases in pharmacist wages relative to similarly educated workers were observed over the decade studied. However, not all states experienced large increases in wages and not all states saw an increase in the number of working pharmacists. These differences in market reactions are difficult to explain with available data. In general, employer surveys have shown similar levels of difficulty across states in filling pharmacist positions; this would suggest similar market pressures to increase wages on the part of all employers.<sup>[4]</sup> Why wage changes would not be similar across states is a question for future research. Basic characteristics of the population, such as age, wealth, and health status, as well as availability of technology, use of technicians, and local policy decisions related to pharmacists, can all have an impact on market equilibrium. The data discussed here provide important baseline information, but a definite need remains for more detailed data collection and synthesis, and a great deal more research to gain an understanding of what drives supply and demand in the market for pharmacists and the effect on the health of the population.

## Limitations

The results of this research should be interpreted in the context of limitations in the analysis. In the Census data, pharmacists are identified based on self-reported occupation rather than licensure and/or employment records. Therefore, the totals reported here may differ from those using licensure information. In addition, totals by state are based on sampling weights from the 5% PUMS, which introduces inherent sampling-related error. This limitation may have greater relevance in states with small populations or limited numbers of pharmacists.

The analysis is based on the most recent Census (2000) data available. The Census is completed every 10 years, and the PUMS data are typically released around 4 years after the survey. Hence, these are the latest available data that examine the pharmacist market across states. Data from 2000 may not represent current levels of pharmacists. However, the distribution of pharmacists across states is unlikely to have changed substantially enough to negate the general findings, and many of the relationships examined (such as migration patterns across age and relationships between net migration and new pharmacy school graduates) would not be expected to change considerably over time.

The migration statistics are based on information on the state of residence 5 years previously. Hence, multiple state changes between 1995 and 2000 would not be counted in the migration analyses.

Further, the pharmacy school graduate data and Census data are from separate sources that cannot be linked. Hence, the migration patterns of pharmacy school graduates are not able to be determined, and whether pharmacists migrated for work, school, or other reasons is unknown. Nevertheless, the data presented here provide a reasonable estimate of the migration patterns of pharmacists across age ranges.

## Conclusion

As the United States moves towards greater reliance on the use of medications to manage medical conditions, understanding the pharmacist market will grow increasingly important. This report provides a variety of descriptive information about general supply levels and sources of change in the supply of pharmacists. The general variance seen across states in broad measures of supply, as well as underlying causes of the dynamics of supply, remains unexplained, and detailed, consistent data at the state level are scarce. Increased effort to measure and evaluate the labor market for pharmacists is needed, particularly on a longitudinal basis.

Clearly, ample room exists for future research to identify and measure structural factors related to pharmacist productivity (e.g., available technology, use of technicians, payment policies) and the underlying demand for pharmacist services (e.g., patient characteristics, insurance coverage, practice patterns of physicians). Finally, more effort should be made to establish data that can be used to identify and examine the effect of policy decisions surrounding the pharmacist labor market (e.g., licensure rules, laws regarding technicians, local tax incentives). Given the constraints imparted by the available data, a strong argument can be made for increased investment into tracking the pharmacist workforce.

## References

1. Health Resources and Services Administration. The pharmacist workforce: a study of the supply and demand for pharmacists. Bethesda, Md.: Health Resources and Services Administration, U.S. Department of Health and Human Services; 2000.
2. Cooksey JA, Knapp KK, Walton SM, et al. Challenges to the pharmacist profession from escalating pharmaceutical demand. *Health Aff (Millwood)*. 2002;21:165–73.
3. Knapp KK, Livesey JC. The Aggregate Demand Index: measuring the balance between pharmacist supply and demand. *J Am Pharm Assoc*. 2002;42:391–8
4. Knapp KK, Quist RM, Walton SM, Miller LM. Update on the pharmacist shortage: national and state data through 2003. *Am J Health Syst Pharm*. 2005;62:492–9.
5. Pharmacy Manpower Project. Aggregate Demand Index. Accessed at [www.pharmacymanpower.com](http://www.pharmacymanpower.com), March 1, 2006.
6. Mott DA. Pharmacist turnover, length of service, and reasons for leaving: 1983–1997. *Am J Health Syst Pharm*. 2000;57:975–84.
7. Gershon SK, Cultice JM, Knapp KK. How many pharmacists are in our future? The Bureau of Health Professions projects supply to 2020. *J Am Pharm Assoc*. 2000;40:757–64.

8. Vector Research, Inc. Pharmacy manpower project: state and national survey reports. Ann Arbor, Mich.: Vector Research, Inc.; 1994.
9. Walton SM, Cooksey JA, Knapp KK, et al. An analysis of pharmacists and the total pharmacist-related workforce from 1998–2000: assessing workforce predictors and differences across states. *J Am Pharm Assoc.* 2004;44:673–83.
10. Cline RR, Mott DA. Job matching in pharmacy labor markets: a study in four states. *Pharm Res.* 2000;17:1537–45.
11. Cline RR. Disequilibrium and human capital in pharmacy labor markets: evidence from four states. *J Am Pharm Assoc.* 2003;43:702–9.
12. Zgarrick D, Fjortoft N. Pharmacist compensation in Illinois. Part I: overall marketplace trends. *KeePosted* 2002;28(6):18–27.
13. Cardinale V. Are rising wages and generous benefits enough to attract pharmacists and keep them from roaming? *Drug Top.* Accessed at [www.drugtopics.com/drugtopics/content/contentDetail.jsp?id=151425](http://www.drugtopics.com/drugtopics/content/contentDetail.jsp?id=151425), March 1, 2006.
14. Cooksey JA, Walton SM, Stankewicz T, Knapp KK. Pharmacy school graduates by state and region: 1990–1999. *J Am Pharm Assoc.* 2003;43:463–9.
15. US Census Bureau. The Census of Population and Housing, 1990 [United States]: Public Use Microdata Sample: 5-Percent Sample.
16. US Census Bureau. The Census of Population and Housing, 2000 [United States]: Public Use Microdata Sample: 5-Percent Sample.
17. US Census Bureau. State population estimates and demographic components of population change: April 1, 1990 to July 1, 1999. ST-99-2. Accessed at [www.census.gov/population/estimates/state/st-99-2.txt](http://www.census.gov/population/estimates/state/st-99-2.txt), March 1, 2006.
18. US Census Bureau. Population, housing units, area, and density (geographies ranked by total population): 2000. GCT-PH1-R. Accessed at [http://factfinder.census.gov/servlet/GCTTable?\\_bm=y&-geo\\_id=01000US&-\\_box\\_head\\_nbr=GCTPH1-R&-ds\\_name=DEC\\_2000\\_SF1\\_U&-redoLog=false&-format=US-9S&-mt\\_name=DEC\\_2000\\_SF1\\_U\\_GCTPH1R\\_US9S](http://factfinder.census.gov/servlet/GCTTable?_bm=y&-geo_id=01000US&-_box_head_nbr=GCTPH1-R&-ds_name=DEC_2000_SF1_U&-redoLog=false&-format=US-9S&-mt_name=DEC_2000_SF1_U_GCTPH1R_US9S), March 1, 2006.
19. Bureau of Labor Statistics. Inflation calculator. Accessed at [www.bls.gov/cpi/home.htm](http://www.bls.gov/cpi/home.htm), March 1, 2006.
20. Pedersen CA, Doucette WR, Gaither CA, et al. Final report of the National Pharmacist Workforce Survey: 2000: Midwest Pharmacy Workforce Research Consortium. Accessed at [www.aacp.org/](http://www.aacp.org/), March 1, 2006.
21. Mott DA, Doucette WR, Gaither CA, et al. A ten-year trend analysis of pharmacist participation in the workforce. *Am Pharm Educ.* 2002;66:223–33.
22. Hussar DA. How many colleges of pharmacy is enough? *J Am Pharm Assoc.* 2005;45:428–30.

## *Sidebar: At a Glance*

### **Synopsis**

The 5% Public Use Microdata Samples data on pharmacists from the 1990 and 2000 U.S. Census surveys and data from the authors' previous research on pharmacy school graduates were used to evaluate nationwide and state-level changes in the pharmacist labor market. On the national level, the ratio of pharmacists to 100,000 population increased from 70 to 76, but 13 states experienced declines, and wide variations were observed from state to state. In terms of pharmacy school graduates, New York produced the greatest number, while Alaska, Delaware, Hawaii, Maine, Nevada, New Hampshire, and Vermont had no pharmacy graduates in the 1990s. An overall reduction in pharmacist supply was suggested in several states combined with fewer pharmacists per 100,000 population. Younger pharmacists (age 24-35 years) migrated more frequently than older pharmacists, and Florida had the greatest inflow of migrating pharmacists. Generally for the United States, a constrained supply is illustrated by the observation of a 17% increase in average wages for pharmacists from 1990 to 2000—nearly double that for college-educated Americans overall.

### **Analysis**

Specific reasons for the state-to-state variance in pharmacist supply are not easily identified. Florida, for example, underwent a relatively large increase in pharmacist supply despite having one of the strictest licensure policies in the country. California, and western states in general, continued to have lower numbers of pharmacists per population, but it is unclear whether pharmacists in the West are more productive, such that fewer are needed per population, or whether overall fewer services are being provided. Changes in technology, such as mail-service delivery, may help to explain why certain states had small positive or even negative changes in numbers of pharmacists during the period of study. Further research examining the productivity of pharmacists across states and differences in the general provision of services is

needed.

### **Acknowledgements**

To Kathleen Odell, University of Illinois at Chicago, for assistance with the data analysis.

### **Funding Information**

Supported by the Health Resources and Services Administration, Bureau of Health Professions (grant U79 HP 00002 1 U76 MB 10004-01), through the Midwest Center for Health Workforce Studies.

### **Reprint Address**

Correspondence: Surrey M. Walton, PhD, Department of Pharmacy Administration (M/C 871), College of Pharmacy, University of Illinois at Chicago, 833 S. Wood St., Rm. 241, Chicago, IL 60612. Fax: 312-996-0868. E-mail: [walton@uic.edu](mailto:walton@uic.edu)

**Surrey M. Walton, PhD**, is Associate Professor, Department of Pharmacy Administration, College of Pharmacy, University of Illinois at Chicago.

**Katherine K. Knapp, PhD**, is Professor and Dean, College of Pharmacy, Touro University, Vallejo, Calif.

**Laura Miller, PhD**, is Senior Economist, National Association of Chain Drug Stores, Alexandria, Va.

**Glen T. Schumock, PharmD, MBA, FCCP**, is Associate Professor, Department of Pharmacy

Disclosure: The authors declare no conflicts of interest or financial interests in any products or services mentioned in this article, including grants, employment, gifts, stock holdings, or honoraria.

**See Figures and Tables below**

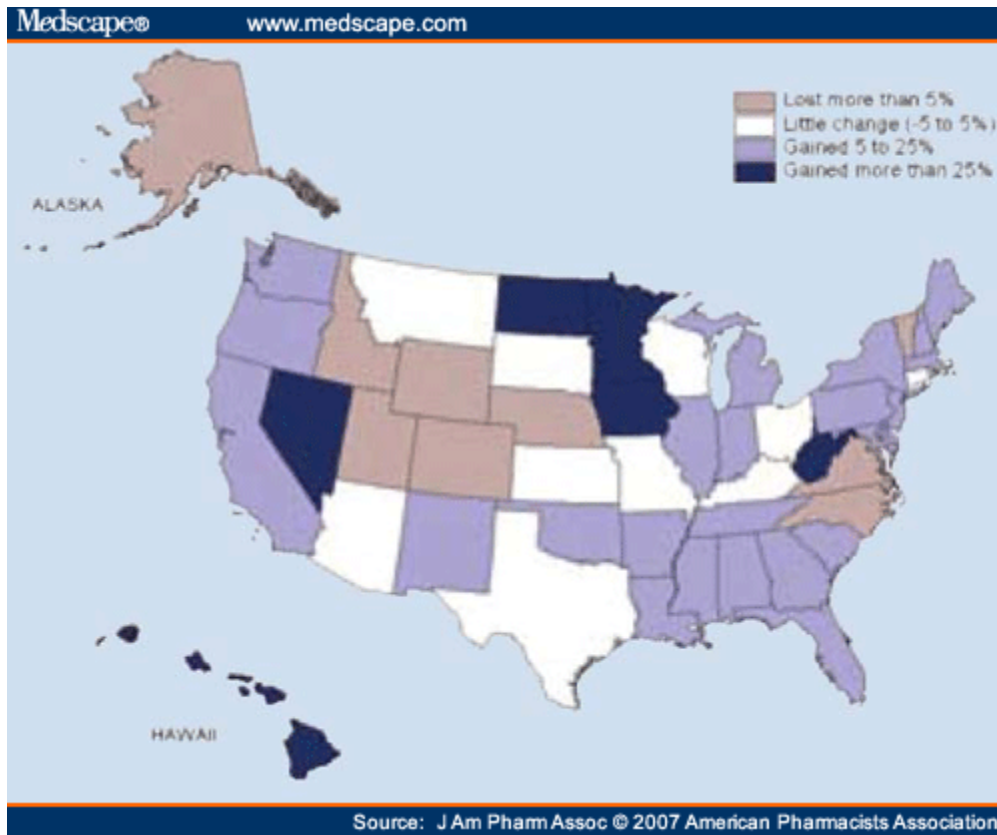


Figure 1. Percentage Change (1990–2000) in U.S. Resident Pharmacists Per 100,000 Population

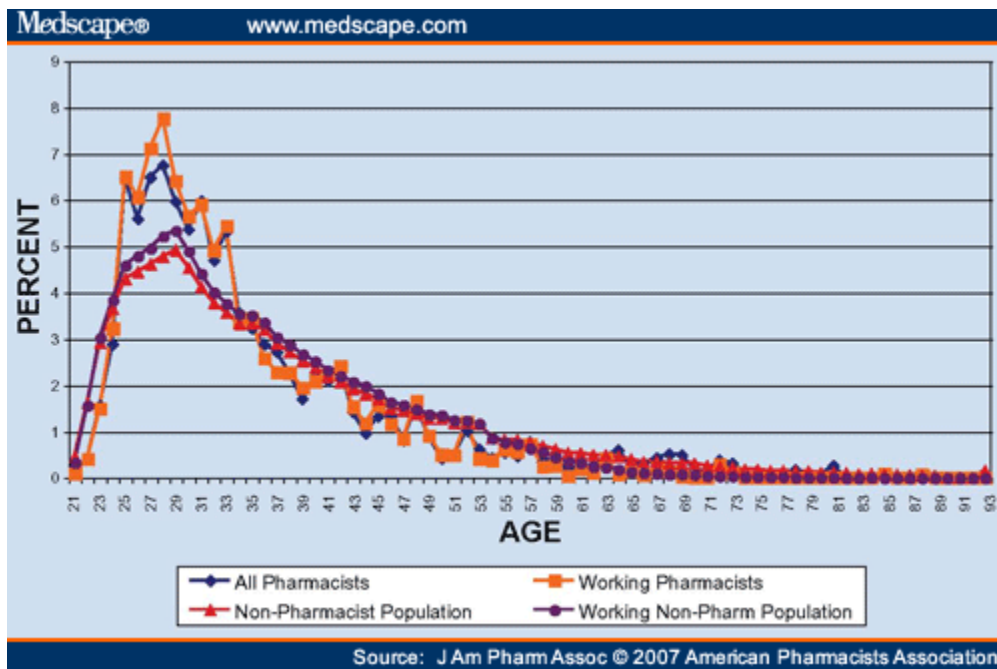


Figure 2. Percentage Migration of Working and All Pharmacists and of Working and All of U.S. General Population in 2000 by Age

**Table 1. Total State Population and Population Older Than 65 Years**

| States                                      | 1990 total state population No. | 2000 total state population No. | 1990 population >65 years No. (%) | 2000 population >65 years No. (%) |
|---|---------------------------------|---------------------------------|-----------------------------------|-----------------------------------|
| Alabama                                     | 4,040,389                       | 4,447,100                       | 486,038 (12)                      | 576,503 (13)                      |
| Alaska*                                     | 550,043                         | 626,932                         | 19,840 (4)                        | 34,776 (6)                        |
| Arizona                                     | 3,665,339                       | 5,130,632                       | 442,405 (12)                      | 668,033 (13)                      |
| Arkansas                                    | 2,350,624                       | 2,673,400                       | 325,087 (14)                      | 374,345 (14)                      |
| California                                  | 29,811,427                      | 33,871,648                      | 2,897,228 (10)                    | 3,586,264 (11)                    |
| Colorado                                    | 3,294,473                       | 4,301,261                       | 302,241 (9)                       | 417,066 (10)                      |
| Connecticut                                 | 3,287,116                       | 3,405,565                       | 410,258 (12)                      | 471,379 (14)                      |
| Delaware*                                   | 666,168                         | 783,600                         | 73,486 (11)                       | 101,440 (13)                      |
| District of Columbia*                       | 606,900                         | 572,059                         | 71,026 (12)                       | 69,933 (12)                       |
| Florida                                     | 12,938,071                      | 15,982,378                      | 2,209,854 (17)                    | 2,806,660 (18)                    |
| Georgia                                     | 6,478,149                       | 8,186,453                       | 606,982 (9)                       | 786,402 (10)                      |
| Hawaii                                      | 1,108,229                       | 1,211,537                       | 114,590 (10)                      | 161,356 (13)                      |
| Idaho*                                      | 1,006,734                       | 1,293,953                       | 111,236 (11)                      | 147,123 (11)                      |
| Illinois                                    | 11,430,602                      | 12,419,293                      | 1,331,616 (12)                    | 1,492,697 (12)                    |
| Indiana                                     | 5,544,156                       | 6,080,485                       | 644,747 (12)                      | 755,041 (12)                      |
| Iowa  | 2,776,831                       | 2,926,324                       | 399,188 (14)                      | 436,464 (15)                      |
| Kansas                                      | 2,477,588                       | 2,688,418                       | 319,463 (13)                      | 354,790 (13)                      |
| Kentucky                                    | 3,686,892                       | 4,041,769                       | 432,577 (12)                      | 505,144 (12)                      |
| Louisiana                                   | 4,221,826                       | 4,468,976                       | 432,675 (10)                      | 518,010 (12)                      |
| Maine                                       | 1,227,928                       | 1,274,923                       | 149,698 (12)                      | 183,330 (14)                      |
| Maryland                                    | 4,780,753                       | 5,296,486                       | 477,323 (10)                      | 597,048 (11)                      |
| Massachusetts                               | 6,016,425                       | 6,349,097                       | 760,208 (13)                      | 858,931 (14)                      |
| Michigan                                    | 9,295,287                       | 9,938,444                       | 1,025,274 (11)                    | 1,217,439 (12)                    |
| Minnesota                                   | 4,375,665                       | 4,919,479                       | 508,679 (12)                      | 593,962 (12)                      |
| Mississippi                                 | 2,575,475                       | 2,844,658                       | 297,690 (12)                      | 345,891 (12)                      |
| Missouri                                    | 5,116,901                       | 5,595,211                       | 667,432 (13)                      | 761,401 (14)                      |
| Montana*                                    | 799,065                         | 902,195                         | 99,200 (12)                       | 119,855 (13)                      |
| Nebraska                                    | 1,578,417                       | 1,711,263                       | 209,145 (13)                      | 232,242 (14)                      |
| Nevada                                      | 1,201,675                       | 1,998,257                       | 116,012 (10)                      | 218,622 (11)                      |
| New Hampshire                               | 1,109,252                       | 1,235,786                       | 116,200 (10)                      | 148,106 (12)                      |
| New Jersey                                  | 7,747,750                       | 8,414,350                       | 953,612 (12)                      | 1,110,795 (13)                    |
| New Mexico                                  | 1,515,069                       | 1,819,046                       | 149,499 (10)                      | 212,102 (12)                      |
| New York                                    | 17,990,778                      | 18,976,457                      | 2,183,554 (12)                    | 2,456,373 (13)                    |
| North Carolina                              | 6,632,448                       | 8,049,313                       | 742,149 (11)                      | 972,080 (12)                      |
| North Dakota*                               | 638,800                         | 642,200                         | 85,740 (13)                       | 94,539 (15)                       |
| Ohio  | 10,847,115                      | 11,353,140                      | 1,307,316 (12)                    | 1,507,518 (13)                    |
| Oklahoma                                    | 3,145,576                       | 3,450,654                       | 392,249 (12)                      | 454,607 (13)                      |
| Oregon                                      | 2,842,337                       | 3,421,399                       | 363,020 (13)                      | 436,861 (13)                      |
| Pennsylvania                                | 11,882,842                      | 12,281,054                      | 1,700,199 (14)                    | 1,922,917 (16)                    |
| Rhode Island*                               | 1,003,464                       | 1,048,319                       | 140,714 (14)                      | 151,798 (14)                      |
| South Carolina                              | 3,486,310                       | 4,012,012                       | 363,801 (10)                      | 488,074 (12)                      |
| South Dakota*                               | 696,004                         | 754,844                         | 96,588 (14)                       | 108,813 (14)                      |
| Tennessee                                   | 4,877,203                       | 5,689,283                       | 571,203 (12)                      | 706,134 (12)                      |
| Texas                                       | 16,986,335                      | 20,851,820                      | 1,577,958 (9)                     | 2,066,585 (10)                    |
| Utah  | 1,722,850                       | 2,233,169                       | 139,269 (8)                       | 191,653 (9)                       |
| Vermont*                                    | 562,758                         | 608,827                         | 59,184 (11)                       | 76,091 (12)                       |
| Virginia                                    | 6,189,197                       | 7,078,515                       | 611,478 (10)                      | 788,814 (11)                      |
| Washington                                  | 4,866,669                       | 5,894,121                       | 534,165 (11)                      | 659,658 (11)                      |
| West Virginia                               | 1,793,477                       | 1,808,344                       | 250,067 (14)                      | 273,831 (15)                      |
| Wisconsin                                   | 4,891,954                       | 5,363,675                       | 609,914 (12)                      | 703,843 (13)                      |
| Wyoming*                                    | 453,589                         | 493,782                         | 44,461 (10)                       | 57,437 (12)                       |
| <b>U.S. total/average</b>                   | <b>248,790,925</b>              | <b>281,421,906</b>              | <b>28,933,538 (12)</b>            | <b>34,980,776 (13)</b>            |
| <b>Population-weighted U.S. average (%)</b> |                                 |                                 | <b>12</b>                         | <b>12</b>                         |

\*Denotes the 10 states with the lowest total population in 1990.

**Table 2. Resident Pharmacists Per 100,000 State Population in 1990 and 2000**

| States                           | 1990 resident pharmacists No. | 2000 resident pharmacists No. | Change in resident pharmacists (1990–2000) % | 1990 resident pharmacists per 100,000 population % | 2000 resident pharmacists per 100,000 population % | Change in pharmacists per 100,000 population % |
|----------------------------------|-------------------------------|-------------------------------|--|--|--|--|
| Alabama                          | 3,243                         | 4,247                         | 31   | 80.3   | 95.5   | 19   |
| Alaska*                          | 255                           | 190                           | -25  | 46.4   | 30.3   | -35  |
| Arizona                          | 2,542                         | 3,748                         | 47   | 69.4   | 73.1   | 5  |
| Arkansas                         | 1,749                         | 2,153                         | 23   | 74.4   | 80.5   | 8  |
| California                       | 17,671                        | 22,284                        | 26   | 59.3   | 65.8   | 11   |
| Colorado                         | 2,598                         | 2,863                         | 10   | 78.9   | 66.6   | -16  |
| Connecticut                      | 2,638                         | 2,616                         | -1   | 80.3   | 76.8   | -4   |
| Delaware*                        | 385                           | 562                           | 46   | 57.8   | 71.7   | 24   |
| District of Columbia*            | 250                           | 269                           | 8  | 41.2   | 47.0   | 14   |
| Florida                          | 9,054                         | 12,830                        | 42   | 70.0   | 80.3   | 15   |
| Georgia                          | 4,893                         | 7,367                         | 51   | 75.5   | 90.0   | 19   |
| Hawaii                           | 497                           | 900                           | 81   | 44.8   | 74.3   | 66   |
| Idaho*                           | 988                           | 799                           | -19  | 98.1   | 61.7   | -37  |
| Illinois                         | 7,263                         | 8,906                         | 23   | 63.5   | 71.7   | 13   |
| Indiana                          | 4,316                         | 5,642                         | 31   | 77.8   | 92.8   | 19   |
| Iowa                             | 1,739                         | 2,619                         | 51   | 62.6   | 89.5   | 43   |
| Kansas                           | 2,085                         | 2,327                         | 12   | 84.2   | 86.6   | 3  |
| Kentucky                         | 2,967                         | 3,368                         | 14   | 80.5   | 83.3   | 4  |
| Louisiana                        | 3,399                         | 4,226                         | 24   | 80.5   | 94.6   | 17   |
| Maine                            | 515                           | 628                           | 22   | 41.9   | 49.3   | 17   |
| Maryland                         | 3,427                         | 4,290                         | 25   | 71.7   | 81.0   | 13   |
| Massachusetts                    | 4,786                         | 5,500                         | 15   | 79.5   | 86.6   | 9  |
| Michigan                         | 6,015                         | 7,025                         | 17   | 64.7   | 70.7   | 9  |
| Minnesota                        | 2,921                         | 4,180                         | 43   | 66.8   | 85.0   | 27   |
| Mississippi                      | 1,836                         | 2,371                         | 29   | 71.3   | 83.3   | 17   |
| Missouri                         | 3,331                         | 3,713                         | 11   | 65.1   | 66.4   | 2  |
| Montana*                         | 669                           | 722                           | 8  | 83.7   | 80.0   | -4   |
| Nebraska                         | 1,462                         | 1,327                         | -9   | 92.6   | 77.5   | -16  |
| Nevada                           | 685                           | 1,580                         | 131  | 57.0   | 79.1   | 39   |
| New Hampshire                    | 673                           | 802                           | 19   | 60.7   | 64.9   | 7  |
| New Jersey                       | 6,445                         | 7,772                         | 21   | 83.2   | 92.4   | 11   |
| New Mexico                       | 858                           | 1,275                         | 49   | 56.6   | 70.1   | 24   |
| New York                         | 13,496                        | 15,625                        | 16   | 75.0   | 82.3   | 10   |
| North Carolina                   | 4,818                         | 5,447                         | 13   | 72.6   | 67.7   | -7   |
| North Dakota*                    | 335                           | 699                           | 109  | 52.4   | 108.8  | 108  |
| Ohio                             | 8,516                         | 8,817                         | 4  | 78.5   | 77.7   | -1   |
| Oklahoma                         | 2,551                         | 3,168                         | 24   | 81.1   | 91.8   | 13   |
| Oregon                           | 2,125                         | 3,043                         | 43   | 74.8   | 88.9   | 19   |
| Pennsylvania                     | 9,333                         | 11,389                        | 22   | 78.5   | 92.7   | 18   |
| Rhode Island*                    | 755                           | 713                           | -6   | 75.2   | 68.0   | -10  |
| South Carolina                   | 2,748                         | 3,606                         | 31   | 78.8   | 89.9   | 14   |
| South Dakota*                    | 614                           | 695                           | 13   | 88.2   | 92.1   | 4  |
| Tennessee                        | 3,696                         | 4,988                         | 35   | 75.8   | 87.7   | 16   |
| Texas                            | 10,677                        | 13,610                        | 27   | 62.9   | 65.3   | 4  |
| Utah                             | 1,333                         | 1,104                         | -17  | 77.4   | 49.4   | -36  |
| Vermont*                         | 418                           | 335                           | -20  | 74.3   | 55.0   | -26  |
| Virginia                         | 4,653                         | 4,753                         | 2  | 75.2   | 67.1   | -11  |
| Washington                       | 2,979                         | 4,475                         | 50   | 61.2   | 75.9   | 24   |
| West Virginia                    | 1,148                         | 1,506                         | 31   | 64.0   | 83.3   | 30   |
| Wisconsin                        | 3,716                         | 4,144                         | 12   | 76.0   | 77.3   | 2  |
| Wyoming*                         | 225                           | 190                           | -16  | 49.6   | 38.5   | -22  |
| U.S. total/average               | 176,291                       | 217,408                       | 24   | 70.4   | 76.0   | 9.6  |
| Population-weighted U.S. average |                               |                               | 23   | 70.9   | 77.3   | 9  |

\*Denotes the 10 states with the lowest total population in 1990.

**Table 3. Cumulative Pharmacy School Graduates, Net Migration, and Change in Counts of Pharmacists by State, Adjusted by 1990 Total State Population**

| States                           | Cumulative graduates (1990–1995) per 100,000 population | Cumulative graduates (1995–2000) per 100,000 population | Net in-migration of pharmacists (1995–2000) per 100,000 population | Net in-migration of pharmacists <30 (1995–2000) per 100,000 population | Change in resident pharmacists (1990–2000) per 100,000 population |
|----------------------------------|---|---|--|--|---|
| Alabama                          | 23  | 21  | -1   | -2   | 15  |
| Alaska*                          | 0   | 0   | -20  | -1   | -16   |
| Arizona                          | 6   | 7   | 23   | 11   | 4   |
| Arkansas                         | 13  | 15  | 4  | 1  | 6   |
| California                       | 7   | 8   | 2  | 1  | 7   |
| Colorado                         | 13  | 19  | 17   | 7  | -12   |
| Connecticut                      | 13  | 14  | -2   | -3   | -3  |
| Delaware*                        | 0   | 0   | -3   | 14   | 14  |
| District of Columbia*            | 51  | 44  | -10  | 7  | 6   |
| Florida                          | 8   | 10  | 11   | 3  | 10  |
| Georgia                          | 18  | 16  | 6  | 2  | 14  |
| Hawaii                           | 0   | 0   | 0  | 5  | 29  |
| Idaho*                           | 19  | 25  | 4  | -4   | -36   |
| Illinois                         | 5   | 11  | -6   | -1   | 8   |
| Indiana                          | 22  | 23  | -4   | -1   | 15  |
| Iowa                             | 31  | 34  | -7   | -6   | 27  |
| Kansas                           | 16  | 17  | -1   | 3  | 2   |
| Kentucky                         | 14  | 10  | 2  | 2  | 3   |
| Louisiana                        | 30  | 30  | -7   | -7   | 14  |
| Maine                            | 0   | 0   | 5  | 4  | 7   |
| Maryland                         | 10  | 8   | 2  | 1  | 9   |
| Massachusetts                    | 26  | 29  | 0  | 0  | 7   |
| Michigan                         | 13  | 15  | 3  | 1  | 6   |
| Minnesota                        | 10  | 8   | 10   | 7  | 18  |
| Mississippi                      | 19  | 15  | -3   | -1   | 12  |
| Missouri                         | 18  | 20  | -3   | -3   | 1   |
| Montana*                         | 24  | 30  | -16  | -2   | -4  |
| Nebraska                         | 39  | 46  | -18  | -5   | -15   |
| Nevada                           | 0   | 0   | 41   | 10   | 22  |
| New Hampshire                    | 0   | 0   | -3   | 9  | 4   |
| New Jersey                       | 8   | 8   | 3  | 2  | 9   |
| New Mexico                       | 19  | 24  | -8   | -2   | 13  |
| New York                         | 19  | 22  | -5   | -2   | 7   |
| North Carolina                   | 17  | 15  | 7  | 3  | -5  |
| North Dakota*                    | 44  | 43  | -42  | -32  | 56  |
| Ohio                             | 18  | 20  | -1   | 0  | -1  |
| Oklahoma                         | 28  | 28  | -8   | -9   | 11  |
| Oregon                           | 15  | 20  | 16   | 6  | 14  |
| Pennsylvania                     | 25  | 26  | -5   | -4   | 14  |
| Rhode Island*                    | 45  | 44  | -6   | 1  | -7  |
| South Carolina                   | 20  | 17  | -4   | 1  | 11  |
| South Dakota*                    | 40  | 32  | -28  | -25  | 4   |
| Tennessee                        | 7   | 8   | 6  | 7  | 12  |
| Texas                            | 10  | 9   | 6  | 4  | 2   |
| Utah                             | 13  | 13  | 4  | 0  | -28   |
| Vermont*                         | 0   | 0   | 10   | 0  | -19   |
| Virginia                         | 8   | 7   | 5  | -2   | -8  |
| Washington                       | 12  | 11  | 7  | 2  | 15  |
| West Virginia                    | 20  | 22  | -14  | -5   | 19  |
| Wisconsin                        | 11  | 11  | 2  | -1   | 1   |
| Wyoming*                         | 43  | 25  | -35  | -9   | -11   |
| U.S. average                     | 17  | 17  | -1b  | 0  | 6   |
| Population-adjusted U.S. average | 14  | 15  | 1b   | 0  | 6   |

\*Denotes the 10 states with the lowest total population in 1990.

<sup>b</sup>Non-zero averages for net immigration can be explained by in-migration from Puerto Rico and abroad.

Table 4. Pharmacists Hourly Wage, 1990 and 2000, and Percent Change

| States                              | 1990<br>pharmacists<br>hourly wage<br>(converted to<br>2000 dollars) | 2000<br>pharmacists<br>hourly wage | Change in<br>pharmacists<br>hourly wage<br>(1990–2000)<br>% |
|-------------------------------------|--|------------------------------------|---|
| Alabama                             | 26.08  | 42.67                              | 64  |
| Alaska*                             | 28.79  | 31.60                              | 10  |
| Arizona                             | 24.33  | 34.97                              | 44  |
| Arkansas                            | 22.71  | 29.36                              | 29  |
| California                          | 47.86  | 37.66                              | -21   |
| Colorado                            | 22.47  | 42.13                              | 87  |
| Connecticut                         | 27.99  | 33.16                              | 18  |
| Delaware*                           | 46.65  | 28.26                              | -39   |
| District of Columbia*               | 27.05  | 30.47                              | 13  |
| Florida                             | 29.10  | 34.44                              | 18  |
| Georgia                             | 25.44  | 32.01                              | 26  |
| Hawaii                              | 25.51  | 33.25                              | 30  |
| Idaho*                              | 22.71  | 27.37                              | 21  |
| Illinois                            | 27.74  | 33.95                              | 22  |
| Indiana                             | 26.25  | 32.59                              | 24  |
| Iowa                                | 21.94  | 28.15                              | 28  |
| Kansas                              | 26.83  | 29.40                              | 10  |
| Kentucky                            | 25.30  | 33.57                              | 33  |
| Louisiana                           | 22.16  | 29.86                              | 35  |
| Maine                               | 22.58  | 29.69                              | 31  |
| Maryland                            | 26.55  | 33.21                              | 25  |
| Massachusetts                       | 25.96  | 30.17                              | 16  |
| Michigan                            | 28.11  | 34.75                              | 24  |
| Minnesota                           | 25.82  | 30.28                              | 17  |
| Mississippi                         | 23.62  | 32.01                              | 36  |
| Missouri                            | 23.85  | 28.99                              | 22  |
| Montana*                            | 20.98  | 24.25                              | 16  |
| Nebraska                            | 19.83  | 26.06                              | 31  |
| Nevada                              | 30.40  | 33.18                              | 9   |
| New Hampshire                       | 27.66  | 32.36                              | 17  |
| New Jersey                          | 27.56  | 38.34                              | 39  |
| New Mexico                          | 24.32  | 25.64                              | 5   |
| New York                            | 26.92  | 34.25                              | 27  |
| North Carolina                      | 31.65  | 31.48                              | -1  |
| North Dakota*                       | 22.39  | 28.10                              | 25  |
| Ohio                                | 28.94  | 31.95                              | 10  |
| Oklahoma                            | 21.35  | 30.12                              | 41  |
| Oregon                              | 36.31  | 32.64                              | -10   |
| Pennsylvania                        | 26.10  | 31.88                              | 22  |
| Rhode Island*                       | 24.24  | 55.78                              | 130   |
| South Carolina                      | 28.31  | 31.24                              | 10  |
| South Dakota*                       | 21.56  | 27.00                              | 25  |
| Tennessee                           | 26.68  | 34.22                              | 28  |
| Texas                               | 30.08  | 38.22                              | 27  |
| Utah                                | 24.60  | 31.90                              | 30  |
| Vermont*                            | 22.07  | 45.28                              | 105   |
| Virginia                            | 26.11  | 31.45                              | 20  |
| Washington                          | 26.16  | 32.72                              | 25  |
| West Virginia                       | 24.75  | 32.63                              | 32  |
| Wisconsin                           | 26.61  | 34.38                              | 29  |
| Wyoming*                            | 26.81  | 21.20                              | -21   |
| U.S. total/average                  | 26.58  | 32.55                              | 25  |
| Population-weighted<br>U.S. average | 28.91  | 33.80                              | 17  |

\*Denotes the 10 states with the lowest total population in 1990.