

# IMPACT OF POPULATION CHANGE ON THE HEALTH CARE DELIVERY SYSTEM, 2000-2010:

## A STATE-LEVEL ASSESSMENT

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### ABSTRACT

*As the US population ages, the need to prepare the health care workforce to address the increased demand for health care is a matter of national concern. The distribution of health care workers is not geographically uniform: previous findings have shown that the disparities between health care needs and health care workforce are strongest in rural areas. Building on this prior research, the objectives of this study include modeling population change and health care worker flow from 2000 to 2010 to determine how changes in population size and structure were met with changes in the health care workforce. We abstracted data from the Bureau of Labor Statistics and US Census Bureau for 2000 and 2010. We conducted a state-by-state analysis assessing the associations between changes in population size – overall, 65+, and 85+ – and changes in major health care workforce categories, including physicians, nurses, technicians, and pharmacists. We used Spearman's correlation to assess associations, and employed dot-plots comparing changes in workforce to changes in population to highlight areas that have the largest disparities between health care need and health care workforce. Despite increases in population size in the Southwest, the flow of physicians and nurses has not matched the increased population, particularly for older adults (65+). In some states where the proportion and size of the older population has decreased, the health care workforce has actually increased the largest. The findings of this analysis can be used to create policies to ensure that the projected health care needs of the US population are addressed through a dedicated health care workforce. In addition, this research can be used to highlight specific geographic areas that can be targeted for increased medical care coverage. We can also project the health care needs of states and local areas in the coming decade.*

### BACKGROUND

Although the issue of labor force availability and distribution has received greater exposure in recent years, ensuring an equitable distribution of good health care workers—physicians, nurses, technicians, and others—remains an important challenge in health care administration today. [1] Current strategies to strengthen the health care have yet to yield meaningful results to address this issue.

The need to address the issue of health care labor will only increase in importance over the coming decades, as the population of baby boomers (born 1946-1964) ages. Plus, the baby boomer cohort itself is dramatically different from the existing elderly population: Baby boomers are more educated and culturally diverse than past and present elderly cohorts. [2]

Compounding this issue is the growing burden of the oldest elderly population. In 2010, approximately 4.2 million people were 85 years or older, comprising roughly 1.5 percent of the entire population. [3] The 85+ population will increase dramatically between 2025 and 2050, once the baby boomers enter this age group. By 2050, there will be at least 21 million Americans 85 years and older, comprising 5 percent of the US population. Given the current status of entitlement programs, such as Social Security and Medicare, this growth will place an enormous stress on the availability of resources.

There are numerous ethical challenges, as well. One is to ensure that rural population have access to the same quality medical care as those living in urban and suburban areas. In providing an adequate supply of health care workers in the United States, we must also avoid the “Brain Drain”—substantially depleting these vital resources from developing nations who may lack the resources necessary to care for their own populations. [4]

### OBJECTIVES

1. How is the supply of health care workers distributed in the U.S.?
2. How has the supply of health care workers changed over time?
3. Are there disparities in the distribution of health care workers by sociodemographic measures?
4. If so, how do these associations differ when examining the ratio of health care workers to the older population (65+ and 85+)?

### DATA

- Employment data from Bureau of Labor Statistics
  - Numbers of physicians, nurses, pharmacists, and some sub-classes
- United States Census Bureau
  - Population size data
    - Overall, 65+, and 85+ population
  - Socioeconomic characteristics
- Variables
  - Health care workers (various) per population
  - Health care workers per 65+ and 85+ population
  - State population density
  - State median income
- Timeframe: 2000 and 2010
- Geographic unit of analysis: State

### METHODS

- Descriptive analyses: statistics, distributions, & frequencies
- Correlations between state-level sociodemographic factors and supply of physicians, nurses, pharmacists, and others
- GIS Mapping
- Software packages: ArcGIS (mapping) and SPSS (statistics)



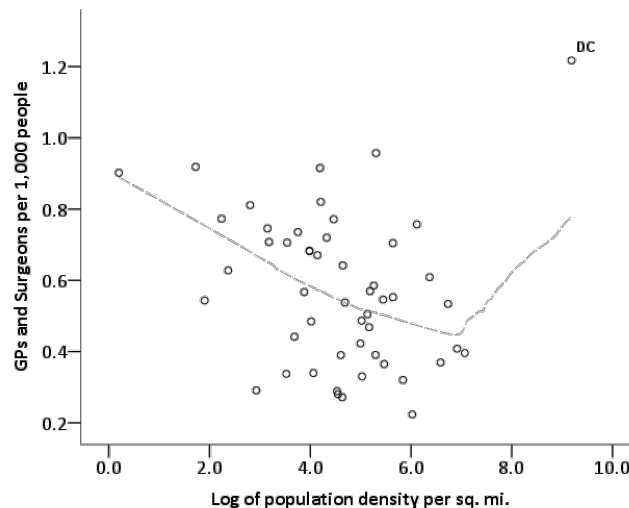
## Sociodemographic factors

**Table 1: Spearman's rho (and p-value) of the associations between health care workers per 1,000 population and sociodemographic factors**

	Workers per 1,000	Log population density	Median income
Total pop.	All health care workers	0.197 (0.165)	-0.057 (0.689)
	General practitioners	<b>-0.325 (0.020)</b>	-0.007 (0.961)
	Surgeons	<b>-0.285 (0.042)</b>	0.084 (0.559)
	Pharmacists	0.012 (0.931)	-0.255 (0.071)
	Registered nurses	0.257 (0.068)	0.004 (0.976)
65+	All health care workers	0.043 (0.766)	0.256 (0.070)
	General practitioners	<b>-0.362 (0.009)</b>	0.056 (0.699)
	GPs and surgeons	<b>-0.328 (0.019)</b>	0.143 (0.318)
	Pharmacists	-0.162 (0.255)	0.069 (0.630)
	Registered nurses	0.150 (0.295)	0.250 (0.077)

**Figure 3: Association between GPs and surgeons per 1,000 population and log of population density**

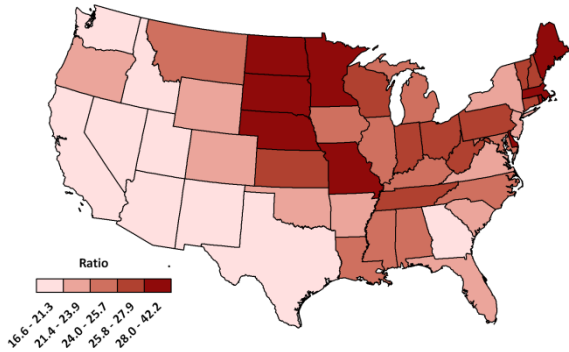
(rho = -0.29)



- Largest percent increase in population found in the western and southeastern states
- Smallest percent increases in population in Midwest and northeastern states
- Negative correlations between population density and GPs and surgeons per person
- Little association between state income and supply of health care workers

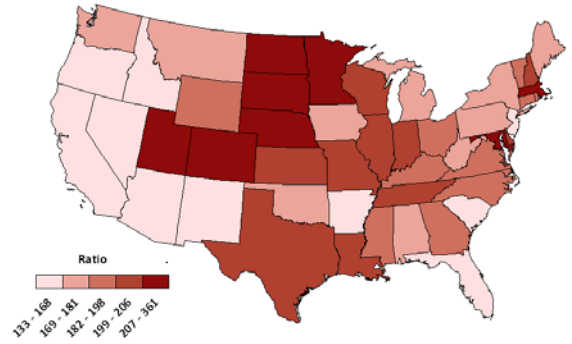
### Distribution of Healthcare Workers (per 1,000 population) in 2000

Map 1: All health care workers

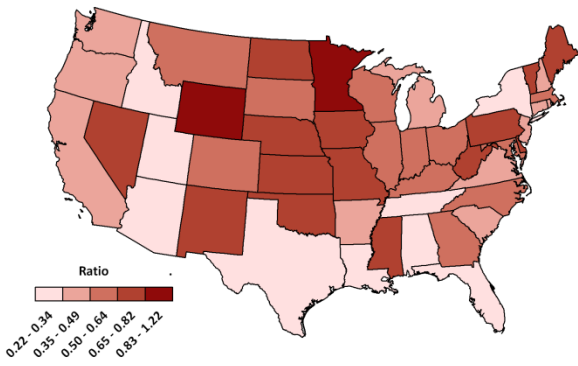


### Distribution of Healthcare Workers (per 1,000 population age 65+) in 2000

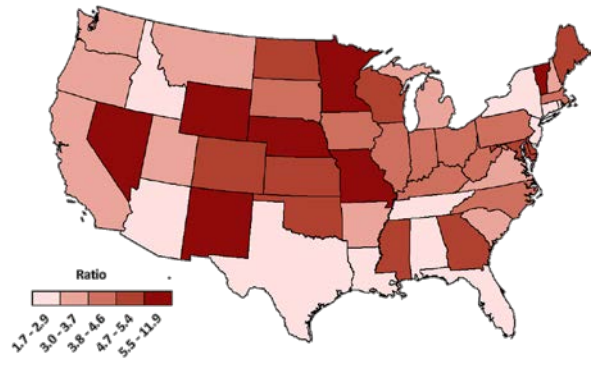
Map 5: All health care workers



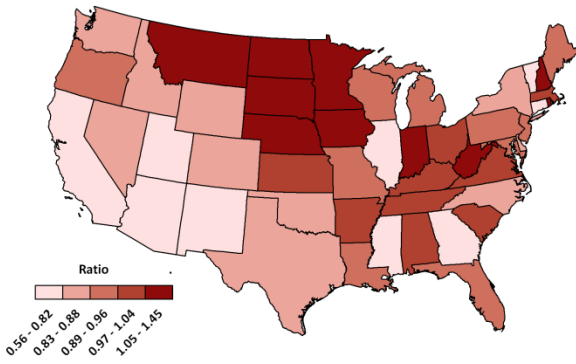
Map 2: GPs and Surgeons



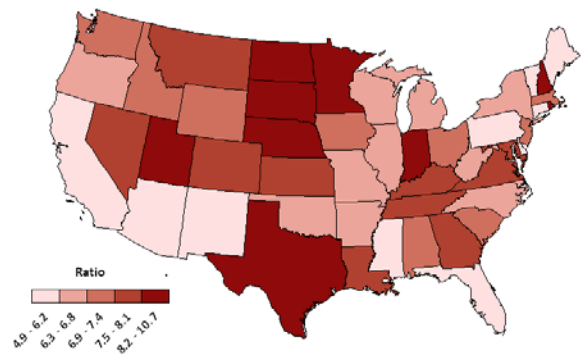
Map 6: GPs and Surgeons



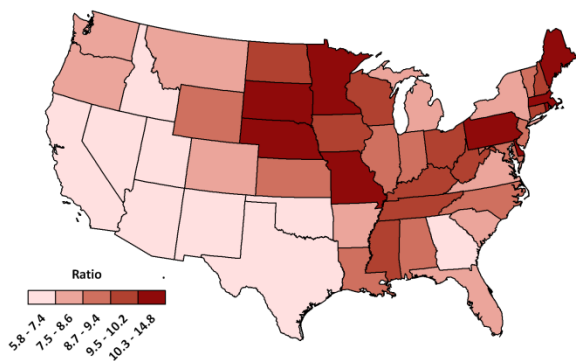
Map 3: Pharmacists



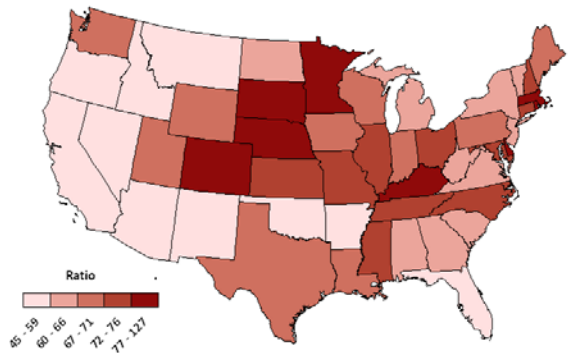
Map 7: Pharmacists



Map 4: Registered Nurses

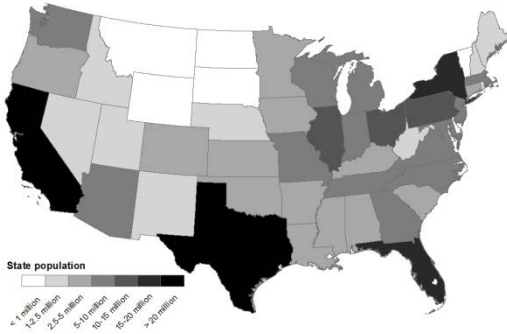


Map 8: Registered Nurses

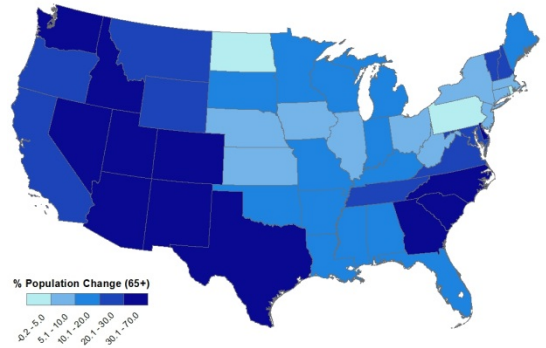


## Population change (2000-2010)

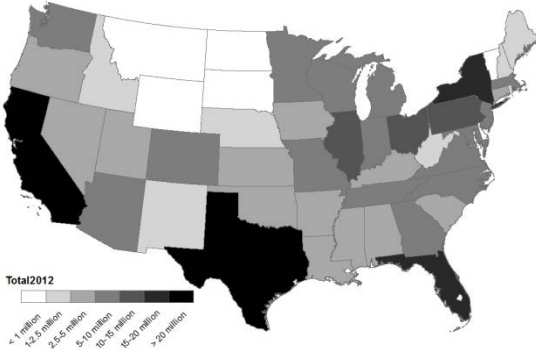
Map 9: Total population in 2000



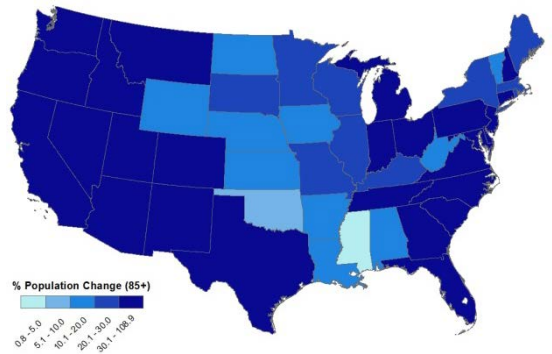
Map 12: Population change in 65+



Map 10: Total population in 2010



Map 13: Population change in 85+



Map 11: Change in total population (2000-2010)

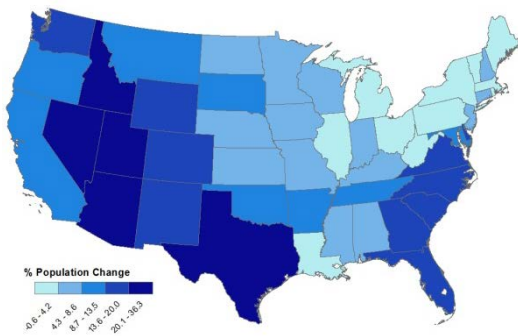
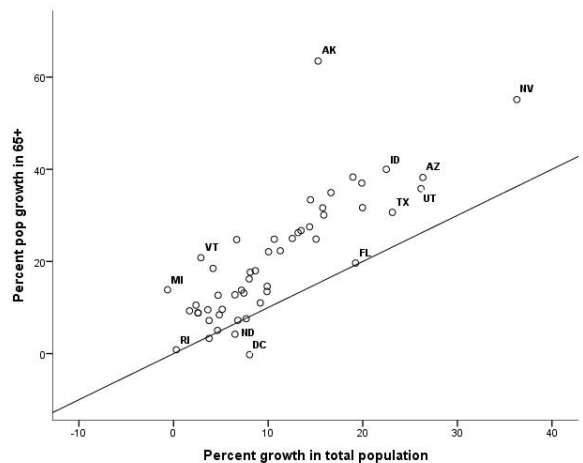


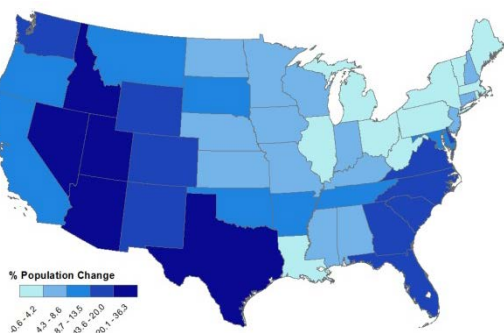
Figure 1: Percent change in 65+ population compared to percent change in overall population

(Note: Diagonal line represents where percent total growth equals percent growth in 65+)



## Comparison of population changes to health care labor force changes

Map 14: Change in total population (2000-2010) (Same as Map 11)



Map 15: Change in total health care workers

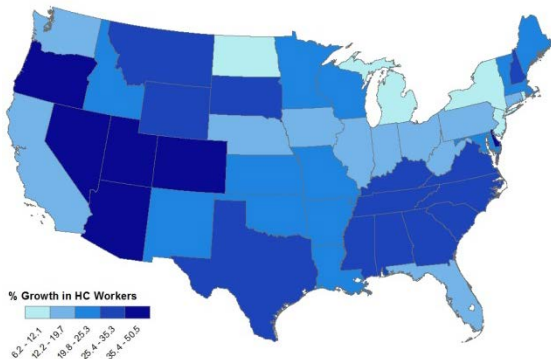
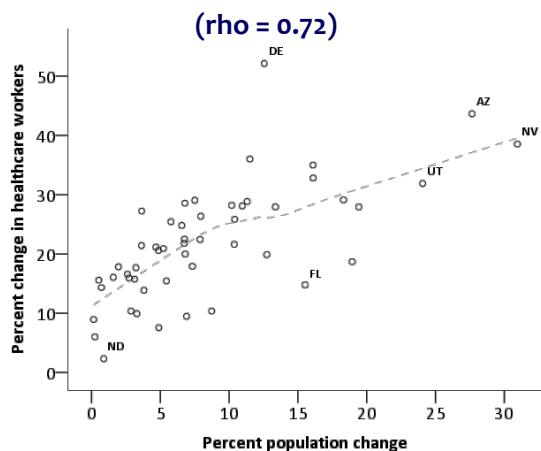


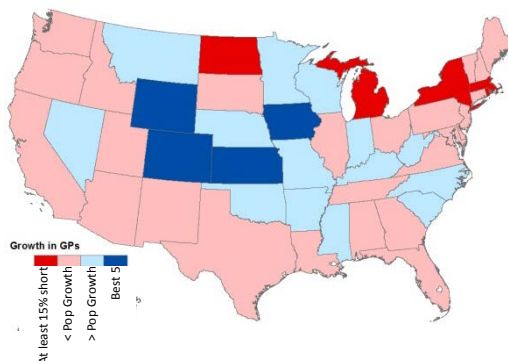
Figure 2: Association between percent change in health care workers and percent population change by state



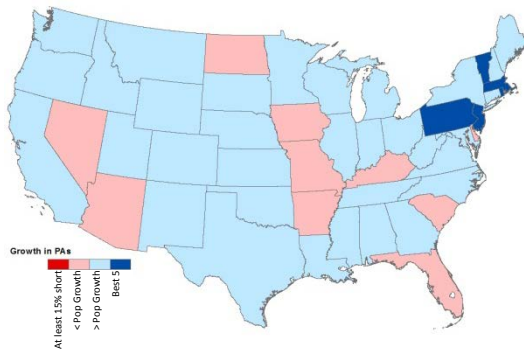
- Strong correlation between population growth and growth in the health care work force
- Disproportionately high change in health care workers compared to population growth in Delaware and South Dakota
- Disproportionately low change in health care workers compared to population growth in Florida and California

## Comparison of population changes in 65+ to occupation-specific changes (2000-2010)

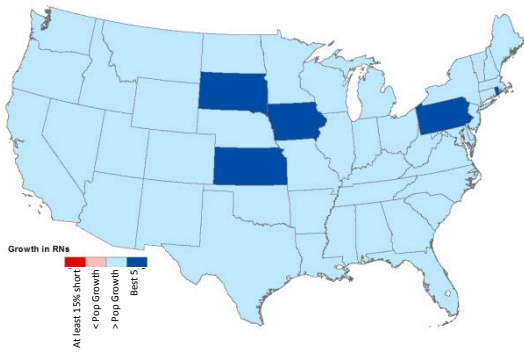
Map 16: Change in GPs relative to 65+ population change



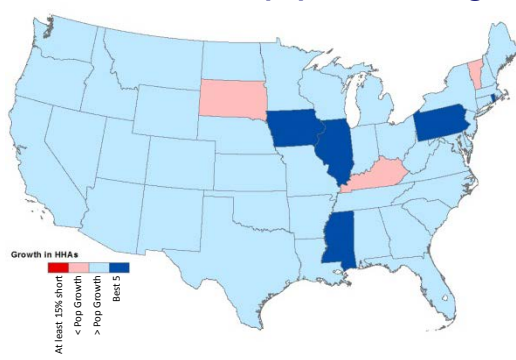
Map 17: Change in PAs relative to 65+ population change



Map 18: Change in RNs relative to 65+ population change



Map 19: Change in home health aides relative to 65+ population change



## RESULTS

- Roughly half of US states (52%) showed that the rate of growth in general practitioners fell short of the rate of population growth of people aged 65 and above.
- In 5 states (NY, MI, ND, MA, and RI) the rate of growth in general practitioners fell at least 15% short of the growth in the 65+ population.
- The physician assistant, registered nurse, and home health aide supply increased relative to population growth in 65+ for most states.
- Substantial heterogeneity within states with respect to supply of health care workers in different categories.
- Few consistencies:
  - KS and PA were had generally more favorable results than most of the rest of the states
  - IA better than most states for growth in general practitioners, nurses, and home health aides, but among the worst states for increase in physician assistants
  - RI in top 5 states for increases in physician assistants, nurses, and home health aides, but one of the worst for general practitioners

## DISCUSSION

- Distribution of health care labor force is highly inequitable across the US.
- Home health aides and registered nurses increased the most compared to increases in population size.
- Some states may do better than others at attracting and maintaining health care workers to keep up with population increases.
- The changes we observe may reflect the changing nature of how health care is delivered.
- Questions to consider raised by the analysis:
  - How will the Patient Protection and Affordable Care Act change the distribution of health care workers in the US, if at all?
  - How will the endemic and perpetually growing practice of informal caregiving to older adults with disabilities and in need of chronic care impact the supply and demand of health care workers in the US?

## FUTURE RESEARCH DIRECTIONS

- Apply methods to other types of health care worker categories
- Assess seasonality in where people are treated [4]

## LIMITATIONS

- Crude, not comprehensive measures used
- State-level means heterogeneity within states
- Two years worth of data used
- Does not address cost of living or supply of materials
- Does not address changing nature of health care delivery
- Does not address overall skill level of workforce

## STRENGTHS

- Among the first comprehensive analysis of population dynamics and dynamics of health care labor force
- Examined multiple categories of health care workers using national data
- Examined trends and factors potentially associated with those trends
- Methods can be extended to other years

## REFERENCES

1. Cohen SA. A review of demographic and infrastructural factors and potential solutions to the physician and nursing shortage predicted to impact the growing US elderly population. *J Public Health Manag Pract.* 2009 Jul-Aug;15(4):352-62.
2. US Census Bureau. U.S. interim projections by age, sex, race, and Hispanic origin: 2000–2050. <http://www.census.gov/ipc/www/usinterimproj/>. Published 2007. Accessed October 22, 2012.
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