

# The Effects Of Specialist Supply On Populations' Health: Assessing The Evidence

The evidence suggests that populations do not necessarily benefit from an overabundance of specialists in a geographic area.

by **Barbara Starfield, Leiyu Shi, Atul Grover, and James Macinko**

**ABSTRACT:** Analyses at the county level show lower mortality rates where there are more primary care physicians, but this is not the case for specialist supply. These findings confirm those of previous studies at the state and other levels. Increasing the supply of specialists will not improve the United States' position in population health relative to other industrialized countries, and it is likely to lead to greater disparities in health status and outcomes. Adverse effects from inappropriate or unnecessary specialist use may be responsible for the absence of relationship between specialist supply and mortality.

**M**ANY INTERNATIONAL COMPARISONS and within-country studies confirm the relationship between the adequacy of a health system's primary care infrastructure and better health outcomes.<sup>1</sup> This study examines the heretofore unexplored relationship between specialist physician supply and death rates, based on data from U.S. counties. After presenting our analysis, we discuss the complicated issues surrounding specialist supply and population health and the policy implications of our findings.

## Study Data And Methods

The period 1996–2000 is the most recent containing the complete set of our chosen study variables for 3,075 counties (99.9 percent of all U.S. counties). We used counties so that we could determine the robustness of prior state-level analyses.

Age-adjusted standardized mortality rates are expressed as the number of deaths per 1,000 population. All-cause mortality is among the most commonly used health status indicators, especially in studies on income inequality and health.<sup>2</sup> Heart disease and cancer are the two specific leading causes of death. Regarding the definition of *specialist* versus *primary care*, physicians engaging in office-

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*Barbara Starfield (bstarfie@jhsph.edu) is University Distinguished Professor in the Johns Hopkins School of Public Health, Baltimore, Maryland. Leiyu Shi is an associate professor there, and Atul Grover is an instructor. James Macinko is an assistant professor of public health at New York University in New York City.*

based patient care in family medicine or general practice, general internal medicine, and general pediatrics were considered primary care physicians because prior data show that only these three fulfill the criteria for primary care practice.<sup>3</sup> Other physicians were considered specialists.

For multivariate analyses, we performed pooled cross-sectional analyses (1996–2000) using the mixed-model method (the SAS PROC MIXED procedure).<sup>4</sup> This allowed us to pool observations over several years, to increase the sample size.

Two different approaches examined the relationship between primary care and specialist physicians and health. In the first, only the supply of primary care or specialist physicians was used as a predictor of mortality indicators. The second included an adjustment for population characteristics known to be associated with higher mortality: per capita income; education; unemployment; location in a metropolitan statistical area (MSA); and the percentages of the population that are elderly, are African American, or have incomes below 100 percent of the federal poverty level.

## Study Results

Exhibit 1 contains mean values for each of the variables, along with standard deviations. During the time period there was a slight mean increase in total mortality and a slight decrease in heart and cancer mortality. Per capita income rose, while

**EXHIBIT 1**  
**Description Of Study Variables, Examination Of Effect Of Specialist Supply On Populations' Health, 1996–2000**

Variable	1996		1997		1998		1999		2000	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All-cause mortality	103.65	30.42	103.19	31.1	104.31	31.8	104.46	29.2	104.61	29.42
Heart mortality	20.93	8.33	20.84	8.41	20.78	8.47	20.73	8.57	20.7	8.32
Cancer mortality	23.18	6.22	23.06	6.31	22.98	6.41	22.92	6.51	22.48	6.24
Per capita income	\$18,951	4,903	\$19,513	5,055	\$20,991	5,527	\$21,954	5,905	\$21,954 <sup>a</sup>	5,905
Percent high school education <sup>b</sup>	68.17%	14.08	68.17%	14.08	68.17%	14.08	68.17%	14.08	68.17%	14.08
Percent unemployment	6.02%	3.16	5.61%	3.01	5.27%	2.88	4.98%	2.76	4.76%	2.62
Percent elderly	14.77%	4.30	14.67%	4.26	14.73%	4.28	14.37%	4.41	14.37%	4.41
Percent African American	9.17%	14.98	9.28%	15.06	9.37%	15.16	9.46%	15.25	8.74%	14.48
Percent below poverty	15.01% <sup>c</sup>	6.34	15.01%	6.34	14.67%	5.93	14.67% <sup>d</sup>	5.93	14.67% <sup>d</sup>	5.93
Percent in MSA	26.63%	– <sup>e</sup>	26.63%	– <sup>e</sup>	26.63%	– <sup>e</sup>	26.63%	– <sup>e</sup>	26.63%	– <sup>e</sup>

**SOURCE:** National Center for Health Workforce Analysis, 2002 Area Resource File (Rockville, Md.: National Center for Health Workforce Analysis, 2002).

**NOTES:** SD is standard deviation. Mortality is deaths per 100,000 population. MSA is metropolitan statistical area.

<sup>a</sup> 1999 data.

<sup>b</sup> 1990 data.

<sup>c</sup> 1997 data.

<sup>d</sup> 1998 data.

<sup>e</sup> Not available.

unemployment, poverty, and percentage of African Americans decreased slightly.

Exhibit 2 shows the relationships between primary care physicians, specialists, and age-adjusted total, heart disease, and cancer mortality. Regression coefficients and standard errors are presented along with tests of significance. The higher the specialist-to-population ratios, the higher the mortality rates for total mortality and cancer mortality, although this relationship disappears after the sociodemographic variables are controlled for. In contrast, the greater the supply of primary care physicians, the lower the total and heart disease mortality rates, and statistical significance is maintained even after the socioeconomic and demographic characteristics are controlled for.

In additional analyses using different types of geographic areas, including seven geographic levels (MSA, non-MSA, metropolitan, metropolitan-adjacent city, nonmetropolitan-adjacent city, metropolitan-adjacent rural, and nonmetropolitan-adjacent rural) and mortality (total, heart, cancer, stroke, and infant), there are thirty-five different results for primary care and for specialist ratios, respectively (data not shown). The higher the primary care ratios, the lower the mortality for twenty-eight of the thirty-five results, with statistical significance reached in twenty of them. For the specialist ratios, the higher the ratio, the higher the mortality in twenty-five of the thirty-five results, with statistical significance reached in two. When sociodemographic characteristics were added, the ratio of primary care to population remained significantly associated with lower total, heart disease, and cancer mortality, whereas the ratio of specialist to population was generally associated with higher mortality. This shows great consistency in the directions of relationships between physician ratios and mortality outcomes.

## EXHIBIT 2

### Relationship Between Primary Care And Specialist Physician Ratios And Mortality: Regression Coefficients, Standard Errors, And Statistical Significance, 1996-2000

Mortality measure (per 100,000)	Primary care				Specialist			
	Unadjusted		Adjusted <sup>a</sup>		Unadjusted		Adjusted <sup>a</sup>	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
All-cause	-0.0353****	0.0029	-0.0086**	0.0035	0.0264****	0.0068	-0.0031	0.0051
Heart	-0.0171****	0.0011	-0.0117****	0.0005	0.0031	0.0017	-0.004**	0.0016
Cancer	-0.0039****	0.0006	-0.0006	0.0005	0.0053****	0.0007	-0.0003	0.0007

**SOURCE:** National Center for Health Workforce Analysis, 2002 Area Resource File (Rockville, Md.: National Center for Health Workforce Analysis, 2002).

**NOTES:** Numbers are regression coefficients derived from Proc-Mixed analysis. The results are interpreted as in an ordinary regression: A one-unit change in the coefficient is associated with a one-unit change in the outcome. Negative values indicate an association with lower mortality; positive values indicate an association with higher mortality.

<sup>a</sup> All values for regression coefficients adjusted for per capita income, percent high school education, percent unemployment, percent elderly, percent African American, percent below the federal poverty level, and percent in a metropolitan statistical area (MSA) or non-MSA. SE is standard error. Tests of significance were based on z-statistics.

\*\* $p < .05$  \*\*\*\* $p < .001$

## Discussion And Policy Implications

■ **The relationship between health and physician supply.** These findings are consistent with those found in previous studies showing a negative relationship between the state-level supply of primary care and death from stroke, infant mortality and low-birthweight, and all-cause mortality.<sup>5</sup> When state-level economic and demographic characteristics were controlled for, an increase of one primary care physician per 10,000 population (about a 20 percent increase) was associated with a 6 percent decrease in all-cause mortality and about a 3 percent decrease in infant, low-birthweight, and stroke mortality. For total mortality, an increase of one primary care physician per 10,000 population was associated with a reduction of 34.6 deaths per 100,000 population at the state level.<sup>6</sup>

The relative position of the United States on health indicators among countries in the Organization for Economic Cooperation and Development (OECD) is at or near the bottom for every indicator and has worsened during the most recent decade, during a time when the proportion of specialists per population has risen.<sup>7</sup> Although the United States has approximately the same number of physicians per population as the OECD average, this number masks a very different balance between generalists and specialists. The number of primary care physicians per population in the United States is 0.25 (0.75 including general internists and pediatricians), compared with one or more per population in Australia, France, and Germany.<sup>8</sup> In the United Kingdom, the number of primary care physicians is low, but the number of specialists is also low.<sup>9</sup> In fact, the specialist-to-population ratio bears little relationship to health outcomes. Although primary care-oriented countries have, in general, more generalists than specialists and better health outcomes, Sweden achieves a relatively high level of primary care practice and one of the best health outcomes with more specialists than generalists.<sup>10</sup> In most if not all Western industrialized countries, the number of visits to generalists greatly exceeds the number of visits to specialists, but this is not the case in the United States.<sup>11</sup> It appears that it is the relative roles of primary care physicians and specialists rather than their number that makes the difference in health outcomes. Evidence of this is the threefold difference between the United States and the United Kingdom in the percentage of people seen by a specialist in a year, even after differences in morbidity burden are controlled for.<sup>12</sup>

■ **The relationship between specialist supply and health outcomes.** Clues about the relationship between activities and outcomes for primary care physicians and specialists can be gleaned from evidence within the United States. In one of the first demonstrations of the relationship between physician supply and outcomes, Frank Farmer and colleagues showed that at the state level, the higher the ratio of primary care physicians to population, the better the outcomes as measured by age-specific mortality rates.<sup>13</sup> A subsequent analysis added several other measures of ill health and specialist supply while also considering supply of hospital beds, educational level and income of the population, unemployment rates, percentage urban,













