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.

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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.

MANY INTERNATIONAL COMPARISONS and within-country studies confirm the relationship between the adequacy of a health system's primary care infrastructure and better health outcomes.[1] 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.[2] 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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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.[3] 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).[4] 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

	1996		1997		1998		1999		2000	
Variable	**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[a]	5,905
Percent high school education[b]	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%[c]	6.34	15.01%	6.34	14.67%	5.93	14.67%[d]	5.93	14.67%[d]	5.93
Percent in MSA	26.63%	–[e]	26.63%	–[e]	26.63%	–[e]	26.63%	–[e]	26.63%	–[e]

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.

[a] 1999 data.

[b] 1990 data.

[c] 1997 data.

[d] 1998 data.

[e] 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[a]		Unadjusted		Adjusted[a]	
	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.

[a] 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.[5] 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.[6]

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.[7] 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.[8] In the United Kingdom, the number of primary care physicians is low, but the number of specialists is also low.[9] 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.[10] 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.[11] 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.[12]

■ **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.[13] 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,

levels of air pollution, lifestyle (individual behavior), and percentage minority. Lower primary care physician supply and higher specialist-to-population ratios were associated with higher overall age-adjusted mortality, mortality from heart disease, mortality from cancer, neonatal mortality, life span, and low-birthweight ratios.[14] Similarly, Elliott Fisher and colleagues, examining care provided to the U.S. Medicare population, showed that the higher the ratio of specialists per population, the higher the surgery rates, performance of procedures, and expenditures; that the higher the level of spending in geographic areas, the more people see specialists rather than primary care physicians; and that quality and outcomes of care, for both illnesses and preventive care, were no better in higher-spending areas.[15] In most cases, outcomes were worse in these areas, even after sociodemographic characteristics, comorbidity, and severity of illness were controlled for. Confirming these findings, Katherine Baicker and Amitabh Chandra showed that an increase of general practitioners (GPs) per 10,000 population is associated with a significant increase in quality of health services as well as a reduction in costs per beneficiary.[16] Conversely, increasing the number of specialists is associated with poor quality and higher costs.

Several other studies had similar results for specific types of specialists. The variation in numbers (per population) of neonatologists does not vary with measures of need (very low birthweight ratios); there is no relationship between the supply of neonatal resources and infant mortality; and increases in the supply of neonatologists beyond a moderate level confers no additional benefit.[17]

Studies in the state of Florida showed a similar phenomenon. Each tenth-percentile increase in primary care physician supply is associated with a statistically significant 4 percent increase in odds of early-stage (rather than late-stage) diagnosis of breast cancer.[18] The higher the specialty care physician-to-population ratio, the greater the likelihood of late-stage (rather than early-stage) diagnosis of colorectal cancer.[19] For cervical cancer, advanced-stage presentation is less common in areas well supplied with family physicians, but there is no significant relationship between these rates and the supply of specialist physicians, either in total or for obstetrician/gynecologists.[20] Melanoma is also identified at an earlier stage in areas where the supply of family physicians is high, in both urban and nonurban areas. The same is the case for the supply of dermatologists, although the effect does not reach statistical significance. In contrast, there is no relationship between the supply of other specialists and early detection of melanoma.[21]

A national study of one-year mortality among elderly adults with acute myocardial infarction (AMI) showed no differences between care provided by cardiologists and family physicians once a variety of characteristics (including comorbidity and use of guidelines) were controlled for, a finding that was considered to confirm the results of other cited studies.[22] In that study, the patients of cardiologists were less ill overall, with fewer comorbid illnesses than the patients of primary care physicians.

"From a population viewpoint, there is considerable evidence for the benefits of an increase in primary care physician supply."

Patients receiving care from specialists for conditions outside their area of specialization have higher mortality rates for community-acquired pneumonia, AMI, congestive heart failure, and upper gastrointestinal hemorrhage.[23] Several other studies indicate better, or at least equivalent, outcomes for primary care physicians as compared with specialists, starting with the Medical Outcomes Study in the 1980s.[24] More recently, Marshall Chin and colleagues demonstrated that disease-oriented specialists adhere to guidelines for processes of care related to the specific disease better than primary care physicians do, but there are no differences in short-term outcomes or satisfaction, and much lower costs for family physicians.[25] Conversely, primary care physicians achieve better generic (that is, not disease-specific) outcomes than do specialists at much lower costs, even though specialists may achieve better "quality" of care in their particular area of competence.[26]

Thus, from a population viewpoint, there is considerable evidence for the benefits (on health outcomes) of an increase in supply of primary care physicians, and no evidence for a similar effect for specialists.

■ **Evidence on adverse effects associated with an excessive supply of specialists.** A second consideration in deliberations about the need for physician personnel concerns the evidence on volume/outcome relationships. At least for hospital services, quality of care for many, if not most, operations is better when the hospital performs at least a certain number per year.[27] More recent studies had similar findings when the analysis was directed at individual surgeon volumes. Patients of high-volume surgeons have lower death rates for heart bypass surgery, carotid endarterectomy, and five other cardiovascular and cancer procedures as compared with surgeons who perform fewer such procedures. The magnitude of difference is considerable: 24 percent greater for lung resections, and four times greater for pancreatic resection.[28]

The more surgical specialists, the lower the volume of procedures for each one, unless the rate of performance of procedures also increases, which raises the specter of increasing overuse or nonindicated interventions with an increased supply of specialists. In the United States, one-third of excessive costs (compared with comparable industrialized countries) is attributed to performance of unnecessary and nonindicated procedures.[29] Despite this evidence, quality-of-care indicators focus primarily on errors of omission (nonperformance of indicated procedures) rather than errors of commission (including too many nonindicated interventions).[30] For example, approximately half of children with headaches who are referred to an academic children's hospital outpatient clinic had one or more imaging procedures, whereas established guidelines indicate that no more than 10

percent of them should have had one. More than 30 percent of the children were given therapy to prevent migraines even before referral to the headache clinic, thus raising the question of whether or not the referral was needed.[31]

The dangers of unnecessary referrals, particularly self-referrals, are documented.[32] Noralou Roos provided a dramatic example of the better short- and long-term outcomes of children whose primary care physician referred them to an ear, nose, and throat (ENT) specialist compared with outcomes in children whose parents self-referred.[33]

By virtue of their training and experience, specialists have a higher likelihood of suspecting serious pathology than is the case for primary care physicians; they have been shown to do excessive (and unnecessary) diagnostic workups to rule out what they suspect.[34] As a result, primary care physicians are better diagnosticians than specialists are, and specialist performance is better in patients referred by primary care physicians.[35] It is possible, therefore, that part of the benefit of primary care is in reducing unnecessary and inappropriate specialist visits.[36]

The third concern deals with the likely increased inequity in health associated with increasing specialization. Specialty care is more costly than primary care; to the extent that cost sharing is present, it will preferentially reduce access for the socially disadvantaged.[37] Moreover, in a country such as the United States, which has no mechanism to prevent physicians from locating in overdoctored areas, increasing the number of physicians does not reduce disparities in regional supply.[38] Thus, care will be preferentially available to the already advantaged, with increasing social disparities in health. The likelihood that access to specialists differs from access to primary care physicians is suggested by our analysis, which showed that, after sociodemographic characteristics were controlled for, specialist supply more often lost its statistically significant relationship with higher mortality, as compared with the persistence of statistical significance for the relationship between primary care physician supply and lower mortality.

A case could be made that there is some degree of overcontrol in including socioeconomic and demographic characteristics, resulting in an underestimation of the benefit of primary care and an overestimation of the benefit of specialty care. In the United States (but not in Western Europe), more socially disadvantaged people have less access to (and use of) primary care services related to their needs.[39] Thus, even where primary care is in good supply, the association between supply and mortality may underestimate the impact of primary care because deprived populations are underusing it. Thus, the apparent lessening of relationship with control for socioeconomic characteristics does not necessarily mean that the actual effect of receipt of primary care lessens. Conversely, a shift in sign (from positive to negative) in the relationship between specialist supply and some types of mortality after controlling for socioeconomic and demographic characteristics may be a result of less unnecessary use by disadvantaged people as a result of the compromised access and less use of specialists.[40]

"Greater rationalization of specialist care is occurring in several countries, particularly where waiting lists are too long."

■ **Study limitations.** Some possible limitations warrant mention. First, indicators of impact were primarily mortality rates. If specialty care improves quality of life, our results may underestimate a beneficial impact on outcomes. The same, however, might be postulated for primary care.

Second, our analysis did not examine the mortality effect of the supply of particular specialists. Subsequent researchers might disaggregate heart disease mortality into components responsive to different types of heart specialists (for example, medical and surgical) and examine mortality/specialist relationships. Similarly, the supply of oncologists could be related to cancer deaths, but even here different types of cancer (for example, skin, gastrointestinal) would have to be related to corresponding types of specialists. Because there is no limitation on the type of care provided by different types of specialists, and it is known that referrals for specific conditions often are made to different types of specialists, such analyses would have to contend with assumptions that would be very difficult to test.[41]

Third, including pediatricians in analyses when mortality is concentrated in adults may be illogical. Studies that have disaggregated the three primary care specialties have found the relationship with better health outcomes to be greater for family physicians than for the other two types of primary care physicians.[42]

■ **Policy implications.** The roles and responsibilities of primary care are well known; the same is not the case for specialty care.[43] Surgical specialists make a unique contribution through surgical interventions, but many are involved in activities other than operations. The need for specialists to deal with conditions too uncommon for primary care physicians to maintain competence in dealing with them undoubtedly is, or at least should be, the basis for specialization. Beyond this generalization, little is known about the roles of specialists. Furthermore, the boundary between "uncommon" and "not uncommon" is not well defined and may differ from place to place. In countries where specialists work in hospitals and see patients only on referral from primary care, there is a clear delineation of roles defined by what primary care physicians do. Referrals have four functions: short-term consultation for diagnosis; short-term consultation for initiation of management; long-term referral for total care of rare conditions; and recurrent consultation for continuing management.[44] Little is known about the relative balance of these functions, although short-term consultations are far more common than long-term consultations or referrals, for virtually all specialist types in the United States.[45]

Greater rationalization of specialist care is occurring in several countries, particularly where waiting lists for specialist care are perceived as too long. None of these efforts involves increasing the supply of specialists. Planning for these im-

provements is seen as a role of central or provincial governments.[46] The special role of information systems is particularly recognized in the Canadian province of Saskatchewan, which systematically collects data on waiting lists and devises clear and transparent patient prioritization processes.[47] In the United Kingdom, there is evidence that many specialist visits can be avoided. If primary care physicians are provided with cameras and the subsequent means to obtain dermatology consults directly, 25 percent of patients who otherwise would have been referred can be managed without a specialist appointment; at least 38 percent can be saved at least one dermatology visit by initiating management without the dermatologist seeing the patient.[48] Furthermore, the need for specialists can be reduced by enabling less costly professionals to do professionally more sophisticated interventions in less costly settings, as long as they are appropriately trained, maintain a reasonable volume, and are subject to assessment of unnecessary or inappropriate use.[49] Experience elsewhere also shows that countries with increasing demand for specialty services are not responding by increasing their supply. In the United Kingdom, the development of primary care physicians with specialty interests is proving successful in reducing waiting time for consults in a variety of specialist types.[50] That is, increased availability of primary care services provides a viable and much less costly alternative to increasing the number of specialists.

IN VIEW OF THE STRONG EVIDENCE that having more specialists, or higher specialist-to-population ratios, confers no advantages in meeting population health needs and may have ill effects when specialist care is unnecessary, increasing the specialist supply is not justifiable. Of course, there may be particular specialists who are in insufficient supply to meet particular needs. Moreover, there is already considerable evidence that increasing the supply of primary care physicians would have a beneficial impact on the health of the population.

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