Is Primary Care Effective?

QUANTIFYING THE HEALTH BENEFITS OF PRIMARY CARE PHYSICIAN SUPPLY IN THE UNITED STATES

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This analysis addresses the question, Would increasing the number of primary care physicians improve health outcomes in the United States? A search of the PubMed database for articles containing "primary care physician supply" or "primary care supply" in the title, published between 1985 and 2005, identified 17 studies, and 10 met all inclusion criteria. Results were reanalyzed to assess primary care effect size and the predicted effect on health outcomes of a one-unit increase in primary care physicians per 10,000 population. Primary care physician supply was associated with improved health outcomes, including all-cause, cancer, heart disease, stroke, and infant mortality; low birth weight; life expectancy; and self-rated health. This relationship held regardless of the year (1980–1995) or level of analysis (state, county, metropolitan statistical area (MSA), and non-MSA levels). Pooled results for all-cause mortality suggest that an increase of one primary care physician per 10,000 population was associated with an average mortality reduction of 5.3 percent, or 49 per 100,000 per year.

Forecasting the need for physicians is generally based on task and time projections (1) and benchmarking with health maintenance organizations rather than on assessments of the likely contributions to improving health (2). In the 1990s, these approaches predicted physician surpluses in the 2000s. However, recent analyses using macroeconomic projections of demand for health services predict physician deficits of as many as 200,000 by 2025 (3). As a consequence, the Council on Graduate Medical Education reversed its position that the United States is producing too many physicians, and it has now endorsed the view that the nation may, in fact, be producing too few (4). The purpose of this article is to summarize existing studies of the likely effect of primary care physician supply on a variety of health outcomes. It addresses the question, Would increasing the number of primary care physicians improve health outcomes in the United States?

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METHODS

Our analysis draws its data from published studies that measure the impact of primary care physician supply on health outcomes in the United States. Articles were obtained by searching the PubMed database in January 2005 for titles including the terms "primary care physician supply" or "primary care supply" for articles published between 1985 and 2005. This search revealed 86 potential articles. Hand searching of references revealed an additional 20 potential articles.

Inclusion criteria for studies were that the study must be based in the United States; address the association of primary care supply with health outcomes; control for relevant ecological variables (e.g., income, education, poverty, income inequality, or unemployment); assess effects in more than one state; and present sufficient data to establish the effect of primary care on the health outcomes in question. Based on these criteria, the final selection of articles included 17 peer-reviewed studies. Seven of these were excluded from the analyses either because the analytical techniques did not lend themselves to reanalysis or because inadequate data were presented to allow the calculation of effect size (5–11). We do include these seven studies in the discussion section.

For the remaining 10 studies, we reanalyzed the data to estimate the effect of increases in primary care physician supply at the various geographic levels. Regression coefficients, after controlling for potentially confounding characteristics (e.g., unemployment levels, average income levels, educational attainment, percentage minority population, or income inequality in the area), were used to estimate the effect of increasing the primary care physician supply variable on the health outcomes in question.

We report results as the primary care effect (percentage change in outcome associated with one more primary care physician per 10,000 population) and as the absolute change in existing outcome measures associated with this one-unit increase in primary care physicians. All results are presented with 95 percent confidence intervals (95% CI).

RESULTS

The composition of the U.S. health care workforce has changed considerably in the past 50 years. In the 1940s and 1950s, more than 50 percent of all physicians practiced primary care. Beginning in 1960, increases in specialist supply outpaced increases in primary care physician supply. Since 1975, the proportion of active physicians in primary care has been relatively stable at just below 35 percent. The composition of the primary care physician supply has fluctuated, with a declining proportion in general or family practice (currently about 12% of total physician supply) and an increasing proportion in general internal medicine (about 15%). The percentage in general pediatrics increased from about 6 percent in 1960 to about 7.5 percent in 2002 (Figure 1).

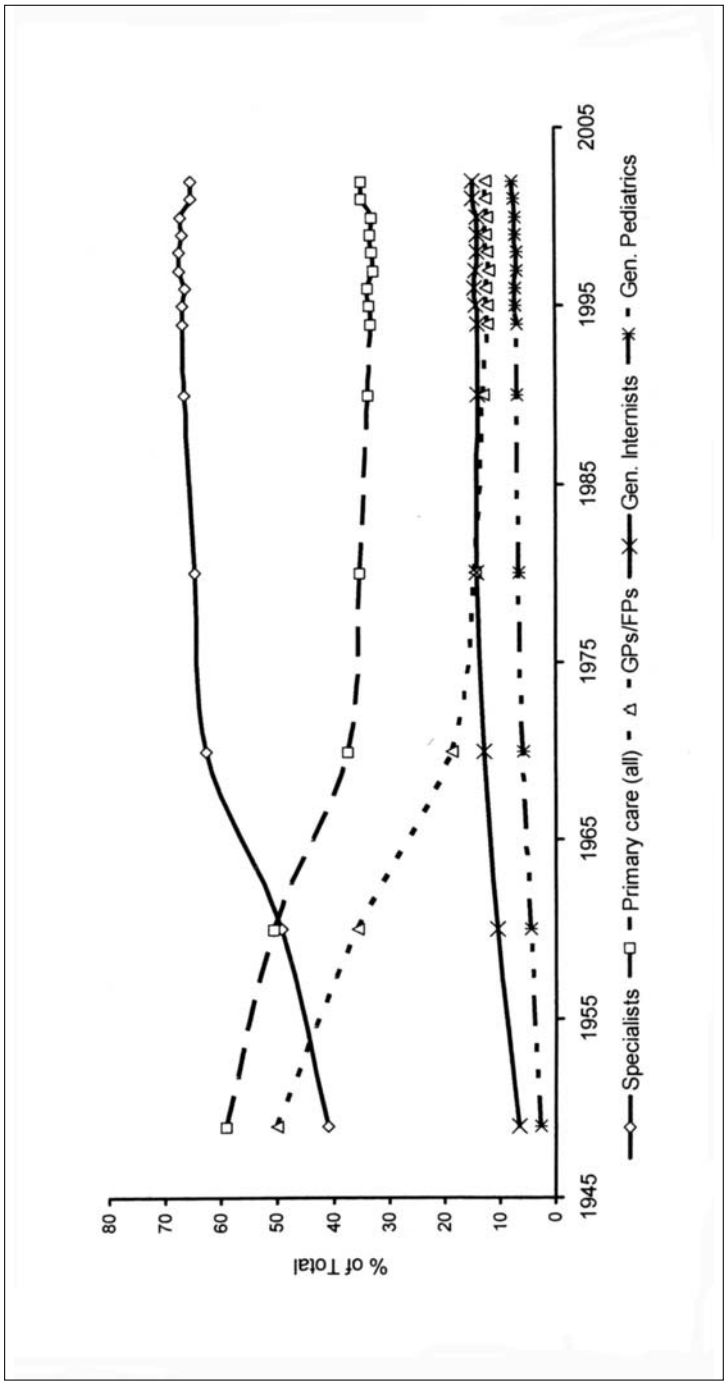

Figure 1. Composition of U.S. physician supply as proportion of total, 1945–2005. Total includes active physicians only; figures include federal physicians, who are generally excluded from most analyses. GPs, general practice; FPs, family practice. Source: National Center for Health Statistics, Health, United States, 2004, Hyattsville, MD, 2004.

The state mean for active, nonfederal, office-based primary care physicians per 10,000 population (hereafter, PCP/10,000) steadily increased from about 5 PCP/10,000 in 1980 to 8 PCP/10,000 in 2000, with a considerable increase in 1995. The average ratio for counties was about 5 PCP/10,000 in the 1990s and has steadily increased over time to about the same level as state averages (Figure 2).

Table 1 provides a summary of the 20 analyses of the 10 studies. Analyses 1 through 5 cover two different studies (12, 13) that assess the relationship between ratios of primary care physician to population and all-cause mortality at the state level, for each of the specified years between 1980 and 1995. Analyses 6 through 10 are longitudinal analyses at the state level that pool data over a 10-year period (1985–1995). The total sample size is 549 (one data point—Delaware in 1991—was dropped from these studies because of incomplete data). These studies assess the effect of primary care supply on mortality for black and for white populations (14), on low birth weight and infant mortality (15), and on stroke mortality (16). Analyses 11 through 13 assess the effects of county-level primary care supply on heart disease, cancer, and total mortality rate (17), and analyses 14 through 16 assess the same relationships but restricted to rural areas (defined as non-metropolitan statistical areas, or non-MSAs) (18). Analyses 17 and 18 compare mortality between black and white populations in metropolitan statistical areas (MSAs) in 1990 (19). Finally, analyses 19 and 20 examine self-rated health and state-level primary care supply (20, 21).

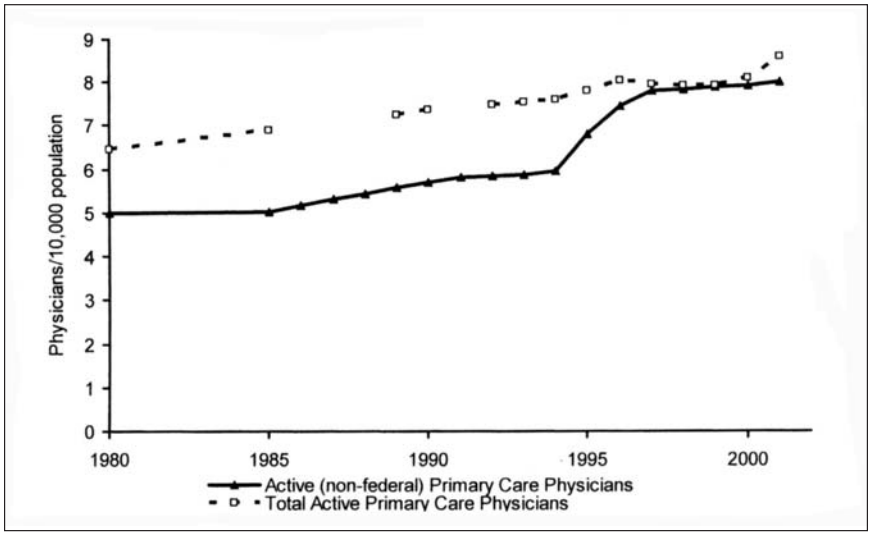

Figure 2. Active, nonfederal, office-based primary care physicians per 10,000 population, United States, 1980–2001. Data for total primary care physicians for 1985 and 1989 were modeled based on average rates of increase. *Source:* Authors' calculations from AMA Master Files.

Primary care supply was measured in two different but related ways. The most common method is a continuous measure of number of primary care physicians per 10,000 population. This measure is calculated at the state, county, or MSA level. The second method uses the PCP/10,000 measure to divide counties into quartiles of increasing primary care physician density. The measure compares counties in the lowest three quartiles with counties having the highest PCP/10,000. In every study, "primary care physicians" was defined as doctors of allopathic medicine working in family medicine, general practice, general internal medicine, and general pediatrics who are in active, nonfederal, office-based patient care (22). Analyses conducted at the state level generally exclude Washington, DC, but county and MSA-level analyses do include Washington, DC.

Table 1 also presents predicted improvements in health outcomes associated with an increase of one PCP/10,000. For every health outcome, the PCP/10,000 measure was found to be associated with improved outcome. In state-level analyses, reductions in all-cause mortality ranged from 1.30 to 9.08 percent, depending on the year analyzed and the study source.

For state-level all-cause mortality, an increase in primary care supply is predicted to reduce mortality by 41 to 85 per 100,000, averaging about 68 per 100,000. One additional primary care physician per 10,000 population is estimated to result in a fourfold greater reduction in mortality for black populations than for white populations.

In 1990, reductions in all-cause mortality associated with increased primary care supply were higher when analyzed at the county level (10.8%) than at the state level (4.4% to 9%, depending on the study). Reductions were lower in rural counties (2.3%). On the other hand, expected changes in mortality rates were actually higher in rural counties (24.64 per 100,000) than in all counties (17.60 per 100,000) because mortality rates are generally higher in rural areas, so even a small percentage decrease translates to a larger change in overall rates.

Cause-specific mortality showed a similar pattern. At the state level, over the period 1985–1995, an increase in primary care physician supply was associated with moderate decreases in low birth weight, infant mortality, and stroke mortality rates. At the county level, primary care supply was associated with moderate reductions in heart disease and cancer mortality. At the county level, an increase of one PCP/10,000 would result in an estimated decrease in heart, cancer, and all-cause mortality of between 0.66 and 10.79 percent. At the rural level, improvements in all outcomes except all-cause mortality were higher than those for counties. Self-rated excellent/good health would be expected to improve between 2 and 3 percent overall.

Figure 3 compares estimated percentage reductions in all-cause mortality associated with an increase of one PCP/10,000. State-level estimates for 1980, 1985, and 1995 all exceed 6 percent. Estimates for 1990 vary by study and unit of analysis. Combining all 11 results, the mean percentage reduction in all-cause mortality was 5.31 percent (95% CI, 4.76–5.85). Values for MSAs and pooled

Table 1

Predicted effects of a one unit change in primary care physician (PCP) supply on health outcomes

Analysis number (reference)	Unit of analysis	N	PCP[a]	Year	Outcome	Percent improvement in outcome with PCP increase	Absolute change in outcome with PCP increase[b]
1 (12)	States (all)	50	A	1980	Mortality, all-cause, per 100,000	7.07 (6.33–7.81)	84.57 (75.74–93.41)
2 (12)	States (all)	50	A	1985	Mortality, all-cause per 100,000	8.14 (7.29–8.99)	69.91 (62.59–77.23)
3 (12)	States (all)	50	A	1990	Mortality, all-cause, per 100,000	9.08 (7.89–10.26)	85.19 (74.11–96.28)
4 (12)	States (all)	50	A	1995	Mortality, all-cause, per 100,000	6.41 (5.83–6.98)	58.28 (53.04–63.52)
5 (13)	States (all)	50	A	1990	Mortality, all-cause, per 100,000	4.43 (3.99–4.86)	41.54 (37.42–45.66)
6 (14)	States (all)	549	A	1985–95	Mortality, whites, per 100,000	1.30 (1.28–1.32)	11.81 (11.66–11.97)
7 (14)	States (all)	549	A	1985–95	Mortality, blacks, per 100,000	3.81 (3.75–3.87)	47.59 (46.85–48.33)
8 (15)	States (all)	549	A	1985–95	Low birth weight, percent	3.17 (3.13–3.21)	0.22 (0.21–0.23)
9 (15)	States (all)	549	A	1985–95	Infant mortality, per 1,000 live births	2.45 (2.41–2.49)	0.22 (0.22–0.23)
10 (16)	States (all)	549	A	1985–95	Stroke mortality, per 100,000	1.52 (1.50–1.55)	0.82 (0.81–0.83)

11 (17)	Counties (all)	3,075	B	1990	Heart disease mortality, per 100,000	1.74 (1.71–1.77)	14.26 (14.10–14.41)
12 (17)	Counties (all)	3,075	B	1990	Cancer mortality, per 100,000	0.66 (0.58–0.73)	4.34 (4.26–4.42)
13 (17)	Counties (all)	3,075	B	1990	Mortality, all-cause, per 100,000	10.79 (8.79–12.78)	17.60 (17.32–17.89)
14 (18)	Non-MSA	815	B	1990	Mortality, all-cause, per 100,000	2.29 (2.22–2.36)	24.64 (23.86–25.43)
15 (18)	Non-MSA	815	B	1990	Heart disease mortality, per 100,000	3.96 (3.87–4.05)	19.56 (19.11–20.01)
16 (18)	Non-MSA	815	B	1990	Cancer mortality, per 100,000	2.77 (2.68–2.87)	6.47 (6.25–6.68)
17 (19)	MSAs	273	B	1990	Mortality, whites, per 100,000	1.95 (1.92–1.99)	N.A.
18 (19)	MSAs	273	B	1990	Mortality, blacks, per 100,000	3.11 (3.07–3.14)	N.A.
19 (20)	Individuals	26,679	A	1996–97	Self-rated health, excellent/good, percent	3.00 (1.00–1.05)	2.65 (N.A.)
20 (21)	Individuals	60,446	A	1996–97	Self-rated health excellent/good, percent	2.00 (1.01–1.04)	1.76 (N.A.)

Note: MSA, metropolitan statistical area; N.A., authors do not provide sufficient data to calculate.

[a]Primary care physician supply: A = PCP/10,000 population; B = counties in the lowest 75th percentile based on PCP/10,000 population.

[b]Absolute values. All figures represent improvements in health, based on the health indicator and the primary care measured used; 95% confidence intervals in parentheses.

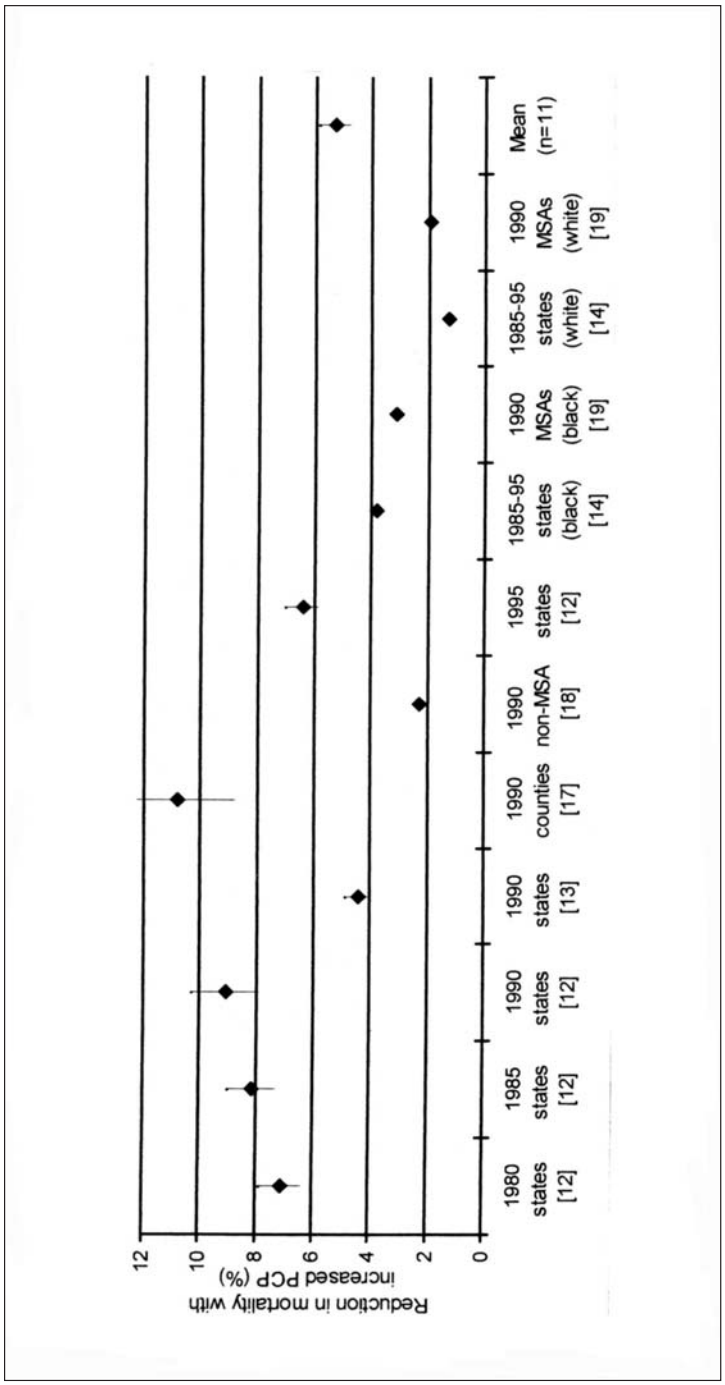

Figure 3. Estimated improvements in all-cause mortality rates associated with increased primary care physician (PCP) supply (percentage reduction in mortality, with 95% confidence intervals). Mean is calculated from all results included in the graph. MSA, metopolitan statistical area. Sources: reference sources in brackets.

years (1985–1995) were generally below the average. Health improvements for black populations (at both the state and county levels) were higher than those for white populations.

Figure 4 compares estimated reductions in all-cause mortality rates associated with the percentage improvements presented above. State-level analyses show an overall declining trend in predicted mortality rate reductions from about 85 per 100,000 in 1980 to about 58 per 100,000 in 1995. Insufficient data were available to calculate the rate reductions for studies conducted at the MSA level. Combining all nine results presented in the graph, the average reduction in all-cause mortality rates associated with a one-unit increase in PCP/10,000 was 49 per 100,000 (95% CI, 44.73–53.97). Mortality rate reductions for black populations were higher than those for white populations.

DISCUSSION

The studies reviewed here suggest that ecological measures of primary care physician supply are consistently associated with improved health outcomes, regardless of the year, level of analysis, or type of outcome studied. A one-unit increase in primary care supply (one PCP/10,000) resulted in improvements in all health outcomes studied, with a range of 0.66 to 10.8 percent improvement, depending on the outcome and the geographic unit of analysis. Limiting results to all-cause mortality, predicted reductions averaged 5.31 percent, with a corresponding average decrease in mortality rate of 49 per 100,000. Race-stratified analyses suggest that potential reductions in mortality would be greater for blacks than for whites.

The policy impact of these findings is considerable. At the national level, a 5.31 percent reduction in all-cause mortality in 2000 would translate into 127,617 deaths potentially averted.

An increase of one PCP/10,000 would necessitate a 12.6 percent overall increase in primary care physician supply, or an absolute increase of 28,726 physicians, based on the supply in 2000. If there is indeed a physician shortage in the United States, these results suggest that considerable health gains could be obtained by creating incentives to train more physicians in primary care.

The estimate of effect presented here is likely to be conservative, because it does not include the impact of increased primary care supply on morbidity and quality of life. The data do not allow the calculation of quality-adjusted life years or other measures that would better capture the contribution of primary care to reducing death and disability over the life course, nor do they allow calculation of the average cost savings associated with reduced use of emergency room and other inappropriate and expensive services required by individuals who lack a primary care physician as their usual source of care. It is therefore likely that increasing primary care supply in the United States represents an effective strategy to improve population health, especially if it is compared with the likely impact of

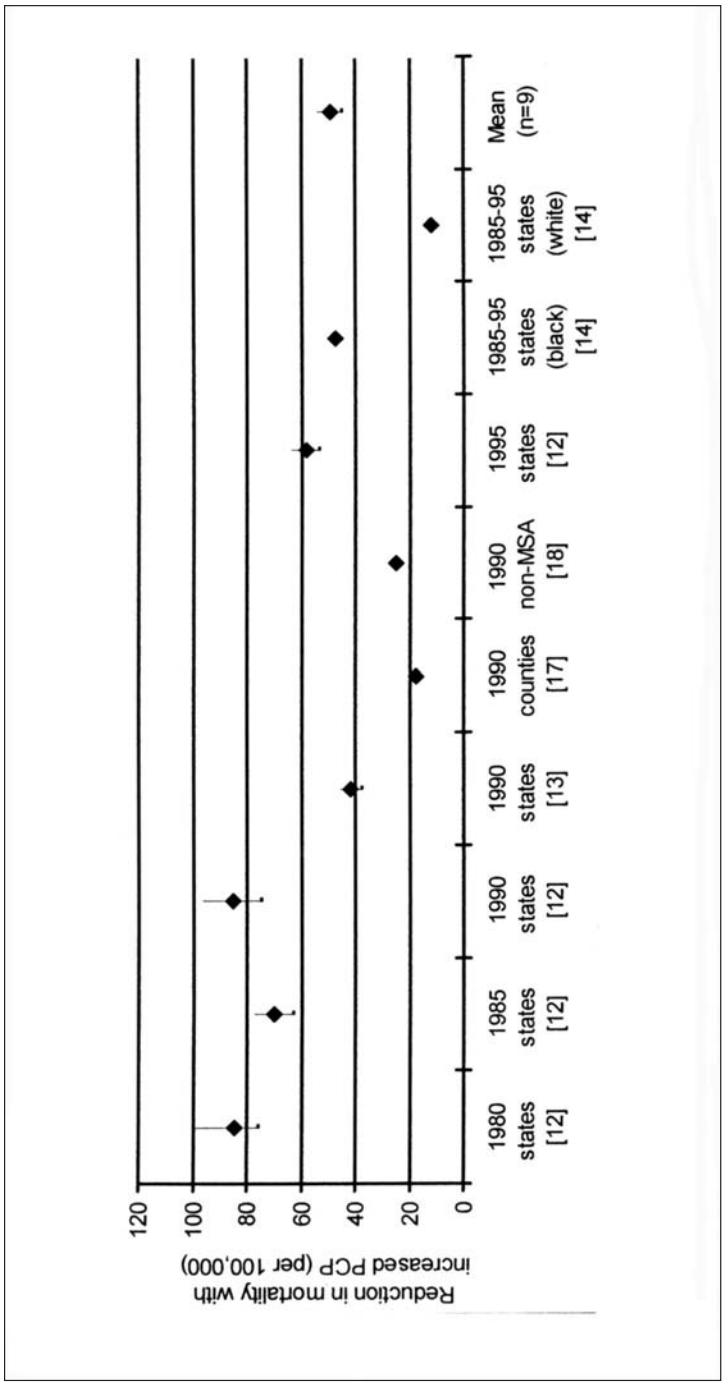

Figure 4. Estimated improvements in all-cause mortality rates associated with increased primary care physician (PCP) supply (absolute reduction in mortality per 100,000, with 95% confidence intervals). Mean is calculated from all results included in the graph. MSA, metropolitan statistical area. Sources: reference sources in brackets.

expanding the supply of specialists. The health effects of expanding specialist supply are unknown, but, at the very least, expanding supply would lead to increased costs, perhaps even with no commensurate benefits for the health of the population (23).

Another implication of these results is that primary care resources could be better targeted to regions with higher levels of social inequality. The studies reviewed here indicate that although primary care supply has a positive effect on the entire population, the magnitude of this effect is greater in areas with higher levels of income inequality (which in general are also areas with higher levels of poverty) and on outcomes for African Americans (14). Expanding community health centers, for example, might be one way to improve the supply of primary care in areas with particularly vulnerable populations (24, 25).

These findings are generally consistent with evidence from other countries. A series of studies that estimated the contribution of primary care systems (not just primary care physicians) to population health in 19 wealthy countries found that better primary care was associated with a 6.5 to 15 percent improvement in health outcomes, depending on the degree to which the outcome was amenable to primary care (26, 27). Similar evidence from Spain showed that primary care reforms were associated with a significant reduction in mortality rates for several major causes of death (28). A study in England also found primary care physician supply to be associated with lower mortality; each unit of increase in general practitioners per 10,000 population was associated with a five-unit (about 6%) decrease in mortality (29).

The finding of a positive impact of primary care physician supply is supported by several studies that could not be included in our meta-analysis because of the analytical techniques used in the study or the lack of information necessary to calculate primary care effects. For example, Vogel and Ackermann (6) found that state-level primary care supply was associated with reduced low birth weight, lower neonatal mortality, and higher life expectancies.

Only two of the studies we identified found no evidence of a positive impact of primary care physician supply, and these were studies of hospitalizations rather than health outcomes. Both assessed the relationship between ambulatory care sensitive hospitalization (ACSH) and primary care physician supply in specific U.S. state. The first found that primary care supply had no relationship to ACSH conditions in North Carolina (10). The second study, conducted in New York State, found a positive relationship; the number of primary care physicians per 1,000 population was associated with increased ACSH rates (11). These findings are not consistent with other studies of ACSH, and their results may be at least partially explained by the peculiarities of the health care markets in the two states examined.

There are several reasons why primary care physician supply might be associated with better population health. First, considerable evidence suggests that primary care improves primary prevention. In the United States, the states with

higher ratios of primary care physicians to population have lower smoking rates, less obesity, and higher seatbelt use than states with lower ratios (21). Continuity of care with a single provider is positively associated with primary preventive care, including smoking cessation and influenza immunization (21, 30).

Second, several state-specific studies illustrate the effectiveness of primary care in early detection of disease. Early detection of breast cancer (31, 32), colorectal cancer (33), cervical cancer (34), and melanoma (35, 36) is enhanced when the supply of primary care physicians is greater. Many regular screening activities take place through primary care. Most mammograms are ordered by primary care physicians (37), and people with an adequate primary care source are more likely to receive blood pressure screening and Pap smears (38).

Finally, availability of good primary care can influence the efficiency of the health system as a whole. Geographic areas with more general and family physicians per population have lower hospitalization rates for conditions that should be preventable or detected early with good primary care (including diabetes mellitus or pneumonia in children and congestive heart failure, hypertension, pneumonia, and diabetes mellitus in adults) (8). Rates of hospital admission are lower in U.S. communities where primary care physicians are more involved in the care of children both before and during hospitalization (39). Adolescents with the same regular source of primary care are much more likely to receive indicated preventive care and less likely to seek care in emergency rooms (40). Individuals who use their primary source of care over time for most health care needs have improved satisfaction, better compliance, lower hospitalization rates, and less emergency room use than those who do not (41–43).

LIMITATIONS OF THE STUDY

The different modes of analysis, different years studied, and consistency of results in terms of sign and relative magnitude indicate how robust these findings are. Yet there may be some limitations to generalizability. Two of the studies included here produced different results for similar years and units of analysis (12, 13). This could be because the studies employed different sets of covariates. The highest primary care supply effects were seen in studies that also controlled for specialist supply (12), suggesting that these analyses may have been more successful in isolating the primary care physician effect from that of other physicians.

Although our analysis was based on a review of the available literature, there is the possibility of bias, because most of the studies analyzed were by the same authors. It is important to note, however, that the few studies performed by other authors generally had similar results.

There is also research to suggest that increasing physician supply may have the effect of improving the health of those who already have access, rather than actually increasing access (44, 45). This hypothesis cannot be tested from the studies presented here, since they are primarily at the ecological level, but

increasing primary care physician supply would certainly not remove financial barriers to access in the absence of concomitant changes in health financing mechanisms.

Another potential limitation is that there is no guarantee that the relationship between primary care physician supply and health is linear; after a certain point there might be a threshold effect beyond which an increase in primary care supply would no longer result in the same rate of improvement in health outcomes. The studies analyzed here show a slight decrease in magnitude as the supply of primary care physicians increased over the 1990s, but there is no evidence to suggest that even if such a plateau does exist, the United States has reached it.

Another potential limitation is that improvements in health outcomes might be achievable by improving the effectiveness of primary care physicians without increasing their number. It is even possible that an increase in primary care supply would necessitate a shift in the type and number of specialist physicians in order to accommodate changing patterns of referrals. A recent analysis found that a selection of pre-paid group practices achieved better health outcomes with lower physician-to-population ratios than those found in the United States as a whole (46). However, even in that study, there was a slightly higher proportion of primary than specialty care physicians than in the United States as a whole and a much higher percentage of non-physician providers of primary care (physician assistants and nurse-practitioners) than the U.S. average. All the organizations studied had specialist-to-population ratios considerably lower than U.S. averages.

CONCLUSIONS

Our analysis found consistent evidence that at the ecological level, the supply of primary care physicians is positively associated with better population health in the United States. The relationship holds at different units of analysis (state, county, and MSA levels) for various health outcomes (all-cause mortality; cancer, heart disease, stroke, and infant mortality; low birth weight; life expectancy; and self-rated health) and for various approaches to categorizing the primary care physician supply.

Previous studies have shown that countries with well-developed primary care systems have lower overall health system costs, better health outcomes, and higher levels of satisfaction than countries without (26, 27). These systems have better results not only because the relative roles of primary care physicians and specialists may be more clearly defined than in the United States, but also because the health system as a whole is more directed at the supply side than at the demand side. Greater use of evidence on the roles of primary care physicians and specialists, and on ways to most effectively deploy them, offers promise of more informed health policy.

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