Income Inequality, Primary Care, and Health Indicators

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BACKGROUND. The significant association of income inequality with a variety of health indicators is receiving increasing attention. There has also been increasing evidence of a link between primary care and improved health status. We examined the joint relationship between income inequality, availability of primary care, and various health indicators to determine whether primary care has an impact on health indicators by modifying the adverse effect of income inequality.

METHODS. Our ecologic study used the US states as the units of analysis. In analyzing the data, we looked at the associations among income inequality, primary care, specialty care, smoking, and health indicators, using Pearson's correlation coefficients for intercorrelations and the adjusted multiple regression procedure. To examine the effect of inequality and primary care on health outcome indicators, we conducted path analyses according to a causal model in which inequality affects health both directly and indirectly through its impact on primary care.

RESULTS. Our study indicates that both primary care and income inequality exerted a strong and significant direct influence on life expectancy and total mortality ($P < .01$). Primary care also exerted a significant direct influence on stroke and postneonatal mortality ($P < .01$). Although levels of smoking are also influential, the effect of income inequality and primary care persists after controlling for smoking. Primary care serves as one pathway through which income inequality influences population-level mortality and at least some other health outcome indicators.

CONCLUSIONS. It appears possible that a primary care orientation may, in part, overcome the severe adverse effects on health of income inequalities.

KEY WORDS. Primary health care; income; health status indicators; epidemiologic factors. *(J Fam Pract 1999; 48:275-284)*

The significant association of income inequality with a variety of health indicators is receiving increasing attention.[1-5] The greater the gap in income between the rich and the poor in a given area, the worse the health status for the population of that area, a phenomenon that may result from less social cohesion and greater psychosocial stress.[6] The recent work by Kawachi and coworkers[4] demonstrates that where income differences are smaller, people perceive their social environment as less hostile and more hospitable.

There has also been evidence of a link between primary care and improved health status. Starfield[7] compared the extent of primary health service and the levels of health indicators, including birth outcomes, life expectancy, and age-adjusted death rates in 11 Western industrialized nations, and found that there was general concordance between the strength of primary care and the health indicators. Ratings for the United States were low for both indicators. In contrast, Canada, Sweden, and the Netherlands had generally high ratings for both primary care and health.

Shi[8-10] conducted a series of studies correlating sociodemographic and behavioral indicators with various health outcomes among the 50 states and the District of Columbia. The indicators included sociodemographic measures (age, geographic location, ethnicity, education, income, unemployment, pollution), lifestyle factors (seat-belt use, smoking, obesity), and supply of medical services (primary care physicians, specialist physicians, hospital beds). The studies found that, among the medical care variables, primary care was by far the most significant in its association with better health status, as reflected in lower overall mortality and lower death rates because of heart disease and cancer.

Both theoretical as well as empirical evidence for the association between primary care and improved health indicators exists.[11] In addition to the evidence derived from studies conducted at the ecological (aggregated population) level, there are individual-level studies leading to the same conclusions.[12-14]

Although studies have examined the relationship

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between income inequality, primary care, and health outcome, to our knowledge no analyses have included all measures simultaneously. Do both primary care and income inequality each have independent association with health indicators after controlling for the strong influence of the other? An independent effect of primary care on health indicators implies that it can ameliorate (though not necessarily prevent) the adverse effect of income inequality. This is particularly relevant in the United States, where the reduction of income inequities or their adverse effects is not an explicit societal priority the way it is in many countries of Europe.

Therefore, one objective of this study was to examine the joint relationship among income inequality, availability of primary care, and various health indicators. The second objective was to determine whether primary care has its impact on health indicators by modifying the adverse effect of income inequality. The logic of this connection is reflected in the goal of primary care, its ethical principles, and the mounting evidence that links a more egalitarian society with a stronger primary care focus. Primary care seeks to improve the health of the population and minimize the disparities across population subgroups so that certain groups are not at a systematic disadvantage with regard to their access to health services and their achievement of optimal health.[15] Equity is embedded in the ethical principles of health services, and primary care is a means by which effectiveness and equity of health services are approached. More egalitarian societies, such as those of many western European countries, are more likely to promote primary care with its emphasis on health; less egalitarian ones, such as the United States, are more likely to promote specialty care with its emphasis on diseases. In this country, there is still a serious imbalance between the production of primary care physicians and those in other specialties.[16-18] Compared with most other industrialized countries, the United States has a low proportion of primary care physicians and a correspondingly high proportion of specialists.[19] Industrialized nations that promote primary care achieve better health status and lower overall costs than the United States.[7,20]

METHODS

Data and Measures

Data for this study came from a variety of sources including the Compressed Mortality Files, the US Department of Commerce and the Census Bureau,[21] the National Center for Health Statistics,[22] the Centers for Disease Control and Prevention (CDC),[23] and the American Public Health Association. Physician data were available from the Area Resource File issued by the Bureau of Health Professions, Health Resources, and Services Administration. Data were drawn from 1990, the year most variables were available at the state level, even though they were published at a later date.

The health indicators were total mortality, cause-specific mortality due to cerebrovascular diseases (ICD-9-CM codes 430-438), neonatal mortality, postneonatal mortality, and life expectancy at birth. The percentage of infants born at low birth weight was also examined. These variables have been used extensively as major health status indicators.[22,24-26] All data on mortality were directly standardized for age according to the 1990 US population and expressed as the number of deaths per 100,000 (except in the case of neonatal and postneonatal mortality, where death rates were expressed per 1000 live births). They were obtained from the compressed mortality files compiled by the CDC using WONDER/PC software.[23]

Income distribution was measured by the Gini coefficient, a commonly used indicator of income inequality in which higher values indicate greater inequality in income distribution. It is derived from the Lorenz curve, which is a mechanism to graphically represent the cumulative share of the total income accruing to successive income intervals. Data used to calculate the Lorenz curve came from the 1990 US census population and housing summary tape file 3A. This file provides annual data on household income for 25 income intervals. Counts of the number of households that fell into each income interval along with the total aggregate income and the median household income were obtained for each state. The Gini coefficient was calculated using software developed by E. Welniak (unpublished software, US Census Bureau, 1988). We also used the Robin Hood index, another measure of income inequality. Since both measures provided similar results, we only present the results of the Gini coefficient here.

For the purpose of this study, physician primary care specialities included family practice and general practice, general internal medicine, and general pediatrics.[21,27] Family and general practice are often combined into one group called family medicine. Therefore, the term primary care physicians referred to doctors of medicine per 10,000 civilian population who were in active office-based patient care in family medicine, internal medicine, and pediatrics. This variable will be called primary care throughout our paper.

Two additional variables were included in the analysis as controls: the physician-population ratio and smoking. We defined physician-population ratio as patient care physicians per 10,000 civilian population (excluding physicians in residency training or osteopathic physicians). Smoking was defined as the percent of the adult population (18 years and older) that have smoked more than 100 cigarettes and currently smoke regularly. Smoking is a major behavioral risk causally linked with leading causes of death, particularly cancer.[28] Nine out of 10 of the leading causes of death can be linked to behavioral risks, including cigarette smoking, alcohol abuse, lack of exercise, unsafe driving, poor dietary habits, and uncontrolled hypertension.[29] Research on determinants of health typically includes smoking as a control mea-

sure in the analysis.[30] In addition to its direct impact on health, smoking may also serve as another pathway through which income inequality affects health.

Analyses also included other potential determinants including household income, education, health insurance coverage, minority composition, poverty status, and specialist physician-population ratio. It should be noted that many of these measures were highly correlated with the income inequality measure so that any absence of effect of income inequality might be explainable by its relationship with these other measures. The correlation matrix, including all measures, is available on the *Journal*'s Web site.*

Design

We did an ecologic study of the unmixed type (ie, our analyses correlated ecologic variables with ecologic outcome).[31] The units of analysis were the 50 US states. Only ecologic variables or variables characteristic of groups rather than individuals were used. For example, the subjects of interest availability of primary care and income dispersion were ecologic measures, and the study examined social and health system contexts rather than relationships at the individual level. Since we avoided making inferences about individuals from grouped data, no cross-level bias occurred.[31-33] One advantage of this approach is the lower likelihood of random fluctuations in both numerators and denominators of the mortality (and other) rates through geographic aggregation at the state level. Using state-level aggregate data also had the advantage of attenuating the likely cross-over effect encountered when smaller units of analysis are used for measuring availability of medical care and mortality.[32,34] The cross-over effect refers to the likelihood that those who require specialized care may seek care in areas where it is more available. To the extent that seekers of specialist care may be more likely to have life-threatening maladies, it can be expected that there would be a positive relationship between the availability of specialized care and mortality. However, patients are less likely to move across states than across smaller geographic units such as counties or cities to seek specialized care.

Analysis

In analyzing the data, we first looked at the association between income inequality, primary care, physician population ratio, smoking, and health indicators, using Pearson product moment correlation coefficients for intercorrelations and weighted multiple regression.[35] The latter procedure takes into account a weight (according to state population size) assigned to each observation that reflects the "relative amount of information"[35] embodied in the observation. The multiple regression model was chosen because the measurements of the variables included in the analysis were either interval or ratio, and the variables appeared to be normally distributed. It allowed us to examine the associations of several variables simultaneously with the dependent variable.

To examine the effect of inequality and primary care on health indicators, we conducted path analyses according to a causal model in which inequality affects health both directly and indirectly through its impact on primary care.[36] In path analysis, the path coefficients are equal to the standardized partial regression coefficients. Model specification is essential in path analysis, which relies on prior knowledge about the likely existence of causal relationships.[37] The model used in this study, therefore, draws on literature regarding the impact of both health care and income inequality on health but augments it by indicating the extent that primary care serves as a mechanism through which inequality affects health outcomes, as well as the magnitude of its direct and indirect effects. We also performed path analyses to test the extent that smoking serves as a pathway through which income inequality and primary care affect health.

RESULTS

Descriptive Results

In 1990, the mean of the state age-adjusted mortality rates was 852.11 per 100,000 population in the United States. The state mean for life expectancy at birth was 74 years. The mean neonatal mortality rate was 6.25 per 1000 live births, and the mean postneonatal mortality rate was 3.75 per 1000 live births. On average, more than one fourth of the adult population smoked cigarettes regularly.

In the same year, the mean of the Gini coefficient among states was .43 (ranging from .38 for Pennsylvania to .48 for Louisiana, a significant gap when considering the number of people affected by the differences in income distribution across states). On average, there were 17.27 total patient-care physicians per 10,000 population (ranging from 11.5 for Idaho to 27.0 for Massachusetts) and 5.35 patient-care primary care physicians per 10,000 population (ranging from 4.3 for Mississippi to 7.1 for Hawaii).

Relationships

Table 1 presents the correlations among income inequality, primary care, physician population ratio, smoking, and health indicators. Both the Gini coefficient and primary care were significantly associated with all health indicators. The correlation between primary care and life expectancy is displayed in Figure 1. Physician population ratio was associated only with stroke. There was also a strong inverse relationship between primary care and the Gini coefficient. Smoking was strongly correlated with all health indicators except stroke mortality. Smoking was significantly and inversely associated with primary care.

Table 2 presents the weighted regression coefficients

*www.jfp.denver.co.us.

TABLE 1

Correlations Between Health Outcomes and Determinants

Variables	Total Mortality	Stroke	Neonatal Mortality	Postneonatal Mortality
Total mortality	1.0			
Stroke	.57*	1.0		
Neonatal mortality	.34†	.39*	1.0	
Postneonatal mortality	.68*	.39*	-.03	1.0
Life expectancy	-.90*	-.51*	-.64*	-.64*
Primary care	-.51*	-.43*	-.29†	-.29†
Physician-population ratio	-.15	.46*	-.10	.10
Gini coefficient	.51*	.28†	.40*	.40*
Smoking	.64*	.18	.43*	.43*

Variables	Life Expectancy	Primary Care	Total Physician	Gini Coefficient	Smoking
Life expectancy	1.0	.54†	.26	-.49†	-.59
Primary care		1.0	.72†	-.33†	-.38†
Total physician			1.0	-.05	-.13
Gini coefficient				1.0	.25
Smoking					1.0

Note: Gini coefficient indicates income inequality.
*Significant at a = .01, on the basis of Pearson's product moment correlation coefficient.
†Significant at a = .05.

of primary care, income inequality, and smoking on health outcome indicators. A comparison of the results of the regression models shows the association of primary care, income inequality, and smoking measures with health outcome indicators. The first comparison can be made in terms of the explanatory power of the equations. The square of the multiple correlation coefficient (R^2) is a measure of the proportion of the variance in the dependent variable explained by all the independent variables in the model. The R^2s (range = .19 - .65) indicate that the models performed well. For example, 65% of variance in age-adjusted total mortality was explained by the included variables. The adjusted R^2s are also presented in the table to take into account the number of parameters used and the number of observations in the model.

The comparison of the equations in terms of the relative significance of the individual parameters reveals several patterns. Income inequality measure (ie, the Gini coefficient) was significantly associated with 3 of the 5 health indicators including total mortality (t = 2.73; P <.01), life expectancy (t = -2.73; P <.01), and neonatal mortality (t = 2.20; P <.05).

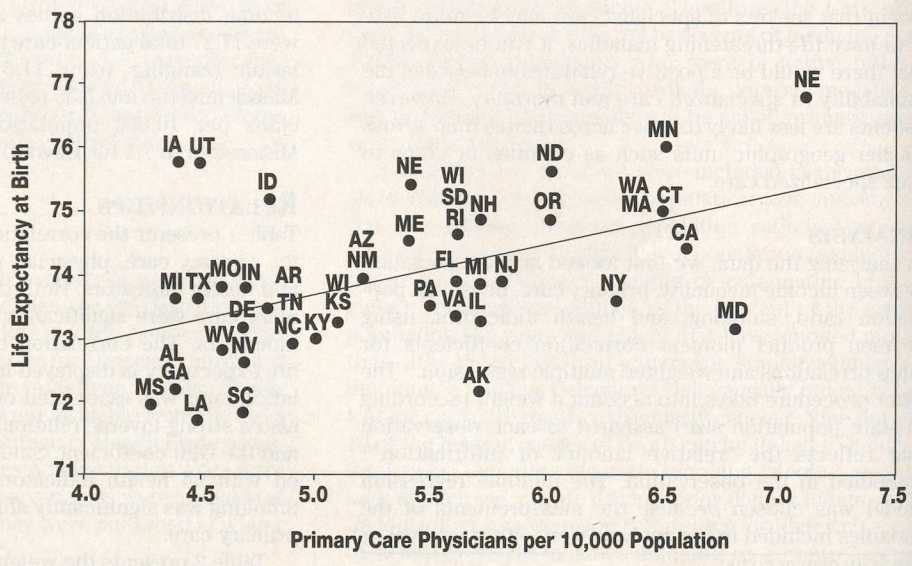
Controlling for the strong influence of socioeconomic and behavioral determinants (income inequality and smoking, respectively), primary care remained an important correlate of health outcome. It was significantly associated with lower total mortality (t = -2.45; P <.05), lower death rates because of stroke (t = -2.03; P <.05), postneonatal mortality (t = -2.77; P <.001), and longer life expectancy (t = 2.53; P <.01). Primary care was not associated with neonatal mortality or low birth weight (which was associated with income inequality; data not shown). In contrast, total physician population ratio was significantly and inversely related with only 2 health indicators—stroke and postneonatal mortality (Table 3).

Table 4 presents the findings when a wider range of possible determinants are included, using total mortality as the dependent variable.* In the unadjusted model (model 1), income inequality was significantly associated with higher total

*The results with the other health indicators are available on the *Journal*'s Web site at www.jfp.denver.co.us.

FIGURE 1

The relationship between the number of primary care physicians and life expectancy.



mortality rate. Adding primary care reduced the size of the impact of income inequality (model 2). Adding smoking and specialists-to-population ratio (model 3) reduced but did not eliminate the significant impact of income inequality and primary care. There was a significant interaction effect between primary care and income inequality (model 4). Primary care, but not income inequality, however, was significantly associated with mortality when other socioeconomic determinants of mortality were taken into account (model 5). As noted above, this finding was anticipated, as these other determinants were significantly correlated with income inequality.

TABLE 2

Weighted Multiple Regression Coefficients of Primary Care Physician-Population Ratio, Income Inequality, and Smoking on Health Outcome Indicators for the 50 States

	Total Mortality, Parameter [SE] (*t*)	Neonatal Stroke, Parameter [SE] (*t*)	Postneonatal Mortality, Parameter [SE] (*t*)	Life Mortality, Parameter [SE] (*t*)	Expectancy, Parameter [SE] (*t*)
Intercept	282.44 [167.92]	39.99 [26.95]	-2.97 [3.69]	4.29 [1.73]	82.51 [3.09]
Gini coefficient	881.03 [322.60] (2.73)‡	79.10 [51.77] (1.53)	15.54 [7.07] (2.20)†	2.90 [2.86] (1.01)	-16.13 [5.91] (-2.73)‡
Primary care population ratio	-22.94 [9.37) (-2.45)†	-3.06 [1.50] (-2.03)†	-.10 [.21] (-.46)	-.28 [.10) (-2.77)‡	.45 [.18] (2.53)‡
Smoking	12.12 [1.97] (6.15)‡	01 [.32] (.04)	.12 [.05] (2.45)†	-.02 [.03] (-.61)	-.16 [.04] (-3.77)‡
R^2	.65	.19	.28	.21	.54
Adjusted R^2	.63	.14	.23	.15	.51
F ratio	28.52‡	3.67	6.00‡	3.98†	17.96‡

Parameter denotes parameter estimates; SE, standard error; *t*, Student *t* test; R^2, multiple correlation coefficient.
Note: The parameter estimates are the partial regression slopes and reflect a unit change in the dependent variable given a unit change in the independent variable, holding other variables in the model constant.
†P <.05.
‡P <.01.

INTERRELATIONSHIPS

Figure 2 presents the results of path analysis examining the interrelationship among income inequality, primary care, and health outcome. Both primary care and income inequality exerted a strong and significant direct influence on life expectancy (.42 and -.35, respectively; P <.01) and total mortality (-.38 and .39, respectively; P <.01). Primary care had a significant impact on stroke (-.38; P <.01) and postneonatal mortality (-.33; P <.01), but income inequality exerted a significant influence on neonatal mortality (.40; P <.01). In addition, income inequality had a large indirect effect on these health outcome indicators through its relationship with primary care (-.33; P <.01). Including the impact of primary care, the total influence (including both direct and indirect influence) of income inequality on health indicators became considerable: .52 for total mortality and .49 for life expectancy.

Figure 3 presents the results of path analysis examining the interrelationship among income inequality, smoking, and health outcome. Both smoking and income inequality exerted a strong and significant direct influence on life expectancy (-.50 and -.36, respectively; P <.01), total mortality (.54 and .38, respectively; P <.01), and neonatal mortality (.36 and .40, respectively; P <.01). However, given the marginally significant path coefficient from income inequality to smoking (P = .07), income inequality had a limited indirect effect on health outcome through its influence on smoking.

DISCUSSION

Our study confirmed earlier findings that income inequality was associated with poorer health.[3,38-41] That is, the greater the disparities in income within a population, the greater the disparities in health indicators, particularly those concerning birth outcomes. As birth outcomes are highly associated with subsequent health, disadvantage in early life has a pervasive impact on subsequent life chances. Income inequality remained a significant correlate of several health indicators, even after accounting for the effect of primary care and smoking.

Both smoking and the ratio of primary care physicians to population appear to be other important correlates of health outcomes. The results of path models suggest that primary care serves as one pathway through which income inequality compromises health; it also has

TABLE 3

Weighted Multiple Regression Coefficients of Physician-Population Ratio, Income Inequality, and Smoking on Health Outcome Indicators for the 50 States

	Total Mortality, Parameter [SE] (*t*)	Neonatal Stroke, Parameter [SE] (*t*)	Postneonatal Mortality, Parameter [SE] (*t*)	Life Mortality, Parameter [SE] (*t*)	Expectancy, Parameter [SE] (*t*)
Intercept	55.56 [144.40]	22.58 [20.41]	-5.19 [2.94]	3.77 [1.29]	86.19 [2.60]
Gini coefficient	1208.31 [329.35] (3.67)‡	103.99 [46.67] (2.23)†	16.56 [6.71] (2.47)†	5.52 [2.81] (1.96)*	-19.79 [5.93] (-3.34)‡
Physician population ratio	-1.15 [1.84) (-.63)	-.78 [.26] (-2.99)‡	.05 [.04] (1.35)	-.10 [.02) (-6.11)‡	.06 [.03] (1.66)
Smoking	11.68 [2.26] (5.18)‡	.15 [.29] (.51)	.14 [.05] (2.95)‡	-.03 [.02] (-1.30)	-.18 [.04] (-4.46)‡
R^2	.55	.26	.31	.47	.51
Adjusted R^2	.52	.22	.26	.44	.47
F Ratio	18.40‡	5.49‡	6.74‡	13.55‡	15.65‡

Parameter denotes parameter estimates; SE, standard error; *t*, Student *t* test; R^2, multiple correlation coefficient.
Note: The parameter estimates are the partial regression slopes and reflect a unit change in the dependent variable given a unit change in the independent variable, holding other variables in the model constant.
*P <.1.
†P <.05.
‡P <.01.

a direct relationship in overcoming some of the adverse impact of income inequality. The nature of the effects is compatible with existing information on the impact of primary care (eg, on postneonatal mortality but not on neonatal mortality).[41] Our findings are robust, with indications that primary care is significantly associated with several additional indicators, including mortality associated with heart disease, cancer, and infancy.* Total physician to population ratio, however, is less related to many of the health outcomes, even though this ratio includes primary care physicians. This finding suggested that the specialist to population ratio might be positively related to poorer health,[8,9] a finding that we confirmed in other analyses.* Because the category of specialists includes many types of physicians, each with its own unique impact on certain aspects of health, more detailed analyses are required before reaching definitive conclusions about the relationship of specialist supply to health indicators.

*These findings are available on the *Journal*'s Web site at www.jfp.denver.co.us.

Although primary care physician to population ratio served as a pathway through which income inequality was related to health, smoking was not (or was marginally) related to income inequality. Smoking is more often related to low income than relative income,[42-44] although people living in areas with greater income disparity may experience greater psychosocial stress that may expose them to greater behavioral risks, such as smoking. Our study confirmed the significant direct relationship between smoking rates and poorer health outcome. Given its association with a variety of poor health outcomes in epidemiologic studies, it appears that smoking should be a high priority in the person-focused preventive efforts of primary care clinicians. There have been a few studies that show the success of concerted efforts of primary care physicians to encourage smokers to stop smoking. To our knowledge, however, there have been no studies that examined the impact of a long-term relationship with a primary care physician on smoking rates in the practice population as compared with the rates of those without such a relationship.

The finding of a relationship between primary care and population ratio and health outcomes does not necessarily imply that an individual's exposure to or experiences with primary care will reduce mortality or increase the likelihood of better health, however measured. Within the past several years, the relationship between income inequality and ill health has been documented.[5,38-40] Although income inequality is an integral ecological variable[28] in the sense that it is not derivable from an aggregation of individual-level data, acceptability of the demonstrated relationship with various measures of ill health is facilitated by a plausible chain of effects from one to the other, and buttressed by very extensive literature demonstrating the progressive worsening of health as the social class of individuals diminishes. The same direct relationship cannot be found between exposure to primary care and better health. First, the mere presence of more primary care physicians per population does not assure that more individu-

TABLE 4

Association of Various Determinants with Total Mortality in the 50 States: Weighted Multiple Regression Coefficients

	Model 1 Parameter [SE] (*t*)	Model 2 Parameter [SE] (*t*)	Model 3 Parameter [SE] (*t*)	Model 4 Parameter [SE] (*t*)	Model 5 Parameter [SE] (*t*)
Intercept	147.30 [169.86]	564.04 [169.10]	337.84 [327.95]	-1894.65 [900.98]	780.72 [190.30]
Gini coefficient	1649.20 [396.97] (4.15)‡	1091.58 [346.80] (3.15)‡	798.81 [327.95] (2.44)†	6224.66 [2175.51] (2.86)‡	-350.79 [453.53] (-.77)
Primary care-population ratio		-32.54 [9.68] (-3.36)‡	-30.49 [11.20] (-2.72)‡	414.05 [176.74] (2.34)†	-34.55 [12.05] (-2.87)‡
Specialist-population ratio			2.80 [2.30] (1.22)	4.19 [2.24] (1.87)*	4.17 [2.88) (1.45)
Smoking			11.67 [2.00] (5.85)‡	10.31 [1.96] (5.25)‡	9.29 [2.45] (3.79)‡
Gini coefficient × primary care				-1072.81 [425.76] (-4.35)†	
Insurance					4.01 [2.20] (1.82)*
Income					-.001 [.004] (-.143)
Education					3.71 [1.56] (2.37)
Poverty				-.04	[.03] (-1.36)
Minority					.04 [.02] (2.29)†
R^2	.27	.37	.66	.70	.74
Adjusted R^2	.25	.34	.63	.67	.68
F Ratio	17.26‡	13.61‡	21.98‡	20.95‡	12.58‡

Parameter denotes parameter estimates; SE, standard error; *t*, Student *t* test; R^2, multiple correlation coefficient.
Note: The parameter estimates are the partial regression slopes and reflect a unit change in the dependent variable given a unit change in the independent variable, holding other variables in the model constant.
*P <.1.
†P <.05.
‡P <.01.

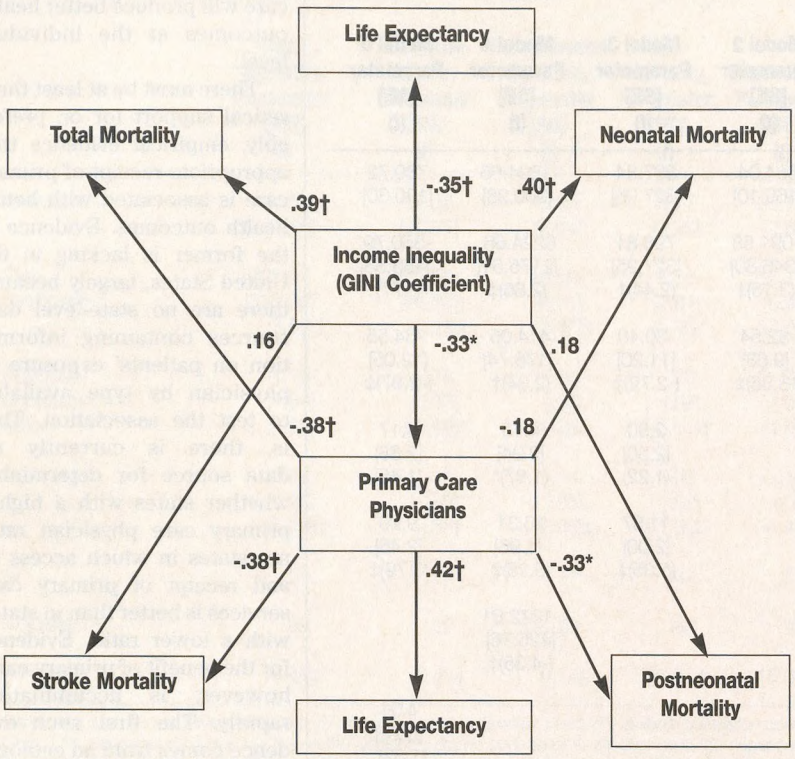
als in the population are exposed to primary care or that the delivery of primary care will produce better health outcomes at the individual level.

There must be at least theoretical support for or, preferably, empirical evidence that appropriate receipt of primary care is associated with better health outcomes. Evidence of the former is lacking in the United States, largely because there are no state-level data sources containing information on patients' exposure to physician by type available to test the association. That is, there is currently no data source for determining whether states with a higher primary care physician ratio are states in which access to and receipt of primary care services is better than in states with a lower ratio. Evidence for the benefit of primary care, however, is accumulating rapidly. The first such evidence comes from an ecologic study conducted in 11 Western industrialized countries. In this study, the strength of the primary care infrastructure was characterized by scoring 7 characteristics of the health system that are considered conducive to a strong primary care infrastructure (including primary care physician to population ratios) and 6 characteristics of patients' experiences in receiving care that are generally considered to reflect strong primary care. Those countries with weak primary care infrastructures had much lower scores for access to and quality of primary care practice.[7]

The second line of evidence comes from ecological studies of the relationship between primary care personnel to population ratios and various types of health outcomes.

FIGURE 2

The relationship between the number of primary care physicians and life expectancy.



*$P<.05$.
†$P<.01$.
Note: The path coefficient of primary care and low birth weight is -.19 ($P=.10$). The path coefficient of the Gini coefficient and low birth weight is .57 ($P<.001$)

Both Farmer and colleagues[45] and Shi[8,9] found better health outcomes in states with higher primary care physician to populations ratios. Parchman and Culler[46] demonstrated that geographic areas with more family physicians and general practitioners per population had lower hospitalization rates for conditions that should be preventable with good primary care; the same was not the case for general internists or general pediatricians. Moreover, there is evidence that primary care physicians are more likely to achieve cardinal primary care functions with known relationships to improved health outcomes.[47,48]

Several studies using individual-level data also show the importance of primary care. Shea and colleagues[17] used a case-control approach to demonstrate the effect of having a primary care physician. They studied men presenting at an emergency department in a large metropolitan area who were characterized as having complications of hypertension or incidental hypertension that was uncomplicated. Those with complications of hypertension were much less likely to have a source of primary care than men whose hypertension was an incidental finding. The presence of a source of primary care was the most notable and significant finding between the 2 groups, even more important than insurance coverage. Franks et al,[49] using nationally representative survey data, showed that adult respondents who reported a primary care physician rather than a specialist as their regular source of care had lower subsequent mortality and lower annual health care costs, after controlling for differences in demographic characteristics, health insurance status, health perceptions, reported diagnoses, and smoking status.

There are, in addition, scores of studies that demonstrate the advantages of each of the 4 cardinal features of primary care: first contact; long-term, person-focused relationships between physician and patient; comprehensiveness of care; and coordination of care.[12]

Moreover, the findings of our study are consistent with previously postulated benefits specific to primary care. Several focus groups of different types derived a list of health outcomes that should be related to primary care adequacy at a population level. The findings of this study are consistent with the prediction.[12]

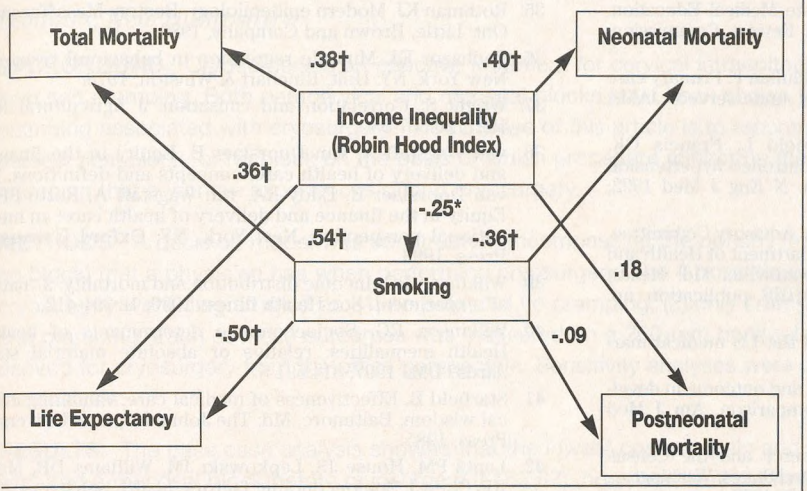
LIMITATIONS

In interpreting the results of this study, several limitations require consideration. It should be noted that the health indicators we used are not the sole output of health services. Reduction in pain, reassurance, improved functional status, and other aspect of health-related quality of life are also outcomes requiring investment of health personnel, including specialists. Unfortunately, there are no widely available or standard measures of these aspects of health, and data that can be generalized to geographic areas are not available.

As is the case for the validity of all analytic models, path analysis depends heavily on prior assumptions about mechanisms of effect. It is a method that combines knowledge of causal relationships with knowledge of the magnitude of relationships provided by the correlation coefficients.[37] It does not provide rules for the discovery of causal relationships but helps justify causal relationships postulated on other grounds.[50] Thus, the significance of the final results hinges on the

FIGURE 3

Path coefficients for the effects of income inequality and smoking on health outcome.



*P=.07.
†P<.01

validity of the postulated causal relationships.

Moreover, it may be that equality in the distribution of income and primary care orientation of a health services system are part of a common underlying social and political process of allocating resources—this may be the ultimate causal agent. That such a phenomenon may be the case is suggested, but not proved, by the demonstrated relationship between the two. The relationship is far from perfect, however, and an international comparison of the relationship between primary care orientation and a country's health indicators suggests that countries with better health are not uniformly the most equitable countries from the viewpoint of income distribution.[12] It may be that variables, such as education and other forms of social capital, or unemployment, although highly related to income inequality, may be more proximal determinants. The extent to which states differ in their underlying social policy regarding resource distribution appears to be a useful subject for subsequent research.

CONCLUSIONS

From a policy perspective, improvement in the health of certain populations is likely to require a multipronged approach that addresses socioeconomic and behavioral determinants of health, as well as strengthens certain aspects of health services. Among Western industrialized nations, the United States has the widest gap in mean income between the rich and the poor. Family income of the most affluent 10% of children is more than 6 times greater than that for the poorest children. The United States is also the most inequitable by far for individuals and families without children. Income inequality is growing with the exodus of manufacturing jobs from the country and an increase in low-paying jobs, part-time jobs, and contract positions that usually lack health benefits.[51] While there is little doubt that social conditions in general, and income inequalities in particular, are key determinants of health, alone and in combination with genetic factors,[52] there is mounting evidence that health services have an independent effect in ameliorating their adverse effect.[42,53] However, it is likely that the major beneficial effects of health services depends on an appropriate balance between primary care and specialty care; international comparisons and studies within the United States point to this conclusion. In the absence of social policy that addresses income inequality, the promotion of primary care may serve as a palliative strategy for reducing the adverse effect of social inequality. This hypothesis deserves consideration in the environment of declining health levels of the US population relative to that of comparably industrialized nations.[12]

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